

**QUALITY ASSURANCE PROGRAM PLAN
FOR ENVIRONMENTAL DATA OPERATIONS FOR THE
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY'S
BROWNFIELDS PROGRAM – REVISION NO. 2**

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Remediation Division – Cleanup, Petroleum and Redevelopment Section
Prepared by: Jason Seyler and Jessica Smith
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TABLE OF CONTENTS

Table of Contents

1	INTRODUCTION	1
2	PROJECT MANAGEMENT	3
2.1	Element A1: Title and Approval Sheet.....	3
2.2	Element A2: Table of Contents.....	3
2.3	Element A3: Distribution List	4
2.4	Element A4: Project/Task Organization.....	4
2.5	Element A5: Problem Definition/Background.....	6
2.6	Element A6: Project/Task Description.....	6
2.7	Element A7: Quality Objectives and Criteria	7
2.8	Element A8: Special Training/Certification	7
2.9	Element A9: Documents and Records.....	9
3	DATA GENERATION AND ACQUISITION	11
3.1	Element B1: Sampling Process Design	11
3.2	Element B2: Sampling Methods	12
3.3	Element B3: Sampling Handling and Custody	12
3.4	Element B4: Analytical Methods	12
3.5	Element B5: Quality Control	14
3.6	Element B6: Instrument/Equipment Testing, Inspection and Maintenance.....	15
3.7	Element B7: Instrument/Equipment Calibration and Frequency.....	15
3.8	Element B8: Inspection/Acceptance of Supplies and Consumables	15
3.9	Element B9: Non-Direct Measurements.....	16
3.10	Element B10: Data Management.....	16
4	ASSESSMENTS AND OVERSIGHT	17
4.1	Element C1: Assessments and Response Actions.....	17
4.2	Element C2: Reports to Management.....	17
5	DATA VALIDATION AND USABILITY	19
5.1	Element D1: Data Review, Verification and Validation.....	19
5.2	Element D2: Verification and Validation Methods.....	19
5.3	Element D3: Reconciliation with User Requirements	19
6	QAPP IMPLEMENTATION	21
7	REFERENCES	22

APPENDIX A: Sampling and Analysis Plan Examples

(\\Deqwmr001\wmr\HWC\CPR\Brownfields\1 - Brownfields Filing Template\4_Programatic SAP & QAPP\Programmatic QAPP\2022\AppendixA_SAPexamples)

- a) Backfill Sampling and Analysis Plan (SAP)-Petroleum Refining Corp, Shelby
- b) Hazardous Building Materials SAP-Memorial Apartments, Helena
- c) Tank pull SAP-Henry's Hideaway, Trout Creek
- d) Groundwater Sampling Plan-Former Equity Co-Op, Harlem
- e) Vapor Intrusion SAP-Office Stop, Butte

APPENDIX B: Glossary

APPENDIX C: Performance Criteria Summary and Data Validation

Figure 1: Brownfields Program Organizational Chart

Approval Sheet

Title and Approval Sheet:

Title: Montana Brownfields Program Quality Assurance Project Plan (Revision No. 2)
The attached Montana Brownfields Program Quality Assurance Project Plan (Revision No. 2) is approved and commits the State of Montana Department of Environmental Quality to follow the elements described within.

Signature: _____

Date: _____

Greg Davis
Project Manager
EPA Region 8
Office Brownfields and Land Revitalization

Signature: _____

Date: _____

Terri Dorrington
Bureau Chief
Tanks, Brownfields, and Federal Facilities Bureau
Waste Management and Remediation Division
Montana Department of Environmental Quality

Signature: _____

Date: _____

Katie Morris
Brownfields Quality Assurance Officer
Section Supervisor
Cleanup, Protection, and Redevelopment Section
Montana Department of Environmental Quality

1 INTRODUCTION

This Quality Assurance Program Plan (QAPP) is intended to satisfy U.S. Environmental Protection Agency (EPA) requirements for the collection of data of known and documented quality during field activities in the State of Montana. This QAPP was developed by the Montana Department of Environmental Quality (DEQ), Remediation Division, as a programmatic QAPP for the Brownfields Program conforming to applicable EPA requirements stated in the document *Requirements for Quality Assurance Project Plans*, QA/R-5, (EPA document EPA/240/B-01/003) dated March 2001 and re-issued May 31, 2006.

The DEQ Quality Management Plan (QMP), dated September 1, 2019(revised 2/4/21) , describes the DEQ quality management processes that are used to maintain DEQ's data quality management system. This QAPP is consistent with the QMP and applicable EPA guidelines. This QAPP is considered the "blueprint" by which individual projects within the Brownfields Program involving environmental data operations are implemented and assessed and specifies how quality assurance and quality control activities will be applied during a particular project. The Brownfields Program will comply with the requirements of the QMP and QAPP when collecting and evaluating data.

By federal law, EPA-funded environmental data collection programs must have an approved QAPP before sample collection begins. The purpose of this requirement is to ensure that the data collected are of known and suitable quality and quantity. However, even programs that do not receive EPA funding need to consider developing a QAPP, or follow an existing QAPP that has been approved for use by the EPA or designated party, especially if data is to be used by state, federal, or local resource managers. The QAPP is a written document that outlines the procedures to ensure data is collected, analyzed, stored, managed and reported in a manner of high enough quality to meet Data Quality Objectives (DQO) for a specific project.

This QAPP is intended to serve as the basic document for all program activities related to the collection of environmental data for the Brownfields Program for which a site-specific QAPP does not already exist. These activities may include site-specific activities using CERCLA Section 128(a) funding such as Targeted Brownfields Assessments (TBA), Environmental Site Assessments (i.e. Phase 1 & 2), Preliminary Assessments (PA), Site Investigations (SI), Site Reassessments (SRA), Expanded Site Investigations (ESI), Remedial Investigations (RI), Removals (REM), Feasibility Studies (FS), Remedial Designs (RD), and Remedial Actions (RA).

This QAPP is intended to be an umbrella document governing such activities with specific details for each project/activity to be outlined in a Sampling and Analysis Plan (SAP) or equivalent titled document. Several SAPs may be required for the various assessment activities throughout the life of a Brownfields project. Appendix A contains examples of SAPs used for TBAs for DEQ's Brownfields Program. SAPs based on this parent QAPP should address site-specific aspects, such as the number and locations of samples, the various media to be sampled, corresponding analytical parameters and chain of custody parameters.

This QAPP further describes the information to be considered and/or addressed when preparing a SAP. The SAP should also include appropriate references to this parent QAPP. During a site investigation, situations may be identified which require modification or

deviation from the QAPP or SAP. In these cases, a justification for the deviation(s) should be provided in the field log and/or the analytical results report or other appropriate report (such as a TBA Report), with an accompanying discussion on the potential impact, if any, on data usability and/or comparability. Deviations affecting the use or interpretation of the results should also be reported along with the results. This QAPP will focus on aspects such as criteria and procedures that should be common to the environmental data collection efforts for any Brownfields project.

This document also provides the rationale and quality assurance requirements for activities of the Brownfields Program; projects that are based on Data Quality Objectives (DQO). The DQO process is a planning process for ensuring environmental data is of the type, quantity and quality needed and required for decision making. Each site-specific SAP will incorporate site-specific DQOs and specific Quality Assurance/Quality Control (QA/QC) requirements.

According to EPA guidance, 24 distinct elements can be included in a QAPP (and therefore a SAP), although not all elements or portions of an element may be necessary for all programs or SAPs. The applicable components of an element can be included in any portion of a SAP. The elements that end up being included in a SAP will depend on the project's DQOs, goals, scope, data uses and on guidance received from the Brownfields Program and EPA quality assurance and project contacts. As previously noted, examples of EPA approved SAPs developed under the Brownfields Programs are included in Appendix A.

The 24 elements are grouped into four overall categories and are listed in the Table of Contents (Sections 2.0 through 5.0). Appendix C contains a Glossary which defines various terms and concepts associated with QA/QC.

2 PROJECT MANAGEMENT

The elements in Table 1 address project management activities, including history and objectives and roles and responsibilities of the participants. The elements document that the project has a defined goal, that the participants understand the goal and the approach to be used and that the planning outputs have been identified.

Table 1. Group A: Project Management Elements	
A1	Title and Approval Sheet
A2	Table of Contents
A3	Distribution List
A4	Project/Task Organization
A5	Problem Definition/Background
A6	Project/Task Description
A7	Quality Objectives and Criteria
A8	Special Training/Certification
A9	Documents and Records

2.1 Element A1: Title and Approval Sheet

The EPA *QA/R-5* document requires the following information on the Title and Approval Sheet(s):

- plan title
- name of the organization(s) implementing the project
- effective date of the plan and revision number
- names, titles, signatures, and approval dates of the appropriate approving officials

Approving officials may include the organization's project manager, the organization's Quality Assurance Officer (QAO), the EPA QAO and/or others, as needed (e.g., field operations manager, laboratory managers, state and other federal agency officials). SAPs generated under this QAPP will contain Title and Approval Sheets.

2.2 Element A2: Table of Contents

In this QAPP and in all Brownfields Program generated SAPs, the sections, references, appendices, figures and tables are/will be listed in the Table of Contents. Use of a document control header in the upper right-hand corner of each page in the body of this QAPP has been included to meet the *QA/R-5* requirements and to facilitate revisions of the QAPP document when necessary. This will allow the Brownfields Program to update an individual section(s) and the Table of Contents, when necessary, without changing the entire QAPP.

2.3 Element A3: Distribution List

The following individuals and organizations will receive a copy of the approved Brownfields Program QAPP and any subsequent revisions. The Quality Assurance Officer (QAO) is responsible for distributing the QAPP electronically or via hard copy. See also Sections 2.4 and 6.0 for more information. In addition, project managers will distribute approved SAPs to the appropriate individuals for each specific project. Project managers will also distribute revised and/or updated SAPs accordingly to ensure all project personnel are working from the most current document.

Brownfields Program Personnel:

Katie Morris	Cleanup, Petroleum and Redevelopment Section Supervisor plus project managers.
Scott Gestring	Brownfields Program Quality Assurance Officer
Jason Seyler	Brownfields Coordinator
Jessica Smith	Brownfields Coordinator
Colleen Owen	Brownfields Coordinator

EPA Personnel:

Mary Goldade	EPA Regional Quality Assurance Manager
Greg Davis	EPA Region 8 Brownfields Project Manager

2.4 Element A4: Project/Task Organization

The *EPA QA/R-5* document requires the identification of the individuals and organizations participating in the project, with a discussion of their specific roles and responsibilities. The principal data users, the decision-makers, the QAO and all persons responsible for implementation must be identified. In addition, a concise organization chart showing the relationships and the lines of communication among all project participants must be shown. Please refer to Section 1.0 above for information regarding the scope of this QAPP.

In the context of this QAPP and future SAPs, the responsibilities of various individuals within the Brownfields Program are outlined below. In addition, an organizational chart is included as Figure 1.

Within the Hazardous Waste Site Cleanup Bureau, Katie Morris manages the Cleanup, Petroleum and Redevelopment Section and is responsible for project management and the performance of all section staff members. The section manager also coordinates all the reviews of all Brownfields Program site assessments, remedial projects, and any additional response actions.

The Brownfields Program QAOs, Scott Gestring, is responsible for coordinating laboratory services between the Brownfields Program project managers and the EPA Contract Laboratory Program (CLP) coordinator and/or commercial laboratories. The QAO also has the responsibility of informing the Brownfields Program management, the EPA Regional CLP coordinator and commercial laboratories of quality assurance needs, problems and overall status of data collection efforts. The QAO is the point-of-contact for all Brownfields Program quality assurance matters and coordinates these matters with the Brownfields Program, EPA, and commercial laboratories. The QAO also assists in providing or obtaining technical assistance when needed for the Brownfields Program project managers.

In general, data collection activities are organized and executed by Brownfields Program project managers. Under the Brownfields Program structure, the QAO is also a project manager with additional experience relating to quality assurance, but is not located in a separate, stand-alone section. Because there are many project managers within the Brownfields Program, the QAO is not directly involved in the majority of day-to-day data collection activities. For the majority of data collection, the QAO is independent from the project manager responsible for collecting the data. The QAO also has responsibilities of a project manager and, on occasion, may collect data under this QAPP as part of his routine duties as a project manager. To eliminate any potential bias or conflict of interest, in cases when the QAO is the lead project manager for the data collection activities, an alternate QAO will be chosen to perform the responsibilities of the QAO for the data collection activities in question. The alternate QAO will have experience with quality assurance protocols. If there is an issue that cannot be resolved by the QAO, the issue will be elevated to the Quality Assurance Committee (QAC) for discussion and resolution, as noted in the QMP dated September 1, 2019.

Brownfields Program coordinators and project managers are responsible for writing SAPs and other reports, performing site-specific field activities, collecting samples, shipping samples to analytical laboratories, data evaluation and assessments. The implementation of the quality control requirements for environmental data collection within a project is the responsibility of the project manager with the assistance of the Brownfields Program QAO. Brownfields Program project managers will follow the sampling procedures described in the site-specific SAP, other applicable EPA guidance, and this QAPP.

Mary Goldade, the EPA Regional Quality Assurance Manager, or her staff advises the Brownfields Program QAOs, Scott Gestring, on quality assurance procedures and issues and assists in resolutions of problems, when necessary. Greg Davis manages DEQ's CERCLA Section 128(a) grant for EPA.

Under the CERCLA Section 128(a) Cooperative Agreement, the Brownfields Program may develop and approve its own SAPs. Plan approvals will be documented by a dated signature on the SAP from the Brownfields Program project manager and the QAO.

In regards to review and approval of this QAPP, the Department's QMP states that the QAC is responsible for reviewing the completeness of the QAPP. Each new QAPP is reviewed by a member of the QAC. Once the QAPP is deemed complete by the QAC, it is considered final. The QMP then allows for quality assurance at the project level to be reviewed and approved by an independent QAO.

Within the Brownfields Program, the QAO is responsible for maintaining the official, approved Brownfields Program QAPP. The QAPP will be reviewed at least annually to ensure that its content continues to be valid and applicable to the Brownfields Program over time. The QAO is responsible for this annual review. Because of the complex and diverse nature of environmental data operations, changes to original plans are often needed. When such changes occur, the QAO shall determine if a substantive change is warranted and, if it is, the originators of the QAPP shall modify the QAPP to document the change and submit the revision for approval by the same personnel that performed the original review. Only after the revision(s) has been approved (at least verbally with written follow-up), will the change be implemented and the QAPP updated.

The Brownfields Program may use various laboratories for analytical services including CLP laboratories and state certified private commercial laboratories. The laboratories are responsible for sample analysis and data processing and must meet the applicable laboratory requirements described in their QAPP as well as the appropriate project requirements. Data validation is the responsibility of the party who receives the data from the laboratory and should be performed by a qualified data validator. Brownfields Program project managers are qualified to review analytical data and determine its usability for specific project DQOs.

2.5 Element A5: Problem Definition/Background

The *EPA QA/R-5* document requires a QAPP to contain a narrative statement of the specific problem the project is designed to address. Since each project will have its own site-specific problem(s) to address, the SAP should contain that statement. Examples of the decisions that might be made following the collection of environmental data for a Phase II ESA would be if additional site investigation is needed, if the nature and extent of the contamination has been defined, or if no further action is needed.

Sufficient background information about the site must also be provided or referenced in the SAP to lend a historical perspective to a particular project. The following information will be addressed or cross-referenced (e.g. reference to background information in an easily accessible workplan on file with the Brownfields Program) in the SAP:

- site description and history
- reason for environmental concern
- existence of relevant previous data and general conclusions of relevant previous studies
- adequacy of existing data and reason(s) why additional/new data is needed

2.6 Element A6: Project/Task Description

The Project/Task Description element requires a description of the work to be performed and a schedule for its implementation to be included in the SAP. The Project/Task Description will identify the data necessary to meet the requirements of the project's specific scope of work. The following items should be addressed in the SAP if applicable:

- discussion of measurements/tests that will be made under the scope of the SAP

- applicable technical and regulatory standards (e.g., DEQ-7 water quality standards, EPA Regional Screening Levels (RSLs), Risk Based Screening Levels (RBSLs), or MCLs)
- time, resource or other constraints on project
- special personnel and equipment requirements
- project schedule
- project and quality records required, including the types of reports needed
- maps and tables that show and state the geographic locations of field tasks
- work to be performed or hypothesis to be tested
- anticipated use of the data
- survey design requirements and description
- sample type and sampling location requirements
- sample handling and custody requirements
- calibration and performance evaluation samples needed for sampling
- sampling or analytical instrumentation requirements

2.7 Element A7: Quality Objectives and Criteria

The SAP will include a detailed statement of the project DQOs and measurement performance criteria. Data Quality Indicators (DQI) and data validation methods provide a general summary that are used to ensure data meets the specified DQOs for a project. DQIs generally include: precision, bias, representativeness, completeness, comparability and sensitivity (see also Appendix C, Glossary, for definitions, and the tables in Appendix C for Performance Criteria Summary and Data Validation). The information in the tables will be reviewed and evaluated by project managers during preparation of the SAP and subsequent review of the data.

Project managers will refer to the DQO process when developing SAPs whether the intent is to use biased, objective or incremental sampling or a statistically derived sampling approach. The DQO process is implemented for all projects. The project manager may determine the size and complexity of the DQO project team and the DQO process may be as simple or complex as deemed necessary by the project manager for the individual project. For further information, refer to *Requirements for Quality Assurance Project Plans*, EPA QA/R-5, 2007 and *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, 2006.

2.8 Element A8: Special Training/Certification

The *EPA QA/R-5* document requires a QAPP to identify and describe any specialized training or certification requirements needed by personnel in order to successfully complete the project or task. At a minimum, all Brownfields Program project managers will have Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and maintain current HAZWOPER status by attending an 8-hour refresher course annually. Brownfields Program project managers will be familiar with the procedures to be used for specific projects. Training will be provided as needed to ensure that Brownfields Program project managers can perform required procedures effectively. If certifications are required for a specific project or procedure, project managers will obtain the appropriate certifications before conducting any site work.

Montana Brownfields Program Quality Assurance Project Plan
Revision No. 2 Effective date October 31, 2022

EPA provides training (both classroom and web-based) on a variety of subjects to Brownfields Program staff. Brownfields Program project managers will be encouraged to attend available training opportunities which are relevant to the work they perform on their sites/projects. These include courses related to risk assessment, groundwater monitoring and environmental sampling. Section Managers will keep track of training needs and courses attended as project managers provide them with the relevant information.

2.9 Element A9: Documents and Records

The *EPA QA/R-5* document requires a QAPP to describe the process and responsibilities for ensuring the appropriate project personnel have the most current approved version of the QAPP, including the appropriate version and any necessary updates. In addition, it is important to itemize the information and records which must be included in a data report package and specify the desired reporting format for hard copy and any electronic forms. Documentation can include raw data, data from other sources such as databases or literature, field logs, sample preparation and analysis logs, instrument printouts, model input and output files and results of calibration and QC checks. The SAP will specify the laboratory turnaround time needed dependent on the analytical method and project schedule.

The Brownfields Program requires that a field log be recorded for every field work event for a project to document field conditions, samples and measurements collected, deviations from the SAP or other approved workplans and any other items that need to be documented. The Brownfields Program and EPA typically request a laboratory case narrative and/or data validation narrative for analyses of any samples submitted by the Brownfields Program. The case narrative and/or data validation narrative provides a complete description of any difficulties encountered during sampling or analysis.

Specific records and documents that are applicable to a project will be listed and defined in the SAP. Such reports may include audit reports, interim progress reports and final reports. The SAP will specify the level of detail required for field sampling, laboratory analysis, literature and database data collection and modeling documents, if applicable. Reports required by the SAP will provide a complete description of any difficulties encountered during sampling or analysis.

Records and documents generated for a specific project will be managed in accordance with: (1) DEQ's Records & Information Management Policy and Procedures, (2) the Montana Code Annotated, Section 2-6-1 and 2-6-2, regarding public records and their management (3) Montana's Secretary of State record requirements, and (4) the Brownfields Program's record retention policy.

With respect to record retention, an agency may specify its own agency specific record retention schedules by filing the appropriate paper work with the Secretary of State for approval or it may rely upon the general retention schedules established by the Secretary of State. A retention schedule is simply a timetable that indicates how long a record has business value. The schedule provides the framework for managing the record, indicating how long the record is kept, when, if ever, the record is transferred to the state archives, when and how the record must be destroyed and who has the right to access the information in the record.

DEQ's Records and Information Management Policy and Procedures are available at the following links:

- [DEQ Records & Information Management Policy](#)
- [DEQ Records & Information Management Procedure](#)

In addition to physical records and documents, DEQ's remediation division has designed an electronic document storage system called Tracking Remediation and Environmental Actions Data

System (TREADS). Currently, all documents for a project that are received by the Brownfields Program are being kept electronically and will be entered into TREADS.

3 DATA GENERATION AND ACQUISITION

The elements in Table 2 cover all aspects of data generation and acquisition, ensuring that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling and QC activities are used and properly documented.

The QAPP elements in this section describe the requirements related to the actual methods or methodology to be used for the collection, handling and analysis of samples, data obtained from other sources (e.g., contained in a computer database from previous sampling activities, compiled from surveys or taken from the literature) and the management (e.g., compiling or handling) of the data. Since the QAPP is intended to be generic, the SAP will define the methods and/or procedures to be used. If the designated methods are well documented and are readily available to all project participants, citations in the SAP will be adequate to define the methods and procedures. For non-standard or uncommon methods or procedures or for standard methods being used in situations or matrices that were not anticipated, detailed copies of the methods and/or standard operating procedures (SOP) must accompany the SAP either in the text or as an attachment(s).

Table 2. Group B: Data Generation and Acquisition Elements	
B1	Sampling Process Design
B2	Sampling Methods
B3	Sample Handling and Custody
B4	Analytical Methods
B5	Quality Control
B6	Instrument/Equipment Testing, Inspection and Maintenance
B7	Instrument/Equipment Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables
B9	Non-Direct Measurements
B10	Data Management

3.1 Element B1: Sampling Process Design

The SAP will outline the data generation or data collection design for the project and the anticipated project activities, including:

- types and numbers of samples required
- design of the sampling network
- sampling locations and frequencies
- sample matrices
- measurement parameters of interest
- rationale for the design

Each SAP will identify in detail the sampling event, schedule and conditions. The actual sampling conditions will be specified in field notebooks and later the final report. The final

report will include discussions on deviations from the SAP, if any. Should the sampling sites become inaccessible, the deviation and resulting schedule and access issue will be cited in a field log and/or final report. If individual sampling plans are to be developed for discrete project phases, the SAP will include their preparation schedule. The SAP will address access considerations and include figures showing proposed sample locations. Examples of SAPs used by the Brownfields Program for Site Investigations and Targeted Brownfields Assessments are included in Appendix A. In addition, EPA Region 8 has developed a generic SAP template for the sampling of PFAS, dated September 2021, which is also useful in helping prepare SAPs.

3.2 Element B2: Sampling Methods

The SAP should describe the procedures for collecting samples and identify the sampling methods and equipment, including any implementation requirements, sample preservation requirements, decontamination procedures and materials needed for projects involving physical sampling. Where appropriate, the SAP will identify sampling and analytical methods. If a method allows the user to select from various options, then the SAP should indicate which options are being selected. The SAP should describe general performance requirements for the method, such as the method's ability to achieve the required detection limits.

The SAP should describe the process for the preparation and decontamination of sampling equipment, including the selection and preparation of sample containers, sample volumes, preservation methods and maximum holding times for sample extraction and/or analysis. The SAP should indicate that the disposal of investigation derived waste will be performed in accordance with current EPA guidance.

If instruments are needed for sampling, the SAP should indicate how the instrument(s) will be calibrated, deployed, operated and maintained to avoid cross-contamination and to ensure reliable information is collected. The SAP should also address the actions to be taken when problems occur with sampling methods and identify the individuals responsible for corrective action. The SAP should indicate how this will be documented.

3.3 Element B3: Sampling Handling and Custody

The SAP should describe the requirements for sample handling and custody in the field taking into account the nature of the samples, special sampling considerations, the maximum allowable sample holding times before extraction or analysis and available shipping options and schedules.

Sample handling includes packaging, shipment from the site and storage at the laboratory. The SAP will discuss the system used to identify the samples, the sample tags and labels to be used, and when possible, provide sample forms. For private laboratories, Brownfields Program project managers will use labels and forms provided by the certified laboratory.

3.4 Element B4: Analytical Methods

The SAP will outline the required analytical methods. In planning the analytical methods to be used, project managers will consider whether the CLP specifications or commercial laboratory specifications will meet the DQOs of each site-specific project. The selection of analytical methods and analytical services will be based on a consideration of the project DQOs which may include some or all of the following:

- target analytes/compounds
- required minimum sample volumes
- analytical SOPs
- equipment or instrumentation needed
- laboratory sub-sample size (portion of sample used by the laboratory for analysis)
- sample preparation and digestion methods
- applicable regulatory requirements (e.g., TCLP for RCRA waste leachability, drinking water methods, etc.)
- sample matrix
- QA/QC requirements (e.g., identity, frequency, and acceptance criteria for field and laboratory QC samples)
- holding or turnaround times
- shipping requirements (e.g., may need to use local analytical service)
- expected concentration level of sample and ranges covered by method
- method interferences and likely presence and concentration of sample co-contaminants
- sensitivity needed (e.g., compare project screening levels such as MCLs or EPA Regional Screening Levels against achievable detection limits of method for that matrix)
- reporting requirements and related data review needs
- costs, including analytical laboratory costs
- lead-time needed for arrangements
- availability of analytical services

This evaluation should take place during the planning stages of a sampling project and the analytical services selected will be documented in the SAP. Some examples of issues to consider while planning a sampling project might include: the detection limits required to meet the project DQOs for some risk assessments might be lower than the contract required detection limits offered by the CLP or commercial laboratory; or, the standard digestion methods or analytical methods may not be suitable for the sample matrix of interest. Analytical turnaround times under one program might be too long for the needs of another program (e.g. emergency response).

The SAP will also address what to do when a failure in the analytical system occurs and who is responsible for corrective action and appropriate documentation. When field analyses are to be performed, the SAP should list the equipment to be used. It is suggested that this section in the SAP include, in table format, information used to help achieve DQOs. The table should identify analytes, analytical methods, sample holding times, sample preservation, types of containers required, detection limits required and any other information pertinent to evaluation of the DQOs. Refer also to Section 3.1 and Appendix C for further information.

3.5 Element B5: Quality Control

QC samples are used to estimate the precision and accuracy/bias of analytical results and to examine sources of error introduced by field and laboratory practices. This section of the SAP should list each required QC procedure, along with the associated acceptance criteria and corrective action. QC procedures may include matrix spikes, duplicates, blanks, blind samples, laboratory control samples, surrogates or second column confirmation. For standardized analytical methods and matrices, the Brownfields Program will defer to the analytical laboratory to specify the spike compounds, spike levels and required control limits to be used for each QC check. The analytical laboratory will follow the analytical method and their own QAPP. It is recognized that QC procedures may be modified on a project-specific basis in order to meet data specifications. As specified by the SAP, a designated number of field QC samples may be included in each batch of samples which are sent to the laboratory.

The types and frequencies of field QC samples should always meet project DQOs. A designated number of laboratory QC samples must be included in each batch of samples sent to the laboratory, as specified in the SAP. The project manager should speak with the Brownfields Program QAO if there are questions as to the number of samples to propose in the SAP. Field QC samples may include field duplicates, trip blanks, equipment blanks, field blanks and decontamination or rinsate blanks. The field QC samples should be prepared (i.e., labeled, packaged, preserved, and shipped to the assigned laboratory) identically to the primary field samples and should remain “blind” to the laboratory to ensure indiscriminate handling. Each field QC sample receives a separate sample number.

In addition to the field QC samples, an additional sample volume (usually double or triple volume as specified by the analytical method) will be collected for each matrix and analysis in the field. These additional sample volumes are used to prepare laboratory QC samples (such as matrix spike/matrix spike duplicates) at the laboratory. Samplers should designate one sample per matrix per analytical method per 20 samples (i.e. 5%) as a “laboratory QC” sample, at a minimum. Again, the additional volume for a laboratory QC sample must be supplied by the sampler. For more information, refer to *Contract Laboratory Program Guidance for Field Samplers* (EPA, 2020).

In addition to laboratory QC samples, the laboratory should employ other QC procedures which may include blanks, laboratory control samples, matrix spikes/matrix spike duplicates, replicates, internal standards and surrogates. Blanks are prepared samples that should not contain the analytes of concern, and are used to evaluate whether contamination is being introduced to the samples by the laboratory. Laboratory control samples are samples prepared by spiking a known amount of analyte(s) into a clean, well defined matrix. Laboratory control samples are used to show that the analytical method is working correctly in an ideal matrix. Matrix spike/matrix spike duplicates are samples prepared from portions of an actual field sample. These samples are used to determine if the sample matrix is affecting the analytical results. Replicates are a re-analysis of the same sample. Replicates are used to show that the analytical method is producing reproducible results. Internal standards are compounds that are similar to the compounds the method is designed to measure but are not likely to be found naturally in the sample. Internal standards are used to normalize typical variations that may occur during sample analysis across all the samples in the analysis group. Finally, surrogates, like internal standards are compounds

similar to the analytes of concern for the given method, but are not likely to be found in them naturally. Surrogates are used to evaluate the effectiveness of the sample extraction procedures.

Table 1 in Appendix C outlines general quality control criteria that can be incorporated in the SAP to help evaluate the usability of data. The criteria in the tables should be evaluated in accordance with the project-specific DQOs to ensure it meets the needs of the project. It is also acceptable to adopt by reference the QAPP of a state-certified laboratory to meet many of the quality assurance elements discussed in this document (e.g., relative percent differences on matrix spike/spike duplicates, surrogate recovery percentages).

3.6 Element B6: Instrument/Equipment Testing, Inspection and Maintenance

The *EPA QA/R-5* document requires a QAPP to describe how inspections and acceptance testing of instruments, equipment and their components affecting quality will be performed and documented to assure their intended use is as specified.

To meet the requirements of this section, the Brownfields Program will adopt by reference the procedures for instrument and equipment testing, inspection and maintenance of the project-specific laboratory's QAPP and SOPs. Analytical laboratories used by the Brownfields Program include private state certified contract laboratories or private laboratories enrolled in the EPA CLP program.

Field equipment used by Brownfields Program project managers, the equipment will be maintained in accordance with the manufacturer's recommendations and will be serviced and/or repaired as needed to ensure its effectiveness in the field. The SAP should address the actions to be taken when problems occur and identify the individuals responsible for corrective action. The SAP should indicate how this will be documented.

3.7 Element B7: Instrument/Equipment Calibration and Frequency

The SAP should identify all field tools, gauges, instruments and other sampling, measuring and testing equipment used for data generation or collection activities that must be controlled or calibrated to maintain performance within specified limits. When applicable, the SAP will identify the frequency and reference the procedures necessary to calibrate each piece of equipment used. In general, field instrumentation will be calibrated in accordance with the manufacturer's requirements and recommendations. For laboratory analysis, the Brownfields Program may adopt by reference the procedures for instrument calibration of the project-specific laboratory's QAPP and the analytical method. The SAP should address the actions to be taken when problems occur and identify the individuals responsible for corrective action. The SAP should indicate how this will be documented.

3.8 Element B8: Inspection/Acceptance of Supplies and Consumables

The SAP should describe how and by whom supplies and consumables (e.g., standard materials and solutions, sample bottles, calibration gases, reagents, hoses, deionized water, potable water, electronic data storage media, etc.) shall be ordered, inspected and accepted for use in a project.

3.9 Element B9: Non-Direct Measurements

The Brownfields Program will ensure that all SAPs have a reference section so that data that is obtained from literature sources or other non-direct measurements is easily referenced or cross-referenced. This section could apply to data sources such as electronic databases, programs, literature files, and other non-analytical data sources. If non-direct measurements are used for a project, the SAP will define any criteria for use of the data and will specify any limitations on its use.

3.10 Element B10: Data Management

The SAP should describe the project data management process, tracking data generation to its final use or storage. Record-keeping procedures are described above in Section 2.9 Element A9: Documents and Records. Each project manager is responsible for keeping their project data, files and documentation up to date. All data received by the Brownfields Program will be treated as a record and managed in accordance with the remediation division's record-keeping policies. All data received for a specific project will be placed in the project file. At this time, the Brownfields Program will use an electronic data management system. Data received electronically can be transformed into paper records and placed in the project file and/or stored on the share drives in TREADS. Data and other project file contents are available to the public (in accordance with the records management requirements discussed in Section 2.9).

When projects or sampling events are completed, data will be summarized in a completion or analytical results report. These reports generally contain summary tables for the analytical results. When summary tables are generated, the Brownfields Program will ensure the accuracy/bias of the data reduction and transcription activities by performing peer-review of the summary tables and by comparison of the tables to the original data source. The Brownfields Program will not omit flags and other analytical qualifiers from summarized data. During the course of data evaluation, the Brownfields Program may choose to reject data based on QC or other concerns. When data is rejected, the Brownfields Program may include the data in the report for the sake of completeness and/or will note the data as rejected in the text.

4 ASSESSMENTS AND OVERSIGHT

The elements in Table 3 address the activities for assessing the effectiveness of project implementation and associated QA/QC activities. The purpose of the assessment is to ensure that the SAP and QAPP are properly implemented.

Table 3. Group C: Assessment and Oversight Elements	
C1	Assessments and Response Actions
C2	Reports to Management

4.1 Element C1: Assessments and Response Actions

The SAP will identify the frequency and type of assessment activities needed for the project. At a minimum, all SAPs generated by the Brownfields Program will be peer-reviewed by the Brownfields Program QAO prior to completion of the document and all data collected under the SAP will undergo data quality assessment in accordance with this QAPP. For field activities, the field team will ensure that all sample equipment is functioning properly and all sampling supplies are available in sufficient quantity and condition for use. The field team should have a copy of the SAP and this QAPP with them in the field to the extent possible.

Depending on project DQOs, additional types of assessment may be applicable. If other quality assessments are used during a project, the SAP will detail the procedures used for the assessment, the expected deliverables and recipients of those deliverables and a schedule for the assessment activities. If the Brownfields Program is not performing a particular assessment, the SAP will identify the organization and individuals responsible for the assessment.

The SAP will define the responsibilities of the individual(s) conducting the assessment. For field activities led by the Brownfields Program, typically the project manager will conduct the assessment. The SAP will define the conditions under which the field work may be stopped. For example, this might be a scenario where there is no ice placed on VOC samples. Recognizing that assessments may be needed at any time during the project, the project manager will periodically evaluate standard operating procedures and corresponding data to ensure that it meets the DQOs for the project. The SAP will also discuss how response actions to non-conforming conditions are to be addressed and by whom and how corrective actions will be verified and documented.

4.2 Element C2: Reports to Management

The SAP should identify the frequency and distribution of reports issued to inform management of project status, as well as the individuals responsible for informing management. As an example, the document could identify the results of performance evaluations and system audits, and identify significant quality assurance problems and recommended solutions. The preparer and the recipients of the reports will be identified in the SAP. Any specific actions, the recipients of the report are expected to take will be detailed.

5 DATA VALIDATION AND USABILITY

The elements in Table 4 address the QA activities that occur after the data collection phase of the project is completed. Implementation of these elements determines whether or not the data conforms to the DQOs.

Table 4. Group D: Data Validation and Usability Elements	
D1	Data Review, Verification and Validation
D2	Verification and Validation Methods
D3	Reconciliation with User Requirements

5.1 Element D1: Data Review, Verification and Validation

The SAP should state the criteria to review and validate data in an objective and consistent manner. Data is typically validated against the project-specific criteria provided in the analytical services request, the SAP and by following the validation guidelines presented in Appendix C. When non-CLP laboratories are to be used, they must demonstrate competence in the desired analyses by having completed appropriate state certification.

5.2 Element D2: Verification and Validation Methods

The need for data validation will be based on project-specific DQOs and addressed in the SAP. For data validation under the Brownfields Program, project managers will review the data and corresponding data package and make a usability assessment relative to the data and the DQOs. In a scenario where there are concerns about the usability of the data, the Brownfields Program will contact the laboratory to gather information to assist with the review and/or resolve any questions. If there is still uncertainty with the data after discussion with the laboratory, the Brownfields Program may qualify or reject the data for the specific project.

The SAP will describe the process to be used for verifying, validating and making a usability determination for the data and convey how the information will be presented to the end user. The SAP will discuss how data usability issues will be resolved and the responsibilities for resolving such issues. To evaluate usability, data is typically reviewed against the project-specific criteria provided in the analytical services request, the SAP, and by following the validation guidance located in Appendix C.

All completion reports drafted by the Brownfields Program will include laboratory analytical data, the validation package (where applicable) and a usability discussion to assist the end user.

5.3 Element D3: Reconciliation with User Requirements

The SAP will describe how the results obtained from the project will be reconciled with the DQOs. The SAP will also describe how issues will be resolved and discuss how limitations on the use of the data will be reported to decision makers.

6 QAPP IMPLEMENTATION

This QAPP is the “blueprint” for environmental data operations for the Brownfields Program. The approved QAPP is intended to be implemented as detailed herein. However, when conditions change during environmental data operations, the SAP can be revised in order to meet site-specific conditions and project DQOs.

Under EPA policy, no person or organization may begin to collect data before the QAPP has been approved by authorized EPA personnel or other persons to whom this authority has been specifically delegated. This applies to work performed by the Brownfields Program, as well as Brownfields Program contractors.

The QAPP will be kept current in the following manner: the QAO will incorporate any changes or updates into the applicable section. The QAO will then update the section and the document control header as well as the Table of Contents. In order to ensure that the most recent version of the document is being used, the QAO will maintain and update a master distribution list for the QAPP. The distribution list will contain the names and contact information for all individuals who are provided a copy of the QAPP. When the QAO updates the QAPP, notification will be provided to the people on the distribution list. The notification will indicate that a new version of the QAPP is available and that older versions of the QAPP are obsolete and need to be destroyed. Notification will be made via e-mail and will contain a read-only PDF file containing the most current version of the QAPP.

Furthermore, a read-only copy of the QAPP will be made available on DEQ’s shared directory for internal Brownfields Program use. In all cases where work is being performed under this QAPP, the document outlining the scope of work (SAP, workplan, etc.) will reference the most current version of the QAPP at the time the work is to be performed. Brownfields Program staff and/or its contractors will not work from documents which do not reference the most current revision number and date of the QAPP. See also Section 2.4 for more information.

The QAPP will be reviewed, at a minimum, annually by the QAO to determine if it continues to meet current program requirements. Suggested changes identified by QAPP users should be submitted to the QAO for consideration during periodic updates. The need for QAPP changes might also be identified as the result of problems in implementation discovered during data reviews, audits and other oversight activities. The following are examples of QAPP revisions that do not require written approval, but will require distribution to the QAPP users: changes to analytical services request forms and procedures, updates to forms (including chain of custody forms) when the update does not reduce information content and updates due to personnel changes. These interim changes can then be formally approved during the next periodic update of the QAPP.

7 REFERENCES

U.S. EPA, *Contract Laboratory Program Guidance for Field Samplers*, EPA/540/R-20-005 November 2020.

U.S. EPA, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, 2006.

U.S. EPA, *Management of Investigation-Derived Wastes During Site Inspections*, OERR Directive 9345.3-03FS, EPA/540/G-91/009, January, 1992.

U.S. EPA, *Requirements for Quality Assurance Project Plans*, EPA QA/R-5, (EPA/240/B-01/003), March 2001 and re-issued May 2006.

Montana Department of Environmental Quality, *Quality Management Plan (QMP)*, September 2019 (revised 2/4/21),

APPENDIX A: Sampling and Analysis Plan Examples

**FORMER EQUITY CO-OP BULK PLANT
HARLEM, MONTANA
FACILITY ID #03-10408; DEQ RELEASE #3132
GROUNDWATER SAMPLING AND ANALYSIS PLAN/
QUALITY ASSURANCE PROJECT PLAN**

Prepared By:

Brandon Kingsbury
***Montana Department of Environmental Quality
Remediation Division***
P.O. Box 200901
Helena, Montana 59620

September 12, 2017

APPROVAL PAGE

**Former Equity Co-op Bulk Plant
Harlem, Montana
Groundwater Sampling and Analysis Plan/Quality Assurance Project Plan**

Prepared By:
Brandon Kingsbury
**Montana Department of Environmental Quality
Remediation Division**
P.O. Box 200901
Helena, Montana 59620

Phone: 406-444-6547
Fax: 406-444-6783
E-mail: BKingsbury@mt.gov

September 12, 2017

Prepared by: Brandon Kingsbury, DEQ Petroleum Brownfields Coordinator

Date

Approved by: Scott Gestring, LUST Brownfields Quality Assurance Officer

Date

Approved by: Mike Trombetta, Contaminated Site Cleanup Bureau Chief

Date

TABLE OF CONTENTS

Distribution List.....	iii
Project/Task Organization.....	iii
 1.0 INTRODUCTION/ BACKGROUND	 1
1.1 Site History and Current Status.....	1
1.2 Location	3
1.3 Hydrology and Hydrogeology	3
1.4 Previous Environmental Investigations	3
1.5 Environmental and/or Human Impact.....	4
1.6 Assurance of Future Redevelopment/Reuse of the Site.....	4
1.7 Benefits of Redevelopment/Reuse of the Site	4
1.8 Reporting Schedule.....	5
2.0 PROJECT DATA QUALITY OBJECTIVES	5
2.1 Data Uses	5
2.2 Expected Data Quality	7
2.3 Data Quality Indicators	7
2.3.1 Accuracy.....	7
2.3.2 Precision.....	7
2.3.3 Completeness.....	8
2.3.4 Representativeness.....	8
2.3.5 Comparability.....	9
2.3.6 Detection Limits.....	9
3.0 SAMPLING DESIGN	9
3.1 Groundwater Sampling.....	9
3.1.1 Laboratory Analysis.....	9
Table 2 Water Container/Analysis/Preservative/Holding Time Information.....	10
3.1.2 Groundwater Sampling Equipment Checklist	10
3.2 Chain of Custody Control and Sampling Records, Decontamination Procedures,.....	10
3.2.1 Chain of Custody.....	11
3.2.2 Decontamination Procedures.....	11
3.2.3 Sample Documentation and Shipment.....	11
3.2.4 Sampling Material Disposal.....	11
3.3 Field Quality Assurance/Quality Control Samples.....	12
3.3.1 Field Duplicates	12
3.3.2 Calibration Procedures and Frequency for Field Test Equipment.....	12
3.3.3 Review of Field Records.....	12
3.3.4 Field Data Validation and Reporting	13
3.3.5 Data Management.....	13
3.4 Quality Assurance Quality Control – Laboratory Data	14
3.4.1 Trip Blanks.....	14
3.4.2 Field Duplicate Samples	14
3.4.3 Review of Field Records.....	14
3.4.4 Field Data Validation and Reporting.....	14

3.5 Document Control.....	14
3.5.1 Field Work.....	14
3.5.2 Laboratory Deliverables.....	14
3.5.3 Contractor Deliverables.....	15
4.0 HEALTH AND SAFETY.....	15
4.1 Field Health and Safety Procedures.....	15
4.2 Personnel Specialized Training.....	15
5.0 REFERENCES	16

Tables

1	Data Quality Objectives
2	Container/analysis/preservative/holding time information

Appendices

A	Site Map
B	Well Logs
C	Sampling Sheets

Distribution List

The following people will receive a copy of the Former Equity Co-op Bulk Plant Groundwater SAP/QAPP:

1. Mike Trombetta, DEQ Contaminated Site Cleanup Bureau Chief
2. Scott Gestring, DEQ Brownfields Quality Assurance Officer

Project/Task Organization

This section outlines personnel involved with the project and outlines their role in execution of the investigation. The list below shows the authority structure of the persons involved:

1. Brandon Kingsbury, DEQ Petroleum Brownfields Coordinator, will be the project officer for DEQ providing oversight for the entire project. This person will conduct groundwater sampling activities identified in this SAP. This person has the authority to issue stop work orders if work is not being completed according to contract and SAP directives. This person will prepare an abbreviated groundwater sampling report that documents field sampling activities and includes validated groundwater laboratory results.
2. Scott Gestring, DEQ Brownfields Quality Assurance Officer, will be responsible for ensuring data quality objectives outlined by the DEQ and EPA are met, but is not involved in the project itself.
3. Marty Szudera, DEQ Fiscal Services, will be responsible for ensuring that laboratory invoices are paid.
4. Patrick Skibicki, Environmental Specialist, DEQ Cleanup, Protection, and Redevelopment Section, will conduct groundwater sampling activities with the project officer, submit samples to the laboratory, and ensure that all tasks outlined in the SAP are completed. This person has the authority to issue stop work order directives if DEQ is not fulfilling the responsibilities of the contract or if he believes working conditions to be unsafe.

1.0 INTRODUCTION/ BACKGROUND

The former Harlem Equity Co-op Bulk Plant, located at 404 4th Street Southwest in Harlem, Montana (Facility) is currently owned by Equity Co-op Association of Harlem (Equity Co-op). The Facility is an abandoned petroleum storage and dispensing facility that operated from 1969 to 1999. It is located adjacent to US Highway 2, just inside the Harlem City limits (Lots 1 – 12, Block P, Alonzo Smith Addition), between residential and agricultural properties in Blaine County. The legal description for the site is as follows: NE quarter of the SW quarter of Section 18, Township 32 North, Range 23 East, Principle Montana Meridian.

On March 24, 1997, DEQ was notified of a petroleum release at the Facility. Diesel fuel was reported to be seeping out of the ground in the vicinity of underground product piping connected to above ground storage tanks (ASTs). In response, Equity Co-op removed the underground product lines. Upon removal, numerous holes were discovered in the diesel and gasoline product lines. A test pit investigation completed after their removal revealed that significant soil and groundwater contamination was present on-site. Free product (mixed gasoline and diesel) was observed in numerous test pits at depths of less than 7 feet below surface grade (bsg). Two free product recovery wells were installed and Equity Co-op personnel recovered approximately 300 gallons of free product. In addition, Equity Co-op completed two remedial investigations in 1998 to further define the extent and magnitude of the petroleum contamination. Equity Co-op discontinued investigation and cleanup in 1999 due to financial insolvency.

The petroleum release (Release #3132) at the Facility is not eligible for reimbursement from the Montana Petroleum Tank Release Compensation Fund (PTRCF). Leaking Underground Storage Tank (LUST) Trust funds cannot be used because no federally-regulated underground storage tanks exist on-site.

In 2016 and 2017, through the use of Senate Bill 96 funding, a remedial approach was developed, which involved injecting CoolOx® into subsurface soil and groundwater in the Montana Department of Transportation (MDT) right-of-way (ROW) on the up-gradient side of US Highway 2. Injections included the application of 10,381 gallons of CoolOx® in 155 injection points encompassing the area where groundwater monitoring wells GWM-3, GWM-4, MW-12, and MW-13 are located. Injection activities occurred between May 9, 2017, and May 15, 2017. Follow-up groundwater sampling is necessary to determine the effectiveness of the CoolOx® injections.

1.1 Site History and Current Status

In 1999, Governor Marc Racicot authorized \$100,000 from the Environmental Contingency Account to continue site investigation and cleanup. In 2000 and 2001, DEQ hired HKM to complete additional investigation and monitoring using these funds. A water main investigation revealed that a 2.5-inch diameter PVC water line located west of US Highway (HWY) 2 from the Facility was in contact with petroleum-contaminated soil and groundwater. In November 2003, HKM replaced a 400-foot section of the 2.5-inch diameter PVC water line servicing the Harlem West Water Users Group with a 400-foot section of 3-inch diameter copper to protect the

water line from the potential breakthrough of volatile organic compounds (VOCs) associated with the petroleum release.

In May 2004, DEQ submitted a cleanup grant application in the amount of \$285,572 through the Montana Department of Natural Resources and Conservation (DNRC) Reclamation and Development Grants (RDG) Program. The grant proposal included the removal of petroleum-contaminated soil, removal and replacement of an irrigation ditch, monitoring well installation, and groundwater monitoring. The grant application was approved by the Montana legislature in April 2005. DEQ contributed \$20,000 remaining from the 1999 Environmental Contingency Account allocation to the cleanup effort. Grant Agreement No. RIT-06-8663 was finalized on August 31, 2005.

DEQ retained MSE Technology Applications, Inc., (MSE) to conduct Facility cleanup activities. In October and November 2005, a total of 7,968 banked (in-place) cubic yards (approximately 10,355 loose cubic yards) of petroleum-contaminated soil were removed from the Facility and taken to a licensed disposal facility (Unified Disposal) located 36 miles west of Harlem. The irrigation ditch (and the contaminated soil beneath it) was left in-place due to logistical concerns and limited funding.

In April 2006, MSE installed 11 groundwater monitoring wells following soil removal activities. In June 2007, two additional groundwater monitoring wells were installed. The downgradient extent of the dissolved-phase plume was not fully determined in the agricultural field located west of US Highway 2 due to access issues. Groundwater monitoring continued through the expiration of the RDG grant on August 31, 2010. Groundwater monitoring results demonstrated an overall decreasing trend in dissolved-phase contaminant concentrations in most monitoring wells during this time period; however, high concentrations of dissolved-phase petroleum hydrocarbons remained in select monitoring wells on the western portion of the Facility on both sides of US Highway 2. Facility data indicate that a target zone, or layer of more permeable contaminated soil, remains beneath US Highway 2 and portions of the MDT ROW that were not accessible for excavation. This target zone provides a continuing source of petroleum contamination that is leaching petroleum constituents to the groundwater.

On April 29, 2015, Bear Paw Development Corporation (BPDC) submitted a Petroleum Brownfields Eligibility Application for the Facility on behalf of the City of Harlem. In correspondence dated May 13, 2015, DEQ determined that the Facility was eligible to receive Petroleum Brownfields Assessment funding.

NewFields LLC. (NewFields) conducted a groundwater monitoring event on behalf of BPDC in December 2015 and the results are included in a NewFields report dated January 2016. Groundwater monitoring results were consistent with earlier groundwater monitoring events. High concentrations of dissolved-phase petroleum hydrocarbons remain on the western portion of the Facility on both sides of US Highway 2. Benzene was detected in monitoring wells MW-3, MW-10, and MW-12 at concentrations of 5,350, 5,190 and 8,330 µg/liter respectively. There are no known impacts to potential receptors at this time. However, the city would like to redevelop this property in the future, which may increase risks.

1.2 Location

The site is located at 404 4th Street SW, Harlem, Montana. See Figure 1.

The specific geographic location is:

Township 32 North, Range 23 East
Section 18– Lot 8 of the Alonzo Smith Addition.

1.3 Hydrology and Hydrogeology

In October 2016 Pioneer completed additional soil borings and groundwater monitoring wells. Site data from October 2016 indicates that the static water levels range from approximately 0.5 to 8 feet below ground surface (bgs). Lithology includes clays in the shallow subsurface from 0 to 8 feet bgs that transitions to a silty-clay from 5 to 8 feet with silty clay encountered at shallower depth towards the eastern portion of the study area. Silty clays are underlain by a submerged sand unit ranging from 8 to 10 feet bgs across the central portion of the study area. Sampling has determined that petroleum contamination is following the submerged sand unit and is traveling from east to west under Highway 2.

Harlem is located in the Milk River Valley, about 40 miles northeast of the Bear Paw Mountains. Bedrock in the area consists of Upper Cretaceous sedimentary rocks, mainly the Bearpaw Shale and sandstone, siltstone, and shale of the Judith River Formation. Harlem is situated on alluvial flood plain deposits of the Milk River which are comprised mainly of interbedded layers of fine-grained sand, silt, and clay. The alluvial deposits are estimated to be 100 to 200 feet thick in the valley. The project study area is situated between Thirty-mile Creek to the north and the Milk River to the south; both waterways meander in a general easterly direction past Harlem. The nearest surface water is an irrigation ditch that flows from northeast to southwest along the northern portion of the property.

1.4 Previous Environmental Investigations

- Equity Co-op completed two remedial investigations in 1998 to further define the extent and magnitude of the petroleum contamination.
- A Site Investigation Report was completed in January 2001, by MSE with recommendations for remedial actions to include excavation.
- In 2005 DEQ retained MSE to conduct Facility cleanup activities and 7,968 banked cubic yards of petroleum contaminated soil were removed from the Facility.
- In April 2006, MSE installed 11 groundwater monitoring wells following soil removal activities. Additionally, two wells were installed in June of 2007 in the ROW to the west of Highway 2.
- Groundwater monitoring continued through the expiration of the RDG grant on August 31, 2010.
- The site became Brownfields Eligible in April of 2015 and NewFields completed groundwater monitoring in December 2015 on behalf of BPDC. Groundwater monitoring

results were consistent with earlier results, which indicated high concentrations of dissolved-phase petroleum hydrocarbons remaining on both sides of US HWY 2.

- In 2016 Orphan Share money was expended as a result of Senate Bill 96 to complete a Remedial Alternatives Analysis and develop a remedial strategy for addressing petroleum contamination remaining in the MDT ROW, including beneath US HWY 2. DEQ retained Pioneer Technical Services, Inc., (Pioneer) to complete the analysis and in October of 2016 they installed vertical and slant soil borings to assess petroleum impacts beneath the highway. Pioneer also installed and sampled groundwater monitoring wells. The laboratory analytical results of soil and groundwater samples indicated significant petroleum impacts to soil and groundwater in the MDT ROW. The remedial alternative chosen was in-situ chemical oxidation using CoolOx® via direct push injection.
- In May 2017 NewFields completed a Phase II ESA on behalf of BPDC to define the extent of petroleum impacts on the Nissen Property and adjacent to the East Irrigation Ditch on the Former Equity Co-op property. Nine boreholes were installed and one temporary groundwater monitoring well was installed. The investigation further defined the sandy water bearing unit and further defined the extent of impacts west of US Highway 2.
- In May 2017 Pioneer and Deep Earth Technologies injected 10,381 gallons of CoolOx® via 155 injection points. The treatment area measured approximately 5,600 square feet.

1.5 Environmental and/or Human Impact

Groundwater is impacted by petroleum hydrocarbons at concentrations that exceed DEQ RBSLs and Circular DEQ-7 Water Quality Standards. Groundwater sampling will provide data to help determine whether or not the injection of CoolOx® has been effective in reducing contaminant concentrations in the targeted treatment zone. Recommendations will be made to determine whether further corrective action, including groundwater monitoring, is required.

1.6 Assurance of Future Redevelopment/Reuse of the Site

The Facility is currently owned by Equity Co-op; however, Equity Co-op is insolvent and the property is essentially abandoned. Both the town of Harlem and Blaine County have expressed interest in acquiring the property for potential redevelopment of the site; possibly as a little league baseball field. Equity Co-op has stated in writing that it is willing to donate the property. Groundwater sampling is necessary to evaluate the results of recent cleanup activities and whether or not additional corrective action is necessary to move the property from Brownfields assessment and cleanup towards redevelopment and reuse.

1.7 Benefits of Redevelopment/Reuse of the Site

The potential use of this property as a baseball park will provide local children with the opportunity for team sports as well provide a regional sports complex that will attract teams from across the state. Additionally, current property taxes are delinquent. Therefore, repurposing of the property under new ownership will provide the community with an increased tax base.

1.8 Reporting Schedule

DEQ will complete an abbreviated groundwater sampling report once groundwater sampling is completed and laboratory analytical is received.

2.0 PROJECT DATA QUALITY OBJECTIVES

Table 1 on page 6 sets forth the seven-step process in determining the site-specific data quality objectives (DQOs) for this SAP.

2.1 Data Uses

This SAP was designed such that the analytical and field data can be used to achieve the following objectives:

- Assess petroleum contamination in groundwater.
- Confirm and monitor depth to groundwater at the site by the completing water level measurements.

This data will assist DEQ in determining the effectiveness of the CoolOx® injections and whether petroleum contamination remains within the treatment zone that may require further assessment and cleanup.

Table 1: Data Quality Objectives Table

Step 1 State the Problem	Step 2 Identify the Decision	Step 3 Decision Inputs	Step 4 Define Study Boundaries	Step 5 Decision Rules	Step 6 Tolerance Limits on Decision Errors	Step 7 Optimization of Sample Design
The former Equity Co-op is a vacant lot with real contamination hindering sale and redevelopment of the property. Historic uses of the property that have resulted in contamination include a petroleum bulk plant and retail dispensers. The results of this SAP will be used to evaluate the effectiveness of CoolOx injections and to determine whether additional cleanup is required to facilitate redevelopment of the site. This SAP constitutes an agreement that quality assurance, and reporting set forth herein, will meet these DQOs.	Principal questions: - To what extent and magnitude is petroleum contamination present above Human Health Standards and Risk Based Screening Levels in the groundwater at the former Equity Co-op Property? - Does contamination associated with the former Equity Co-op appear to be migrating off-site?	Information needed: - Groundwater samples, analyzed for volatile petroleum hydrocarbons (VPH). - Concentrations will be considered a risk to human health if the contaminant concentrations exceed Montana DEQ's September 2016 Tier 1 Risk based Screening Levels for soil and groundwater. See appendix A for actions levels for MTBE, benzene, toluene, ethylbenzene, xylenes, naphthalene, VPH, and EPH hydrocarbons fractions.	The study area encompasses the groundwater underlying MDT ROW, immediately adjacent to the former Equity Co-op Property. SAP field work will take place by October 2017. Based on the results of the groundwater sampling event, redevelopment or further assessment will be planned. DEQ-7 Standards, DEQ Risk Based Screening Levels (RBSLs), will be used to compare results of groundwater analyses.	All Action Levels have been predetermined and include DEQ RBSLs and MT DEQ-7 Standards. For each analyte in each matrix, the concentration of the analyte will be compared to the appropriate action level. If an analyte in a given sample exceeds the Action Level, then additional work (risk assessment, sampling, etc.) will need to be done. If an analyte in a given sample does not exceed the action level, then no further assessment will be required (human health and the environment are not likely to be impacted by that analyte from that location).	DEQ cannot calculate Tolerance Limits on Decision Errors (TLDEs) when no data is available for a given contaminant in a specific area. Decision Errors have not been calculated because of the non-random nature of the sampling. Judgmental sampling will be used in an effort to ensure that the areas most likely to be contaminated are sampled. DEQ will review the laboratory-provided Quality Assurance/Quality Control (QA/QC) data to determine whether the laboratory analytical data represent the "true" value of the analyte in the media. Laboratory reporting limits must be less than or equal to the action levels listed in the 2016 RBSLs and DEQ-7 water quality standards.	DEQ has constructed the SAP based on the information needed for the Decision Inputs.

2.2 Expected Data Quality

The Quality Assurance/Quality Control (QA/QC) practices and analytical methods will be designed to produce data of such quality that the results can be compared to DEQ RBSLs (DEQ, 2016), and DEQ-7 Standards, (DEQ 2017), EPA Regional Screening Levels). Data must also be of sufficient quality to support decisions regarding property redevelopment or further assessment. The data quality will be assured by selecting appropriate analytical methods with Method Detection Limits (MDLs) below the relevant screening levels, goals, or standards. Implementing appropriate sample collection methods, collecting appropriate duplicates and blanks, reviewing laboratory reports, and adequately designing the sampling plan are also necessary to assure adequate data quality. These data quality elements will be further discussed throughout this document.

2.3 Data Quality Indicators

Data assessment criteria will be used to evaluate the quality of the field sampling and laboratory performance. These criteria, which are described in detail in the following subsections, are expressed in terms of analytical accuracy, precision, completeness, representativeness, and comparability.

2.3.1 Accuracy

Accuracy is a measure of the closeness of a reported concentration to the true value. Accuracy is expressed as a bias (high or low) and is determined by calculating percent recovery (%R) from matrix spike/matrix spike duplicates (MS/MSDs), laboratory control samples (LCSs), and surrogate spikes. The MS/MSD and surrogate spike %Rs indicate accuracy relevant to a unique sample matrix. The LCS %Rs indicate accuracy relevant to an analytical batch lot, and is strictly a measure of analytical accuracy conditions independent of samples and matrices. The %R of an analyte, and the resulting degree of accuracy expected for the analysis of QC-spiked samples, are dependent upon the sample matrix, method of analysis, and the compound or element being measured. The concentration of the analyte relative to the detection limit of the method is also a major factor in determining the accuracy of the measurement.

Accuracy is expressed as %R and is calculated as follows:

$$\%R = [(A-B)/C] \times 100$$

where: A = spiked sample concentration;
 B = measured sample concentration (without spike); and
 C = concentration of spike added.

For this sampling, acceptable %R will be the %R required in each respective analytical method.

2.3.2 Precision

Precision is the measure of variability among individual sample measurements under prescribed conditions. The results of LCSs demonstrate the precision of the methods. When the LCS

results meet the specified accuracy criteria, results are believed to be precise. This is based on the LCS being within control limits in comparison to LCS results from previous analytical batches of similar methods and matrices. The relative percent difference (RPD) of field duplicate, laboratory sample duplicate, and MS/MS results demonstrate the precision of the sample matrix. Precision will be expressed in terms of RPD between the values resulting from duplicate analysis. The RPD is calculated as follows:

$$RPD = [(x1-x2)/X][100]$$

where: x1 = analyte concentration in the primary sample;
 x2 = analyte concentration in the secondary sample; and
 X = average analyte concentration of the primary and duplicate samples.

Acceptable levels of precision will vary according to the analytical method, the sample matrix, and the analytical concentration relative to the MDL. Acceptable RPDs will be those specified in the respective methods.

2.3.3 Completeness

Completeness is defined as the percentage of laboratory measurements judged to be valid on a method-by-method basis. Valid data are defined as all data and/or qualified data considered when meeting the DQOs for this project. Data completeness is expressed as percent complete (PC) and should be 90%. The goal for meeting analytical holding times is 100%. At the end of the sampling event, the completeness of the data will be assessed. The laboratory results will be reviewed as they become available to assess laboratory performance and its effect on data completeness requirements. When appropriate, additional samples will be collected to ensure that laboratory performance meets PC requirements.

PC is calculated as follows:

$$PC = NA/N1 \times 100$$

where: NA = actual number of valid analytical results obtained; and
 N1 = theoretical number of results obtainable under ideal conditions.

2.3.4 Representativeness

Representativeness expresses the extent to which collected data define actual site contamination. Where appropriate, sample results will be statistically characterized to determine the degree to which the data accurately and precisely represent a characteristic of a population, parameter variation at a sampling point, a process, or an environmental condition. Sample collection, handling, and analytical procedures will strive to obtain the most representative sample possible. Representative samples will be achieved by collection of samples from locations fully representing site conditions. Factors that affect representativeness include:

- Use of appropriate sampling procedures, including equipment, equipment decontamination, and sampling holding temperatures;

- Use of appropriate analytical methods for the required parameters and project reporting limits; and
- Analysis of samples within the required holding times.

The portion of each collected sample that is chosen for analysis also affects sample representativeness. The laboratory will adequately and appropriately homogenize all samples prior to taking aliquots for analysis to ensure that the reported results are representative of the sample received.

2.3.5 Comparability

Comparability expresses the confidence with which data from one sample, sampling round, site, laboratory, or project can be compared to those from another. Comparability during sampling is dependent upon sampling program design and time periods. Comparability during analysis is dependent upon analytical methods, detection limits, laboratories, units of measure, and sample preparation procedures. Comparability is determined on a qualitative rather than quantitative basis. For this project, comparability of all data collected will be ensured by adherence to standard sample collection procedures, standard field measurement procedures, and standard reporting methods, including consistent units.

In addition, to support the comparability of fixed-base laboratory analytical results with those obtained in any future testing; all samples will be analyzed by EPA-Approved methods. The EPA-recommended maximum permissible holding times for organic or inorganic parameters will not be exceeded. All analytical standards will be traceable to standard reference materials. Instrument calibrations will be performed in accordance with EPA method specifications, and will be checked at the frequency specified for the methods. The results of these analyses can then be compared with analyses performed by other laboratories.

2.3.6 Detection Limits

Groundwater will be analyzed for volatile petroleum hydrocarbons (VPH). All samples will be sent to Energy Laboratories in Helena, Montana for analysis. Analytical methods are discussed under sampling design. Detection limits will be at or below the RBSL, Human health Standards, or PRG for each respective analyte, unless exceptions are discussed with DEQ or the sample matrix requires dilution that would raise the detection limit of the sample, in which case the laboratory report shall contain a qualifier and an explanation for the increased detection limit.

3.0 SAMPLING DESIGN

2.1 Groundwater Sampling

DEQ personnel will sample four monitoring wells; GMW-3, GMW-4, MW-12, and MW-13 (2 one-inch diameter wells and 2 two-inch diameter wells) for water quality parameters (pH, temperature, dissolved oxygen, oxidation reduction potential, specific conductance, and turbidity) and volatile petroleum hydrocarbons (VPH).

3.1.1 Laboratory Analysis

Prior to sampling groundwater, depth measurements will be collected, and if present, free product thickness measurement will be collected to 0.01 ft. Groundwater field parameters will be measured for pH, dissolved oxygen, specific conductance, temperature, oxidation reduction potential, and turbidity. Each well will be purged using low flow sampling methods (either peristaltic or bladder pump) until field parameters stabilize prior to sampling.

Groundwater samples shall be collected from the four monitoring wells and submitted to an analytical laboratory for VPH analysis using the Montana Modified Massachusetts Method. (See Table 3, below, for water analyses, containers, etc.) One duplicate groundwater sample shall be collected from one monitoring well for analysis of VPH. One equipment rinsate blank and one trip blank will be obtained. Depth to water measurements, free product thickness measurements, field parameter measurements, and groundwater samples will be collected. Up to six (6) groundwater samples shall be submitted for laboratory analysis of VPH.

Table 2. Water Container/Analysis/Preservative/Holding Time Information

Analysis	Matrix	Container Type	Preservative	Holding Time
VPH 2016 Montana Method as modified by the Montana DEQ	Groundwater	2-40 ml glass/Teflon VOA vials, no bubbles	5-10 drops HCl, pH < 2 Chill to 4°C	14 days to analysis

3.1.2 Groundwater Sampling Equipment Checklist

- Low-flow pumps (peristaltic and bladder), water quality meter flow-through cell, and associated equipment
- 4 disposable plastic bailers and string (as back-up)
- 150 feet of disposable plastic tubing
- 20 pairs of nitrile sampling gloves
- Solinst Interface Meter
- 20- 40 ml glass VOA vials
- Sample preservative
- 1 Environmental Field Book
- 4 indelible ink pens, includes 3 extra
- Calculator
- Plastic trash bags
- Graduated plastic bucket
- Deionized water
- Non-phosphate detergent
- Scrub brushes
- Paper towels
- Digital camera
- Coolers filled with ice

3.2 Chain of Custody Control and Sampling Records, Decontamination Procedures, Sample Documentation and Shipment, and Disposal of Residual Material

3.2.1 Chain of Custody

Chain-of-custody must demonstrate that samples have not been tampered with during collection, transfer, storage, or analysis. This requires custody of the samples to be documented from the time the samples are collected. A sample is under custody if it is in the person's possession; or it is in the person's view, after being in the person's possession; or it was in the person's possession and then it was locked up or placed in a sealed container to prevent tampering; or it is in a designated secure area.

3.2.2 Decontamination Procedures

Samples must be collected using equipment that has been properly decontaminated and procedures appropriate to site-specific factors including the matrix, the parameters to be analyzed, and the sampling objective. The general decontamination sequence for field equipment includes: wash with Liquinox or an equivalent degreasing detergent; deionized water rinse; 10% dilute methanol rinse; rinse with de-ionized water three times.

3.2.3 Sample Documentation and Shipment

Soil and water samples must be placed on ice immediately after collection to minimize the loss of volatiles. Once the sampling is complete and the sampler has left the site, chain-of-custody must be maintained and properly documented. Preferably, groundwater samples should be transported directly to the laboratory by the sampler or representative. When shipping is required, the samples must be placed in a container acceptable to both the laboratory and the carrier. Dry ice should not be used when shipping water samples to prevent the samples from freezing and breaking the glass containers.

3.2.4 Sampling Material Disposal

Disposable sampling equipment must be disposed of as a solid waste.

The definition of "purge water" is the water removed from a monitoring well before a groundwater sample is collected. Groundwater is usually purged from the monitoring wells before collecting the sample to ensure that the groundwater sample represents water from the aquifer rather than static groundwater within the monitoring well. Purge water is generally allowed to infiltrate to the groundwater by discharging it on the ground next to the well. The purge water must return to the same groundwater where the purge water originated. The discharge of purge water must comply with the requirements of the Montana Water Quality Act (75-5-101 et seq MCA) and the rules that have been adopted to implement the act. If purge water must be containerized, stored, transported, and disposed of, it must be done in accordance with federal and state regulations. Purge water may not be discharged to the ground if it may cause contamination of soil, groundwater, or surface water.

3.3 Field Quality Assurance/Quality Control Samples

As a check on field sampling, QA/QC samples will be collected during each sampling event. Definitions for field QA/QC samples are presented below.

3.3.1 Field Duplicates

A field duplicate is defined as two or more samples collected independently at the same sampling location during a single act of sampling. Field duplicates will be indistinguishable from other samples by the laboratory. Each of the field duplicates will be uniquely identified with a coded identifier, which will be in the same format as other sample identifiers. Duplicate sample results are used to assess the precision of the sample collection process. Five percent (one for every 20 samples) of all field samples will be field duplicates.

3.3.2 Calibration Procedures and Frequency for Field Test Equipment

Instruments and equipment used to gather, generate, or measure environmental data in the field will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Field instruments shall include a groundwater quality flow-through cell. Directions and spare parts for each meter will be available in the field.

3.3.3 Review of Field Records

All field records are evaluated for the following:

Completeness of field records. The check of field record completeness will ensure that all requirements for field activities have been fulfilled, complete records exist for each field activity, and that the procedures specified in the SAP (or approved as field change requests) were implemented. Field documentation will ensure sample integrity and provide sufficient technical information to recreate each field event. The results of the completeness check will be documented, and environmental data affected by incomplete records will be identified in the technical report.

Identification of valid samples. The identification of valid samples involves interpretation and evaluation of the field records to detect problems affecting the representativeness of environmental samples. For example, field records can indicate whether monitoring points were properly constructed or if unanticipated environmental conditions were encountered during soil boring advancement. Records also should note sample properties such as clarity, color, odor, etc. Photographs may show the presence or absence of obvious sources of potential contamination, such as operating combustion engines near a point during sampling. Judgments of sample validity will be documented in the technical report, and environmental data associated with poor or incorrect fieldwork will be identified.

Identification of anomalous field test data. Anomalous field data will be identified and explained to the extent possible. For example, a soil boring with a lithology significantly different than any other point on the property will be explained in the technical report.

Accuracy and precision of field data and measurements. The assessment of the quality of field measurements will be based on instrument calibration records and a review of any field corrective actions.

3.3.4 Field Data Validation and Reporting

All screening data will be reviewed prior to reporting. The project officer will determine if the DQOs for field data have been met. At a minimum, the review of screening data will focus on the following topics:

- Holding times
- Method blanks
- Comparison of field duplicates
- Field instrumentation detection limits
- Analytical batch control records including calibrations and spike recoveries
- Flag all results with an “S” to denote sample results from field screening versus fixed laboratory results

Field data will be validated using four different procedures, as described below:

- Routine checks (e.g., looking for errors in identification codes) will be made during the processing of data.
- Internal consistency of a data set will be evaluated. This step will involve plotting the data and testing for outliers.
- Checks for consistency of the data set over time will be performed. This can be accomplished by comparing data sets against gross upper limits obtained from historical data sets, or by testing for historical consistency. Anomalous data will be identified.
- Checks may be made for consistency with parallel data sets. An example of such a check would be comparing data from the same volume of soil.

If a QC audit results in detection of unacceptable conditions or data, the project manager and the DEQ Quality Assurance Officer will be responsible for developing and initiating corrective action. If the unacceptable conditions indicate a program difficulty or if corrective action is likely to require expertise not immediately available to the project team, the PTC project manager will be notified. Corrective action may include:

- Reanalyzing the samples, if holding time criteria permit.
- Re-sampling and analysis of the samples.
- Evaluating and amending sampling and analytical procedures.
- Acceptance of data, with an acknowledgment of the level of uncertainty surrounding the analytical results.

The selected corrective action will depend on how critical the samples are and the range of the reported values. If reported data is not adequate to determine whether contamination is present or not, the samples will be reanalyzed or retaken (MDEQ, 2011).

3.3.5 Data Management

Field and analytical data will be stored by up to two entities; DEQ, and Energy Laboratories through their Energysource database. Analytical data from the laboratory will be delivered

electronically to DEQ and stored on the web available database, Energysource which is maintained by Energy Laboratories, Inc. The DEQ project manager will have access to Energysource.

3.4 Quality Assurance Quality Control – Laboratory Data

This section describes the type, number, and collection points of the quality control samples that will be collected for this SAP.

3.4.1 Trip and Rinsate Blanks

One trip blank will be submitted for this groundwater sampling event. Trip blanks are typically analyzed to assess VOC cross-contamination. The laboratory will provide the trip blank, which will remain in the cooler with the sampling containers from the laboratory to the field, and will remain with the samples until their receipt at the laboratory. One rinsate blank will be obtained via collection of deionized water used for equipment rinsing.

3.4.2 Field Duplicate Samples

One duplicate groundwater sample will be collected during the groundwater sampling event. Duplicate samples will be assigned their own separate coded sampling location number so that the integrity of the samples is insured. Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix.

3.4.3 Review of Field Records

The DEQ project manager will review the field records prior to preparing the draft abbreviated groundwater sampling report to ensure that all procedures and changes to protocol have been documented in the Methods section.

3.4.4 Field Data Validation and Reporting

Any exceedances to the control limits shall be documented in the Results section of the abbreviated groundwater sampling report. All statistical analyses based on laboratory analytical data will be reviewed by the DEQ project manager who will decide whether data exceedances are true and should be included in the report. The DEQ project manager will review the findings and will either agree or disagree with any conclusions based on statistical analyses.

3.5 Document Control

This section will identify the documents necessary by field staff and project managers to execute the groundwater sampling event in a thorough manner. DEQ will review the field forms at the end of each work day and DEQ will review laboratory QA/QC documentation to ensure data quality.

3.5.1 Field Logs

DEQ will utilize standard operating procedures to track all field activities for sampling, decontaminating, and calibration of field equipment.

3.5.2 Laboratory Deliverables

Energy Laboratories, Inc. will be utilized to conduct groundwater sample analyses. DEQ will be provided with Chain-of-Custody forms as described in section 3.2.1. Laboratory will provide the DEQ with analytical data in electronic .pdf format and electronic data deliverable through their EnergySource website.

3.5.3 Deliverables

DEQ will prepare one paper copy and one electronic copy (PDF format) of the final abbreviated groundwater sampling report. DEQ will maintain a Petroleum Brownfields file in hardcopy and electronically using the data management system. This information will be maintained indefinitely for public record at 1225 Cedar Street, Helena, Montana.

Chain of Custody forms will be provided by the Laboratory and filled out by DEQ personnel. One copy of the Chain of Custody form will be signed and retained by each person handling the samples on the way to the laboratory.

Laboratory deliverables will include electronic documentation of all analyses performed including QA/QC reports and chromatographs. Analytical SOPs are kept on file at Energy Labs, Inc. in the Helena office and are available upon request. Laboratory deliverables include an electronic copy of the Analytical Report such as .pdf format as well as data storage on Energysource at www.energylab.com which can be downloaded in Microsoft Excel format.

Individuals identified in the distribution list (page iii) will be provided with either hard copies or electronic copies of the final QAPP prior to the start of the project through the mail or electronic mail.

4.0 HEALTH AND SAFETY

4.1 Field Health and Safety Procedures

DEQ sampling personnel will follow a site-specific health and safety plan (HASP), dated May 3, 2017 and prepared by Pioneer prior to field activities. Field safety procedures, including safety equipment and clothing, hazard identification, and the location and route to the nearest hospital, will be included in the HASP. A first aid kit, cellular phone, and appropriate personal protective equipment will be taken to the field.

4.2 Personnel Specialized Training

All DEQ personnel visiting the site during the investigation will be required to have had a 40 Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and a current 8 Hour HAZWOPER refresher course within one year of the full course completion. The training will have been provided and documented by each person's employer, with certifications maintained in employee's file. Managers are responsible for ensuring trainings are appropriate and current.

5.0 REFERENCES

DEQ, Circular DEQ-7; Montana Numeric Water Quality Standards, May 2017

DEQ, Montana Tier 1 Risk Based Corrective Action Guidance for Petroleum Releases, September 2016

DEQ, Petroleum Brownfields Eligibility Determination Form and Supporting Documentation, form prepared by Bear Paw Development, Havre and submitted to DEQ November 2016.

DEQ, Montana Quality Assurance Program Plan for Environmental Data Operations For the Montana Department of Environmental Quality's Brownfields Program – Revision No. 0.0, April 2015.

APPENDIX A

Site Map



- LEGEND**
- + NEW MONITORING WELL
 - + EXISTING MONITORING WELL
 - o SOIL BORING

Path: P:\DEQ\Harlem\GIS\Project\Hmng_GIS\CPM-007-18.mxd

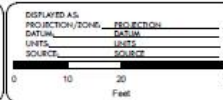
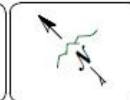
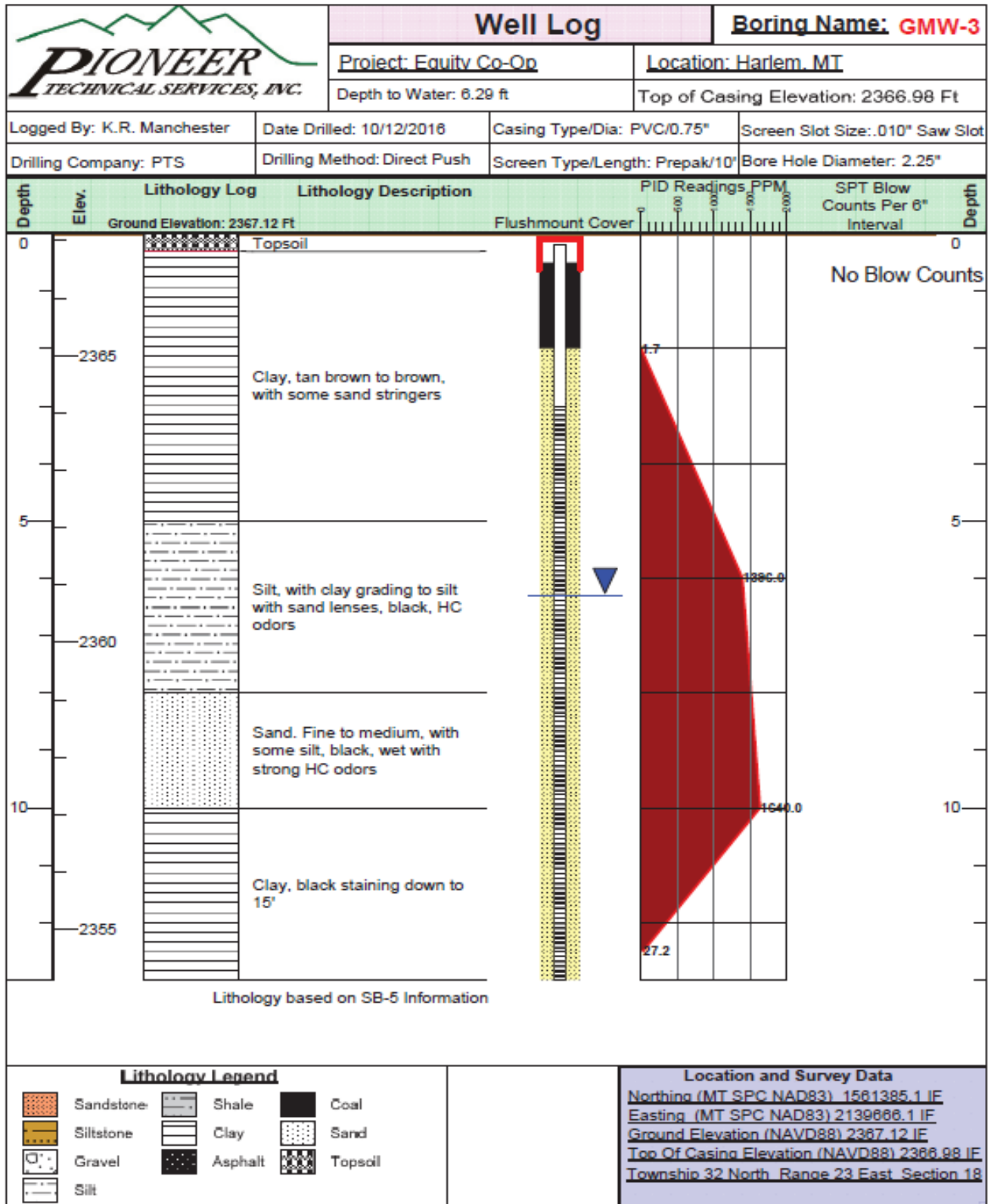


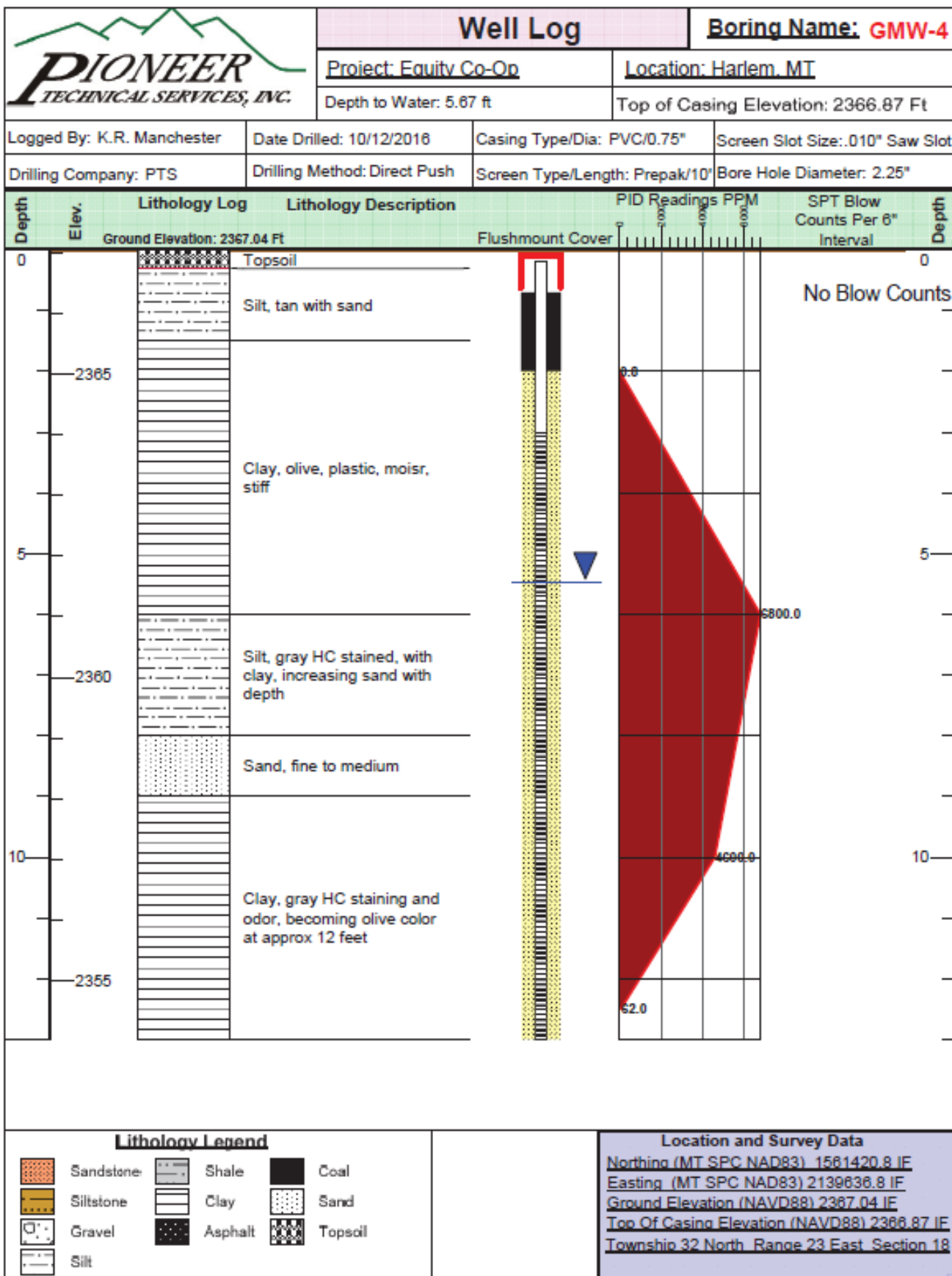
FIGURE 3-2

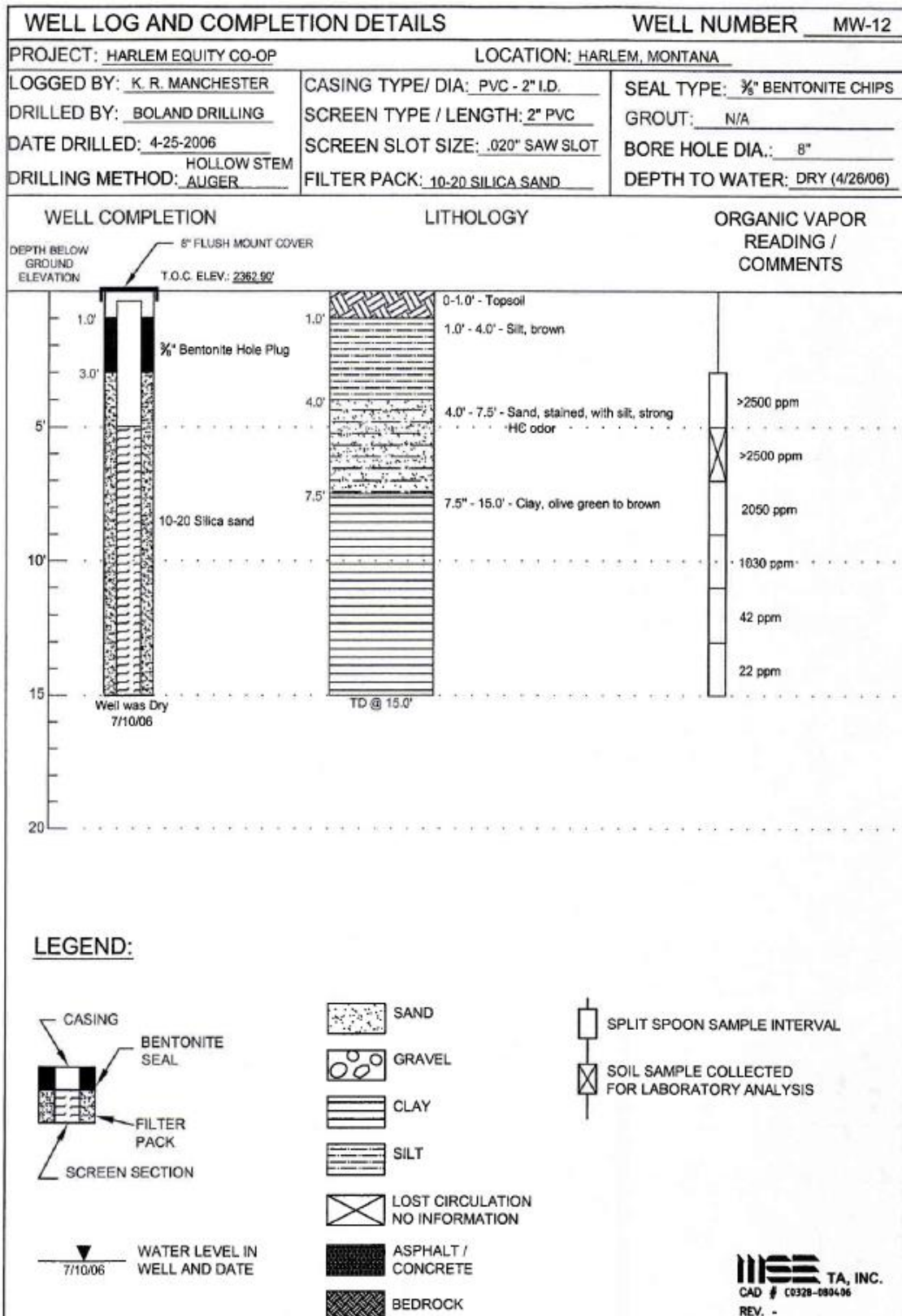
NEW MONITORING WELL
LOCATION MAP
HARLEM, MT

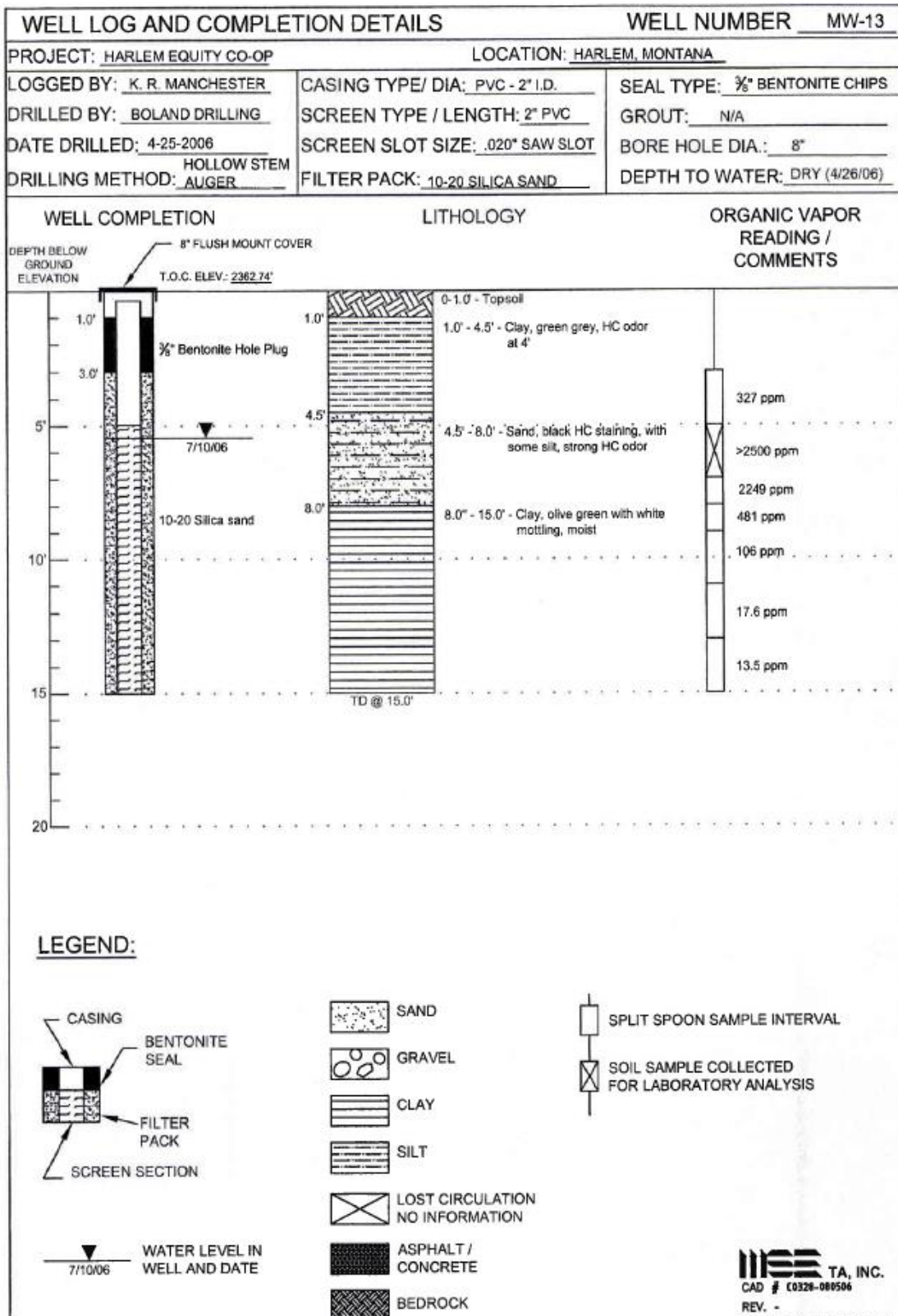
DATE: 12/22/2016

APPENDIX B Well Logs









APPENDIX C Sampling Sheets

Monitoring Well Sampling Data Sheet

Site Name and Address :										
Facility ID #			Release ID #				Well ID #			
Date			Time				Sampler			
Screened Interval			Measuring Point				Analysis:		Preservative:	
<u>Site Characterization</u>										
Aboveground Well Box			Flushmounted Well Box				Measureable Product		FP- Thickness	
Product Sheen Y/N			Petroleum Odor Y/N				Silty		Clear	
<u>Weather Conditions:</u>			Wind Direction & Speed				Overcast/Clear		Temp	
			Precipitation				Surface Conditions (wet/dry/snow cover)			
Total Depth of Well:							One Well Volume of Water (gallons/lineal foot in well)			
Depth to Water (initial):			DTW(final)				2" Well: .17xheight of water column			
Height of Water Column:							4" Well: .66 x height of water column			
Well Casing Diameter:							0.75" well .023 x height of water column			
One Well Volume:							Purge Rate			
Total Purge Volume:							Pump depth (intake)			
<u>Purge Method:</u>			Disposable Bailer Whale Pump				Peristaltic Pump Submersible Pump		Bladder Pump	
<u>Sample Collection Method</u>			Disposable Bailer Whale Pump				Peristaltic Pump Submersible Pump		Bladder Pump	
Time	Purge Volume (gal)	Temp (C)	SC (mS)	DO (ppm)	pH	Salin	DO%	ORP	Turbidity (Ntu)	
<u>Comments</u>										
Field Instrument(s):										
Date Calibrated:										
<u>Decontamination</u>										
Liquinox			Methanol				DI Water			

Monitoring Well Sampling Data Sheet

Site Name and Address :

Facility ID #

Release ID #

Well ID #

Date

Time

Sampler

Screened Interval

Measuring Point

Analysis:

Preservative:

Site Characterization

Aboveground Well Box

Flushmounted Well Box

Measureable Product

FP- Thickness

Product Sheen

Y/N

Petroleum Odor

Y/N

Silty

Clear

Weather Conditions:

Wind Direction & Speed

Overcast/Clear

Temp

Precipitation

Surface Conditions (wet/dry/snow cover)

Total Depth of Well:

Depth to Water (initial):

DTW(final)

Height of Water Column:

Well Casing Diameter:

One Well Volume:

Total Purge Volume:

One Well Volume of Water (gallons/lineal foot in well)

2" Well: .17xheight of water column

4" Well: .66 x height of water column

0.75" well .023 x height of water column

Purge Rate

Pump depth (intake)

Purge Method:

Disposable Bailer

Whale Pump

Peristaltic Pump

Submersible Pump

Bladder Pump

Sample Collection Method

Disposable Bailer

Whale Pump

Peristaltic Pump

Submersible Pump

Bladder Pump

Time

Purge Volume (gal)

Temp (C)

SC (mS)

DO (ppm)

pH

Salin

DO%

ORP

Turbidity (Ntu)

Comments

Field Instrument(s):

Date Calibrated:

Decontamination

Liquinox

Methanol

DI Water

Monitoring Well Sampling Data Sheet

Site Name and Address :

Facility ID #

Release ID #

Well ID #

Date

Time

Sampler

Screened Interval

Measuring Point

Analysis:

Preservative:

Site Characterization

Aboveground Well Box

Flushmounted Well Box

Measureable Product

FP- Thickness

Product Sheen

Y/N

Petroleum Odor

Y/N

Silty

Clear

Weather Conditions:

Wind Direction & Speed

Overcast/Clear

Temp

Precipitation

Surface Conditions (wet/dry/snow cover)

Total Depth of Well:

One Well Volume of Water (gallons/lineal foot in well)

Depth to Water (initial):

DTW(final)

2" Well: .17xheight of water column

Height of Water Column:

4" Well: .66 x height of water column

Well Casing Diameter:

0.75" well .023 x height of water column

One Well Volume:

Purge Rate

Total Purge Volume:

Pump depth (intake)

Purge Method:

Disposable Bailer
Whale Pump

Peristaltic Pump
Submersible Pump

Bladder Pump

Sample Collection Method

Disposable Bailer
Whale Pump

Peristaltic Pump
Submersible Pump

Bladder Pump

Time

Purge Volume (gal)

Temp (C)

SC (mS)

DO (ppm)

pH

Salin

DO%

ORP

Turbidity (Ntu)

Comments

Field Instrument(s):

Date Calibrated:

Decontamination

Liquinox

Methanol

DI Water

Monitoring Well Sampling Data Sheet

Site Name and Address :

Facility ID #

Release ID #

Well ID #

Date

Time

Sampler

Screened Interval

Measuring Point

Analysis:

Preservative:

Site Characterization

Aboveground Well Box

Flushmounted Well Box

Measureable Product

FP- Thickness

Product Sheen

Y/N

Petroleum Odor

Y/N

Silty

Clear

Weather Conditions:

Wind Direction & Speed

Overcast/Clear

Temp

Precipitation

Surface Conditions (wet/dry/snow cover)

Total Depth of Well:

One Well Volume of Water (gallons/lineal foot in well)

Depth to Water (initial):

DTW(final)

2" Well: .17xheight of water column

Height of Water Column:

4" Well: .66 x height of water column

Well Casing Diameter:

0.75" well.023 x height of water column

One Well Volume:

Purge Rate

Total Purge Volume:

Pump depth (intake)

Purge Method:

Disposable Bailer
Whale Pump

Peristaltic Pump
Submersible Pump

Bladder Pump

Sample Collection Method

Disposable Bailer
Whale Pump

Peristaltic Pump
Submersible Pump

Bladder Pump

Time

Purge Volume (gal)

Temp (C)

SC (mS)

DO (ppm)

pH

Salin

DO%

ORP

Turbidity (Ntu)

Comments

Field Instrument(s):

Date Calibrated:

Decontamination

Liquinox

Methanol

DI Water

**SAMPLING, ANALYSIS, AND QUALITY ASSURANCE
PROJECT PLAN**

**Sampling of Backfill for the
Petroleum Refining Company CECRA Facility
Shelby Montana**

- FINAL -

Prepared by:

Mr. Jason Seyler

Montana Department of Environmental Quality
Remediation Division/Site Response Section
P.O. Box 200901
Helena, MT 59620-0901

January 2015

APPROVAL SIGNATURE PAGE

Approvals:

_____ Jason Seyler MDEQ Project Manager Brownfields Coordinator MT Department of Environmental Quality Remediation Division Helena, MT	_____ Date	_____ Aimee Reynolds Project QA Manager MT Department of Environmental Quality Remediation Division Helena, MT	_____ Date
		_____ Wendy Thomi EPA Delegated QA Document Reviewer U.S. EPA Region 8 Helena, MT	_____ Date

TABLE OF CONTENTS

APPROVAL SIGNATURE PAGE	ii
LIST OF TABLES	v
LIST OF FIGURES.....	v
LIST OF APPENDICES	v
LIST OF EXHIBITS	vi
1.0 PROBLEM DEFINITION AND BACKGROUND.....	1-1
1.1 CONSTITUENTS OF INTEREST	1-1
1.2 KEY PROJECT INDIVIDUALS.....	1-1
1.3 PROJECT SCHEDULE.....	1-2
1.4 DISTRIBUTION LIST.....	1-2
2.0 PROJECT DATA QUALITY OBJECTIVES	2-1
2.1 DATA USES.....	2-1
2.2 EXPECTED DATA QUALITY	2-1
2.3 DATA QUALITY INDICATORS.....	2-2
2.3.1 Precision.....	2-2
2.3.2 Accuracy	2-2
2.3.3 Completeness	2-3
2.3.4 Comparability.....	2-4
2.3.5 Representativeness	2-4
2.4 DATA MANAGEMENT.....	2-5
2.5 ASSESSMENT OVERSIGHT	2-5
2.5.1 Laboratory Quality Control Samples	2-5
2.5.2 Field Quality Control Samples.....	2-6
2.5.2.1 Field Duplicates	2-6
2.5.2.2 Equipment Rinsate Blanks.....	2-6
2.5.3 Field Data Quality Assurance/Quality Control Procedures	2-6
2.5.4 Data Validation and Reporting	2-6
3.0 SAMPLING LOCATIONS.....	3-1

3.1 SELECTION OF SAMPLING LOCATIONS	3-1
3.2 SAMPLING LOCATION DESIGNATIONS	3-1
4.0 METHODS AND PROCEDURES.....	4-2
4.1 FIELD HEALTH AND SAFETY PROCEDURES.....	4-2
4.2 FIELD EQUIPMENT	4-2
4.2.1 Typical Sampling Equipment.....	4-2
4.2.2 Equipment Calibration and Maintenance.....	4-2
4.3 FIELD SAMPLING PROCEDURES	4-2
4.3.1 Soil Sampling.....	4-2
4.3.2 Field Notes and Sample Log Forms.....	4-3
4.3.3 Site Photographs	4-4
4.3.4 GPS Coordinates.....	4-4
4.3.5 Field Quality Control Samples.....	4-4
4.4 DECONTAMINATION PROCEDURES	4-4
4.5 SAMPLE DOCUMENTATION AND SHIPMENT	4-5
4.5.1 Sample Labeling, Packaging, and Shipping.....	4-5
4.5.2 Chain-of-Custody.....	4-5
4.6 LABORATORY ANALYSIS.....	4-6
4.7 DATA EVALUATION.....	4-6
4.7.1 Data Verification and Validation	4-6
5.0 CORRECTIVE ACTION	5-1
5.1 FIELD CORRECTIVE ACTION	5-1
5.2 LABORATORY CORRECTIVE ACTION	5-1
5.3 DATA VALIDATION/VERIFICATION CORRECTIVE ACTION	5-1
6.0 DOCUMENTATION AND RECORDS	6-1
6.1 FIELD DATA MANAGEMENT	6-1
6.2 FINAL REPORT.....	6-1
7.0 REFERENCES	7-1

LIST OF TABLES

TABLE 1.	DATA QUALITY OBJECTIVES PLANNING – MONTANA BACKFILL SOIL INVESTIGATION
TABLE 2.	ANALYTICAL METHODS AND DETECTION LIMITS FOR BACKFILL SOIL SAMPLES

LIST OF FIGURES

FIGURE 1.	APPROXIMATE AREA OF BACKFILL AND SAMPLE LOCATIONS
FIGURE 2.	APPROXIMATE AREA OF BACKFILL AND SAMPLE LOCATIONS
FIGURE 3.	APPROXIMATE AREA OF BACKFILL AND SAMPLE LOCATIONS

LIST OF APPENDICES

APPENDIX A	EPA REGION 8 QA DOCUMENT REVIEW CROSSWALK
APPENDIX B	MDEQ DATA VALIDATION GUIDELINES, AUGUST 2010
APPENDIX C	FIELD LOG SHEET AND PHOTO LOG FORM
APPENDIX D	PROJECT HEALTH AND SAFETY PLAN (<i>SUBMITTED AS A SEPARATE DOCUMENT</i>)

SAMPLING, ANALYSIS, AND QUALITY ASSURANCE PROJECT PLAN

Sampling of Backfill for the Petroleum Refining Company CECRA Facility Shelby Montana

1.0 PROBLEM DEFINITION AND BACKGROUND

On December X, the City of Shelby imported approximately 6,446 NT (i.e. 3,270 CY) of sub-ballast from the Bay Materials LLC's Normont Farms licensed gravel pit. This material was used to surficially cover the area of the former petroleum excavation in-lieu of revegetating the area. More information related to the previous excavation and cleanup activities can be found in the August 13, 2014 Construction Completion Report (CCR). The intention of the City is to use this area for parking or storage as the Institutional Control (IC) on the property excludes any buildings or habitable structures.

Given that the source of the backfill has no identified sources of contamination or adjacent sites listed in DEQ's Digital Atlas (See Figure 1 & 2), all samples will be analyzed for only the eight Resource Conservation Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury) per DEQ's FAQs. One 5-point composite sample (within a 25x25 ft. area) will be collected for every 400 CY of material that was brought on to the facility. Therefore, eight samples (and one QA/QC duplicate sample) will be collected from 0-6 in of the newly placed gravel.

1.1 CONSTITUENTS OF INTEREST

The constituents of interest for this investigation are the eight Resource Conservation Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury). These constituents will be analyzed on the fine fraction (60-mesh sieved) portion of the samples collected.

1.2 KEY PROJECT INDIVIDUALS

Key project individuals for the Backfill Soil Investigation and their responsibilities are listed below:

Jason Seyler (Montana Department of Environmental Quality) – Mr. Seyler will be the MDEQ project manager for this investigation, with responsibilities including the development of the draft and final SAP/QAPP, coordinating implementation of the SAP/QAPP (including scheduling and managing field crews), data management of data

generated from field to final use, oversight of data validation, and preparation of the draft and final project report.

Aimee Reynolds (Montana Department of Environmental Quality) – Ms. Reynolds will serve as MDEQ's Project QA Manager for this investigation, with responsibilities including review and approval of all QA/QC aspects of this SAP/QAPP.

1.3 PROJECT SCHEDULE

In accordance with the project contract/task order between Hydrometrics and MDEQ, the schedule for field work, data review, and preparation of final deliverables will conform to the following:

1. Implementation of the SAP/QAPP will be initiated within 14 days of approval of the final revised SAP/QAPP by MDEQ.
2. All field work will be completed within 1 week of the field work start date.
3. Data validation will be completed within 15 days of receipt of the final analytical data package from the laboratory.
4. A Final Report will be completed within 15 days of finalizing the data validation.

1.4 DISTRIBUTION LIST

DEQ will provide a copy of the most current approved SAP/QAPP and the Sampling Analysis Results Report for this investigation via email (electronic copy) and/or regular mail (compact disc or hard copy report) to the following individuals:

- Jason Seyler (MDEQ);
- Aimee Reynolds (MDEQ); and
- Wendy Thomi (EPA Region 8).

2.0 PROJECT DATA QUALITY OBJECTIVES

This SAP/QAPP for the collection, analysis, and interpretation of data as part of the Backfill Sampling Plan for the Petroleum Refining Company CECRA Facility has been developed in general accordance with EPA's Data Quality Objectives (DQO) process (EPA, 2006), a series of steps intended to facilitate systematic planning for resource-effective acquisition of environmental data. The steps in the DQO process include:

1. State the Problem;
2. Identify the Goal of the Study;
3. Identify Information Inputs;
4. Define the Boundaries of the Study;
5. Develop the Analytic Approach;
6. Specify Performance of Acceptance Criteria; and
7. Develop the Plan for Obtaining Data.

The results of the DQO process for this investigation, consisting of brief descriptions of the outcomes of each of these steps are presented in Table 1. The activities and procedures described in this SAP/QAPP are based on the project objectives and structure outlined in Table 1.

2.1 DATA USES

The information from these samples will determine if the backfill material brought onto the Facility to surficially cover the excavation area exceeds DEQ's screening levels for the RCRA eight metals. Given that the source of the backfill has no identified sources of contamination or adjacent sites listed in DEQ's Digital Atlas (See Figure 1 & 2), all samples will be analyzed for only the eight Resource Conservation Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury) per DEQ's FAQs. One 5-point composite sample (within a 25x25 ft. area) will be collected for every 400 CY of material that was brought on to the facility. A total of eight samples (and one QA/QC duplicate sample) will be collected from 0-6 in of the newly placed gravel.

2.2 EXPECTED DATA QUALITY

Quality Assurance/Quality Control (QA/QC) practices and analytical methods for this project have been designed to produce data of sufficient quality to support the intended data uses (Section 2.1). Quality of data will be assured by adherence to the methods and procedures outlined in this SAP/QAPP, including full documentation of all field activities; specification and use of appropriate analytical methods; collection, analysis, and review of appropriate field quality control samples; review of laboratory reports; verification and validation of analytical data; and adequate design of the sampling plan. Each of these data quality elements is discussed in subsequent sections of this document.

2.3 DATA QUALITY INDICATORS

Data assessment criteria will be used to aid in the evaluation of overall data quality for data generated during the Backfill Soil Investigation. These data quality indicators (DQIs) and are expressed in terms of precision, accuracy, representativeness, completeness, and comparability, which are described in detail below.

2.3.1 Precision

Precision is defined as a measure of variability or reproducibility of replicate measurements, and is inversely related to the variability among the results obtained (e.g., highly variable results have low precision). Precision is assessed by field and laboratory duplicate result comparisons (including matrix spike and laboratory control sample or LCS duplicates). Field duplicates measure combined field and laboratory precision, whereas laboratory duplicates measure only laboratory precision.

Field and laboratory precision will be expressed in terms of RPD between the values resulting from duplicate analysis. RPD is calculated as follows:

$$RPD = [(x1 - x2)/X][100]$$

where: x1 = analyte concentration in the primary sample
 x2 = analyte concentration in the duplicate sample
 X = average analyte concentration in the primary and
 duplicate sample.

The precision objective for soil sample duplicates will be agreement of duplicate sample results to within an RPD of $\leq 35\%$ when both sample concentrations (original and duplicate) are greater than five times the reporting limit, and plus or minus two times the reporting limit when either of the sample concentrations is less than five times the reporting limit.

2.3.2 Accuracy

Accuracy is a measure of the closeness of a reported concentration to a true (i.e., known to a certain degree of confidence) value. For this project, accuracy will be assessed by calculating percent recovery (%R) for LCSs, matrix spikes, and matrix spike duplicates. Matrix spike %Rs indicate accuracy relevant to a unique sample matrix, while LCS %Rs indicate accuracy relevant to an analytical batch lot, and are strictly a measure of analytical accuracy conditions independent of samples and matrices. The %R of an analyte, and the resulting degree of accuracy expected for the analysis of QC spiked samples, are dependent upon the sample matrix, method of analysis, and the compound or element being measured. The concentration of the analyte relative to the detection limit of the method also is a major factor affecting the accuracy of the measurement.

Accuracy is expressed as %R, calculated as follows for matrix spike (and matrix spike duplicate) samples:

$$\%R \text{ for matrix spike samples} = [(A-B)/C] \times 100$$

where: A = spiked sample concentration
 B = measured sample concentration (without spike)
 C = concentration of spike added

The accuracy objective for matrix spike samples is recovery within the range of 75% to 125%, for samples where the spike value is at least four times the concentration in the original sample.

For LCSs, %R is calculated as follows:

$$\%R \text{ for LCSs} = [(SR/KV)] \times 100$$

where: SR = reported sample result for LCS
 KV = known value of LCS

The accuracy objective for LCSs is recovery within the range of 80% to 100%, or within the 95% confidence limit of the known value. If method-specific control limits for spike recovery or LCS recovery for particular laboratory techniques differ from these, comparisons will be made with the method-specific control limits.

2.3.3 Completeness

Completeness is defined as the number of samples or valid measurements obtained, compared with the total number planned, expressed as a percentage ("percent complete" or PC). PC is calculated as follows:

$$PC = NA/NI \times 100$$

where: NA = actual number of samples/valid measurements obtained
 NI = intended or planned number of samples/valid measurements

For this project, two separate measures of completeness will be calculated, as follows:

1. Sampling Completeness – Eight separate backfill soil samples are planned for collection under this SAP/QAPP (excluding one QC samples). Sampling completeness will therefore be calculated as the actual number of samples collected (including both routine and QC samples) as a percentage of the planned number of samples included in this SAP/QAPP.
2. Data Completeness – Each sample will be analyzed for total concentrations of 8 metal analytes (see Section 1.3). Data completeness will be calculated as the actual number

of valid (not rejected) individual measurements (parameter concentration values) obtained as a percentage of the planned number of total measurements. Results qualified during the data validation process (see Section 4.7.1) are counted as valid measurements, unless the value is qualified with an “R” as rejected.

The completeness goal for this project is 100 percent for sampling completeness, and 95 percent for data completeness. Sampling completeness will be assessed following field sampling activities, and data completeness will be assessed following data validation. If necessary, additional samples will be collected to ensure that project completeness requirements are met.

2.3.4 Comparability

Comparability expresses the confidence with which data from one sample, sampling round, site, laboratory, or project can be compared to those from another. Comparability during sampling is dependent upon sampling program design and time periods. Comparability during analysis is dependent upon analytical methods, detection limits, laboratories, units of measure, and sample preparation procedures.

Comparability is determined on a qualitative rather than quantitative basis. For this project, comparability of all data collected will be ensured by adherence to standard sample collection procedures, standard field measurement procedures, standard reporting methods, including consistent units, and the use of the same analytical laboratory. In addition, all samples will be analyzed using EPA-approved methods. All analytical standards will be traceable to standard reference materials. Instrument calibrations will be performed in accordance with EPA method specifications, and will be checked at the frequency specified for the methods. The results of these analyses can then be compared with analyses by other laboratories and/or with analyses for other sites.

2.3.5 Representativeness

Representativeness expresses the extent to which collected data define actual environmental conditions (the true “state of nature”). Similar to comparability, representativeness is determined on a qualitative rather than a quantitative basis. For this investigation, sample collection, handling, and analytical procedures for the Backfill Soil Investigation have been designed to maximize the representativeness of both sample collection and analytical results, within the fiscal, logistical, and practical constraints typically encountered during environmental investigations. Collection of representative samples of backfill will be achieved by:

- Establishment of appropriate general sampling locations (Section 3.0);
- Collection of eight five-point composite samples (within a 25x25 ft. area) plus one additional QA/QC duplicate sample using standardized, consistent, and fully-documented procedures (Section 4.0); and
- Providing flexibility in designating specific sampling locations, to allow field crew and project manager to adjust sampling locations if necessary.

Generation of representative analytical data will be achieved by:

- Use of consistent sample preparation (i.e., homogenization and digestion), analytical, and reporting procedures by the selected analytical laboratory; and
- Analysis of specified laboratory QC samples to ensure analytical processes are in control.

Calculation of representative samples for constituents of interest will be achieved by:

- Validation of data to ensure data quality is sufficient for the intended use;

2.4 DATA MANAGEMENT

In order to provide complete documentation of the Backfill Soil Investigation, detailed field records will be collected by field personnel, as described in Section 4.0. All field notes, sample logs, and site photographs will become part of the permanent data record, and will be included with the final investigation report. All hard copy original field documents will be scanned to Adobe Portable Document Format (.pdf) to facilitate electronic storage and transfer. Documentation of sample custody (completed chain-of-custody forms) and sample transfer from sampling personnel to the laboratory, including cover letters and parameter lists with project-required analytical methods and reporting limits, will also be included as part of the field records package for this project. Details regarding field sample documentation and handling, including sample identification and labeling, field forms, logs, and notebooks, and sample custody and shipment are in Section 4.0.

Laboratory analytical reports and electronic data deliverables (EDDs) will be archived by the DEQ's project manager in electronic and/or hard copy formats. Summary data tables, data validation results and reports, draft and final project reports, and other files generated as part of the sampling will also be archived by the project manager. Additional information regarding data management is in Section 6.0.

2.5 ASSESSMENT OVERSIGHT

As a check on the quality of field sampling activities, field quality control samples will be collected as part of the Backfill Soil Investigation (i.e. field duplicate samples). Other field QA/QC procedures include use of analyte-appropriate sample collection equipment and sample containers, chain-of-custody procedures for sample handling and tracking, and daily review of field documentation to ensure complete and accurate field records are collected. Laboratory quality control samples will also be analyzed to provide information regarding analytical data quality.

2.5.1 Laboratory Quality Control Samples

Laboratory QC sample types and frequencies (including blanks, duplicates, matrix spikes and matrix spike duplicates, and laboratory control standards) will be consistent with the quality assurance plan and standard operating procedures of the selected analytical laboratory

(Energy Laboratories in Helena, Montana). Current quality systems documentation for Energy Laboratories is available online at <http://www.energylab.com/QualityControl.asp>. The results of laboratory QC sample analysis will be reviewed during the data validation process (Section 2.5.3).

2.5.2 Field Quality Control Samples

Field quality control (QC) samples will be collected during the Backfill Soil Investigation to provide information on the precision and accuracy of the data obtained.

2.5.2.1 Field Duplicates

For the purposes of this investigation, field duplicates will be collected at a frequency of 10% (1 field duplicate for every 10 natural samples collected). Locations for collection of duplicate samples will be selected randomly by the field crew. Duplicates will be collected as splits of the regular backfill soil sample. At the duplicate sample location, a double volume of raw sample will be collected, mixed and homogenized to obtain one large raw composite, and two separate sample containers will be filled from the single large composite sample. Duplicate sample containers will be assigned unique sample identification numbers, as described in Section 4.5.1. Duplicate sample results will be used to assess the precision of the sampling and compositing process, as well as the precision of laboratory analysis.

2.5.2.2 Equipment Rinsate Blanks

Equipment rinsate blank samples will not be collected as disposable trowels will be used for the collection of the soil samples and these samples will be homogenized in a zip-lock bag instead of a stainless-steel mixing bowl.

2.5.3 Field Data Quality Assurance/Quality Control Procedures

Field records will be checked for completeness at the end of each day of sampling by the members of the field sampling team. The check of field record completeness will ensure that all requirements for field activities have been fulfilled, complete records exist for each field activity, and that the procedures specified in the SAP/QAPP were implemented. Field documentation will ensure sample integrity and provide sufficient technical information to recreate each field event.

Identification of Valid Samples: The identification of valid samples involves interpretation and evaluation of the field records to identify problems affecting the representativeness of environmental samples. Judgments of sample validity will be documented in the validation report, any environmental data associated with poor or incorrect fieldwork will be identified, and the potential impacts on data utility (if any) will be noted in the data validation report.

2.5.4 Data Validation and Reporting

Validation or data quality review is a systematic process for determining the compliance of the analytical data with the applicable method requirements and project specifications. Data will be assessed in general accordance with EPA's data verification and validation guidance

procedures (EPA, 2002). In addition, MDEQ's Data Validation Guidelines in Appendix B (MDEQ, 2010) will be completed as part of the validation process and a data validation report will be produced as an attachment or appendix to the final project report. Data validation will include an evaluation of the project data quality indicators specified above in Section 2.3, and will also include an overall assessment to determine if the data are the correct type, quantity and quality to support the stated project Data Quality Objectives. Additional details on the data review and validation process are outlined below in Section 4.7.

3.0 SAMPLING LOCATIONS

The objective of this investigation is to collect representative surface backfill soil samples from across the backfilled location. As previously stated, a total of eight samples (and one QA/QC duplicate sample) will be collected from 0-6 in of the newly placed gravel.

3.1 SELECTION OF SAMPLING LOCATIONS

Upon arrival at the site, the area of backfill will be divided into roughly eight equal areas. The field crew will have flexibility in determining exact sample locations during the field sampling effort. A visual inspection will ensure that only the most recent gravel backfill is sampled and not previously installed material. Coordinates (latitude and longitude) will be recorded using hand-held GPS equipment for all final sampling locations, and locations will be fully described and documented photographically as described in Section 4.0.

3.2 SAMPLING LOCATION DESIGNATIONS

The eight approximate locations selected for backfill sampling are shown on Figure 3. As noted above, these locations are approximate only, and field crews will determine and obtain GPS coordinates for exact sampling locations, using the criteria outlined in Section 3.1.

Unique site identification codes have been created for each sampling location using the following convention:

Site ID = BSI-##

where:	BSI	=	Backfill Soil Investigation
	##	=	01 – 09 (09 being the duplicate sample)

4.0 METHODS AND PROCEDURES

This section describes the procedures to be used to implement the Backfill Soil Investigation, from field sampling and documentation, through laboratory analysis, and data validation. Sample documentation forms to be used during field sampling are in Appendix C.

4.1 FIELD HEALTH AND SAFETY PROCEDURES

Soil sampling activities will be conducted by a DEQ field crew consisting of 1 to 2 people. Field safety procedures, including safety equipment and clothing, and hazard identification are included in the project Health and Safety Plan (HASP), submitted separately from this SAP/QAPP as Appendix D. A first aid kit and appropriate personal protective equipment (PPE) will be taken to the field.

4.2 FIELD EQUIPMENT

4.2.1 Typical Sampling Equipment

Field sampling crews will take the following equipment (at a minimum) to the field:

- Gallon-size ziplock plastic bags;
- Tape measure;
- Shovel;
- Disposable sampling trowel or scoop;
- Nitrile gloves;
- Project field notebook;
- Field log sheets;
- Indelible ink pens;
- Plastic trash bags;
- Digital camera;
- GPS instrument; and
- Sample coolers.

4.2.2 Equipment Calibration and Maintenance

This investigation will not use field equipment requiring calibration. Normal maintenance for hand tools, cameras, or GPS units will be performed as necessary by the field team.

4.3 FIELD SAMPLING PROCEDURES

4.3.1 Soil Sampling

General sampling locations have been determined as discussed in Section 3.0. Exact sampling locations will be determined by the field crew, and properly documented as described below. In some instances, sampling locations may need to be modified based on

access constraints or other considerations. In no case will soil samples be collected outside of the newly placed backfill.

For this project, surface soil samples will be collected as five-point composite samples from the 0-6 inch depth interval. Five surface soil grab samples will be collected and combined to provide a single soil sample from each location. The soil sampling procedure will consist of the following steps:

1. Establish a center grab sample point and mark the location (e.g., with a pin flag).
2. Establish four peripheral grab sample locations approximately 20 feet north, 20 feet south, 20 feet east and 20 feet west of the center point, and mark these locations.
3. Remove surface debris (sticks, stones), sod, or other vegetation from each grab sample location.
4. Collect a 0-6 inch grab sample from each grab sample locations using a disposable trowel, or similar implement and placing the sample in a 1-gallon zip-lock bag. Remove and discard loose vegetation and large rocks by hand during sample collection. Collect approximately equal volumes of backfill from each grab sample location, to give a minimum total final composite volume of approximately 0.6 – 1.0 gallons (2 – 4 kg).
5. Thoroughly homogenize the composite sample in the zip-lock bag after all five grab samples have been collected.
6. Place the thoroughly homogenized sample in a new gallon-size ziplock bag, until the bag is at least half to three-quarters full. The bag should be pre-labeled with sample information including the unique sample identification number (see Section 4.5.1) and the date and time of sample collection.
7. Discard any extra composite sample into the backfill sample pits. Since this investigation targets backfill material, generation of hazardous or contaminated soils is not anticipated, and any extra backfill will be returned to the sample pit(s) following sample collection.
8. Place the labeled ziplock bag in a second ziplock bag and store soil sample in a cooler with ice to achieve an approximate sample temperature of $4 \pm 2^{\circ}\text{C}$.
9. Complete sample collection forms, field notebooks, photographing the sample location, and recording GPS coordinates of the center point (Sections 4.3.2, 4.3.3, 4.3.4).
10. Backfill grab sample locations.

4.3.2 Field Notes and Sample Log Forms

All field-sampling activities will be recorded in bound, sequentially-paginated field log books and on pre-printed field log sheets (Appendix C). All sample collection entries will include, at a minimum, the following information:

- Project name;
- Date and time;
- Sampling and other personnel present;
- Sample location;

- Sample ID number;
- Sample depth interval;
- Soil descriptions;
- GPS coordinates and datum of center point (in decimal degrees);
- General field observations (e.g. land use);
- Weather observations;
- A sketch of the general area;
- Any deviations from the SAP/QAPP; and
- Other relevant project-specific site or sample information.

Entries will be made in permanent ink, with corrections crossed out with a single line, dated and initialed. Field books will be signed at the bottom of each page by personnel making entries on that page. Completed field forms will also be signed by sampling personnel.

4.3.3 Site Photographs

Each field sampling location will be documented with a minimum of one photograph. Additional photographs may be taken at the field team's discretion or if a location-specific issue warrants documentation. Field personnel taking the photographs will record the following information on the field form for the location where the photograph was taken:

- Time, date, and location;
- Location and direction in which photo was taken; and
- A description of the subject photographed.

Site photographs will be summarized and presented on photo log forms (Appendix C) for reporting purposes.

4.3.4 GPS Coordinates

Field teams will record the GPS coordinates (latitude and longitude in decimal degrees) of the sample location on the sample form for each location. GPS coordinates will be recorded at the center grab sample point (see Section 4.3.1).

4.3.5 Field Quality Control Samples

The duplicates field quality control sample will be collected as described in Section 2.5.1. All field QC sample collection locations and procedures will be fully documented in the field notebook and on field sampling forms.

4.4 DECONTAMINATION PROCEDURES

Decontamination procedures will not be necessary as only disposable field equipment will be used to collect the Backfill Soil Investigation samples.

4.5 SAMPLE DOCUMENTATION AND SHIPMENT

All samples collected and delivered to the laboratory for analysis will follow standard documentation, packing, and chain-of-custody procedures, as described in the following sections.

4.5.1 Sample Labeling, Packaging, and Shipping

Each sample will be labeled with a unique sample identification number, according to the following nomenclature:

BSI-##

where: BSI = Backfill Soil Investigation

= sampling location designation, as described in Section 3.2

Field QC samples will be designated with similar sample ID numbers, except that the ## identifier will be 09 (for the field duplicate samples)

Samples will be stored in iced coolers or refrigerated following collection to maintain a sample temperature of approximately $4 \pm 2^{\circ}\text{C}$. Samples will be shipped overnight or hand-delivered to Energy Laboratories in Helena, Montana for analysis, and will be delivered to the laboratory as soon as possible after acquisition.

All sample shipments (either hand-delivered or shipped overnight) will be accompanied by the following documentation:

- Chain-of-custody form(s);
- Cover letter to the laboratory describing the accompanying samples; and
- Analytical parameter list with methods and required reporting limits (Table 2).

4.5.2 Chain-of-Custody

During and after sampling until the time of sample shipment or delivery, samples will be in the custody of sampling personnel. Sample custody (responsibility for the integrity of samples and prevention of tampering) will be the responsibility of the field crew until

samples are delivered to the laboratory. “Custody” refers to the samples being in the immediate care of the field personnel, either in physical possession, immediate view, locked up, or held in a secure area restricted to authorized personnel.

Chain-of-custody procedures will be followed to establish a written record of sample handling and movement between the sampling site and the laboratory. All sample deliveries will be accompanied by a chain-of-custody record, to be signed by both the person delivering the samples and the receiving laboratory. Sampling personnel will retain one copy of the chain-of-custody after signing samples over to the laboratory, and the remaining copies will be transferred to the laboratory.

Upon arrival at the laboratory, sample custody shifts to laboratory personnel, who are responsible for tracking individual samples through login, analysis, and reporting. At the time of sample login, the laboratory will assign a unique laboratory sample number, which can be cross-referenced to the field sample number and used to track analytical results.

4.6 LABORATORY ANALYSIS

Upon arrival at the laboratory, soil samples will be processed for analysis. Samples will be thoroughly homogenized, dried, and disaggregated. A representative aliquot of the bulk sample will be sieved through a 60-mesh (250 µm) sieve, with the portion passing through the sieve to be retained for analysis of the fine fraction.

Laboratory analysis will consist of determination of total metals concentrations, using appropriate digestion procedures as outlined in Table 2. Standard laboratory turnaround time (about 2 to 3 weeks) will be requested. Required project reporting limits and analytical methods for individual constituents are also presented in Table 2. Lower-level reporting limits have been requested for many trace constituents, in order to minimize (to the extent possible) the reporting of data as “below detect.” Trace constituent concentrations are expected to be generally low for many parameters, since this investigation focuses on samples from a backfill location.

4.7 DATA EVALUATION

Data evaluation for the Backfill Soil Investigation will consist of data verification and validation to assess data quality.

4.7.1 Data Verification and Validation

Overall completeness and adherence to project procedures will be assessed through validation and verification. Verification includes confirmation of adherence to sample design, collection, handling, custody, shipping, transmittal, and documentation procedures. Validation includes the confirmation of adherence to specific analytical procedure criteria and protocols, and the assessment of data quality in terms of usability.

The number and type of samples collected will be compared with project specifications to ensure conformance with the sampling process design. Review of sample collection and handling procedures will include verification of the following:

- Completeness of submittal packages;
- Completeness of field documentation, including chain-of-custody documentation;
- Field equipment calibration and maintenance and/or quality of field measurements; and
- Adherence to proper sample collection procedures.

The laboratory will provide the DEQ with electronic data deliverables (EDDs). Upon receipt of EDDs, laboratory data reports will be reviewed for completeness and administrative errors. Following this procedure, data validation will be conducted by the project manager in accordance with the principles of the USEPA national functional guidelines for inorganic data review (EPA, 2004), and with MDEQ's data validation guidelines (MDEQ, 2010). All data received from the laboratory as part of this investigation will be validated. The results of this validation will be summarized in an appendix to the final project report.

Data validation will include a detailed review of all analytical results, including:

- Reporting limits (RLs) vs. project-required reporting limits;
- Holding times;
- Analytical methods;
- Field QC sample results; and
- Laboratory QC sample results.

Potential data qualifiers to be used during the validation and their definitions are listed below:

- U – Compound was analyzed for but not detected. The associated numerical value is the sample reporting or quantitation limit.
- J – Estimated data due to exceeded quality control criteria.
- B – Analyte detected in the associated blank and in the sample.
- R – Data is rejected due to exceeded quality control criteria or professional judgment.

Qualifiers will be added to the data as required, and any data quality issues will be discussed in the validation report. The final investigation report will also include a discussion of any uncertainty or biases associated with the data, as indicated by field or lab QC sample results or other results of the validation. Validation results will be evaluated in terms of any potential effects on the intended data use, and the usability of all qualified data will be evaluated based upon how much uncertainty it introduces into the analysis.

Validated data will be incorporated into a data summary table.

5.0 CORRECTIVE ACTION

Corrective action is the process of acting on non-conforming procedures that are unacceptable based on the procedures set forth in this SAP/QAPP. Corrective actions can be implemented for field activities, laboratory analyses, data validation and data assessment. The data validation report (an attachment to the final project report) will document non-conforming conditions identified (e.g., when overall objectives for precision, accuracy, completeness, representativeness, or comparability are not satisfied), or when procedural practices or conditions differ from those described in this SAP/QAPP. All corrective actions proposed and implemented will also be documented and will include measures to preclude a repetition of the original deficiency. The project manager will be notified immediately of all non-conformances with this SAP/QAPP that affect data quality before initiation of corrective actions both in the field and in the laboratory. Corrective action will only be implemented after approval by the MDEQ project manager.

5.1 FIELD CORRECTIVE ACTION

Field conditions may vary from those anticipated in project planning documents; therefore, it may become necessary to implement minor modification to sampling procedures presented in this SAP/QAPP. If such modifications are deemed necessary, the project manager will be notified and verbal approval obtained prior to implementing the changes (if feasible), or as soon as possible thereafter. Any field modifications or corrective actions will be documented in the field logbook, and in the data validation and final project reports.

5.2 LABORATORY CORRECTIVE ACTION

The laboratory is required to comply with the most recent version of their Quality Assurance Manual (February 2014), including all applicable Standard Operating Procedures (SOPs). The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this SAP/QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data. The Laboratory Project Manager or QA/QC Manager will be notified if any quality control sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. A narrative describing the anomaly, the steps taken to identify and correct the anomaly and the treatment of the relevant sample batch (i.e., recalculation, reanalysis) will be submitted with the data package in the form of a cover letter.

5.3 DATA VALIDATION/VERIFICATION CORRECTIVE ACTION

Corrective action may be needed based on either the data validation or data assessment (statistical evaluation). Potential types of corrective action may include re-sampling or re-analysis of samples by the laboratory. DEQ will be responsible for approving any corrective action, including re-sampling or re-analysis. All corrective actions of this type will be documented.

6.0 DOCUMENTATION AND RECORDS

This SAP/QAPP, all field sampling and photo log forms, all laboratory data, and the final report for this study (including data validation results) will be stored in the DEQ Remediation Building Library located at 1225 Cedar St. in Helena, MT. All of this information will also be stored electronically on DEQ's server and backed up in disc form, which will also be stored in the DEQ Remediation Building Files. These documents will be archived in hard copy and electronic copy for an indefinite amount of time.

6.1 FIELD DATA MANAGEMENT

All data generated from field activities such as field notebooks and sampling forms, and digital photographs will remain in the possession of field sampling crew during the field sampling event. Upon return from the field, field sampling crews will duplicate and scan all hard copies of their records as soon as possible, to prevent the possibility of lost or misplaced information. Laboratory transmittal documents (chains-of-custody, cover letters, and analytical parameter lists) will also be duplicated and scanned after samples are delivered to the laboratory. Electronic and hard copies of these records will be stored in the project manager's files and network system, and as part of the final project report.

6.2 FINAL REPORT

Following the field sampling event, data validation, a draft final report will be prepared summarizing the results of the Backfill Soil Investigation. As specified in the project task order, the final report will include the following sections of text, as appropriate:

- A. Background
- B. Sampling Procedures
- C. Identification of SAP/QAPP deviations, including:
 - a. Changes in sample frequency in a given area
 - b. All opportunity samples; and
 - c. Any other changes.
- D. Field Observations
- E. Analytical Results and Analysis
 - a. Data Quality Objectives
 - b. Description of QA/QC issues, including:
 - i. Sample holding times, temperatures, and preservatives;
 - ii. Results of field and laboratory blanks and duplicates;
 - iii. Data validation results; and
 - iv. Impact of any QA/QC issues on the data and rationale.
 - c. Summary of Sample Results
- F. References
- G. Tables, Figures, and Appendices
 - a. GPS data for each sample location
 - b. Copy of the field log book or field data sheets
 - c. Tables depicting laboratory results as necessary

- d. Map or diagram showing all sample locations
- e. Photos of all sample locations
- f. Data validation reports
- g. Copies of the analytical data

Following DEQ review, a final report will be prepared incorporating all DEQ comments.

7.0 REFERENCES

- EPA, 2015. Regional Screening Levels for Chemical Contaminants. Obtained online at <http://www.epa.gov/region9/superfund/prg/>. Updated January 2015.
- EPA, 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process – EPA QA/G-4. EPA/240/B-06/001. Office of Environmental Information. February 2006.
- EPA, 2004. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review -- Final. EPA-540/R-04-004, October 2004.
- EPA, 2002. Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8). EPA/240/R-02/004, Office of Environmental Information, November 2002.
- MDEQ, 2010. Montana Department of Environmental Quality Data Validation Guidelines for Evaluating Analytical Data. Obtained online at <http://www.deq.mt.gov/StateSuperfund/PDFs/DataValidationReport.pdf>. Accessed January 27, 2015.
- MDEQ, 2015. Montana Department of Environmental Quality Frequently Asked State Superfund Questions. Obtained online at <http://deq.mt.gov/StateSuperfund/FrequentlyAskedQuestions.mcp>. Accessed January 27, 2015.

**TABLE 1. DATA QUALITY OBJECTIVES PLANNING –BACKFILL SOIL INVESTIGATION
PETROLEUM REFINING COMPANY – SHELBY, MT**

Step 1 State the Problem	Step 2 Identify the Goal of the Study	Step 3 Identify Information Inputs	Step 4 Define the Boundaries of the Study	Step 5 Develop the Analytic Approach	Step 6 Specify Performance or Acceptance Criteria	Step 7 Develop the Plan for Obtaining Data
It is unknown if the backfill gravel material used as a surficial cover exceeds DEQ screening levels. Therefore, backfill samples are required for the MDEQ to accurately identify if any contaminants of potential concern exist within this backfill source. This investigation targets backfill surface soil.	The data will be used to allow MDEQ to determine if the backfill surficial cover exceeds DEQ screening levels.	The information that is required to arrive at a decision includes: Analytical data from set of backfill surface soil samples collected from the facility.	This study is designed to acquire the analytical data from just the backfill recently placed at the facility. For the purposes of this investigation, backfill surface soils have been defined as the 0 to 6 inch depth interval (exclusive of surface vegetation, vegetative litter, debris, and any soils that appear native).	All analytical results will be verified and validated using MDEQ-specified procedures. Analytical results will be compared to current default RSLs and routine analytical reporting limits.	Sampling, measurement, and decision errors will be minimized as follows: - Use of standard surface soil sampling procedures and thorough documentation of all field activities; - Collection and analysis of field quality control samples; - Specification of consistent laboratory analytical methods and analysis of laboratory quality control samples; - Validation and verification of analytical data to estimate data precision, accuracy, representativeness, completeness, and comparability.	Eight 5-point composite soil samples (with one QA/QC duplicate sample) will be collected from across the area where gravel was recently placed. If samples exceed DEQ screening levels additional actions may be necessary. However, if no screening levels are exceeded, DEQ can issue a letter of “No Further Action.”

**TABLE 2. ANALYTICAL METHODS AND DETECTION
LIMITS FOR BACKFILL SOIL SAMPLES**

Total Metals Analysis						
Parameter⁽¹⁾	Digestion Method⁽²⁾	Analytical Method⁽²⁾	Required Reporting Limit (mg/kg)	EPA Regional Screening Level (RSL)⁽³⁾ (mg/kg)	Maximum Holding Time (days)	Preservation
Arsenic (As)	3050B	6010/6020	0.1	22.5	180	Cool to 4± 2°C
Barium (Ba)	3050B	6010/6020	1	1500	180	Cool to 4± 2°C
Cadmium (Cd)	3050B	6010/6020	0.1	7	180	Cool to 4± 2°C
Chromium (III)	3050B	6010/6020	0.1	12000	180	Cool to 4± 2°C
Lead (Pb)	3050B	6010/6020	0.1	153	180	Cool to 4± 2°C
Mercury (Hg) ⁽⁴⁾	7471A	7471A	0.05	0.94	28	Cool to 4± 2°C
Selenium (Se)	3050B	6010/6020	0.2	39	180	Cool to 4± 2°C
Silver (Ag)	3050B	6010/6020	0.1	39	180	Cool to 4± 2°C

(1) All parameters except mercury (Hg) will be analyzed on fine fraction samples (portion of sample passing 60-mesh sieve). Sieving shall be conducted by the analytical laboratory. Due to the volatility of mercury and potential losses during sieving, mercury will be analyzed on bulk samples only.

(2) Laboratory analytical methods are from EPA's Test Methods for Analysis of Solid Waste (SW-846) (EPA, 2007) or Methods for Chemical Analysis of Water and Wastes (EPA, 1983). Equivalent procedures may be used as long as required reporting limits are achieved.

(3) EPA RSL for residential soil obtained from www.epa.gov/region9/superfund/prg (updated January 2015). Note that, per Montana DEQ policy, RSLs for non-carcinogens have been adjusted downward by a factor of 10 from those published in the EPA table.

(4) Mercury will be analyzed on bulk samples only (see footnote (1)).

FIGURE 1: SOURCE OF BACKFILL

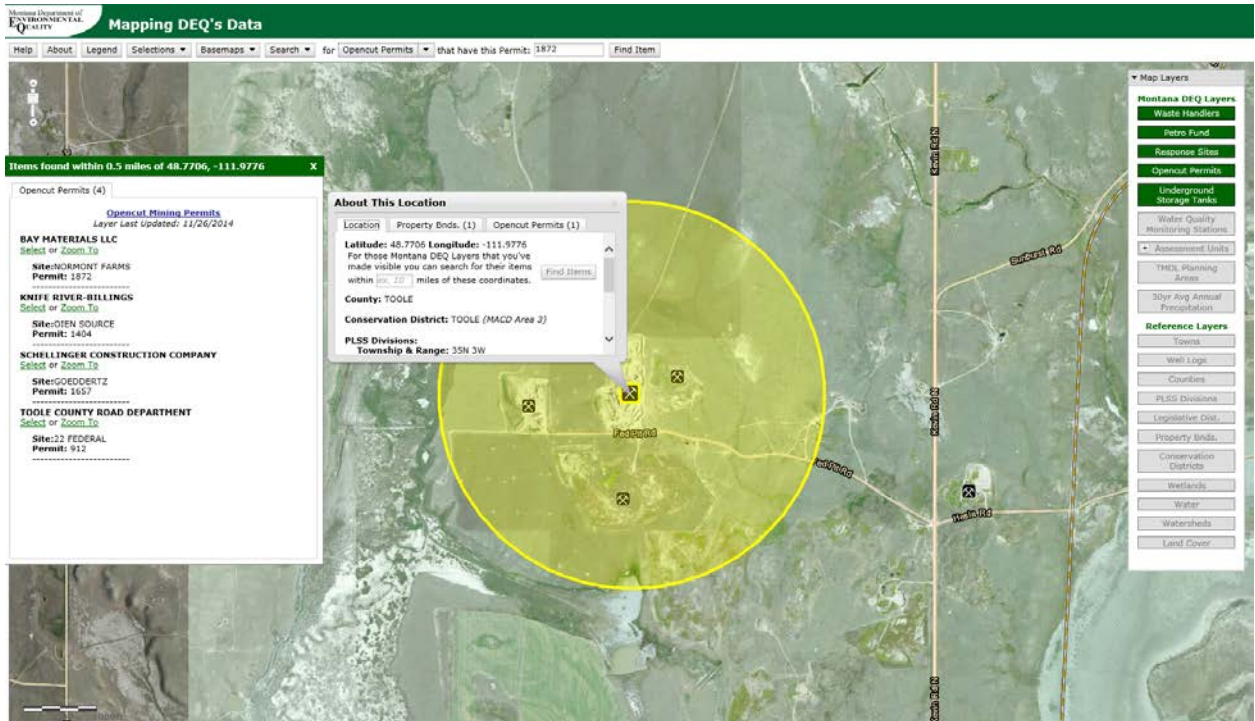


FIGURE 2: SOURCE OF BACKFILL (Showing I-15)

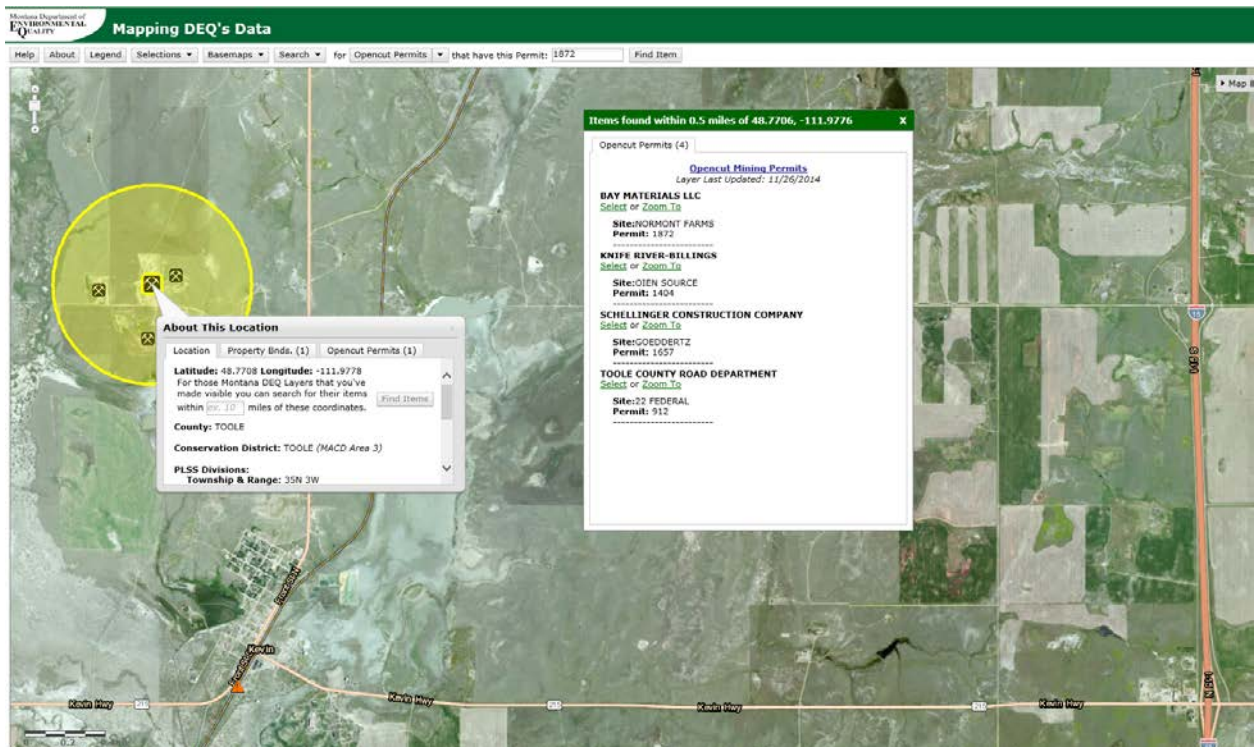


FIGURE 3: APPROXIMATE AREA OF BACKFILL AND SAMPLE LOCATIONS



Area in Red illustrate approximate location of Backfilled Area.

Orange boxes illustrate approximate locations of the eight locations to be sampled.

APPENDIX A

EPA REGION 8 DOCUMENT REVIEW CROSSWALK

Sampling of Backfill for the Petroleum Refining Company CECRA Facility - Shelby Montana

EPA REGION 8 QA DOCUMENT REVIEW CROSSWALK

QAPP/FSP/SAP for: <i>(check appropriate box)</i>	Entity <i>DEQ Brownfields Section</i>	Regulatory Authority	☐ 40 CFR 31 for Grants ☐ 48 CFR Part 46 for Contracts ☐ Interagency Agreement ☐ EPA Administrative Order ☐ EPA Program Funding ☐ EPA Program Regulation ☐ EPA CIO 2105
☐ GRANTEE			
☐ CONTRACTOR			
☐ EPA			
☐ Other			
Document Title <i>[Note: Title will be repeated in Header]</i>	Sampling of Backfill for the Petroleum Refining Company CECRA Facility in Shelby Montana		
QAPP/FSP/SAP Preparer	DEQ – Jason Seyler		
Period of Performance <i>(of QAPP/FSP/SAP)</i>		Date Submitted for Review	
EPA Project Officer	Wendy Thomi	PO Phone #	
EPA Project Manager		PM Phone #	
QA Program Reviewer		Date of Review	

Information to be reviewed <i>(see R8 Instructions for Project-Level QA Document Review):</i> 1. QAPP/FSP/SAP 2. Work Plan(WP)/Statement of Work (SOW), Task Order, Proposal for Research 3. QARF for Task Order 4. If reviewing Sampling & Analyses Plan (SAP) or Field Sampling Plan (FSP), is governing QAPP provided?	Describe Information here: 1. QA Document date _____ 2. WP/SOW/TO date _____ WP/SOW/TO Performance Period _____ 3. QARF signed by R8 QAM <u>Yes/No/NA</u> Funding Mechanism <u>IAG/contract/grant/NA</u> Amount _____ 4. QAPP provided for SAP/FSP? <u>Yes/No/NA</u>
Is QAPP/FSP/SAP consistent with the WP/SOW/TO (current/next year)? (Yes/No)	
Implementation of QAPP/FSP/SAP assigned to:	
Oversight of QAPP/FSP/SAP assigned to:	
Summary of Comments:	
Note: In addition to addressing concerns in the Summary of Comments, the QAPP Preparer must also respond to the issues identified in the Comment section(s) that includes a “Response (date)” and Resolved (date)”.	

Click here and type Title

Element	Acceptable Yes/No/NA	Page/ Section	Comments
A. Project Management			
A1. Title and Approval Sheet			
a. Contains project title		Cover	
b. Date and revision number line (for when needed)		Cover	
c. Indicates organization's name		Cover	
d. Date and signature line for organization's project manager		p. ii	
e. Date and signature line for organization's QA manager		p. ii	
f. Other date and signatures lines, as needed		p. ii	
A2. Table of Contents			
a. Lists QA Project Plan information sections		p. iii-v	
b. Document control information indicated		NA	
A3. Distribution List			
Includes all individuals who are to receive a copy of the QA Project Plan and identifies their organization		Sec. 1.4	
A4. Project/Task Organization			
a. Identifies key individuals involved in all major aspects of the project, including contractors		Sec. 1.2	
b. Discusses their responsibilities		Sec. 1.2	
c. Project QA Manager position indicates independence from unit generating data		Sec. 1.2	
d. Identifies individual responsible for maintaining the official, approved QA Project Plan		Sec. 1.2	
e. Organizational chart shows lines of authority and reporting responsibilities		NA	
A5. Problem Definition/Background			
a. States decision(s) to be made, actions to be taken, or outcomes expected from the information to be obtained		Sec. 2.1	
b. Clearly explains the reason (site background or historical context) for initiating this project		Sec. 1.0	
c. Identifies regulatory information, applicable criteria, action limits, etc. necessary to the project		Sec. 2.1 Table 2	

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Element	Acceptable Yes/No/NA	Page/ Section	Comments
A6. Project/Task Description			
a. Summarizes work to be performed, for example, measurements to be made, data files to be obtained, etc., that support the project's goals		Sec. 1.0 Sec. 2.0 Table 1	
b. Provides work schedule indicating critical project points, e.g., start and completion dates for activities such as sampling, analysis, data or file reviews, and assessments		Sec. 1.3	
c. Details geographical locations to be studied, including maps where possible		Figure 3	
d. Discusses resource and time constraints, if applicable		NA	
A7. Quality Objectives and Criteria			
a. Identifies - performance/measurement criteria for all information to be collected and acceptance criteria for information obtained from previous studies, - including project action limits and laboratory detection limits and - range of anticipated concentrations of each parameter of interest		Sec. 4.6 Table 1 Table 2	
b. Discusses precision		Sec. 2.3.1	
c. Addresses bias		Sec. 2.3.2	
d. Discusses representativeness		Sec. 2.3.5	
e. Identifies the need for completeness		Sec. 2.3.3	
f. Describes the need for comparability		Sec. 2.3.4	
g. Discusses desired method sensitivity		Sec. 2.3.4, Sec. 4.6 Table 2	
A8. Special Training/Certifications			
a. Identifies any project personnel specialized training or certifications		NA	
b. Discusses how this training will be provided		NA	
c. Indicates personnel responsible for assuring training/certifications are satisfied		NA	

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Element	Acceptable Yes/No/NA	Page/ Section	Comments
d. identifies where this information is documented		NA	
A9. Documentation and Records			
a. Identifies report format and summarizes all data report package information		Sec. 2.4, Sec. 6.2	
b. Lists all other project documents, records, and electronic files that will be produced		Sec. 2.4, Sec. 4.3.2, Sec. 6.0	
c. Identifies where project information should be kept and for how long		Sec. 6.0	
d. Discusses back up plans for records stored electronically		Sec. 6.0	
e. States how individuals identified in A3 will receive the most current copy of the approved QA Project Plan, identifying the individual responsible for this		Sec. 1.2, Sec. 1.4	
B. Data Generation/Acquisition			
B1. Sampling Process Design (Experimental Design)			
a. Describes and justifies design strategy, indicating size of the area, volume, or time period to be represented by a sample		Sec. 2.1 Sec. 3.1, Sec. 3.2	
b. Details the type and total number of sample types/matrix or test runs/trials expected and needed		Sec. 2.1 Sec. 3.0, Sec. 3.2	
c. Indicates where samples should be taken, how sites will be identified/located		Sec. 3.1, Sec. 3.2, Figure 3	
d. Discusses what to do if sampling sites become inaccessible		Sec. 4.3.1 Sec. 5.1	
e. Identifies project activity schedules such as each sampling event, times samples should be sent to the laboratory, etc.		Sec. 1.3 Sec. 4.5.1	
f. Specifies what information is critical and what is for informational purposes only		Sec. 4.3.2, Sec. 4.3.3, Sec. 4.3.4 Sec. 4.3.5	
g. Identifies sources of variability and how this variability should be reconciled with project information		Sec. 2.2 Sec. 4.7	
B2. Sampling Methods			

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Element	Acceptable Yes/No/NA	Page/ Section	Comments
a. Identifies all sampling SOPs by number, date, and regulatory citation, indicating sampling options or modifications to be taken		Sec. 4.3	
b. Indicates how each sample/matrix type should be collected		Sec. 4.3.1	
c. If in situ monitoring, indicates how instruments should be deployed and operated to avoid contamination and ensure maintenance of proper data		NA	
d. If continuous monitoring, indicates averaging time and how instruments should store and maintain raw data, or data averages		NA	
e. Indicates how samples are to be homogenized, composited, split, or filtered, if needed		Sec. 4.3.1	
f. Indicates what sample containers and sample volumes should be used		Sec. 4.3.1	
g. Identifies whether samples should be preserved and indicates methods that should be followed		Sec. 4.3.1 Sec. 4.5.1	
h. Indicates whether sampling equipment and samplers should be cleaned and/or decontaminated, identifying how this should be done and by-products disposed of		Sec. 4.3.1 Sec. 4.4	
i. Identifies any equipment and support facilities needed		Sec. 4.2.1	
j. Addresses actions to be taken when problems occur, identifying individual(s) responsible for corrective action and how this should be documented		Sec. 5.0 Sec. 5.1	
B3. Sample Handling and Custody			
a. States maximum holding times allowed from sample collection to extraction and/or analysis for each sample type and, for in-situ or continuous monitoring, the maximum time before retrieval of information		Table 2	
b. Identifies how samples or information should be physically handled, transported, and then received and held in the laboratory or office (including temperature upon receipt)		Sec. 4.5.1	
c. Indicates how sample or information handling and custody information should be documented, such as in field notebooks and forms, identifying individual responsible		Sec. 4.5.2	

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Element	Acceptable Yes/No/NA	Page/ Section	Comments
d. Discusses system for identifying samples, for example, numbering system, sample tags and labels, and attaches forms to the plan		Sec. 4.5.1	
e. Identifies chain-of-custody procedures and includes form to track custody		Sec. 4.5.2	
B4. Analytical Methods			
a. Identifies all analytical SOPs (field, laboratory and/or office) that should be followed by number, date, and regulatory citation, indicating options or modifications to be taken, such as sub-sampling and extraction procedures		Sec. 2.1 Sec. 4.6 Table 2 Sec. 5.2	
b. Identifies equipment or instrumentation needed		Table 2	
c. Specifies any specific method performance criteria		Table 2	
d. Identifies procedures to follow when failures occur, identifying individual responsible for corrective action and appropriate documentation		Sec. 5.2	
e. Identifies sample disposal procedures		Sec. 4.3.1 Lab QA Plan and SOPs	
f. Specifies laboratory turnaround times needed		Sec. 4.6	
g. Provides method validation information and SOPs for nonstandard methods		NA	
B5. Quality Control			
a. For each type of sampling, analysis, or measurement technique, identifies QC activities which should be used, for example, blanks, spikes, duplicates, etc., and at what frequency		Sec. 2.3.5 Sec. 4.7.1	
b. Details what should be done when control limits are exceeded, and how effectiveness of control actions will be determined and documented		Lab QA Plan and SOPs Sec. 4.7.1 Sec. 5.2	

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Element	Acceptable Yes/No/NA	Page/ Section	Comments
c. Identifies procedures and formulas for calculating applicable QC statistics, for example, for precision, bias, outliers and missing data		Sec. 2.3	
B6. Instrument/Equipment Testing, Inspection, and Maintenance			
a. Identifies field and laboratory equipment needing periodic maintenance, and the schedule for this		Lab QA Plan and SOPs, Sec. 5.2	
b. Identifies testing criteria			
c. Notes availability and location of spare parts			
d. Indicates procedures in place for inspecting equipment before usage			
e. Identifies individual(s) responsible for testing, inspection and maintenance			
f. Indicates how deficiencies found should be resolved, re-inspections performed, and effectiveness of corrective action determined and documented			
B7. Instrument/Equipment Calibration and Frequency			
a. Identifies equipment, tools, and instruments that should be calibrated and the frequency for this calibration		Lab QA Plan and SOPs Sec. 5.2	
b. Describes how calibrations should be performed and documented, indicating test criteria and standards or certified equipment			
c. Identifies how deficiencies should be resolved and documented			
B8. Inspection/Acceptance for Supplies and Consumables			
a. Identifies critical supplies and consumables for field and laboratory, noting supply source, acceptance criteria, and procedures for tracking, storing and retrieving these materials		Lab QA Plan and SOPs	
b. Identifies the individual(s) responsible for this		Lab QA Plan and SOPs	
B9. Non-direct Measurements			
a. Identifies data sources, for example, computer databases or literature files, or models that should be accessed and used		Sec. 1.0	

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Element	Acceptable Yes/No/NA	Page/ Section	Comments
b. Describes the intended use of this information and the rationale for their selection, i.e., its relevance to project		Sec. 1.0	
c. Indicates the acceptance criteria for these data sources and/or models		NA	
d. Identifies key resources/support facilities needed		NA	
e. Describes how limits to validity and operating conditions should be determined, for example, internal checks of the program and Beta testing		NA	
B10. Data Management			
a. Describes data management scheme from field to final use and storage		Sec. 2.4 Sec. 6.0	
b. Discusses standard record-keeping and tracking practices, and the document control system or cites other written documentation such as SOPs		Sec. 2.4 Sec. 6.0	
c. Identifies data handling equipment/procedures that should be used to process, compile, analyze, and transmit data reliably and accurately		Sec. 6.0	
d. Identifies individual(s) responsible for this		Sec. 1.4	
e. Describes the process for data archival and retrieval		Sec. 2.4 Sec. 6.0	
f. Describes procedures to demonstrate acceptability of hardware and software configurations		NA	
g. Attaches checklists and forms that should be used		NA	
C. Assessment and Oversight			
C1. Assessments and Response Actions			
a. Lists the number, frequency, and type of assessment activities that should be conducted, with the approximate dates		Sec. 2.5	
b. Identifies individual(s) responsible for conducting assessments, indicating their authority to issue stop work orders, and any other possible participants in the assessment process		Sec. 1.2	
c. Describes how and to whom assessment information should be reported		Sec. 4.7 Sec. 5.0	

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Element	Acceptable Yes/No/NA	Page/ Section	Comments
d. Identifies how corrective actions should be addressed and by whom, and how they should be verified and documented		Sec. 5.0	
C2. Reports to Management			
a. Identifies what project QA status reports are needed and how frequently		NA	
b. Identifies who should write these reports and who should receive this information		NA	
D. Data Validation and Usability			
D1. Data Review, Verification, and Validation			
Describes criteria that should be used for accepting, rejecting, or qualifying project data		Sec. 4.7.1	
D2. Verification and Validation Methods			
a. Describes process for data verification and validation, providing SOPs and indicating what data validation software should be used, if any		App. B Sec. 4.7.1	
b. Identifies who is responsible for verifying and validating different components of the project data/information, for example, chain-of-custody forms, receipt logs, calibration information, etc.		Sec. 4.7.1	
c. Identifies issue resolution process, and method and individual responsible for conveying these results to data users		Sec. 5.0	
d. Attaches checklists, forms, and calculations		App. B	
D3. Reconciliation with User Requirements			
a. Describes procedures to evaluate the uncertainty of the validated data		App. B	
b. Describes how limitations on data use should be reported to the data users		Sec. 2.5.3, Sec. 4.7.1	

APPENDIX B
MDEQ DATA VALIDATION GUIDELINES
AUGUST 2010

Montana Department of Environmental Quality
Data Validation Guidelines for Evaluating Analytical Data
(updated August 5, 2010)

This document was assembled by the Montana Department of Environmental Quality Site Response Section (DEQ) to formalize technical direction for conducting data validation. Data validation is a standardized review process for judging the analytical quality and usefulness of a discrete set of chemical data and is necessary to ensure that data of known and documented quality are used in making environmental decisions.

While these guidelines are generally used by DEQ, there may be circumstances that warrant a higher level of data validation review and DEQ reserves the right to require additional validation. For investigations where XRF or other field screening equipment is used, an evaluation including the comparison and correlation of field screening data to laboratory confirmation data must be also be included in the data validation discussion (please see DEQ's frequently asked questions at <http://deq.mt.gov/StateSuperfund/FrequentlyAskedQuestions.mcp>x for specifics associated with the use of XRF equipment and data collection/evaluation).

A separate data validation report must be completed for each sample batch/group. A brief summary of this validation report and the usability of the data should be included in the text of the project report with the validation report included as an appendix. The data validation should include an assessment of data using the precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters:

Precision: The degree of mutual agreement between individual measurements of the same property under similar conditions.

- Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD). Laboratory analytical precision is evaluated by analyzing matrix spike/matrix spike duplicate (MS/MSD) samples and using the results to calculate an RPD.

Accuracy: The degree of agreement between an analytical measurement and a reference accepted as a true value.

- The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, and analytical techniques. Analysis of MS/MSD samples, laboratory control spikes (LCS) or blank spikes, surrogate standards, and method blanks are typically used to calculate the percent recovery (%R) for evaluating accuracy.

Representativeness: The degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent.

- Typically, representative data will be obtained through careful selection of sampling locations and analytical parameters; proper collection and handling of samples; and through use and consistent application of established field and laboratory procedures. Evaluation of field and laboratory blank samples for presence of contaminants can be useful in evaluating representativeness of sample results.

Completeness: A measure of the percentage of project-specific data that is valid.

- Valid data are obtained when samples are collected and analyzed in accordance with quality control (QC) procedures outlined in the SAP, and when none of the QC criteria that affect data usability are exceeded. Once data validation is complete, the number of useable sample results is divided by the total number of sample results planned for the investigation to determine the percent completeness. A completeness goal should be developed for each project (i.e., 100% completeness for residential samples to ensure that all properties requiring sampling are sampled).

Comparability: Expression of the confidence with which one data set can be compared with another.

- Comparability of data is achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

DATA VALIDATION REPORT

1. Please provide the following information at the beginning of the data validation report:
 - Project name
 - Name and Date of approved Quality Assurance Project Plan (QAPP), Sampling and Analysis Plan (SAP), or other applicable document
 - Laboratory Name
 - Laboratory Project ID
 - Sample Matrix
 - Sample Start and End Dates
 - Parameters Included (e.g., volatile organic compounds using EPA Method 8260)
 - Date Validated
 - Name of Validator
2. Please include a description of the data validation criteria used. These data validation criteria should be outlined in the appropriate QAPP, SAP, or other applicable document. **For example:**
 - *USEPA Contract Laboratory Program (CLP) National Functional Guidelines (NFG) for Superfund Organic Methods Data Review, USEPA-540-R-08-01, June 2008; with additional reference to USEPA CLP NFGs for Organic Data Review, EPA 540/R-99-008, October 1999*
 - *USEPA CLP NFGs for Inorganic Superfund Data Review, EPA 540R-10-011, January 2010.*
 - *USEPA Region 1 Laboratory Data Validation Function Guidelines for Evaluation of Organic Analysis, December 1996.*
3. Please include a table or list identifying all samples evaluated in this validation report. Please provide the associated laboratory sample identification numbers if different than the project sample ID/name.
4. Please include a description of the acceptability and usability of the data, including any qualified data. Please explain data qualification flags or any other notes used by the laboratory. Please identify and explain any exceptions (i.e., rejected data) to the acceptability and usability of the data. Also include a cross reference where data qualified by the laboratory is discussed. **For example:** *Based on a data validation review, the data are acceptable as delivered with the exceptions noted below as rejected data. Data qualified by the laboratory are discussed in Section #2 [of the project report].*
5. Please include a description of the data qualifiers used during this validation. **For example:** *J - estimated concentration; UJ – estimated reporting limit (for non-detect results); or R - rejected, data not usable.*
6. Does the laboratory case narrative note any nonconformance issues with the analytical data? Please identify the nonconformance issues.
7. Were sample chain-of-custody (CoC) forms complete? Please describe. **For example:** *The CoC records from field to laboratory were complete, and custody was maintained as evidenced by field and laboratory personnel signatures, dates, and times of receipt.*
8. Were detection limits in accordance with the project requirements? If applicable, discuss how this relates to method selection, screening levels, and matrix interference. Please explain, and include discussion of how this affects the data.

9. Were the requested analytical methods in compliance with project requirements (i.e., QAPP, SAP)? If not, please explain, and include discussion of how this affects the data.
10. Were samples received in good condition within method specified requirements? Please explain any exceptions, and how sample condition may affect the results. **For example:** *Sample collected and listed on CoC; however, lab noted sample not received in shipment. No qualification necessary.*
11. Were samples analyzed within method specified or technical holding times? Please explain any exceptions, and how this may affect the results.
12. Were reported units appropriate for the associated sample matrix/matrices and method(s) of analyses? Please explain.
13. Do the laboratory reports include all constituents requested to be analyzed on the CoC or under the QAPP, SAP, or other applicable document? Please explain.
14. Was there indication from the laboratory that the initial or continuing calibration verification results were within acceptable limits? Please explain. **For example:** *Initial and continuing calibration data were not included as part of this data set; however, these data are assumed to be acceptable as the laboratory did not note any calibration results that were outside of QC limits.*
15. Was the total number of method blank samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? Please explain.
16. Were laboratory blank samples free of analyte contamination? Please explain, and include discussion of how this affects the data. **For example:** *The method blank samples were reported to be free of analyte contamination with the following exceptions: MADEP VPH - the analyte naphthalene was detected at 0.0256 mg/Kg in the method blank prepared for batch X. As naphthalene was not detected in the associated samples, no qualification of data was required.*
17. Was the total number of matrix spike samples prepared equal to at least 5% of the total number of samples, or analyzed as required by the method? Please include a discussion of the project samples used to prepare the MS and MSD samples, if applicable. Please explain, and include discussion of how this affects the data. **For example:** *The total number of MS/MSD samples was equal to at least 5% of the total number of samples for each analysis and batch, with the exception of pesticides by Method 8081A batch X, where the laboratory indicated with a MNR1 qualifier that sufficient sample volume was not available to perform matrix spikes. These data were evaluated using other laboratory QC data. Additionally, no matrix spike samples were analyzed for percent dry solids as it is not required by the method.*
18. Please include a discussion of the project samples used to prepare the MS and MSD samples, if applicable.
19. Were MS/MSD percent recoveries and MS/MSD relative percent difference (RPDs) within data validation or laboratory QC limits? Please explain, and include discussion of how this affects the data.
20. Was the reference material used for the laboratory control standard (LCSs) the correct matrix and concentration? Please explain, and include discussion of how this affects the data.
21. Was the total number of LCSs samples analyzed equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? **For example:** *The frequency requirements for laboratory quality control samples (1/20) were met.*

22. Were LCSs prepared in the same way as the associated samples? Please explain, and include discussion of how this affects the data.
23. Were LCS/LCSD percent recoveries and LCS/LCSD RPDs within laboratory QC limits? Please explain, and include discussion of how this affects the data.
24. Were surrogate recoveries within laboratory QC limits? Please explain and include a discussion of how this affects the data. **For example:** *In sample A, the surrogates 2-fluorobiphenyl and 2-bromonaphthalene were recovered outside the laboratory QC limits of 40-140% at 143% and 151%, respectively. As a result, the detection for the analyte C19-C36 aliphatic hydrocarbons was qualified as J in this sample due to possible high bias.*
25. Were the number of equipment, trip, or field blanks collected equal to at least 10% of the total number of samples, or as required by the project requirements, QAPP, or SAP? Please explain, and include discussion of how this affects the data.
26. Were the trip blank, field blank, and/or equipment blank samples free of analyte contamination? Please explain, and include discussion of how this affects the data.
27. Were the field duplicates collected as required by the project requirements, QAPP or SAP? Please explain, and include discussion of how this affects the data. Also, please provide a summary or a table identifying primary and duplicate sample pairs.
28. Were field duplicate RPD values within data validation QC limits (generally soil 0-50%, water 0-30%, or air 0-25%, or otherwise specified in the QAPP/SAP)? Please explain, and include discussion of how this affects the data.
29. Were laboratory duplicate RPD values within laboratory-specified limits? Please explain, and include discussion of how this affects the data.
30. If any data was qualified, please provide a data qualification summary or table that includes the analyte, sample ID, laboratory ID, laboratory result, validator qualifier, and reason for qualification (and include how data is affected/biased). **For example:**

Analyte	Sample ID	Laboratory ID	Laboratory Result	Validator Qualifier	Reason for Qualification
C5-C8 Aliphatic Hydrocarbons	All Samples	Lab-01 through Lab-14	Detects and Non-Detects	J for detections or UJ for non-detections	The RPD for the MS/MSD or LCS/LCSD was greater than the acceptable difference indicating poor repeatability. The MS and/or MSD recovery(ies) were below the acceptable limits indicating possible matrix interference.
Benzene	All Samples	Lab-01 through Lab-14	Detects and Non-Detects	J for detections or UJ for non-detections	The RPD for the MS/MSD or LCS/LCSD was greater than the acceptable difference indicating poor repeatability. The MS and/or MSD recovery(ies) were below the acceptable limits indicating possible matrix interference.

31. If DEQ collected split samples, explain how those results compare to the natural sample.
32. Please provide any other general comments or other observations.

APPENDIX C

FIELD LOG SHEET AND PHOTO LOG FORM

Soil Sample Field Log Form

Sample ID: SB- _____	Site ID: _____	County: _____
Date: _____		
Time: _____		
Personnel: _____	Descriptive Location:	
Project: Shelby Backfill Source Investigation		
Project #: _____		
	Latitude: _____	Longitude: _____
Soil Type/Description:		

<i>Site/Location Sketch (General Features and Grab Sample Locations)</i>	<i>Additional Comments/Observations</i>
Sampler Signature: _____ Date: _____	Sampler Signature: _____ Date: _____

MBSI Photo Point Documentation Form

Sample ID: _____

Site ID: _____

County: _____

Date: _____

Time: _____

Personnel: _____

Descriptive Location:

Project: Shelby Backfill Source Investigation

Project #: _____

Latitude: _____

Longitude: _____

Comments:

Photo 1

Photo 2

Final Sampling and Analysis Plan

Remedial Investigation of the Butte Office Stop
55 E Galena, Butte, Montana

Prepared for:
Montana Department of Environmental Quality



Prepared by:
Weston Solutions, Inc.
318 North Last Chance Gulch, Suite 2A
Helena, MT 59601

Montana DEQ Contract Number: 414024-TO5
Weston Project Number: 15409.005.001

March 2016



Sampling and Analysis Plan
Remedial Investigation of the Butte Office Stop
55 E Galena, Butte, Montana

MTDEQ Contract Number: 414024-TO5
Weston Project Number: 15409.005.001

Approved by: 
Chris Morgan, Project Manager
Weston Solutions, Inc.

3/18/2016
Date

Approved by: _____
Jason Seyler, DEQ Liaison
Montana Department of Environmental Quality

Date

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TABLE OF CONTENTS

Section	Page
1.0 INTRODUCTION.....	1-1
1.1 PROJECT SCOPE.....	1-1
1.2 REGULATORY FRAMEWORK.....	1-1
1.3 PROJECT ORGANIZATION	1-1
2.0 BACKGROUND	2-1
2.1 SITE OR SAMPLING AREA DESCRIPTION.....	2-1
2.2 OPERATIONAL HISTORY AND PREVIOUS INVESTIGATIONS.....	2-1
2.2.1 Thirty Day Leak Report (1995)	2-2
2.2.2 Phase I Environmental Site Assessment (1996)	2-2
2.3 GEOLOGICAL/METEOROLOGICAL INFORMATION	2-3
3.0 OBJECTIVES AND DESIGN OF THE INVESTIGATION.....	2-4
3.1 OBJECTIVES OF STUDY.....	3-1
3.2 PARAMETERS OF CONCERN.....	3-1
3.3 STUDY DESIGN	3-1
3.3.1 Vapor Intrusion Investigation	3-1
3.3.2 Installation of Soil Borings and Groundwater Monitoring Wells.....	3-2
3.3.3 Groundwater Monitoring	3-3
4.0 FIELD SAMPLING METHODS	3-4
4.1 FIELD MEASUREMENTS.....	4-1
4.2 SITE FEATURES AND SAMPLE LOCATIONS	4-1
4.3 SAMPLE COLLECTION	4-1
4.3.1 Subslab Soil Vapor Grab Sampling.....	4-1
4.3.2 Indoor and Ambient Outdoor Air Sampling	4-2
4.3.3 Soil Sampling.....	4-2
4.4 INVESTIGATION DERIVED WASTE	4-3
4.5 FIELD FORMS/RECORD KEEPING.....	4-3
4.5.1 Field Log Books and Field Forms	4-3
4.5.2 Field Forms	4-4
4.5.3 Photograph Procedures and Documentation.....	4-4
5.0 ANALYTICAL METHODS AND LABORATORY SAMPLE HANDLING PROCEDURES.....	5-1
5.1 ANALYTICAL METHODS.....	5-1
5.2 LABORATORY REPORTING PROCEDURES	5-1
5.3 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES	5-1
5.4 SAMPLE LABELING	5-1
5.5 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS	5-2
5.6 SAMPLE PACKAGING AND SHIPPING	5-2
6.0 QUALITY CONTROL.....	6-1

TABLE OF CONTENTS

Section	Page
6.1 QC LIMITS FOR FIELD INSTRUMENTS	6-1
6.2 FIELD QUALITY CONTROL SAMPLES.....	6-1
6.2.1 Assessment of Field Contamination (Blanks).....	6-1
6.2.1.1 Equipment Blanks.....	6-1
6.2.1.2 Trip Blank	6-1
6.2.1.3 Temperature Blanks	6-1
6.2.2 Assessment of Field Variability (Field Duplicate Samples).....	6-2
6.3 FIELD SCREENING	6-2
6.4 LABORATORY QUALITY CONTROL SAMPLES	6-2
7.0 DATA ANALYSIS, RECORD KEEPING, AND REPORTING REQUIREMENTS	
7-1	
7.1 DATA VERIFICATION AND VALIDATION PROCESS AND QA/QC REPORTING	7-1
7.2 DATA INTERPRETATION APPROACH.....	7-1
7.3 PROJECT RECORD KEEPING PROCEDURES	7-1
7.4 DATA MANAGEMENT PROCEDURES	7-1
8.0 FIELD HEALTH AND SAFETY PROCEDURES	8-1
9.0 SCHEDULE.....	9-1
10.0 REFERENCES.....	10-1

LIST OF TABLES

Table		Page
Table 1-1	Key Project Personnel Contact Information	1-2
Table 5-1	Soil Analytical Services	5-4
Table 5-2	Soil Vapor Analytical Services	5-5
Table 6-1	Field Instruments and Quality Control Limits	6-3
Table 7-1	Project Reporting Limits and Data Quality Indicators for Soil Samples	7-2
Table 7-2	Project Reporting Limits and Data Quality Indicators for Soil Vapor Samples	7-6
Table 9-1	Project Schedule	9-1

LIST OF FIGURES

Figure		Page
Figure 1	Site Vicinity Map	
Figure 2	Site Map	
Figure 3	Proposed Sample Locations	

LIST OF APPENDICES

Appendix A	Health and Safety Plan
Appendix B	Standard Operating Procedures

LIST OF ACRONYMS

AOC	analyte of concern
APH	Air-Phase Petroleum Hydrocarbon
Atlatl	Atlatl, Inc.
bgs	below ground surface
COC	chain-of-custody
DEQ	Montana Department of Environmental Quality
EPA	United States Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
HASP	Health and Safety Plan
ID	identification
LNAPL	light non-aqueous phase liquid
PID	photoionization detector
QA	Quality Assurance
QC	Quality Control
RBSL	risk-based screening level
RI	Remedial Investigation
RP	responsible party
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbon
WESTON	Weston Solutions, Inc.

1.0 INTRODUCTION

Weston Solutions, Inc. (WESTON®) was contracted by the Montana Department of Environmental Quality (DEQ), under contract 414024-TO5, to conduct a Remedial Investigation (RI) of the Butte Office Stop, located at 55 E Galena Street in Butte, Montana.

1.1 PROJECT SCOPE

This Sampling and Analysis Plan (SAP) includes the investigation and sampling methods to collect data to support a RI. The purpose of the RI is to provide technical expertise and services for the Butte Office Stop property to assist DEQ with:

- Installation of soil borings and groundwater monitoring wells;
- Indoor air sampling;
- Groundwater monitoring; and
- Reporting.

This SAP describes the project objectives, tasks, sampling design and rationale, sample methods, quality control (QC) summary, sample handling, disposal methods and data validation procedures. The SAP is intended to reflect the planned data-gathering activities for this investigation, however, site conditions and additional DEQ direction may warrant modifications. All significant changes will be documented in the final report.

A Health and Safety Plan has been developed for this field work and is located in Appendix A.

1.2 REGULATORY FRAMEWORK

WESTON will follow Title 17, Chapter 56 of the Administrative Rules of the State of Montana regarding the investigation for petroleum tank cleanup.

1.3 PROJECT ORGANIZATION

The following lists project personnel and their responsibilities. **Table 1-1** provides contact information for DEQ and WESTON project personnel, including subcontractors.

- **DEQ Liaison** – The DEQ Liaison is Jason Seyler. Mr. Seyler is the primary decision maker for this investigation.
- **Weston Program Manager** – The Program Manager is Mark Bell. Mr. Bell is responsible for the overall management of the contract including cost, schedule, and technical quality.
- **Weston Project Manager/Quality Assurance (QA) Manager** – Chris Morgan is the WESTON Project Manager. Mr. Morgan is responsible for all tasks assigned to WESTON by DEQ; working with the DEQ Liaison to ensure project quality assurance goals are met, preparing the SAP and final report, and implementing the field investigation.

- **Weston Technical Lead** – Technical lead support will be provided by Jenny O’Mara. Mrs. O’Mara is responsible for overseeing Weston’s Technical Support Team and the technical delivery of the project.
- **Weston Technical Support**– Technical support will be provided by Shaun Cwick and Lara Kapelanczyk. Mr. Cwick and Ms. Kapelanczyk are responsible for overseeing field subcontractors; collecting, handling, documenting, and transporting samples; and generating field documentation of field activities.
- **Drilling Subcontractor (To be determined)** A drilling subcontractor will install soil borings using geoprobe and groundwater monitoring wells, if applicable.
- **Analytical Laboratory (To be determined)** – Analytical laboratory services will be performed to determine the analytical results for soil and vapor samples.
- **Private Utility Locator (To be determined)** – A private utility locator will be utilized to determine the location of underground utilities prior to drilling activities.
- **Land Surveyor (To be determined)** – If monitoring wells are installed, a land surveyor will be used to determine their height.

Table 1-1 Key Project Personnel Contact Information

Title/Responsibility	Name/Email Address	Phone Number
Montana Department of Environmental Quality		
DEQ Project Manager	Jason Seyler JSeyler@mt.gov	(406) 444-6447
Weston Solutions, Inc.		
Program Manager	Mark Bell Mark.Bell@westonsolutions.com	(303) 729-6153
Project Manager	Chris Morgan Chris.Morgan@westonsolutions.com	(808) 5275-5951
Technical Lead	Jenny O’Mara Jenny.OMara@westonsolutions.com	(406) 502-1570
Technical Support	Shaun Cwick Shaun.Cwick@westonsolutions.com	(303) 729-6109
Technical Support	Lara Kapelanczyk Lara.Kapelanczyk@westonsolutions.com	(406) 502-1570

2.0 BACKGROUND

2.1 SITE OR SAMPLING AREA DESCRIPTION

The Office Stop Facility is located in Silver Bow County on the northwest corner of Galena and Wyoming Streets in the town of Butte, Montana (Figure 1). It is located in the northeast quarter of Section 13, Township 3N, Range 8W. The property is located at an elevation of approximately 5,700 feet above mean sea level, and the surface slopes gently to the south (Dames and Moore, 1996). Additionally, the property is located approximately 4,500 feet southwest of the Berkley Pit Mine and 6,300 feet from the north bank of Silver Bow Creek (Dames and Moore, 1996).

The legal description of the property is described as Lots 22, 23, 24, 25, and 26 in Block 38 of the Townsite of Butte. The site covers 16,856 square feet. The property contains a building and an asphalt parking lot (Figure 2). The building is brick construction with a wood frame roof and a concrete slab-on-grade floor on the main level (Dames and Moore, 1996).

Based on a description of the building in the 1996 Phase I Report, the first floor of the building is 10,680 square feet, the second floor is a 6,024 square foot mezzanine, and the basement is 2,952 square feet. The first floor of the building has walls of drywall, a ceiling with suspended acoustical tiles, and carpet over concrete for flooring. The second floor has a wood frame ceiling, walls of drywall or brick, and wood floors. The basement has concrete floors, cinder block walls, and wooden ceilings. Additionally, a crawl space is accessed through the basement (Figure 3). (Dames and Moore, 1996).

2.2 OPERATIONAL HISTORY AND PREVIOUS INVESTIGATIONS

A petroleum release (#2692) was reported at the Office Stop property on 21 August 1995 while two of six petroleum tanks were being removed. Both tanks had been perforated and soil was observed to be stained. Further releases were observed when the remaining four tanks were pulled on 23 August 1995. DEQ approved the excavation of 350 cubic yards. Closure samples were collected only from the base of the excavation and not from the sidewalls. While sample results collected from 21 feet below ground surface were below risk-based screening levels (RBSLs), these still had a strong petroleum odor. On 8 September 1995, the excavation was backfilled. On 26 September 1995, the site was deemed PetroFund eligible.

There has been no field activity at this site since 1995. A No Current Corrective Action Required letter was sent to the Responsible Party (RP) Kenneth Fink, in January 1996. A Site Status Update Letter was sent to the RP in February 2000. He did not wish to pursue closure at that time. This property has since changed hands, and is now owned by the non-profit North American Indian Alliance. The non-profit was never notified of the Release. The Property presently serves as a Health Care clinic and afterschool youth program center.

A summary of reports conducted for the Office Stop facility are summarized below.

2.2.1 Thirty Day Leak Report (1995)

A Thirty Day Leak Report for the Petroleum Release at the Office Stop Facility Located at 55 East Galena Street in Butte, Montana, Facility ID# 47-03007 was completed in October 1995 by Atlatl, Inc. (Atlatl) after strong petroleum odors were detected in soils during the removal of 6 petroleum tanks. Atlatl notified DEQ of the contamination and arranged for additional excavation of soils and to investigate the vertical extent of the contamination. Excavation and transportation to and disposal of soil at the local landfill was considered the best alternative for the contaminated soils and Atlatl began the process. Approximately 350 cubic yards of contaminated soil was excavated and transported to Butte Silver Bow County Landfill. During excavation, storm drain water from severe rain storms entered the excavation and threatened the stability of the excavation walls and nearby utilities. Atlatl contacted DEQ and recommended that excavation be halted and the excavation backfilled. DEQ agreed. The excavation was backfilled and concrete was replaced (Atlatl, 1995).

2.2.2 Phase I Environmental Site Assessment (1996)

A Phase I Environmental Site Assessment was conducted by Dames & Moore in 1996. The study was conducted to review land use practices and site operations and evaluate the potential for the presence of hazardous substances on the property, including soil and or groundwater contamination that could arise from their presence. Additionally, the Phase I conducted a regulatory agency list review of neighboring properties and facilities in the site vicinity, and evaluated the potential for asbestos-containing material to exist on the site. At the time of the assessment the site was being used as a warehouse and distributor of office supplies.

A review of historical information during the Phase I indicates that the first reference to the property was in 1934 as a Firestone Service Center. Firestone Tire and Rubber Company is listed as the original owner of the building. It remained listed as Firestone Service Center until 1979 (Dames and Moore, 1996).

The results of the Phase I indicated that the site's previous use had the potential to environmentally impact the site. Asbestos-containing building materials were located in the basement and it was noted that they were scheduled to be removed from the property. Lead-based paint was detected within the building. Contamination was found in the sump on the first floor (diesel and motor oil range hydrocarbons) and in the drain in the basement (diesel and motor oil range hydrocarbons, and lead). Indications of environmental concerns which would impact the Office Stop property were not observed at adjacent properties, although an auto body shop south of the site had potential for adverse environmental impacts. At the time the site was listed as a hazardous waste generator (small quantity) and Dames and Moore recommended that the owner remove the site from the list if it did not actually generate waste. (Dames and Moore, 1996).

The Phase I recommended that there be confirmation of the removal of asbestos from the property and that the basement should be posted with a warning sign regarding the presence of asbestos until the removal is complete. They also recommended that areas identified as

containing lead-based paint be sample quantified by a laboratory as samples taken during the Phase I only tested for presence or absence of lead paint (Dames and Moore, 1996).

2.3 GEOLOGICAL/METEOROLOGICAL INFORMATION

The region surrounding Butte is located within the Northern Rocky Mountain Geologic Province. This area is defined by horst and graben topography and characterized by fault dropped basins filled with tertiary alluvial sediments composed of sand, silt and clay. The mountain ranges are composed of consolidated or metamorphosed sedimentary rocks and igneous intrusive and extrusive rocks either exposed in outcrop or covered by a thin layer of coarse grained soils (Atlatl, Inc., 1995).

The Office Stop facility is located in the middle of the Butte Hill. Butte Hill is known for rich deposits of precious metals and copper. The site is underlain by Cretaceous Boulder batholith which is composed of quartz monzonite with abundant pegmatitic and aplitic dikes, which are exposed in outcrops in the site vicinity. The batholith weathers in-place to a granite sand to a depth of approximately 5-20 feet. The material becomes less weathered with depth and eventually grades into hard rock (Atlatl, Inc., 1995).

The soils of the site vicinity are mapped as "Carbol and Lucky Soils," by the United States Department of Agriculture Soil Conservation Service (SCS) (SCS, 1968). These soils are intermittently stony with gravelly loam or gravelly sandy loam textures. This type of soil developed in place from granitic rock on rolling to hilly uplands. These well drained dark colored soils are noncalcareous throughout. They typically have a thin loam surface layer and a clay loam subsoil. The subsoil is underlain by granite bedrock

Groundwater beneath the site is found in bedrock fractures and joints and occurs at depths greater than 75 feet below ground surface (Atlatl, 1995). Groundwater in the batholith material is not used for residential or commercial applications because of the low yielding aquifer. Based on the topography, the groundwater flow direction is assumed to be to the south (Dames and Moore, 1996).

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3.0 OBJECTIVES AND DESIGN OF THE INVESTIGATION

3.1 OBJECTIVES OF STUDY

The objectives of the investigation are to assess soil and soil vapor at the site to determine if fuel-related contaminants related to a prior petroleum release (#2692) at the site remain in the subsurface above DEQ Tier 1 Risk Bases Screening Levels (RBSLs).

3.2 PARAMETERS OF CONCERN

The Butte Office Stop facility was historically used as a Firestone Service Center. It is currently owned by the non-profit North American Indian Alliance and used as a health care clinic and afterschool youth program center. The greatest concern for human health and the environment at the site is the past release of petroleum during the removal of petroleum tanks in 1995.

Potential environmental contaminants (analytes of concern [AOCs]) related to buried petroleum tanks include the following:

- United States Environmental Protection Agency (EPA) Method TO-15 analytes (vapor samples)
- Massachusetts Air-Phase Petroleum Hydrocarbons (APH) (vapor samples)
- Volatile petroleum hydrocarbons (VPH) (soil and groundwater samples)
- Extractable petroleum hydrocarbons (EPH) (soil and groundwater samples).

3.3 STUDY DESIGN

3.3.1 Vapor Intrusion Investigation

A vapor intrusion investigation will be completed at the Office Stop facility located at 55 E. Galena Street, Butte, Montana. As part of the investigation both indoor and ambient outdoor air samples will be collected as well as sub-slab soil vapor samples. Each sample type is described below (DEQ, 2011):

- Indoor air samples characterize the nature and extent of vapors within a structure. Indoor air sample results help to evaluate whether vapors are currently present inside a structure. They are also compared to sub-slab vapor and ambient outdoor air results to help determine where volatile chemicals may be coming from (indoor sources, outdoor sources, and/or soil vapor beneath the structure).
- Ambient outdoor air samples characterize site-specific background air conditions. Ambient outdoor air results are used to evaluate the extent to which outdoor sources, such as automobiles, lawn mowers, oil storage tanks, gasoline stations, or commercial/industrial facilities may be affecting indoor air quality. However, the presence of a contaminant in the ambient outdoor air does not necessarily mean that the contaminant will be present in indoor air. When a structure may be impacted through

both a subsurface VI pathway and a surface air pathway from the same contaminant source, a more detailed ambient outdoor air survey may be required.

- Sub-slab soil vapor samples characterize the nature and extent of vapor contamination in the soil immediately beneath a structure with a concrete slab. Sub-slab vapor results are used to determine the potential for VI within the structure.

Prior to sampling, an “Occupied Building Questionnaire” form for the property will be completed. WESTON will review the completed questionnaire and discuss with the resident any steps that must be taken prior to the vapor sampling event, which may include the removal of products that could influence the results of the vapor sampling. Additionally, WESTON will ensure that the sampling canisters are individually certified and that the selected lab can achieve the detection limits established in Section 7.0.

WESTON will complete one round of indoor ambient air quality samples at the four previously sampled locations within the building, with an additional quality control sample for a total of five samples. WESTON will collect two soil vapor samples from the basement of the building and three soil vapor samples from the trench that extends toward the tanks from the basement, with an additional quality control sample for a total of six soil vapor samples (Figure 3).

Once the vapor samples are collected, they will be sent to an analytical laboratory and analyzed for EPA Method TO-15 and Massachusetts APH method. If the detection limit cannot be met, the best achievable practical quantitation limit will be used.

During the collection of soil vapor samples in the building, WESTON will also locate and inspect the floor sump along the southeast basement wall.

Once the analytical data is received, WESTON will contact the DEQ liaison to discuss the results. If follow-up confirmation sampling is required (based on analytical results), the same sampling locations will be used as were used in the first sampling event.

3.3.2 Installation of Soil Borings and Groundwater Monitoring Wells

Five soil borings will be completed to assess the areas surrounding the former tank basins, the piping systems, and downgradient impacts. Soil boring depths will not exceed a total of 200 linear feet for all borings. Proposed sampling locations are presented in Figure 3.

During the advancement of each borehole, WESTON will classify and record soils on standard lithologic logs. Selected intervals will be screened with a photoionization detector (PID). A soil sample from the interval where the highest PID headspace reading is recorded, and/or the soil sample from the groundwater interface, will be submitted to an analytical laboratory for VPH and EPH screen analysis. One soil sample will be split and submitted to the laboratory as a blind duplicate for QA/QC of a total of six analyses.

Following the installation of bore holes, monitoring wells may be installed in up to three soil borings, as deemed necessary based on field data collected during the advancement of the

boreholes. WESTON may modify the final soil boring and monitoring well locations based on updated information in the field with DEQs verbal permission.

If monitoring wells are installed, WESTON will construct them using ¾-inch diameter pre-packed slotted PVC screens and PVC casing and appropriate completion methods. Final completion depths and screened intervals will be determined in the field based on the presence and depth of contamination encountered in each soil boring. Each well will be completed flush with the ground surface and each well will be fitted with a locking steel well protector. WESTON will properly abandon all soil borings not completed as monitoring wells. If soil samples exceed 200 parts per million for EPH, they may be analyzed for EPH carbon fractions. These samples will be agreed upon by DEQ and WESTON.

3.3.3 Groundwater Monitoring

If any groundwater monitoring wells were installed, WESTON will complete a groundwater monitoring event. During the monitoring event, WESTON will measure the depth to groundwater and light non-aqueous phase liquid (LNAPL) thickness, if any, in each new groundwater monitoring well and the existing groundwater monitoring or remediation wells on the property. WESTON will collect groundwater samples from each new and existing groundwater monitoring well or remediation well, without measurable LNAPL, and submit them for VPH and EPH screen analysis.

WESTON will collect field dissolved oxygen, pH, conductivity, temperature, turbidity, and oxidation-reduction potential measurements from each new and existing groundwater monitoring well sampled. A duplicate QA/QC sample will be collected and submitted for VPH and EPH screen analysis, as well. If non-disposable sampling equipment is used, WESTON will collect a minimum of one equipment blank.

The total number of groundwater samples submitted for VPH and EPH screen analysis will not exceed five. Up to two groundwater samples may be analyzed for EPH carbon fractions, as agreed upon by WESTON and DEQ. WESTON will dispose of any purge water from the groundwater monitoring wells in accordance with DEQs Technical Guidance Document: *Options for Discharge of Hydrocarbon Contaminated Water*.

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4.0 FIELD SAMPLING METHODS

4.1 FIELD MEASUREMENTS

Instruments required for field measurements include a PID, water level indicator (if monitoring wells are installed), soil sampling tools (disposable scoops), electric hammer drill, and vapor sampling tools (disposable sampling probe and tubing). Calibration methods for the PID and water level indicator are listed in Section 6.4. Field measurement procedures are included in Section 4.3.

4.2 SITE FEATURES AND SAMPLE LOCATIONS

Soil samples will be collected from each of the five soil boring locations. Proposed soil boring locations are shown on Figure 3. In addition, one QC sample will be collected.

Three soil vapor samples will be collected from the basement and three will be collected from the crawl space in the basement that extends toward the tanks. Proposed locations are shown on Figure 3.

In addition, one round of indoor ambient air quality sampling will be conducted. Samples will be taken at the four previously sampled locations. One QC sample will be collected for a total of five samples.

If any groundwater monitoring wells are installed, a groundwater sample will be collected from each one without measurable LNAPL. If any monitoring or remediation wells already exist on the site, one samples will be collected from each, as well.

4.3 SAMPLE COLLECTION

4.3.1 Subslab Soil Vapor Grab Sampling

Subslab Soil Vapor Grab Sampling will be collected as discrete samples and will be collected into Summa canisters in accordance with DEQ Sub-Slab Soil Vapor Sampling Guide (DEQ 2011). Soil vapor sampling will be conducted using the following steps:

1. Locate the identified sample locations using building construction drawings. If field conditions require the location to be adjusted, record new locations on floor plans.
2. Drill into concrete foundation with 6" drill bit until reaching sub-slab material beneath. Switch to 12" drill bit and continue to ream out hole in the slab in order to create preferential pathway in sub-slab material.
3. Insert teflon tubing approximately ½" above the bottom of the hole in the slab, add silica sand to slightly above the bottom of the concrete slab, and then add bentonite to 1" below the top of the slab. Hydrate the bentonite with de-ionized water and top with low-voc quick-setting cement to ensure a sealed hole.
4. Cut the tubing to leave approximately 3-4' above the top of the slab.
5. Sampling points may be sampled after the hydraulic cement has been set for approximately 20 minutes or until hard to the touch.
6. Sub-slab port points will be removed and foundation holes will be patched.

7. Soil gas samples will be properly recorded and shipped to the analytical laboratory.

Subslab soil vapor grab samples will be collected at designated indoor locations with 1-liter Summa canisters and in accordance with EPA Soil Gas sampling standard operating procedures (SOP) in Appendix B (EPA 1996).

4.3.2 Indoor and Ambient Outdoor Air Sampling

Indoor air samples will be collected from inside the building as time-integrated air samples and will be collected into Summa canisters in accordance with EPA's General Air Sampling Guidelines SOP (EPA 1994). Indoor air sampling will be performed as follows:

1. Locate the identified sample location. Indoor air samples should be collected in the breathing zone (approximately 3 to 6 feet above grade).
2. Connect the flow controller, with attached in-line filter and vacuum gauge, to the canister utilizing a compression fitting.
3. Connect sampling tube to sample inlet on the filter.
4. Place the canister in the predetermined location and begin sampling by turning the canister valve as specified by the manufacturer and/or laboratory.
5. Record the sample number, location, date, flow controller and canister serial numbers, initial vacuum reading, and start time on the identification tag attached to the canister and Indoor Air Sampling Form (Appendix B, Field Documentation SOP).
6. After sampling is complete, close the canister valve and record the time and final canister vacuum on the canister identification tag and Indoor Air Sampling Form. Do not over-tighten the valves or compression fittings.
7. Package the canisters and flow controllers in the laboratory-provided shipping container or box and transport to the laboratory under chain-of-custody protocol.

A more detailed description of air sampling is located in the General Air Sampling Guidelines SOP in Appendix B.

4.3.3 Soil Sampling

Discrete soil samples will be collected from each borehole in the interval where the highest PID headspace reading is recorded or from the groundwater interface. Samples will be collected using disposable scoops in accordance with the detailed Soil Sampling SOP located in Appendix B. A summary of soil sampling steps is as follows:

1. Carefully remove the top layer of soil to the desired sample depth with a disposable spade.
2. Using a disposable scoop or trowel, collect the sample.
3. Transfer the sample into the appropriate sample bottle.
4. Remove any soil clinging to the bottle threads or rim, and secure the cap tightly.
5. Label the sample bottle with the appropriate sample label. Complete the label carefully and clearly, addressing all the categories or parameters.
6. Place filled sample containers on ice immediately.

7. Complete all chain-of-custody documents and record in the field.
8. Prepare samples for shipping.

4.4 INVESTIGATION DERIVED WASTE

In the process of collecting environmental sample data, field personnel will generate several different types of potentially contaminated investigation-derived wastes (IDW), including the following:

- PPE consisting of sample gloves
- Disposable sampling equipment
- Paper towels
- Excess soil from drilling and sampling

PPE and disposable sampling equipment will be double bagged in plastic trash bags and disposed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Excess soil recovered from direct-push drilling activities will be placed back in their respective boring following completion of subsurface soil sampling. If groundwater is encountered and well construction is completed, excess soil from drilling and sampling will be taken to a municipal landfill for processing.

4.5 FIELD FORMS/RECORD KEEPING

Record keeping in the field will be performed through a combination of logbook, field data sheets and photographs. The level of detail and types of field records will vary according to the types of information necessary for decision inputs.

4.5.1 Field Log Books and Field Forms

Field logbooks will document where, when, how and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks are bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink and signed by the individual making the entries. Language will be factual, objective and free of personal opinions. At a minimum, the following information will be recorded, if applicable, during the collection of each sample:

- Sample location/description
- Sampler's name(s)
- Date and time of sample collection
- Type of sample (e.g., soil)
- Classification of sample materials according to the applicable conditions or intended use of the information
- Type of sampling equipment used
- Field instrument readings and calibration readings for any equipment used, and equipment model(s) and serial number(s)

- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, XRF readings, etc.)
- Sample preservation
- Sample identification numbers and any explanatory codes, and chain-of-custody form numbers
- Shipping arrangements
- Name(s) of recipient laboratory

Additional information regarding Field Logs books is located in the Field Documentation SOP in Appendix B.

4.5.2 Field Forms

Various field data collection forms may be used to streamline the documentation of field data. If field data are recorded on a field form, this data entry should be documented in the daily field logbook entry. Field form data entry should be executed with the same quality standards as field logbook data entry. Entries should be neatly written in black or blue ink and corrections made with single line strike-out and initials. The following field forms may be used on this project, as applicable: soil boring logs, well construction logs, well development forms, and low-flow groundwater sampling records. More detailed information regarding field forms is located in the Field Documentation SOP in Appendix B.

4.5.3 Photograph Procedures and Documentation

Photograph procedures and documentation will include the following:

- Camera and PDA (IDs).
- Date of pictures.
- Time of pictures.
- Directions of photos.
- Description of photos.
- Photographer/witness.

5.0 ANALYTICAL METHODS AND LABORATORY SAMPLE HANDLING PROCEDURES

5.1 ANALYTICAL METHODS

As described in Section 4.0 and shown in Tables 5-1 and 5-2, subsurface soil samples, soil vapor samples, and field duplicates will be collected and submitted for laboratory analysis. Field QC samples will be collected according to the frequency and methods described in Sections 6.0. Samples will be submitted to the laboratory under standard turn-around times (i.e., 10 working days).

5.2 LABORATORY REPORTING PROCEDURES

Samples will be submitted to Montana certified environmental laboratory for analyses of soil and soil vapor samples. WESTON will discuss the project required analytical methods and reporting limits with laboratory staff once the laboratory is selected.

5.3 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Samples will be stored on ice in a secure location pending shipment to the laboratory. Sample coolers will be retained in the custody of the site personnel at all times or secured so as to deny access to anyone else. Samples may be transported by field personnel to the laboratory, or picked up by a laboratory courier/representative, if delivery can be made to ensure that preservation or analytical holding times will be met (Tables 5-1 and 5-2).

5.4 SAMPLE LABELING

Samples collected for analyses will be labeled in a clear and precise way for proper identification in the field and tracking in the laboratory. Sample labels will be affixed to the sample containers with a unique, identifiable name as follows:

Example Direct-Push Soil Samples: BOS-SSBSS-DP01-9, *where*
BOS = Project Name (Butte Office Stop)
SSBSS = Sample matrix (Subsurface Soil Sample)
DP01 = Sample Location (Direct Push Boring Number)
9 = Sample depth (feet bgs)

Example Soil Vapor Samples: BOS-SV-BH01, *where*
BOS = Project Name (Butte Office Stop)
SV = Sample matrix (Soil Vapor)
BH01 = Sample Location (Boring Number)

Field Duplicate samples will be identified with a separate, unique number following the above scheme. The field duplicate sample identification number will be documented in the field logbook. Sample labels for each sample will contain the following information as appropriate:

- Site name

- Sample ID
- Date and time of collection
- Analytical parameter
- Preservation method

5.5 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

All sample shipments for analyses will be accompanied by a COC record. Forms will be completed and sent with the samples for each laboratory and each shipment (i.e., each day). If multiple coolers are sent to the laboratory on a single day, form(s) will be completed and sent with the samples for each cooler.

The COC form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. The sampling personnel will sign the COC form in the "relinquished by" box and note date, time, and air bill number (if samples are being shipped).

The sample numbers for all samples and duplicates will be documented on the COC form. The COC must include the following:

- Sample identification numbers
- Site name
- Sample date
- Number and volume of sample containers
- Required analyses
- Signature and name of samplers
- Signature(s) of any individual(s) with control over samples
- Note(s) indicating special holding times and/or detection limits

5.6 SAMPLE PACKAGING AND SHIPPING

Soil vapor canisters will be pre-cleaned, leak tested, and certified by the selected laboratory prior to sample collection. Soil vapor canisters will be labeled and shipped back to the laboratory in the boxes in which they were originally sent. Soil vapor canisters will not be shipped to the laboratory on ice. Soil vapor samples will be stored in a secure location pending shipment to the laboratory.

Soil sample containers will be pre-cleaned and will not be rinsed prior to sample collection. Sample containers will be labeled and chilled to 4°C after collection. Soil samples will be stored on ice in a secure location pending shipment to the laboratory.

Soil Sample shipments performed will conform to the following procedures:

- Ice will be packed in double zip-locked plastic bags.
- The drain plug of the cooler will be taped shut to prevent leakage.
- The bottom of the cooler will be lined with bubble wrap to prevent breakage during shipment.

- Screw caps will be checked for tightness.
- Containers will have custody seals affixed so as to prevent opening of the container without breaking the seal.
- All glass sample containers will be wrapped in bubble wrap.
- All containers will be sealed in zip-lock plastic bags. The sample numbers will be written on the outside of the plastic bag with indelible ink.
- Samples will be placed in a sturdy cooler(s) lined with a large plastic trash bag. The appropriate COC(s) will be enclosed in a zip-lock plastic bag and affixed to the underside of the cooler lid.
- Empty spaces in the cooler will be filled with either bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment.
- Each ice chest will be securely taped shut with packing tape and custody seals will be affixed to each cooler.

Shipment tracking information will be retained to communicate with the laboratory and confirmation of receipt will be requested for all shipments directly from the laboratory.

Table 5-1 Soil Analytical Services

Specific Analyses Requested				Method MADEP VPH (VPH) ^a	Method MADEP EPH (EPH) ^a	Method EPA 8270CSIM (PAHs) ^a
Preservatives:				Cool to 4°C	Cool to 4°C	Cool to 4°C
Analytical Holding Time(s):				7 days to extraction in MeOH, 40 days after extraction	14 days to extraction, 40 days after extraction	7 days to extraction 40 days after extraction
Number of Containers per Analysis:				One 4-ounce glass jar	One 4-ounce glass jar	One 4-ounce glass jar
Sample Number	Sample Location	Sample Depth (feet bgs)	Quality Control Designation			
BOS-SSBSS-DP1-xx	Direct-Push Boring	TBD	--	X	X	H ^b
BOS-SSBSS-DP2-xx	Direct-Push Boring	TBD	--	X	X	H ^b
BOS-SSBSS-DP3-xx	Direct-Push Boring	TBD	--	X	X	H ^b
BOS-SSBSS-DP4-xx	Direct-Push Boring	TBD	--	X	X	H ^b
BOS-SSBSS-DP5-xx	Direct-Push Boring	TBD	--	X	X	H ^b
BOS-SSBSS-DP6-xx-D	Direct-Push Boring	TBD	Field Duplicate	X	X	H ^b
Number of Soil Samples				5	5	0
Number of Contingency Samples				0	0	5
Number of Duplicate Samples				1	1	1
Total Samples:				6	6	6

a Samples are to be reported in dry weight, which will be indicated on the COC.

b Laboratory will hold sample. PAHs will be analyzed if the results of EPH analysis exceed 200 mg/kg.

Table Abbreviations:

xx = Anomaly ID and final sample depth (e.g., BOS- SSBSS-DP01-9 indicates a sample collected from boring depth 09 bgs).

Bgs = below ground surface

BOS = Butte office stop

DP = Direction Push

EPA = Environmental Protection Agency

EPH = Extractable Petroleum Hydrocarbon

MADEP = Massachusetts Department of Environmental Protection

PAH = Polycyclic aromatic hydrocarbon

SSBBS = Subsurface soil sample

TBD = To-be-determined

VPH = Volatile Petroleum

Hydrocarbons

Table 5-2 Soil Vapor Analytical Services

Specific Analyses Requested				EPA Method TO-15 (APH) and MA-APH Method (APH)
Preservatives:				n/a
Analytical Holding Time(s):				30 days for samples collected in a Summa canister for APH and TO-15 analysis
Number of Containers per Analysis:				One 1-liter Summa canister
Sample Number	Sample Location	Sample Depth (feet bgs)	Quality Control Designation	
BOS-IA-01	Indoor	TBD	--	X
BOS-IA-02	Indoor	TBD	--	X
BOS-IA-03	Indoor	TBD	--	X
BOS-IA-04	Indoor	TBD	--	X
BOS-IA-05-D	Indoor	TBD	Lab Duplicate	X
BOS-SV-BH01	Indoor	TBD	--	X
BOS-SV-BH02	Indoor	TBD	--	X
BOS-SV-BH03	Indoor	TBD	--	X
BOS-SV-BH04	Outdoor	TBD	--	X
BOS-SV-BH05	Outdoor	TBD	--	X
BOS-SV-BH06-D	Outdoor	TBD	Lab Duplicate	X
Number of Vapor Samples				9
Number of Contingency Samples				0
Number of Duplicate Samples				2
Total Samples:				11

Table Abbreviations:

APH = Air-phased petroleum hydrocarbons.
BOS = Butte office stop.
D = Duplicate sample.
EPA = Environmental Protection Agency
IA = Indoor air.

PAH = Polycyclic aromatic hydrocarbon.
SV-BH = Soil vapor borehole.
TBD = To-be-determined.
MA-APH = Massachusetts Air-Phased Petroleum Hydrocarbons.

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6.0 QUALITY CONTROL

The following sections describe the QC samples to be collected to support the sampling activities. For this project, these samples include field QC and laboratory QC samples.

6.1 QC LIMITS FOR FIELD INSTRUMENTS

Equipment necessary to obtain environmental samples is summarized in Table 6-1. Included in the table are the QC limits for all field instruments (i.e. calibration, maintenance, testing, etc.)

6.2 FIELD QUALITY CONTROL SAMPLES

Field QC samples are intended to help evaluate conditions resulting from field activities and are intended to accomplish two primary goals: assessment of field contamination and assessment of sampling variability.

6.2.1 Assessment of Field Contamination (Blanks)

In general, all soil samples will be collected with disposable sampling scoops. All soil vapor samples will be collected using disposable sampling probes and tubing. Since samples will be collected using disposable sampling equipment, equipment rinsate samples will not be collected.

6.2.1.1 Equipment Blanks

Only disposable sampling equipment is planned; therefore, equipment blanks will not be collected.

6.2.1.2 Trip Blank

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the samples, and if cross contamination in the form of VOC migration has occurred between the collected samples. A minimum of one trip blank will be submitted to the laboratory for analysis with every cooler of samples for VOC analysis. Trip blanks are 40-ml vials that have been filled with High Performance Liquid Chromatography (HPLC)-grade water that has been purged so it is VOC free and shipped with the empty sampling containers to the site or sampling area prior to sampling. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same cooler with the samples collected for volatile analyses. The trip blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each trip sample and it will be submitted blind to the laboratory.

6.2.1.3 Temperature Blanks

For each cooler that is shipped or transported to an analytical laboratory, a sample container will be included that is marked as a Temperature Blank. This blank will be used by the laboratory sample custodian to check the temperature of samples upon receipt.

6.2.2 Assessment of Field Variability (Field Duplicate Samples)

The assessment of field variability will occur through duplicate soil samples, as indicated in Sections 5.0. One duplicate soil sample will be collected and submitted to the laboratory for the same analysis as their counterparts. Duplicate samples are collected simultaneously with a sample from the same source under identical conditions into separate sample containers. A duplicate sample is treated independently of its counterpart in order to assess laboratory performance through comparison of the results. Duplicate samples should be collected from areas of known or suspected contamination. As such, duplicate sample locations will be selected in the field based on field screening results and/or observations (e.g., soil staining).

6.3 FIELD SCREENING

Field screening for this investigation is limited to measurement of organic vapors using a photoionization detector (PID) during soil sampling. Quality control procedures for field screening therefore primarily consist of instrument calibration according to manufacturer's guidelines. However, periodic checks of the screening equipment in ambient air during sampling will also be performed to determine if instrument performance is varying outside of calibration (Table 6-1). Frequency of QC measurement checks in ambient air will occur nominally at each sample location, or at a minimum of twice per work day after initial calibration. Measurements of breathing zone vapors should not be considered ambient QC checks due to potential vapors associated with sampling activities.

6.4 LABORATORY QUALITY CONTROL SAMPLES

Laboratory QC samples are analyzed as part of the standard laboratory QC protocols. The laboratory monitors the precision and accuracy of the results of its analytical procedures through analysis of QC samples. In part, laboratory QC samples consist of matrix spike and matrix spike duplicates for organic and inorganic analyses. Laboratory QC samples are an aliquot of the field sample. They are not separate samples, but a special designation of an existing sample. The laboratory will be alerted as to which sample is to be used for QC analysis by the notation on the sample container label, the traffic report, and chain-of-custody record or packing list.

At a minimum, one laboratory QC sample is required per 14 days or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than one week or involves collection of more than 20 samples, additional QC samples will be designated.

Because sample locations for this sampling event will be selected in the field, the sample designated as the laboratory QC sample will also be identified in the field. The location was chosen at random as levels of contamination at the Site are unknown. Soil samples for laboratory QC purposes will be obtained by collecting twice the volume of subsample material for preservation at a specific location/depth consistent with the original samples. The COC records for these samples will identify them as laboratory QC samples.

Table 6-1 Field Instruments and Quality Control Limits

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Title or Position of Responsible Person	Verification	SOP Reference
Photoionization Detector (PID)	Calibrate with span gas, as recommended by manufacturer	Check battery	Calibration check	Visually inspect equipment	Refer to instrument SOP	Refer to instrument SOP	Refer to instrument SOP	Field personnel	WAM/COR	G-15/ MultiRae/ Toxic Vapor Analyzer (TVA) – 1000
Water Level Indicator	Calibrate tape against calibrated steel measuring tape	Clean prior and after each use, check battery	Calibration and operational equipment check	Visually inspect for obvious defects, broken parts, or cleanliness	Prior to use	Equipment operational	Repair/	Field personnel	WAM/COR	Instrument-Specific
Soil Sampling Tools (Disposable Scoops)	NA	NA	NA	Visually inspect for obvious defects or broken parts	Prior to use	NA	Replace	Field personnel	WAM/COR	NA
Electric Hammer Drill	NA	NA	NA	Visually inspect for obvious defects or broken parts	Prior to use	NA	Replace	Field personnel	WAM/COR	NA
Vapor Sampling Tools (Disposable Sampling Probe and Tubing)	NA	NA	NA	Visually inspect for obvious defects or broken parts	Prior to use	NA	Replace	Field personnel	WAM/COR	NA

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7.0 DATA ANALYSIS, RECORD KEEPING, AND REPORTING REQUIREMENTS

7.1 DATA VERIFICATION AND VALIDATION PROCESS AND QA/QC REPORTING

Due to the limited scope, limited duration, and investigation nature of this project, the data will not undergo data validation by a third party. Data will undergo verification by the WESTON QA Manager (to-be-determined).

Problems or questions about analytical data quality that may require corrective action will be brought to the attention of the laboratory in writing from the WESTON Project Manager. The request may be initiated if QC results exceed method or project criteria, if reporting or flagging errors are identified, or to request information that has not been reported. The laboratory's response shall include a written explanation of the problem, a plan and a schedule for corrective action, and/or a re-issuance of laboratory reports or electronic data files. If significant data quality problems have occurred and the data are critical to decision making, reanalysis of samples may be required, or recollected and reanalyzed at the discretion of WESTON and MTDEQ.

7.2 DATA INTERPRETATION APPROACH

Analytical results for delineation samples from each media sampled will be compared to the applicable screening and/or regulatory criteria, which are included in Table 7-1 and 7-2.

7.3 PROJECT RECORD KEEPING PROCEDURES

All field notes, field data sheets, laboratory reports, and data validation reports will be checked for transcription errors and omissions. Transcription error checks and data collection and maintenance will be conducted by the WESTON Project Manager.

7.4 DATA MANAGEMENT PROCEDURES

All project deliverables (SAP, Data Summaries, Project Report) will be peer reviewed prior to release to DEQ. In time-critical situations, the peer review may be concurrent with the release of a draft document to DEQ. Errors discovered in the peer review process will be reported by the reviewer to the originator of the document, who will be responsible for corrective action.

The Project Manager will review project documentation (field logs/logbooks, chain of custody forms, etc.) to ensure the SAP was followed and that sampling activities were adequately documented. The Project Manager will document deficiencies and will be responsible for corrective actions.

Table 7-1 Project Reporting Limits and Data Quality Indicators for Soil Samples

Analyte	Project Action Limits		PAL Reference	PQL Goal (mg/kg)	LQL ^a (mg/kg)	LDL ^a (mg/kg)
	Surface (0-2 feet) Commercial (mg/kg)	Subsurface (>2 feet) (mg/kg)				
Volatile Petroleum Hydrocarbons – Analytical Method MADEP VPH						
VPH C5-C8 Aliphatics	300	500	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	300	TBD	TBD
VPH C9-C10 Aromatics	700	700	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	700	TBD	TBD
VPH C9-C12 Aliphatics	700	1,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	700	TBD	TBD
Extractable Petroleum Hydrocarbons – Analytical Method MADEP EPH ^b						
EPH Screen	200	200	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	200	TBD	TBD
C9-C18 Aliphatics	1,000	2,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	1,000	TBD	TBD
C19-C36 Aliphatics	100,000	100,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	100,000	TBD	TBD
C11-C22 Aromatics	2,000	2,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	2,000	TBD	TBD
Volatile Organic Compounds – Analytical Method 8260B						
Benzene	0.2	0.2	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	0.2	TBD	TBD
Ethylbenzene	30	60	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	30	TBD	TBD

Analyte	Project Action Limits		PAL Reference	PQL Goal (mg/kg)	LQL ^a (mg/kg)	LDL ^a (mg/kg)
	Surface (0-2 feet) Commercial (mg/kg)	Subsurface (>2 feet) (mg/kg)				
Methyl tert-butyl ether	0.3	0.3	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	0.3	TBD	TBD
Naphthalene	20	50	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	20	TBD	TBD
Toluene	60	60	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	60	TBD	TBD
Xylenes, Total	300	600	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	300	TBD	TBD
Polycyclic Aromatic Hydrocarbons (PAHs) – Analytical Method 8270CSIM						
Acenaphthene	1000	200	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	200	TBD	TBD
Anthracene	20,000	20,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	20,000	TBD	TBD
Benzo(a)anthracene	2	50	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	2	TBD	TBD
Benzo(a)pyrene	0.2	5	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	0.2	TBD	TBD
Benzo(b)fluoranthene	2	50	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	2	TBD	TBD
Benzo(k)fluoranthene	20	500	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	20	TBD	TBD

Analyte	Project Action Limits		PAL Reference	PQL Goal (mg/kg)	LQL ^a (mg/kg)	LDL ^a (mg/kg)
	Surface (0-2 feet) Commercial (mg/kg)	Subsurface (>2 feet) (mg/kg)				
Chrysene	200	5,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	200	TBD	TBD
Dibenzo(a,h)anthracene	0.2	5	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	0.2	TBD	TBD
Fluoranthene	2,000	2,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	2,000	TBD	TBD
Fluorene	2,000	2,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	2,000	TBD	TBD
Indeno(1,2,3-cd)pyrene	2	50	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	2	TBD	TBD
Naphthalene	20	50	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	20	TBD	TBD
Pyrene	2,000	2,000	MTDEQ Tier 1 Surface and Subsurface Soil RBSLs (>20 feet to groundwater)	2,000	TBD	TBD

Table Notes and Abbreviations:

a A laboratory has not been selected for this project. Once a laboratory has been selected, the LQLs and LDLs will be reviewed against the PQL Goal and added prior to starting work.

b Note that EPH screening process requires speciation analyses if initial screening result exceeds 200 mg/kg. If analytical results for EPH exceed 200 mg/kg, speciation will include benzene, toluene, ethylbenzene, total xylenes, MTBE, naphthalene and PAH analysis.

> = greater than

EPA Residential RSL = Environmental Protection Agency Residential Regional Screening Level (November 2015)

EPH = Extractable Petroleum Hydrocarbons

LDL = Laboratory Detection Limit

LQL = Laboratory Quantitation Limit

MADEP = Massachusetts Department of Environmental Protection

mg/kg = milligrams per kilogram

MTDEQ RBSL = Montana Department of Environmental Quality Risk Based Screening Level (December 2009)

PAL = Project Action Limit

PQL = Project Quantitation Limit

TBD = to-be-determined

VPH = Volatile Petroleum Hydrocarbons

Table 7-2 Project Reporting Limits and Data Quality Indicators for Soil Vapor Samples

Analyte	EPA Residential RSL (µg/m³)	EPA Industrial RSL (µg/m³)	PAL Reference	PQL Goal (µg/m³)	LQL ^a (µg/m³)	LDL ^a (µg/m³)
Massachusetts Air-Phase Petroleum Hydrocarbons (MA APH)						
C5-C8 Aliphatic	62.6	262.8	MA-DEP APH	62.6	TBD	TBD
C9-C12 Aliphatic	10.4	43.8	MA-DEP APH	10.4	TBD	TBD
C9-C10 Aromatic	10.4	43.8	MA-DEP APH	10.4	TBD	TBD
Volatile Organic Compounds - Method TO-15						
1,2-Dichloroethane	0.11	0.47	EPA RSL Table	0.11	TBD	TBD
1,3-Butadiene	0.094	0.41	EPA RSL Table	0.094	TBD	TBD
Benzene	0.36	1.6	EPA RSL Table	0.36	TBD	TBD
Ethylbenzene	1.1	4.9	EPA RSL Table	1.1	TBD	TBD
Ethylene Dibromide (EDB)	0.0047	0.02	EPA RSL Table	0.77	TBD	TBD
Xylenes (total)	10	44	EPA RSL Table	10	TBD	TBD
Methyl Tert Butyl Ether	11	47	EPA RSL Table	11	TBD	TBD
Naphthalene	0.083	0.36	EPA RSL Table	2.62	TBD	TBD
Toluene	520	2,200	EPA RSL Table	520	TBD	TBD

Table Notes and Abbreviations:

a A laboratory has not been selected for this project. Once a laboratory has been selected, the LQLs and LDLs will be reviewed and added prior to starting work.

EPA RSL = Environmental Protection Agency Residential Regional Screening Level (November 2015).

LDL = Laboratory Detection Limit

LQL = Laboratory Quantitation Limit

MA-DEP APH = Massachusetts Department of Environmental Protection Air-Phase Petroleum Hydrocarbons.

PAL = Project Action Limit

PQL = Project Quantitation

Limit

TBD = to-be-determined

µg/m³ = micrograms per cubic meter

8.0 FIELD HEALTH AND SAFETY PROCEDURES

Field activities will be conducted in accordance with the site-specific Health and Safety Plan (HASP). Daily health and safety briefings with all personnel working on site will be completed to discuss the day's scope of work and hazards that may occur. The site-specific HASP is presented in Appendix A.

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9.0 SCHEDULE

Table 9-1 includes the schedule for project tasks and expected project completion dates for the Butte Office Stop RI. If an alternate delivery date is required, WESTON will request it in writing and the extension may be agreed to in writing by DEQ in lieu of a Task Order Modification. All services under this task order are to be completed no later than 10 June 2016.

Table 9-1 Project Schedule

Task	Completion Date
Task 1: All access agreements, permits, and other preliminary work completed prior to fieldwork	NA
Task 2: Pre-Investigation Walk-Thru	4 March 2016
Task 3: Draft SAP, including draft Facility Map	16 March 2016
Task 4: Final SAP, including final Facility Map	25 March 2016
Task 5: Vapor Intrusion Investigation	22 April 2016
Task 6: Installation of Soil Borings and Groundwater Monitoring Wells	22 April 2016
Task 7: Groundwater Monitoring (if occurring)	29 April 2016
Task 8: Draft Remedial Investigation Report	13 May 2016
Task 9: Final Remedial Investigation Report	10 working days following receipt of DEQ comments on the Draft Remedial Investigation Report

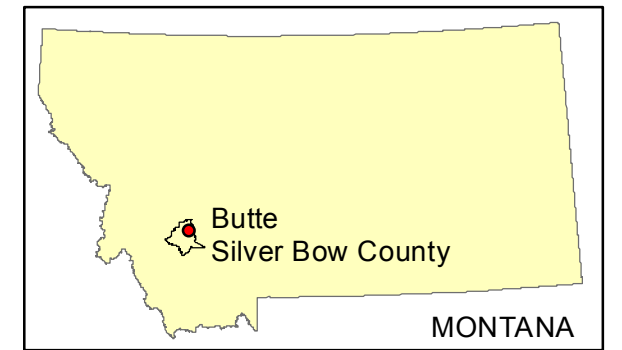
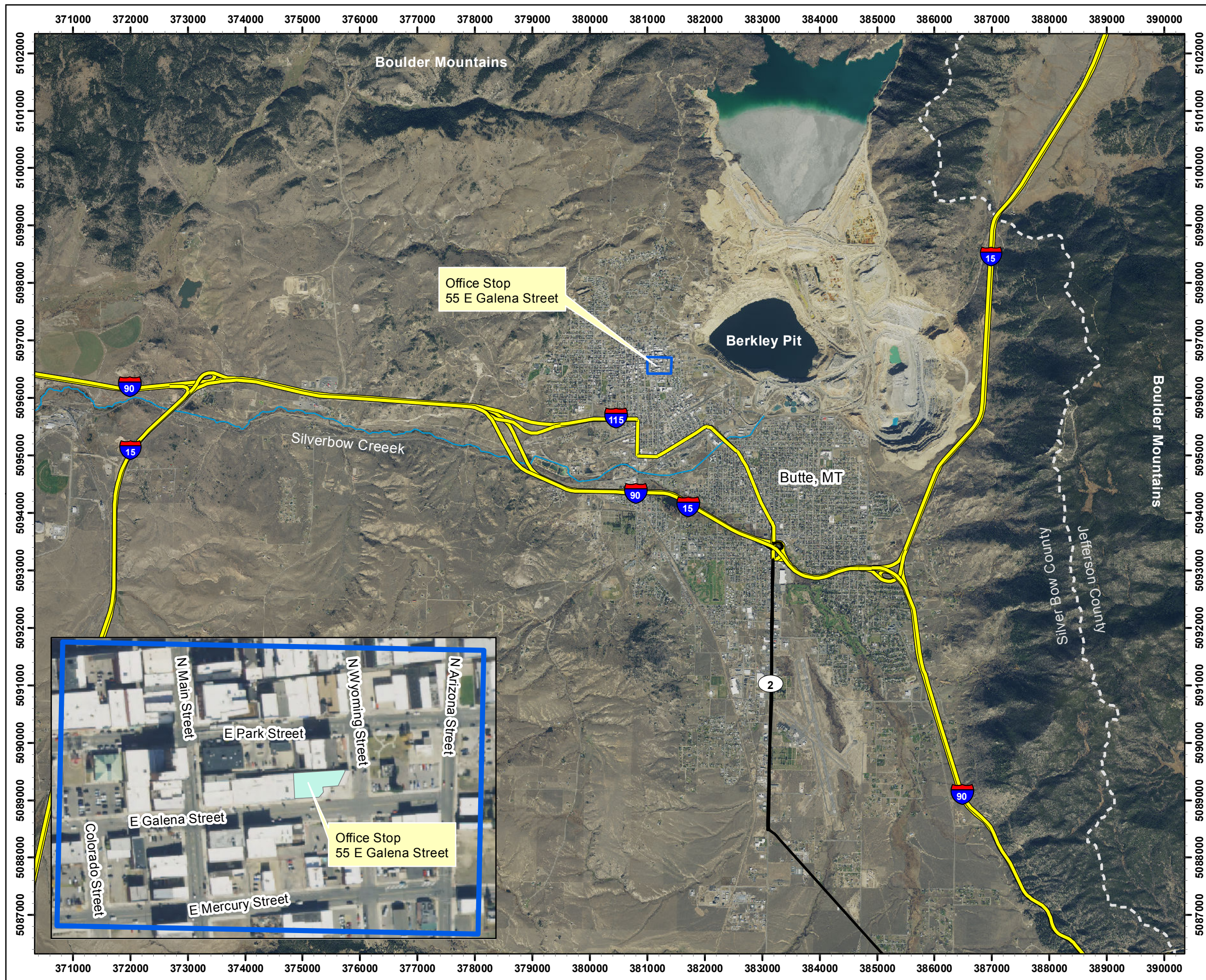
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10.0 REFERENCES

- ASTM, 2009. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), Designation D 2488-09a.
- Atlatl, Inc., 1995. *Thirty Day Leak Report for the Petroleum Release at the Office Stop Facility*
- Dames and Moore, 1996. *Report, Phase I Environmental Site Assessment, Office Stop, Butte Montana*. December 23.
- EPA Environmental Response Team, 1994. *Standard Operating Procedures, Sample Equipment Decontamination*. SOP#2006.
- Montana Department of Environmental Quality, 2011. *Sub-Slab Soil Vapor Sampling Guide*.
- Montana Department of Environmental Quality (DEQ), 2011. *Montana Vapor Intrusion Guide*. April 22.
- Rae Systems, 2014. *MiniRAE 3000 User's Guide*. RAE Systems by Honeywell, 2014.
- United States Environmental Protection Agency (EPA), Management of Investigation-Derived Wastes During Site Inspections. EPA/540/G-91/009. Office of Emergency and Remedial Response (OERR) Directive 9345.3-02. Dated May 1991.

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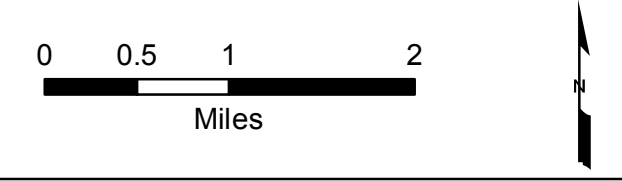
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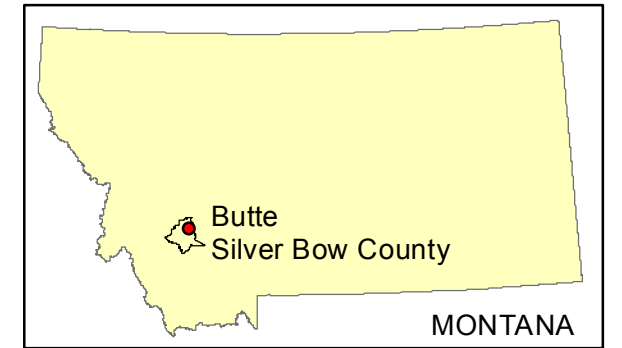


- Legend**
- Interstate
 - State Highway
 - Creek
 - Inset Map Location
 - Office Stop Building Location
 - County Line

Aerial Image: NAIP, 2015
County and Town Location Source: Montana State Library
Coordinates: NAD83, UTM Zone 12 N

Figure 1
Vicinity Map
Remedial Investigation of the
Butte Office Stop 55 E Galena Street, Butte
Silver Bow County, Montana



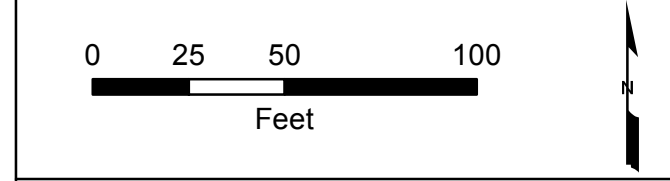


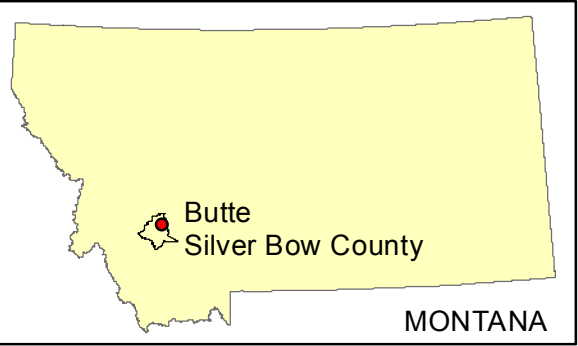
Legend

- Office Stop Building Location
- Tank Location Prior to Removal (approx.)

Coordinates: NAD83, UTM Zone 12 N

Figure 2
Site Map
Remedial Investigation of the
Butte Office Stop 55 E Galena Street, Butte
Silver Bow County, Montana



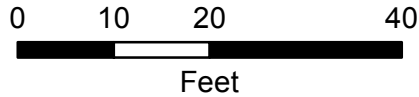


Legend

- Proposed Soil Boring Location
- Proposed Soil Vapor Sample Location
- Basement Location (approximate)
- Crawl Space Location (approx.)
- Office Stop Building Location
- Tank Location Prior to Removal (approx.)

Coordinates: NAD83, UTM Zone 12 N

Figure 3
Proposed Sample Locations Map
Remedial Investigation of the
Butte Office Stop 55 E Galena Street, Butte
Silver Bow County, Montana



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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APPENDIX A

Site-Specific Health and Safety Plan

SITE HEALTH AND SAFETY PLAN (HASP)

Office:	Helena, MT (HMT)
Site Name:	Butte Office Stop
Client:	Montana DEQ
Work Location:	55 E Galena, Butte, MT (46.012430°, -112.533545°)
WO#:	15409.005.001.3000.00

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1435 Garrison Street, #100
Lakewood, CO 80215
303-729-6100

Butte_Office_Stop_HASP_2016.03.09_DRAFT.docx

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SITE HEALTH AND SAFETY PLAN (HASP)																												
Prepared by: Shaun Cwick		W.O. Number: 15409.005.001.3000.00	Date: 3/09/16																									
Cilent:	Montana DEQ	GPS Coord:	46.012430°, -112.533545°																									
Site Name:	Butte Office Stop (BOS)																											
Work Location Address: 55 E Galena, Butte, MT																												
Site History: EPA ID: MTD006230635, NPL Status: Final The Office Stop Facility is located in Silver Bow County on the northwest corner of Galena and Wyoming Streets in the town of Butte, Montana. A petroleum release (#2692) was reported at the Office Stop property on 21 August 1995 while two of six petroleum tanks were being removed. Both tanks had been perforated and soil was observed to be stained. Further releases were observed when the remaining four tanks were pulled on 23 August 1995. DEQ approved the excavation of 350 cubic yards. Closure samples were collected only from the base of the excavation and not from the sidewalls. While sample results collected from 21 feet below ground surface were below risk based screening levels (RBSLs), these still had a strong petroleum odor. On 8 September 1995, the excavation was backfilled. On 26 September 1995, the site was deemed PetroFund eligible. There has been no field activity at this site since 1995. A No Current Corrective Action Required letter was sent to the Responsible Party (RP) Kenneth Fink, in January 1996. A Site Status Update Letter was sent to the RP in February 2000. He did not wish to pursue closure at that time. This property has since changed hands, and is now owned by the non-profit North American Indian Alliance. The non-profit was never notified of the Release. The Property presently serves as a Health Care clinic and afterschool youth program center.																												
Scope of Work: Project Tasks: 1. Task 1: Preliminary Items to Schedule and Coordinate 2. Task 2: Pre-Investigation Walk-Thru 3. Task 3: Sampling and Analysis Plan Development 4. Task 4: Site Feature Survey and Facility Mapping 5. Task 5: Vapor Intrusion Investigation 6. Task 6: Installation of Soil Borings and Groundwater Monitoring Wells 7. Task 7: Groundwater Monitoring 8. Task 8: Project Report																												
☐ Site visit only; site HASP not necessary. List personnel here and sign off below: ☐ Utility notification required. If required, provide utility notification agency, authorization number, and valid dates (Include FLD-34 Attachment A documentation as an attachment to this HASP.																												
Regulatory Status:																												
Site regulatory status: <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">CERCLA/SARA</td> <td style="width: 33%;">RCRA</td> <td style="width: 33%;">Other Federal Agency</td> </tr> <tr> <td>☐ U.S. EPA</td> <td>☐ U.S. EPA</td> <td>☐ DOE</td> </tr> <tr> <td>☒ State</td> <td>☐ State</td> <td>☐ USACE</td> </tr> <tr> <td>☐ NPL Site</td> <td>NRC</td> <td>☐ Air Force</td> </tr> <tr> <td>☐ OSHA</td> <td>☐ 10 CFR 20</td> <td>☐ _____</td> </tr> </table> Hazard Communication (Req'd See Attachment D) ☒ 1910 ☐ 1926 ☐ State			CERCLA/SARA	RCRA	Other Federal Agency	☐ U.S. EPA	☐ U.S. EPA	☐ DOE	☒ State	☐ State	☐ USACE	☐ NPL Site	NRC	☐ Air Force	☐ OSHA	☐ 10 CFR 20	☐ _____	Safety Officer Manual (Required to be On-Site) Based on the Hazard Assessment and Regulatory Status, determine the Standard HASP(s) applicable to this project. Indicate below which Standard HASP will be used and append the appropriate pages of this form along with the Standard Plan. <table style="width: 100%; border: none;"> <tr> <td>☐ Stack Test</td> <td>☐ _____</td> </tr> <tr> <td>☐ Air Emissions</td> <td>☐ _____</td> </tr> <tr> <td>☐ Asbestos</td> <td>☐ _____</td> </tr> <tr> <td>☐ Industrial Hygiene</td> <td>☐ _____</td> </tr> <tr> <td>☐ _____</td> <td>☐ _____</td> </tr> </table>	☐ Stack Test	☐ _____	☐ Air Emissions	☐ _____	☐ Asbestos	☐ _____	☐ Industrial Hygiene	☐ _____	☐ _____	☐ _____
CERCLA/SARA	RCRA	Other Federal Agency																										
☐ U.S. EPA	☐ U.S. EPA	☐ DOE																										
☒ State	☐ State	☐ USACE																										
☐ NPL Site	NRC	☐ Air Force																										
☐ OSHA	☐ 10 CFR 20	☐ _____																										
☐ Stack Test	☐ _____																											
☐ Air Emissions	☐ _____																											
☐ Asbestos	☐ _____																											
☐ Industrial Hygiene	☐ _____																											
☐ _____	☐ _____																											
Review and Approval Documentation:																												
Reviewed by: SO / RCO-SO		Date:																										
Name (Print)		Signature																										
Environmental Compliance Advisor		Date:																										
Name (Print)		Signature																										

Approved by:

Project Manager

Chris Morgan

Date:

Name (Print)

Signature

Schedule / Site Personnel Acknowledgement				
In accordance with WESTON's Personal Protective Equipment Program and 29 CFR 1910.132, at the site prior to personnel beginning work, the FSO and/or the Site Manager have evaluated conditions and verified that the personal protective equipment selection outlined within this HASP is appropriate for the hazards known or expected to exist. (Refer to CEHS Program Manual Section 5, Personal Protection Program, for guidance.)				
☒ FSO	Lara Kapelanczyk			Date:
	Name	Signature		
☒ Site Manager	Lara Kapelanczyk			Date:
	Name	Signature		
☐ Project Env. Compliance Officer				Date:
	Name	Signature		
☐ Dangerous Goods Shipping Coordinator				Date:
	Name	Signature		
Field Work Schedule:				
Start date:	4/22/16	This site HASP must be reissued/reapproved for any activities conducted after:	Amendment date(s) 1. 2. 3.	By:
End date:	4/29/16	Date: 4/29/17 No more that 1 yr after HASP Approval Date		
Additional Site History / Background				



BEHAVIOR-BASED SAFETY (BBS) – Pledge

I Accept and Understand 100% Safe Work Is an Achievable Goal

- ★ I will work to develop strong connections and team with my co-workers to establish a culture of working safely 100% of the time.
- ★ I will actively care about all Weston employees, our families, team contractors and clients.
- ★ I will help to keep our projects safe and will meet and exceed compliance requirements.
- ★ I will understand and comply with the Health and Safety Plan, Accident Prevention Plan, and Environmental Compliance Plan for each field project. They guide my actions.
- ★ I will stop any work that presents an imminent hazard to people or the environment or is not adequately addressed in the Health and Safety Plan, Accident Prevention Plan, or Environmental Compliance Plan.
- ★ I will identify changing conditions to address safety implications. No surprises!
- ★ I will identify unsafe working conditions and be proactive in correcting them.
- ★ I will coach and mentor and will accept coaching from others to encourage safe work behaviors.
- ★ I am empowered to share lessons-learned and foster continuous improvement.

I will Learn where I can get Assistance

- ★ I will develop high quality relationships with my Division Environmental, Health, and Safety (EHS) Manager; Profit Center Safety Officer; and Field Safety Officer.
- ★ I will learn how and when to contact our Environmental Advisors.
- ★ I will get to know our Corporate EHS staff and become familiar with the Corporate EHS Portal Site.

I will Report All Incidents

- ★ If a safety incident occurs, even if there is no injury or damage but there could have been, I will report the incident immediately.
- ★ I will conduct safety reviews of all incidents with my supervisor, if requested. The review will focus on cause and lessons-learned so that we can be proactive in preventing it from happening again.

TABLE OF CONTENTS

Section	Page
1. PERSONNEL ON SITE INFORMATION	1-1
1.1 WESTON REPRESENTATIVES	1-2
1.2 WESTON SUBCONTRACTORS	1-2
1.3 SITE PERSONNEL AND CERTIFICATION STATUS	1-3
1.3.1 WESTON Employee Certification	1-3
1.3.2 Subcontractor's Health and Safety Program Evaluation	1-4
2. HEALTH AND SAFETY EVALUATION	2-1
2.1 HEALTH AND SAFETY EVALUATION	2-2
2.1.1 Task Hazard Assessment	2-2
2.1.2 Chemical Hazards of Concern	2-3
2.1.3 Biological Hazards of Concern	2-4
2.1.4 Radiation Hazards of Concern	2-5
2.1.5 Applicable WESTON Field Operating Procedures	2-6
3. SITE SECURITY	3-1
3.1 SITE SECURITY ASSESSMENT FORM	3-2
3.2 WESTON SITE SECURITY CHECKLIST	Error! Bookmark not defined.
4. TASK BY TASK ASSESSMENT	4-1
4.1 TASK-BY-TASK RISK ASSESSMENT	4-2
4.1.1 Task 1 Description	Error! Bookmark not defined.
4.1.2 Task 2 Description	4-3
4.1.3 Task 3 Description	Error! Bookmark not defined.
4.2 PERSONNEL PROTECTION PLAN	4-7
4.3 DESCRIPTION OF LEVELS OF PROTECTION	4-8
5. MONITORING PROGRAM	5-1
5.1.1 Air Monitoring Instruments	5-2
5.1.1 Air Monitoring Instruments Calibration Record	5-3
5.2 SITE AIR MONITORING PROGRAM	5-4
5.3 ACTION LEVELS	5-5
6. HOSPITAL INFORMATION	6-1
6.1 CONTINGENCIES	6-2
6.1.1 Emergency Contacts and Phone Numbers	6-2
6.1.2 Hospital Map	6-4
6.1.3 Response Plans	6-6
7. DECONTAMINATION PLAN	7-1
7.1 GENERAL DECONTAMINATION PLAN	7-2
7.2 LEVEL D DECONTAMINATION PLAN	7-3
8. TRAINING AND BRIEFING TOPICS/SIGN OFF SHEET	8-1
8.1 TRAINING AND BRIEFING TOPICS	8-2
8.2 HEALTH AND SAFETY PLAN APPROVAL/SIGNOFF FORM	8-3

ATTACHMENTS

ATTACHMENT A	Chemical Contaminants Data Sheets
ATTACHMENT B	Safety Data Sheets
ATTACHMENT C	Safety Procedures/Field Operating Procedures (FLD Ops)
ATTACHMENT D	Hazard Communication Program
ATTACHMENT E	Air Sampling Data Sheets
ATTACHMENT F	Incident Reporting
ATTACHMENT G	Traffic Control Plan
ATTACHMENT H	Environmental Health & Safety Inspection Checklist
ATTACHMENT I	Hazard Checklist (Single Page)
ATTACHMENT J	Audit and Other Forms

1. PERSONNEL ON SITE INFORMATION

1.1 WESTON REPRESENTATIVES			
Organization/Branch	Name/Title	Address	Telephone
Weston / HMT	Lara Kapelanczyk/SM, FSO	318 N. Last Chance Gulch, 2A Helena, MT 59601	Mobile: 406-890-5304 Office: 406-502-1570
Weston / HMT	Shaun Cwick	1435 Garrison St. Ste 100, Lakewood, CO 80215	Mobile: 815-236-4350 Office: 303-729-6109
			Mobile: Office:
			Mobile: Office:
			Mobile: Office:
Roles and Responsibilities:			
1.2 WESTON SUBCONTRACTORS			
Organization/Branch	Name/Title	Address	Telephone
Roles and Responsibilities:			
Drilling of five soil boring using a direct-push drill rig. Possible well construction in three of the five bore holes.			
SITE-SPECIFIC HEALTH AND SAFETY PERSONNEL			
The Site Field Safety Officer (FSO) for activities at this site is:		Lara Kapelanczyk	
Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as FSOs must be experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120.			
Qualifications of FSO:			
40hr Hazwoper, 8hr Refreshers, 8hr SHSC/FSO, FA/CPR/BBP current, appropriate competent person training			
Designated alternates include: Shaun Cwick			

1.3 SITE PERSONNEL AND CERTIFICATION STATUS

1.3.1 WESTON Employee Certification

For each team member, enter the name and that person's role on the project (Title). Identify which of the tasks identified in Section 4 the person will be working on. Don't enter anything in the 'Certification Level....' box.

Using the link below, verify the the status of each person's Medical, Training and Fit Test records and enter the results with the checkboxes.

<http://prdnet/EHSTrack/>

Under the 'Personnel' tab, use 'Search' and find the person via their last name. Review their status for each of the Items listed in the check box table. Please note the distinction between a Qualitative (QLFT) and Quantitative (QNFT) fit test.

Name: Lara Kapelanczyk Title: FSO, Site Mgr Task(s): Certification Level or Description: C-S ☒ Medical Current ☒ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	Name: Shaun Cwick Title: Field Personnel Task(s): Certification Level or Description: ☒ Medical Current ☒ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: Title: Task(s): Certification Level or Description: ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	Name: Title: Task(s): Certification Level or Description: ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
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TRAINING CURRENT - Training: All personnel, including visitors, entering the exclusion or contamination reduction zones must have certifications of completion of training in accordance with OSHA 29 CFR 1910, 29 CFR 1926, or 29 CFR 1910.120.

FIT TEST CURRENT - Respirator Fit Testing: All persons, including visitors, entering any area requiring the use or potential use of any tight-fitting respirator must have had, as a minimum, a qualitative fit test, administered in accordance with OSHA 29 CFR 1910.134 or ANSI, within the last 12 months. If site conditions require the use of a full-face, tight-fitting, air-purifying respirator for protection from asbestos or lead, employees must have had a quantitative fit test, administered according to OSHA 29 CFR 1910.1001 or .1025 or 29 CFR 1926.1101 or .62, within the last 12 months.

MEDICAL CURRENT - Medical Monitoring Requirements: All personnel, including visitors, entering the exclusion or contamination reduction zones must be certified as medically fit to work and able to wear a respirator, if appropriate, in accordance with 29 CFR 1910 or 29 CFR 1926 (substance-specific), or 29 CFR 1910.120 (HAZWOPER).

The Site Field Safety Officer is responsible for verifying all certifications and fit tests.

SITE PERSONNEL AND CERTIFICATION STATUS		
1.3.2 Subcontractor's Health and Safety Program Evaluation		
Name of Subcontractor: TBD Address:		
Activities To Be Conducted by Subcontractor:		
Evaluation Criteria		
This section defaults to having the subcontractor agree to work under this (Weston's) HASP for their work on the site. If a subcontractor chooses to work under their own HASP, a formal review of the subcontractor and their site-specific HASP by a Weston Safety Officer is required.		
Medical Program meets OSHA/WESTON criteria ☐ Acceptable ☐ Unacceptable Comments:	Personal Protective Equipment available ☐ Acceptable ☐ Unacceptable Comments:	On-site monitoring equipment available, calibrated, and operated properly ☐ Acceptable ☐ Unacceptable Comments:
Safe Working Procedures clearly specified ☐ Acceptable ☐ Unacceptable Comments:	Training meets OSHA/WESTON criteria ☐ Acceptable ☐ Unacceptable Comments:	Emergency Procedures ☐ Acceptable ☐ Unacceptable Comments:
Decontamination Procedures ☐ Acceptable ☐ Unacceptable Comments:	General Health and Safety Program evaluation ☐ Acceptable ☐ Unacceptable Comments:	Additional comments: ☐ Subcontractor has agreed to and will conform to the WESTON HASP for this project. ☐ Subcontractor will work under its own HASP, which has been accepted by Project PM.
Evaluation Conducted by:		Date:
Evaluation Source (SubTrack, etc.):		
Subcontractor		
Certifications for all subcontractor personnel will be added to the HASP prior to beginning work.		
Name: TBD Title: Operator Task(s): All Certification Level or Description: ☐ Medical Current ☐ Fit Test Current (Qual.) ☐ Training Current ☐ Fit Test Current (Quant.)	Name: Title: Task(s): Certification Level or Description: ☐ Medical Current ☐ Fit Test Current (Qual.) ☐ Training Current ☐ Fit Test Current (Quant.)	
Name: Title: Task(s): Certification Level or Description: ☐ Medical Current ☐ Fit Test Current (Qual.) ☐ Training Current ☐ Fit Test Current (Quant.)	Name: Title: Task(s): Certification Level or Description: ☐ Medical Current ☐ Fit Test Current (Qual.) ☐ Training Current ☐ Fit Test Current (Quant.)	

2. HEALTH AND SAFETY EVALUATION

2.1 HEALTH AND SAFETY EVALUATION

2.1.1 Task Hazard Assessment

Background Review: ☐ Complete ☐ Partial

If partial why?

Activities Covered Under This Plan:

HASP Task	Hazard ID#'s (from below)	Task Description	Schedule
1	4	Travel to / from the site for the Weston team	4/22/16
2	1, 2, 4	Vapor Intrusion Investigation	2/22/16
3	1, 2, 4	Installation of Soil Borings and Groundwater Monitoring Wells (if water encountered)	2/22/16
4			
5			

Types of Hazards:

Numbers refer to one of the following hazard evaluation forms. Complete hazard evaluation forms for each appropriate hazard class.

Physiochemical **1**

- ☒ Flammable
- ☐ Explosive
- ☐ Corrosive
- ☐ Reactive
- ☐ O₂ Rich
- ☐ O₂ Deficient

Chemically Toxic **1**

- ☒ Inhalation ☐ Carcinogen
- ☒ Ingestion ☐ Mutagen
- ☒ Contact ☐ Teratogen
- ☒ Absorption
- ☒ OSHA 1910.1000 Substance
(Air Contaminants)
- ☐ OSHA Specific Hazard
Substance Standard
(Refer to following page for
listing)

Radiation **3**

- Ionizing:
- ☐ Internal exposure
 - ☐ External exposure
- Non-ionizing:
- ☐ UV ☐ IR
 - ☐ RF ☐ MicroW
 - ☐ Laser

Biological **2**

- ☐ Etiological Agent
- ☒ Other (plant, insect, animal)

☒ Physical Hazards **4**

- ☐ Construction Activities

Source/Location of Contaminants and Hazardous Substances:

Directly Related to Tasks

- ☒ Air
- ☒ Other Surface
- ☐ Groundwater
- ☒ Soil
- ☐ Surface Water
- ☐ Sanitary Wastewater
- ☒ Process Wastewater
- ☐ Other _____

Indirectly Related to Tasks — Nearby Process(es) That Could Affect Team Members:

- ☐ Client Facility/WESTON Work Location
- ☐ Nearby Non-Client Facility

Describe:

- ☐ Has Weston or the Client secured access to the site and coordinated activities with facility personnel?

Comments: Weston will be introduced to the site by MT/DEQ's site contractor.

HEALTH AND SAFETY EVALUATION

2.1.2 Chemical Hazards of Concern

☐ N/A

Chemical Contaminants of Concern

Attach data sheets from an acceptable source such as NIOSH pocket guide, condensed chemical dictionary, ACGIH TLV booklet, Hazardous Substances Data base (HSDB), etc. List chemicals and concentrations below and locate data sheets in Attachment A of this HASP.

☐ N/A

Identify hazardous materials used or on-site and attach Safety Data Sheets (SDSs) for all reagent type chemicals, solutions, or other identified materials that in normal use in performing tasks related to this project could produce hazardous substances. Ensure that all subcontractors and other parties working nearby are informed of the presence of these chemicals and the location of the SDSs. Obtain from subcontractors and other parties, lists of the hazardous materials they use or have on-site and identify location of the SDSs here. List chemicals and quantities below and locate SDSs in Attachment B of this HASP.

Chemical Name	Concentration (soils)	Chemical Name	Quantity

HAZARDOUS SUBSTANCES WITH OSHA-SPECIFIC STANDARDS

☐ 1910.1001 Asbestos	☐ 1910.1002 Coal tar pitch volatiles	☐ 1910.1003 4-Nitrobiphenyl, etc.	☐ 1910.1004 alpha-Naphthylamine
☐ 1910.1005 [Reserved]	☐ 1910.1006 Methyl chloromethyl ether	☐ 1910.1007 3,3'-Dichlorobenzidine (and its salts)	☐ 1910.1008 bis-Chloromethyl ether
☐ 1910.1009 beta-Naphthylamine	☐ 1910.1010 Benzidine	☐ 1910.1011 4-Aminodiphenyl	☐ 1910.1012 Ethyleneimine
☐ 1910.1013 beta-Propiolactone	☐ 1910.1014 2-Acetylaminofluorene	☐ 1910.1015 4-Dimethylaminoazobenzene	☐ 1910.1016 N-Nitrosodimethylamine
☐ 1910.1017 Vinyl chloride	☐ 1910.1018 Inorganic arsenic	☐ 1910.1025 Lead (Att. FLD# 46)	☐ 1910.1026 Chromium VI (att. FLD 53)
☐ 1910.1027 Cadmium (Att. 50 FLD)	☐ 1910.1028 Benzene (Att. FLD# 54 or 61)	☐ 1910.1029 Coke oven emissions	☐ 1910.1043 Cotton dust
☐ 1910.1044 1,2-Dibromo-3-chloropropane	☐ 1910.1045 Acrylonitrile	☐ 1910.1047 Ethylene oxide	☐ 1910.1048 Formaldehyde
☐ 1910.1050 Methylenedianiline	☐ 1910.1051 1,3 Butadiene	☐ 1910.1052 Methylene chloride	☐ 1926.60 Methylenedianiline
☐ 1926.62 Lead	☐ 1926.1101 Asbestos (Att. FLD 52)	☐ 1926.1127 Cadmium	

HEALTH AND SAFETY EVALUATION

2.1.3 Biological Hazards of Concern

☒ **Poisonous Plants** (FLD 43-D)

Location/Task No(s) **All**

Source: ☐ Known ☒ Suspect
 Route of Exposure: ☐ Inhalation ☐ Ingestion
☒ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No
 Immunization required: ☐ Yes ☒ No

☒ **Insects** (FLD 43-B)

Location/Task No(s) **All**

Source: ☐ Known ☒ Suspect
 Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No
 Immunization required: ☐ Yes ☒ No

☒ **Snakes, Reptiles** (FLD 43-A)

Location/Task No(s) **All**

Source: ☐ Known ☒ Suspect
 Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No
 Immunization required: ☐ Yes ☒ No

☒ **Animals** (FLD 43-A)

Location/Task No(s) **All**

Source: ☐ Known ☒ Suspect
 Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No
 Immunization required: ☐ Yes ☒ No

FLD 43 — WESTON Biohazard Field Operating Procedures: Att. OP ☐

☐ **Sewage**

Location/Task No.(s):

Source: ☐ Known ☐ Suspect
 Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☐ No
 Immunization required: ☐ Yes ☐ No

Tetanus Vaccination within Past 10 yrs: ☐ Yes ☐ No

☐ **Etiologic Agents** (FLD –C)(List)

Location/Task No.(s):

Source: ☐ Known ☐ Suspect
 Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☐ No
 Immunization required: ☐ Yes ☐ No

FLD 43-C — Mold and Fungus. Att. OP ☐

FLD 44 — WESTON Bloodborne Pathogens Exposure Control Plan – First Aid Procedures: Att. OP ☒

FLD 45 — WESTON Bloodborne Pathogens Exposure Control Plan – Working with Infectious Waste: Att. OP ☐

[illegible]

HEALTH AND SAFETY EVALUATION

2.1.5 Applicable WESTON Field Operating Procedures

Physical Hazard Condition	Physical Hazard	Attach OP	WESTON OP Titles
Occupational Noise	Hearing loss/disruption of communication	☒	Section 7.0 - ECH&S Program Manual Occupational Noise & HC Program
Inclement weather	Rain/humidity/cold/ice/snow/lightning	☒	FLD02 - Inclement Weather
Steam heat stress	Burns/displaced oxygen/wet working surfaces	☐	FLD03 - Hot Process - Steam
Heat stress	Burns/hot surfaces/low pressure steam	☐	FLD04 - Hot Process - LT3
Ambient heat stress	Heat rash/cramps/exhaustion/heat stroke	☒	FLD05 - Heat Stress Prevention/Monitoring
Cold stress	Hypothermia/frostbite	☒	FLD06 - Cold Stress
Cold/wet	Trench/paddy/immersion foot/edema	☐	FLD02 - Inclement Weather
Confined spaces	Falls/burns/drowning/engulfment/electrocution	☐	FLD08 - Confined Space Entry
Industrial Trucks	Fork Lift Truck Safety	☐	FLD09 - Powered Industrial Trucks
Improper lifting	Back strain/abdomen/arm/leg muscle/joint injury	☒	FLD10 - Manual Lifting/Handling Heavy Objects
Uneven surfaces	Vehicle accidents/slips/trips/falls	☒	FLD11 - Rough Terrain
Poor housekeeping	Slips/trips/falls/punctures/cuts/fires	☐	FLD12 - Housekeeping
Structural integrity	Crushing/overhead hazards/compromised floors	☐	FLD13 - Structural Integrity
Improper cylinder. handling	Mechanical injury/fire/explosion/suffocation	☐	FLD16 - Pressure Systems - Compressed Gases
Water hazards	Poor visibility/entanglement/drowning/cold stress	☐	FLD17 - Diving
Water hazards	Drowning/heat/cold stress/hypothermia/falls	☐	FLD18 - Operation and Use of Boats
Water hazards	Drowning/frostbite/hypothermia/falls/electrocution	☐	FLD19 - Working Near/Over Water
Vehicle hazards	Struck by vehicle/collision	☒	FLD20 - Traffic
Explosions	Explosion/fire/thermal burns	☐	FLD21 - Explosives
Moving mechanical parts	Crushing/pinch points/overhead hazards/electrocution	☐	FLD22 - Earth Moving Equipment
Moving mech. parts	Overhead hazards/electrocution	☒	FLD23 - Cranes, Rigging, and Slings
Working at elevation	Overhead hazards/falls/electrocution	☐	FLD24 - Aerial Lifts/Man lifts
Working at elevation	Overhead hazards/falls/electrocution	☐	FLD25 - Working at Elevation
Working at elevation	Overhead hazards/falls/electrocution/slips	☐	FLD26 - Ladders
Working at elevation	Slips/trips/falls/overhead hazards	☐	FLD27 - Scaffolding
Trench cave-in	Crushing/falling/overhead hazards/suffocation	☐	FLD28 - Excavating/Trenching
Physiochemical	Explosions/fires from oxidizing, flam./corr. material	☐	FLD30 - Hazardous Materials Use/Storage
Physiochemical	Fire and explosion	☐	FLD31 - Fire Prevention/Response Plan Required
Physiochemical	Fire	☒	FLD32 - Fire Extinguishers Required
Structural integrity	Overhead/electrocution/slips/trips/falls/fire	☒	FLD33 - Demolition
Electrical	Electrocution/shock/thermal burns	☒	FLD34 - Utilities
Electrical	Electrocution/shock/thermal burns	☐	FLD35 - Electrical Safety
Burns/fires	Heat stress/fires/burns	☐	FLD36 - Welding/Cutting/Brazing/Radiography
Impact/thermal	Thermal burns/high pressure impactation/heat stress	☐	FLD37 - Pressure Washers/Sand Blasting
Impaction/electrical	Smashing body parts/pinching/cuts/electrocution	☒	FLD38 - Hand and Power Tools
Poor visibility	Slips/trips/falls	☐	FLD39 - Illumination
Fire/explosion	Burns/impaction	☐	FLD40 - Storage Tank Removal/Decommissioning
Communications	Disruption of communications	☒	FLD41 - Std. Hand/Emergency Signals
Energy/release	Unexpected release of energy	☐	FLD42 - Lockout/Tag-out
Biological Hazards	Biological Hazards at site	☐	FLD43 - Biological Hazards
Animals	Animals	☒	FLD43A - Animals
Insects	Stinging and Biting Insects	☒	FLD43B - Stinging and Biting Insects
Molds/Fungi	Molds and Fungi	☐	FLD43C - Molds and Fungi
Hazardous Plants	Hazardous Plants	☒	FLD43D - Hazardous Plants
Etiologic Agents	Etiologic Agents	☐	FLD43E - Etiologic Agents

2.1.5 Applicable WESTON Field Operating Procedures (Continued)

Physical Hazard Condition	Physical Hazard	Attach OP	WESTON OP Titles
Biological Hazards/BBP	Biological Hazards/BBP at site/First Aid Providers	☒	FLD44 - Biological Hazards – Bloodborne Pathogens Exposure Control Plan – First Aid Providers
Infectious Waste	Infectious Waste at site/BBP/ at site/Infectious Waste	☐	FLD45 – Biological Hazards – Bloodborne Pathogens Exposure Control Plan – Work With Infectious Waste
Lead Contaminated sites	Lead poisoning	☐	FLD46 - Control of Exposure to Lead
Puncture/cuts	Cuts/ dismemberment/gouges	☐	FLD47 - Clearing, Grubbing and Logging Operations
Government Inspector	Disruption of Operations	☐	FLD48 – Federal, State, Local Regulatory Agency Inspections
Unknown Chemicals	Exposure to hazardous materials/waste	☒	FLD49 – Safe Storage of Samples
Cadmium	Exposure Control	☐	FLD50 – Cadmium Exposure Control Plan
Process Safety Procedure	Safety Procedure	☐	FLD51 – Process Safety Procedure
Asbestos	Asbestos Exposure	☐	FLD52 – Asbestos Exposure Control Plan
Hexavalent Chromium	Exposure Control Plan	☐	FLD53 – Hexavalent Chromium Exposure Control Plan
Benzene	Exposure Control Plan	☐	FLD54 - <u>Benzene Exposure Control Plan</u>
Hydrofluoric acid	Working with HF	☐	FLD55 – Working with Hydrofluoric Acid
Moving drill rig parts	Crushing/pinch points/overhead hazards/electrocution	☒	FLD56 – Drilling Safety
Vehicles/driving	Accidents,/fatigue/cell phone use	☒	FLD 57 – Motor Vehicle Safety
Improper material handling	Back injury/crushing from load shifts/equipment/tools	☒	FLD 58 – Drum Handling Operations
COC decontamination	COCs/slip, trip, and falls/waste generation/environmental compliance/PPE	☒	FLD59 - Decontamination
Drilling hazards	Electrocution/overhead hazards/pinch points	☒	Environmental Remediation Drilling Safety Guideline - 2005
Fatigue	Long work hours	☐	FLD60 – Employee Duty Schedule
Benzene/Gasoline	Benzene exposure	☒	FLD61 – Gasoline Contaminant Exposure
Cardiac Arrest	Accident/Heart Attack	☐	FLD62 – 2009 Automatic External Defibrillator (AED) Program Guidelines
Ionizing Radiation	Ionizing Radiation	☐	FLD63 – Using Handheld X-Ray Fluorescence (XRF) Analyzers
Working Alone	Isolated Working Conditions	☐	FLD64 – Employees Working Alone

Client or Site-Specific EHS SOPs (Describe):

3. SITE SECURITY

3.1 SITE SECURITY ASSESSMENT FORM

DESCRIPTION	
Site Name and Location: Butte Office Stop	Number of Employees and Subcontractors on Site: Tasks 4,5,6,7: 2 Weston personnel. Task 6: TBD
Type of Work: Site feature survey and facility mapping, vapor intrusion investigation, and installation of soil borings and groundwater monitoring (groundwater encountered).	
Projected Start Date: 4/22/16	Projected Completion Date: 4/24/16
Are Chemicals Used or Stored That Meet DHS/CFATS Requirements? No. http://www.dhs.gov/files/programs/gc_1185909570187.shtm	
If Yes, Attach Plan and DHS Approvals to HASP. http://www.dhs.gov/files/programs/gc_1169501486197.shtm	
SURROUNDING AREA (urban/suburban/rural; residential/commercial/industrial; traffic volume, population density, etc) Urban/Suburban – Commercial/Industrial	
THREAT INDICATORS (apparent social, economic, political, ethnic, criminal, gang related, and other risk factors) Crime stats show Butte to be higher than the national average for property crimes, at the national average for violent crimes.	
COUNTERMEASURES (Current and projected risk mitigation factors)	
Security Systems (Reference Site Security Checklist): Unknown	
Security Procedures (Reference Site Security Checklist): Site awareness and the buddy system at all times on the site. Notify client representative, and if needed, local law enforcement of the site schedule.	
Closest police station location and contact information: Butte Sheriff's Department 225 N Alaska St, Butte, MT 59701 bsb.mt.gov (406) 497-1120	
Other relevant observations or information to factor into the Site Security Plan:	
OVERALL SECURITY ASSESSMENT (Submit "Medium" and "High" risk assessments to Corporate Security for review)	
Risk Level: ☒ Low ☐ Medium ☐ High	Date:
Site Safety Officer: Lara Kapelanczyk	RCO Safety Manager:
USE ATTACHMENTS FOR ADDITIONAL COMMENTS, MAPS AND DIAGRAMS	

3.2 WESTON SITE SECURITY CHECKLIST

*To be used for completing the Site Security Assessment Form required on all WESTON projects.
Contact Corporate Security for guidance on any items that are "NEEDED" and "NOT IN PLACE".*

CONTROL MEASURES:	In-Place / Not In-Place	Needed / Not Needed
Fencing, lockable gates, no holes (enter details below): a. Chain Link material b. Other material (describe) c. Height (in feet and inches) d. Top cover (e.g., razor wire) e. Signage (e.g., No Trespassing)	☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐	☐ / ☒ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐
Guard service: 24 Hour Work Operations a. During working hours? b. During non-working hours? c. As a stationary post? d. As a roving patrol? e. Do they have written instructions? f. Do they have adequate training? g. Do they have adequate supervision? h. Do they have daily reports? i. Do they have daily inspections?	☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐	☐ / ☒ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐
ID badges displayed by: Hard Hat Decal a. Employees? b. Contractors? c. Visitors?	☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐	☐ / ☒ ☐ / ☐ ☐ / ☐ ☐ / ☐
Log books for: a. Employee sign-in? b. Visitor sign-in? c. Vehicle sign-in? d. Incident reports? e. Property removal? f. Keys and access cards?	☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐	☐ / ☒ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐
Electronics and hardware options (enter details below): a. Access card readers b. Adequate lighting c. Closed circuit TV d. Alarm system e. Other (describe)	☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐	☐ / ☒ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐
Procedures documented for: a. Security training? b. Security instructions? c. Contingency plans? d. Opening and closing protocols? e. Other (describe)?	☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐	☐ / ☒ ☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐
Law enforcement liaison documented for: a. Municipal police? b. County sheriff? c. State police? d. Federal agencies (specify)?	☐ / ☐ ☐ / ☐ ☐ / ☐ ☐ / ☐	☐ / ☒ ☐ / ☐ ☐ / ☐ ☐ / ☐

WESTON SITE SECURITY CHECKLIST (CONTINUED)

*To be used for completing the Site Security Assessment Form required on all WESTON projects.
Contact Corporate Security for guidance on any items that are "NEEDED" and "NOT IN PLACE".*

CHAIN OF COMMAND:	Name	24/7 Contact Information
a. Site Security Coordinator	Lara Kapelanczyk	406-502-1570
b. Site Supervisor	Lara Kapelanczyk	406-502-1570
c. Project Manager	Chris Morgan	808-387-9750
d. CSM	Mark Bell	303-619-3781
e. RCO Director	Steve Mitchell	505-589-8657

REMARKS (use this section and supplemental pages to comment on details, exceptions or additional observations):

Weston personnel will hold a site-specific health and safety tailgate meeting at the start of work every day. Site awareness and the buddy system will be practiced at all times on the site.

4. TASK BY TASK ASSESSMENT

4.1 TASK-BY-TASK RISK ASSESSMENT

4.1.1 Task 1 Description

TASK 1: Mobilization to and demobilization from the Site.

POTENTIAL HAZARDS/RISKS

Chemical

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?
None Anticipated

Physical

☐ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?
Driving is an inherently dangerous activity. The team will assess current weather conditions along the route and will allow extra time and take appropriate precautions if adverse weather is anticipated. All drivers and passengers will adhere to traffic laws, drive defensively, and wear seatbelts at all times vehicles are operated. Safe lifting practices will be utilized when loading and unloading equipment from vehicles.

Biological

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?
None Anticipated

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?
None Anticipated

LEVELS OF PROTECTION/JUSTIFICATION

Street clothes / Appropriate work uniform

EQUIPMENT REQUIRED/USED

vehicle		

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

All work will be performed in accordance with the provisions of this HASP, OSHA guidelines, and WESTON Standard Operating Procedures.

TASK-BY-TASK RISK ASSESSMENT (Continued)

4.1.2 Task 2 Description

TASK 2: Vapor Intrusion Investigation

Soil vapor sampling will be completed inside and outside the building. The samples will be collected and analyzed for air phased hydrocarbons.

POTENTIAL HAZARDS/RISKS

Chemical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What justifies risk level?

Chemical hazards include exposure to any impacted soil encountered during subslab and soil boring activities (dermal contact or vapor inhalation). Dermal exposure to the impacted soil is mitigated by wearing protective clothing (modified D) and decontamination. Vapor concentrations will be monitored with a PID where potential contaminants of concern may be detected.

Physical

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What justifies risk level?

A hand held impacted drill will be used for the sub-slab soil vapor sampling setup. Weston's sub-slab sampling experience has produced procedures outlining safety precautions which are outlined in Attachment C (FLDs).

Biological

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What justifies risk level?

The site is located in the City of Butte in an industrial/commercial area. There may be feral pets in the area.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L

What justifies risk level?

LEVELS OF PROTECTION/JUSTIFICATION

Level D PPE with boot covers to minimize the risk of contact with contaminated soils; Surgical nitrile gloves if any site equipment or materials must be handled.

EQUIPMENT REQUIRED/USED

Level D PPE	Camera	
Sample jars	Logbook	
Sampling equipment (disposable probes and tubing)	Electric Hammer Drill	

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

All work will be performed in accordance with the provisions of this HASP, OSHA guidelines, and WESTON Standard Operating Procedures.

TASK-BY-TASK RISK ASSESSMENT (Continued)

4.1.3 Task 3 Description

TASK 3: Installation of Soil Borings and Groundwater Monitoring Wells (if water encountered)

POTENTIAL HAZARDS/RISKS

Chemical

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L
 What justifies risk level?
 Possible low-level petroleum hydrocarbon contaminated soils.

Physical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
 What justifies risk level?
 Drilling is an inherently dangerous activity. The Drilling Safety Guideline (Saved electronically on site computer) will be followed. All FLDs noted will be followed during drilling and along with FLD 34 – Utilities all overhead power lines noted and de-energized if necessary.

Biological

☒ Hazard Present Risk Level: ☐ H ☐ M ☒ L
 What justifies risk level?
 The site is located in the City of Butte in an industrial/commercial area. There may be feral pets in the area.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
 What justifies risk level?
 UV from SUNLIGHT - Personnel will utilize appropriate clothing as well as sunscreen as needed to help mitigate exposure to excess sunlight.

LEVELS OF PROTECTION/JUSTIFICATION

Level D PPE with double surgical nitrile gloves for sampling activities. Outer glove should be discarded and replaced after each sampling point.

EQUIPMENT REQUIRED/USED

Level D PPE	Camera	
Sample jars	Logbook	
Sampling equipment (disposable scoops)		

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

All work will be performed in accordance with the provisions of this HASP, OSHA guidelines, and WESTON Standard Operating Procedures.

TASK-BY-TASK RISK ASSESSMENT (Continued)

4.1.4 Task 4 Description

TASK 4:

POTENTIAL HAZARDS/RISKS

Chemical

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?

Physical

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?

Biological

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?

LEVELS OF PROTECTION/JUSTIFICATION

EQUIPMENT REQUIRED/USED

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

All work will be performed in accordance with the provisions of this HASP, OSHA guidelines, and WESTON Standard Operating Procedures.

TASK-BY-TASK RISK ASSESSMENT (Continued)

4.1.5

TASK 5:

POTENTIAL HAZARDS/RISKS

Chemical

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?

Physical

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?

Biological

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L
What justifies risk level?

LEVELS OF PROTECTION/JUSTIFICATION

EQUIPMENT REQUIRED/USED

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

All work will be performed in accordance with the provisions of this HASP, OSHA guidelines, and WESTON Standard Operating Procedures.

4.2 PERSONNEL PROTECTION PLAN

Engineering Controls

Describe Engineering Controls used as part of Personnel Protection Plan:

Task(s)

- 1 Use of seatbelts for all travel to/from/around the site.

Administrative Controls

Describe Administrative Controls used as part of Personnel Protection Plan:

Task(s)

- All Site team will coordinate activities with MTDEQ contractor and will maintain a list of mobile phone #s for emergency contacts.

Personal Protective Equipment

Action Levels for Changing Levels of Protection. Refer to Site Air Monitoring Program—Action Levels. Define Action Levels for up or down grade for each task:

Task(s)

- 2 Level D PPE – tough work gloves while operating the electric hammer drill.
3 Level D PPE – ear plugs while drilling and nitrile gloves while sampling.

Description of Levels of Protection

Level D		Level D Modified	
<u>Task(s): 2</u>		<u>Task(s):3</u>	
☐ Head		☒ Head	Hard Hat
☒ Eye and Face	Safety Glasses (ANSI Z87)	☒ Eye and Face	Z87 rated Safety Glasses and/or Face Shield
☐ Hearing	Ear plugs if site conditions warrant (>85dBA)	☒ Hearing	Ear plugs
☐ Arms and Legs Only		☐ Arms and Legs Only	
☒ Appropriate Work Uniform	Long pants, long sleeve shirt, appropriate outerwear	☒ Whole Body	Class II or III Reflective Safety vest
☒ Hand – Gloves	Leather and/or surgical nitrile as needed	☐ Apron	
☒ Foot - Safety Boots	Safety-toe Boots	☐ Hand - Gloves	
☐ Fall Protection		☒ Gloves - inner	Surgical Nitrile for sampling
☐ Flotation		☐ Gloves - outer	Leather for pipe disassembly
☐ Other		☒ Foot - Safety Boots	Safety toed Boots
		☐ Over Boots	

4.3 DESCRIPTION OF LEVELS OF PROTECTION

Level C	Level B () or Level A ()
Task(s): <u>NA</u>	Task(s): <u>NA</u>
☐ Head	☐ Head
☐ Eye and Face	☐ Eye and Face
☐ Hearing	☐ Hearing
☐ Arms and Legs Only	☐ Arms and Legs Only
☐ Whole Body	☐ Whole Body
☐ Apron	☐ Apron
☐ Hand – Gloves	☐ Hand - Gloves
☐ Gloves	☐ Gloves
☐ Gloves	☐ Gloves
☐ Foot - Safety Boots	☐ Foot - Safety Boots
☐ Outer Boots	☐ Outer Boots
☐ Boots (Other)	☐ Boots (Other)
☐ Half Face	☐ SAR - Airline
☐ Cart./Canister	☐ SCBA
☐ Full Face	☐ Comb. Airline/SCBA
☐ Cart./Canister	☐ Cascade System
☐ PAPR	☐ Compressor
☐ Cart./Canister	☐ Fall Protection
☐ Type C	☐ Flotation
☐ Fall Protection	☐ Other
☐ Flotation	
☐ Other	

5. MONITORING PROGRAM

5.1 SITE OR PROJECT HAZARD MONITORING PROGRAM

5.1.1 Air Monitoring Instruments

Instrument Selection and Initial Check Record

Reporting Format: ☒ Field Notebook ☐ Field Data Sheets* ☐ Air Monitoring Log ☐ Trip Report ☐ Other

Instrument	Task No.(s)	Number Required	Number Received	Checked Upon Receipt	Comment	Initials
☐ RAD						
☐ GM (Pancake)				☐		
☐ NaI (Micro R)				☐		
☐ ZnS (Alpha Scintillator)				☐		
☐ Other _____				☐		
☒ PID						
☒ MiniRAE	2,3			☐		
☐ MultiRAE (LEL/O2/H2S/CO/PID)				☐		
☐ TVA 1000 (PID/FID)				☐		
☐ Other _____				☐		
☐ FID						
☐ TVA 1000 (FID/PID)				☐		
☐ Other _____				☐		
☐ Datram DR4000 (Particulate)				☐		
☐ PDR 1000 (Particulate)				☐		
☐ Single Gas Meter (SGM)				☐		
Specify Chemical:						
☐ Personal Sampling Pump				☐		
Specify Media:						
☐ Bio-Aerosol Monitor				☐		
☐ Tubes/type: _____				☐		
☐ Tubes/type: _____				☐		
☐ Tubes/type: _____				☐		
☐ Tubes/type: _____				☐		

5.1 SITE OR PROJECT HAZARD MONITORING PROGRAM

5.1.1 Air Monitoring Instruments Calibration Record

[illegible]

5.2 SITE AIR MONITORING PROGRAM

Action Levels

These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/TLV/REL. That number must also be adjusted to account for instrument response factors.

	Tasks	Action Level		Action
☐ Explosive or Flammable Atmosphere	All	<i>Ambient Air Concentration</i>	<i>Confined Space Concentration</i>	
		<10% LEL	0 to 1% LEL	Work may continue. Consider toxicity potential.
		10 to 25% LEL	1 to 10% LEL	Work may continue. Increase monitoring frequency.
		>25% LEL	>10% LEL	Work must stop. Ventilate area before returning.
☐ Oxygen	All	<i>Ambient Air Concentration</i>	<i>Confined Space Concentration</i>	
		<19.5% O ₂	<19.5% O ₂	Leave area. Re-enter only with self-contained breathing apparatus.
		19.5% to 25% O ₂	19.5% to 23.5% O ₂	Work may continue. Investigate changes from 21%.
		>25% O ₂	>23.5% O ₂	Work must stop. Ventilate area before returning.
☐ Radiation	All	< 3 times background		Continue work.
		3 times background to < 1 mR/hour		Radiation above background levels (normally 0.01-0.02 mR/hr) signifies possible radiation source(s) present. Continue investigation with caution. Perform thorough monitoring. Consult with a Health Physicist.
		> 1 mrem/hour		Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of Health Physicist.
☐ Organic Gases and Vapors		NA		
☐ Inorganic Gases, Vapors, and Particulates		NA		

5.3 ACTION LEVELS

Contact a Weston Safety Leader for assistance calculating project-specific action levels.

6. HOSPITAL INFORMATION

6.1 CONTINGENCIES

6.1.1 Emergency Contacts and Phone Numbers

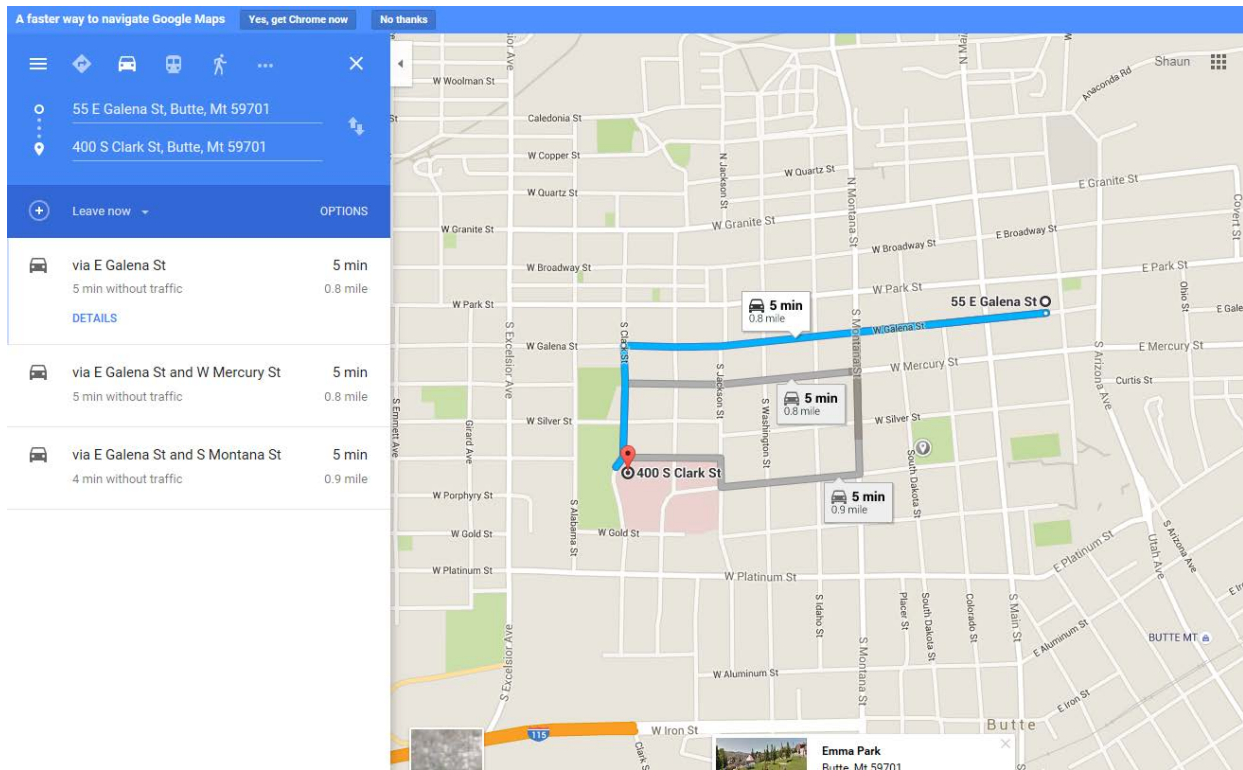
Agency	Contact	Phone Number
In Case of Emergency During Business Hours (After summoning 911 or other emergency services)	WorkCare "Delta" Team	From 08:30 am to 17:30 pm Mountain Time: call 800-455-6155, X2219 and speak to the "Team Delta" representative. If you don't reach someone, dial extension 2110 and speak to Paula Sandrock.
In Case of Emergency After-Business Hours (After summoning 911 or other emergency services)	OMC Service Rep.	17:30 to 08:30 Mountain Time, Saturdays, Sundays, and Holidays: call 800-455-6155 follow the prompts to reach the OMC's service and alert them if you need a physician or an administrative staff person.
WorkCare Incident Intervention	Non-Emergency #	888-449-7787 (See HASP Attachment F)
WorkCare WESTON Medical Director	Dr. Peter Greaney	800-455-6155, X2219, connect to "Delta Team" and request Dr. Greaney if the situation warrants.
WESTON Corporate EHS Manager	Herold Hannah	610-701-3024 (office), 267-516-0274 (mobile)
WESTON Medical Programs Manager	Herold Hannah	610-701-3024 (office), 267-516-0274 (mobile)
WESTON RCO Safety Manager	Dave Robinson	303-729-6181 (o), 937-572-3630 (m)
WESTON Local Safety Officer	Ellie Kastner	303-729-6158 (o), 302-540-0099 (m)
Fire Department	Butte Fire Department	911 or 406-497-6481
Police Department	Butte Police Department	911 or 406-497-1120
WESTON FSO Cell Phone	Lara Kapelanczyk	406-890-5304 (m)
WESTON PM Cell Phone	Chris Morgan	808-387-9750 (c)
Client Contact Phone	TBD	
Poison Control	Operator	(800) 222-1222
Local Medical Emergency Facility(s) – LMF		
Hospital Name and Address: St. James Healthcare 406-723-2500 400 S. Clark Street Butte, MT 59701		
Name of Contact: EMERGENCY ROOM		Phone No.: 406-723-2500
Type of Service: ☒ Physical trauma only ☐ Chemical exposure only ☐ Physical trauma and chemical exposure ☒ Available 24 hours	Route to Hospital: Link to Google Maps": https://www.google.com/maps	Travel time from site: __5__ minutes Distance to hospital: __0.8__ miles Name/no. of 24-hr ambulance service: 911

Secondary or Specialty Service Provider		
Name of Hospital:		
Address:		Phone No.:
Name of Contact:		Phone No.:
Type of Service: ☐ Physical trauma only ☐ Chemical exposure only ☐ Physical trauma and chemical exposure ☐ Available 24 hours	Route to Hospital (see attached):	Travel time from site: __ minutes Distance to hospital: __ miles Name/no. of 24-hr ambulance service: 911 /

See reporting an incident in Attachment F.

6.1.2 Hospital Map

This map is subject to Google's Terms of Service, and Google is the owner of rights therein. Portions of this image may have been removed for clarity



Butte Office Stop – Site Map



6.1 CONTINGENCIES				
6.1.3 Response Plans				
Medical - General Provide first aid, if trained; assess and determine need for further medical assistance. Transport or arrange for transport after appropriate decontamination. LMF = Local Medical Facility		First Aid Kit: ☒ Yes ☐ No Blood Borne Pathogens Kit: ☒ Yes ☐ No	Type Appropriate sized ANSI-approved Type III Kit, plus BBP	Location In Vehicle Special First-Aid Procedures: Cyanides on-site ☐ Yes ☒ No If yes, contact LMF. Do they have antidote kit? ☐ Yes ☐ No
		Eyewash required ☒ Yes ☐ No	Type 16 oz or 15 minutes worth of rinse agent	Location In Vehicle HF on-site ☐ Yes ☒ No If yes, need neutralizing ointment for first-aid kit. Contact LMF.
		Shower required ☐ Yes ☒ No	Type Location	
Plan for Response to Spill/Release		Plan for Response to Fire/Explosion		Fire Extinguishers
In the event of a spill or release, ensure safety, assess situation, and perform containment and control measures, as appropriate.	a. Cleanup per SDSs if small; or sound alarm, call for assistance, notify Emergency Coordinator b. Evacuate to pre-determined safe place c. Account for personnel d. Determine if team can respond safely e. Mobilize per Site Spill Response Plan	In the event of a fire or explosion, ensure personal safety, assess situation, and perform containment and control measures, as appropriate:	a. Sound alarm and call for assistance, notify Emergency Coordinator b. Evacuate to predetermined safe place c. Account for personnel d. Use fire extinguisher <u>only if safe and trained</u> in its use e. Stand by to inform emergency responders of materials and conditions	Type/Location <u>ABC/Vehicle</u> / / / / / /
Description of Spill Response Gear	Location	Description (Other Fire Response Equipment)		Location
Plan to Respond to Security Problems				
Avoid confrontation				
Call 911				
Update WESTON PM, SO and Client, as applicable; Prepare / save NOI on NOITrack within 24hr				

7. DECONTAMINATION PLAN

7.1 GENERAL DECONTAMINATION PLAN

Personnel Decontamination

Consistent with the levels of protection required, step-by-step procedures for personnel decontamination for each level of protection are attached.

Levels of Protection Required for Decontamination Personnel

The levels of protection required for personnel assisting with decontamination will be:

☐ Level B

☐ Level C

☒ Level D

Modifications include:

Disposition of Decontamination Wastes

Provide a description of waste disposition including identification of storage area, hauler, and final disposal site, if applicable

All waste material generated will be placed in appropriate containers (garbage bags) and disposed of as general refuse in accordance with applicable laws and regulations.

Equipment Decontamination

A procedure for decontamination steps required for non-sampling equipment and heavy machinery follows:

All equipment will be steam cleaned, pressure washed, or wiped clean as appropriate.

Sampling Equipment Decontamination

Sampling equipment will be decontaminated in accordance with the following procedure:

Disposable sampling equipment will be used.

7.2 LEVEL D DECONTAMINATION PLAN	
Check indicated functions or add steps, as necessary:	
Function	Description of Process, Solution, and Container
☐ Segregated equipment drop	
☐ Boot cover and glove wash	
☐ Boot cover and glove rinse	
☐ Tape removal - outer glove and boot	
☐ Boot cover removal	
☒ Outer glove removal	
HOTLINE	
☐ Suit/safety boot wash	
☐ Suit/boot/glove rinse	
☐ Safety boot removal	
☐ Suit removal	
☐ Inner glove wash	
☐ Inner glove rinse	
☐ Inner glove removal	
☐ Inner clothing removal	
CONTAMINATION REDUCTION ZONE (CRZ)/SAFE ZONE BOUNDARY	
☒ Field wash	Hand and face wash prior to any hand to mouth contact
☐ Redress	
Disposal Plan, End of Day: Dispose of site waste according to existing procedures at the site.	
Disposal Plan, End of Week: 	
Disposal Plan, End of Project: 	

7.3 LEVEL C DECONTAMINATION PLAN - NA

Check indicated functions or add steps, as necessary: N/A

Function	Description of Process, Solution, and Container
☐ Segregated equipment drop	
☐ Boot cover and glove wash	
☐ Boot cover and glove rinse	
☐ Tape removal - outer glove and boot	
☐ Boot cover removal	
☐ Outer glove removal	
HOTLINE	
☐ Suit/safety boot wash	
☐ Suit/boot/glove rinse	
☐ Safety boot removal	
☐ Suit removal	
☐ Inner glove wash	
☐ Inner glove rinse	
☐ Facepiece removal	
☐ Inner glove removal	
☐ Inner clothing removal	
CONTAMINATION REDUCTION ZONE (CRZ)/SAFE ZONE BOUNDARY	
☐ Field wash	
☐ Redress	
Disposal Plan, End of Day: Discard trash bag as solid waste.	
Disposal Plan, End of Week: Discard trash bag as solid waste.	
Disposal Plan, End of Project: Discard trash bag as solid waste.	

7.4 LEVEL B (x) or Level A () DECONTAMINATION PLAN - NA

Check indicated functions or add steps, as necessary:

Function	Description of Process, Solution, and Container
☐ Segregated equipment drop	
☐ Boot cover and glove wash	
☐ Boot cover and glove rinse	
☐ Tape removal - outer glove and boot	
☐ Boot cover removal	
☐ Outer glove removal	

HOTLINE

☐ Suit/safety boot wash
☐ Suit/SCBA/boot/glove rinse
☐ Safety boot removal
☐ Remove SCBA backpack without disconnecting
☐ suit removal
☐ Inner glove wash
☐ Inner glove rinse
☐ SCBA disconnect and facepiece removal
☐ Inner glove removal
☐ Inner clothing removal

CONTAMINATION REDUCTION ZONE (CRZ)/SAFE ZONE BOUNDARY

☐ Field wash
☐ Redress

Disposal Plan, End of Day:

Discard trash bag as solid waste.

Disposal Plan, End of Week:

Discard trash bag as solid waste.

Disposal Plan, End of Project:

Discard trash bag as solid waste.

8. TRAINING AND BRIEFING TOPICS/SIGN OFF SHEET

8.1 TRAINING AND BRIEFING TOPICS

The following items will be covered at the site-specific training meeting, daily or periodically.

☒ Site characterization and analysis, Sec. 3.0, 29 CFR 1910.120 I	☐ Level A
☒ Physical hazards	☐ Level B
☒ Chemical hazards	☐ Level C
☒ Animal bites, stings, and poisonous plants	☒ Level D
☐ Etiologic (infectious) agents	☐ Monitoring, 29 CFR 1910.120 (h)
☒ Site control, 29 CFR 1910.120 d	☒ Decontamination, 29 CFR 1910.120 (k)
☒ Engineering controls and work practices, 29 CFR 1910.120 (g)	☐ Emergency response, 29 CFR 1910.120 (l)
☒ Heavy machinery	☐ Elements of an emergency response, 29 CFR 1910.120 (l)
☐ Forklift	☒ Procedures for handling site emergency incidents, 29 CFR 1910.120 (l)
☐ Backhoe	☐ Off-site emergency response, 29 CFR 1910.120 (l)
☒ Equipment	☐ Handling drums and containers, 29 CFR 1910.120 (j)
☒ Tools	☐ Opening drums and containers
☐ Ladder, 29 CFR 1910.25.26.26 + 29 CFR 1926.1053	☐ Electrical material handling equipment
☒ Overhead and underground utilities	☐ Radioactive waste
☐ Scaffolds	☐ Shock-sensitive waste
☐ Structural integrity	☐ Laboratory waste packs
☐ Unguarded openings - wall, floor, ceilings	☐ Sampling drums and containers
☐ Pressurized air cylinders	☐ Shipping and transport, 49 CFR 172.101, IATA
☒ Personal protective equipment, 29 CFR 1910.120 (g); 29 CFR 1910.134	☐ Tank and vault procedures
☐ Respiratory protection, 29 CFR 1910.120 (g); ANSI Z88.2	☐ Illumination, 29 CFR 1926.26
☐ Working over water FLD-19 ☐	☐ Sanitation, 29 CFR 1926.27
☐ Boating safety FLD-18	☒ Proper lifting techniques
☒ Heat Stress / Cold Stress	☐ Pentachlorophenol hazards

8.2 HEALTH AND SAFETY PLAN APPROVAL/SIGNOFF FORM	
Site Name: Butte Office Stop	WO#: 25049.004.001.0010
Address: 55 E Galena, Butte, MT	
I understand, agree to, and will conform with the information set forth in this Health and Safety Plan (and attachments) and discussed in the personnel health and safety briefing(s).	

WO#: 25049.004.001.0010

I understand, agree to, and will conform with the information set forth in this Health and Safety Plan (and attachments) and discussed in the personnel health and safety briefing(s).

Date _____

[illegible]

ATTACHMENT A

CHEMICAL CONTAMINANTS DATA SHEETS

The entire NIOSH Pocket Guide list of chemicals is available online at:

<http://www.cdc.gov/niosh/npg/npgsyn-a.html#a>

ATTACHMENT B
SAFETY DATA SHEETS
(ATTACH SDS)

Attach all appropriate SDS's following this page.

ATTACHMENT C

SAFETY PROCEDURES/FIELD OPERATING PROCEDURES (FLD OPS)

Insert documents on following page.

In lieu of attaching individual copies of FLDs, the site safety officer or his designee may elect to maintain an electronic copy of the WESTON Corporate Environmental Compliance, Health, and Safety Program Manual (including all FLDs) on site in an electronic format. The most recent version of the CEHS Program Manual and supporting documents are located at:

<http://portal/services/EHS/SitePages/CEHSProgramElements.aspx>

ATTACHMENT D
HAZARD COMMUNICATION PROGRAM

SITE-SPECIFIC HAZARD COMMUNICATION PROGRAM

Location-Specific Hazard Communication Program/Checklist

To ensure an understanding of and compliance with the Hazard Communication Standard, WESTON will use this checklist/document (or similar document) in conjunction with the WESTON Written Hazard Communication Program as a means of meeting site- or location-specific requirements.

While responsibility for activities within this document reference the WESTON Safety Officer (SO), it is the responsibility of all personnel to ensure compliance. Responsibilities under various conditions can be found within the WESTON Written Hazard Communication Program.

To ensure that information about the dangers of all hazardous chemicals used by WESTON is known by all affected employees, the following Hazard Communication Program has been established. All affected personnel will participate in the Hazard Communication Program. This written program, as well as WESTON's Corporate Hazard Communication Program, will be available for review by any employee, employee representative, representative of OSHA, NIOSH, or any affected employer/employee on a multi-employer site.

Site or other location name/address:	Butte Office Stop	
Site/Project/Location Manager:	Lara Kapelanczyk/Chris Morgan/NA	
Site/Location Safety Officer:	Lara Kapelanczyk	
List of chemicals compiled, format:	☒ HASP ☐ Other	
Location of SDS files:	HASP	
Site Briefing conducted by:		Date:
Indicate format of training documentation:	☐ Field Log: ☒ Other	
Client briefing conducted regarding hazcom:		
Other employers working at site:		
Other employer(s) notified of SDS information:		
Has WESTON been notified of other employer's or client's hazard communication program(s), as necessary?	☐ Yes ☐ No	

List of Hazardous Chemicals

A list of known hazardous chemicals used by WESTON personnel must be prepared and attached to this document or placed in a centrally identified location with the SDSs. Further information on each chemical may be obtained by reviewing the appropriate SDS. The list will be arranged to enable cross-reference with the SDS file and the label on the container. The SO or Location Manager is responsible for ensuring the chemical listing remains up-to-date.

Container Labeling

The WESTON SO will verify that all containers received from the chemical manufacturer, importer, or distributor for use on-site are clearly labeled.

The SO is responsible for ensuring that labels are placed where required and for comparing SDSs and other information with label information to ensure correctness.

Safety Data Sheets (SDSs)

The SO is responsible for establishing and monitoring WESTON's SDS program for the location. The SO will ensure that procedures are developed to obtain the necessary SDSs and will review incoming SDSs for new or significant health and safety information. He/she will see that any new information is passed on to the affected employees. If an SDS is not received at the time of initial shipment, the SO will call the manufacturer and have an SDS delivered for that product in accordance with the requirements of WESTON's Written Hazard Communication Program.

A log for, and copies of, SDSs for all hazardous chemicals in use will be kept in the SDS folder at a location known to all site workers. SDSs will be readily available to all employees during each work shift. If an MSDS is not available, immediately contact the WESTON SO or the designated alternate. When a revised SDS is received, the SO will immediately replace the old SDS.

Employee Training and Information

The SO is responsible for the WESTON site-specific personnel training program. The SO will ensure that all program elements specified below are supplied to all affected employees.

At the time of initial assignment for employees to the work site, or whenever a new hazard is introduced into the work area, employees will attend a health and safety meeting or briefing that includes the information indicated below.

- Hazardous chemicals present at the work site.
- Physical and health risks of the hazardous chemicals.
- The signs and symptoms of overexposure.
- Procedures to follow if employees are overexposed to hazardous chemicals.
- Location of the SDS file and Written Hazard Communication Program.
- How to determine the presence or release of hazardous chemicals in the employee's work area.
- How to read labels and review SDSs to obtain hazard information.
- Steps WESTON has taken to reduce or prevent exposure to hazardous chemicals.
- How to reduce or prevent exposure to hazardous chemicals through the use of controls procedures, work practices, and personal protective equipment.
- Hazardous, non-routine tasks to be performed (if any).
- Chemicals within unlabeled piping (if any).

Hazardous Non-routine Tasks

When employees are required to perform hazardous non-routine tasks, the affected employee(s) will be given information by the SO about the hazardous chemicals he or she may use during such activity. This information will include specific chemical hazards, protective and safety measures the employee can use, and steps WESTON is using to reduce the hazards. These steps include, but are not limited to, ventilation, respirators, presence of another employee, and emergency procedures.

Chemicals in Unlabeled Pipes

Work activities may be performed by employees in areas where chemicals are transferred through unlabeled pipes. Prior to starting work in these areas, the employee will contact the SO, at which time information as to the chemical(s) in the pipes, potential hazards of the chemicals or the process involved, and the safety precautions that should be taken will be determined and presented.

Multi-Employer Work Sites

It is the responsibility of the SO to provide other employers with information about hazardous chemicals imported by WESTON to which their employees may be exposed, along with suggested safety precautions. It is also the responsibility of the SO and the Site Manager to obtain information about hazardous chemicals used by other employers to which WESTON employees may be exposed. WESTON's chemical listing will be made available to other employers, as requested. SDSs will be available for viewing, as necessary.

The location, format, and/or procedures for accessing SDS information must be relayed to affected employees.

ATTACHMENT E

AIR SAMPLING DATA SHEETS

SITE AIR MONITORING PROGRAM								
Field Data Sheets								
Location:								
% LEL	% O ₂	PID (units)	FID (units)	Aerosol Monitor (mg/m ³)	GM: Shield Probe/ Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		
Monitox (ppm)				Detector Tube(s)				
Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other
Location:								
% LEL	% O ₂	PID (units)	FID (units)	Aerosol Monitor (mg/m ³)	GM: Shield Probe/ Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		
Monitox (ppm)				Detector Tube(s)				
Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

ATTACHMENT F INCIDENT REPORTING

WorkCare Incident Intervention & Reporting Program

If a medical emergency occurs on your project site:

Emergency Medical Procedures:

- ✓ Do **not** attempt to move seriously injured personnel.
- ✓ **Implement WorkCare Incident Intervention Program & Reporting:**

In an Emergency: If the event is an emergency or you are not sure if it is an emergency, activate your emergency response system; the well being of the injured person takes precedence. **CALL 911 or other emergency number specified in this HASP.** Notify WorkCare as specified in Section 6.1.1 and notify a Weston Safety Officer or the Project Manager as soon as it is safe to do so but within one hour of the injury. If the team member has non-specific musculoskeletal complaints such as low back or wrist pain, notify the SO or PM immediately at the onset of symptoms. Contact a Weston SO to begin the process for preparation of a Notice of Incident (NOI).

Not an Emergency: Contact the **WorkCare Incident Intervention Hotline number (888) 449-7787 (24/7)** and report the injury to the clinician. The FSO or Field Team Lead should participate in the call during the initial injury description portion of the assessment. To protect the injured employee's privacy, the FSO or FTL will be asked by the nurse to drop off the call when personal medical history is discussed. Once the personal assessment is completed, the supervisor may speak with the nurse to discuss the recommendations and determine whether the employee has elected self-care or a clinic visit is being arranged.

If the injured person chooses to perform **self-care** measures, the Incident Intervention Nurse will make arrangements for **follow-up** calls as needed. If at any time symptoms develop or worsen, or if the supervisor or the employee have questions about the injury and recovery process, they can call the **WorkCare Incident Intervention Hotline number (888) 449-7787** and speak with a clinician. A case can be reopened if needed.

When an employee is sent to a provider for a **clinic visit**, the FSO or Field Team Lead, if possible, should accompany the employee and provide support. This also gives the FSO or FTL an opportunity to provide information to the provider about the employee's job and return-to-work options.

Additional procedures will be followed during the recovery process.

In a non-emergency situation, please contact a Weston SO within 1 hr of the incident or as soon as it is safe to do so.

Weston NOITrack System

Within one hour of an incident, contact your Office SO or RCO Safety Officer and begin the process of preparing a Notice of Incident (NOI) within the WESTON EHS Portal NOITrack System.

Please assemble the notes, photos, and other information you have on the incident and work with the SO to prepare the basic information about the incident – within the NOI system, this means the “Incident Information”, the “Individual Data”, and for photos, the “File Attachment” tabs on the NOI preparation page. If you are in the field, please work with the SO to get the basic incident information into the system. If you are entering the information on these tabs of the web application, please “Save” the information on each page and DO NOT “Submit” the NOI. Notify your SO that you’ve entered the information and work with them to complete the NOI process. The initial record for NOI’s should be completed within 24hr of the incident.

NOITrack “Incident Information” screen for data entry and Portal link:

<http://asweb/NOITrack/IncidentInfo.aspx>

The screenshot shows the NOITrack web application in a Windows Internet Explorer browser. The address bar shows the URL <http://prdntrk/NOITrack/IncidentInfo.aspx>. The browser's menu bar includes File, Edit, View, Favorites, Tools, and Help. The toolbar contains various icons for navigation and utility. The main content area displays the NOITrack application interface. At the top, there is a banner with the NOITrack logo and a navigation bar with links: Open NOI's, Search, Add New Incident, Reports, Admin, Help, and Blog. Below the navigation bar, there are four tabs: Incident Info (selected), Individual Data, Investigation, and File Attachment. The Incident Info tab contains a form with several sections. At the top, there is a checkbox for "Near Incident" and a note: "Fields marked with * are required". Below this, there are four columns of checkboxes for incident types: Security, Safety, Computer, and Other. The Security column includes: Threat or Intimidation, Act of Violence, Theft, Vandalism, Violation of Company or Government Security Requirements, and Other Security. The Safety column includes: Vehicle, Injury, Illness, Exposure, and Other Safety. The Computer column includes: Computer/Technology and Other. The Other column includes: Environmental, Property/Equipment Damage, Regulatory Agency, and Other. Below these columns, there is a text area for "Was this a single event or the latest in a series(describe)?". A note below the text area states: "Note: This description is limited to 255 characters. If more information is required, add the information in the submitted description." At the bottom of the form, there are fields for "Date of Incident *" and "Time of Incident *". The Date field has a calendar icon, and the Time field has dropdown menus for hours, minutes, and AM/PM. There are also checkboxes for "Unknown Date" and "Unknown Time". The browser's status bar at the bottom shows "Done", "Local intranet", and "100%".

Security	Safety	Computer	Other
☐ Threat or Intimidation	☐ Vehicle	☐ Computer/Technology	☐ Environmental
☐ Act of Violence	☐ Injury	☒ Other	☐ Property/Equipment Damage
☐ Theft	☐ Illness		☐ Regulatory Agency
☐ Vandalism	☐ Exposure		☐ Other
☐ Violation of Company or Government Security Requirements	☐ Other Safety		
☐ Other Security			

Was this a single event or the latest in a series(describe)?

Note: This description is limited to 255 characters. If more information is required, add the information in the submitted description.

Date of Incident *

Time of Incident * Hrs min AM

☐ Unknown Date ☐ Unknown Time

ATTACHMENT G

TRAFFIC CONTROL PLAN

If you will be doing work in or near the right-of-way or in any other location with traffic issues on or near the site, you may need a Traffic Control Plan. Consult with a Safety Officer to get a plan from a subcontracted Traffic Control company or prepare a plan in accordance with current Manual of Uniform Traffic Control Devices.

ATTACHMENT H

ENVIRONMENTAL HEALTH & SAFETY INSPECTION CHECKLIST

For projects lasting more than 30 days in the field, the PTL or FSO should complete this audit every 2 weeks. The audit form is available at:

[\\fsden03\data\Project Files\20408 EPA Region 8 START IV\Laptop Resources\Resources - Templates\Audit_Forms](\\fsden03\data\Project Files\20408 EPA Region 8 START IV\Laptop Resources\Resources - Templates\Audit_Forms)

ATTACHMENT I HAZARD CHECKLIST

Use this form for periodic site EHS inspections or for Site Reconnaissance prior to preparation of a HASP.

Site Reconnaissance or Periodic EHS Site Inspection Checklist

Date: _____ Site Manager/EHS Officer: _____ Location: _____

Address: _____

Street

State

ZIP:

Task Team (name or reference via daily Sign-in Sheet): _____

HAZARDS IDENTIFIED (check applicable)									
Chemical		Biological		Physical		Physical, con't		Remote Areas	
☐	Flammable/combustible	☐	Insects	☐	Noise	☐	Man. Material Handling	☐	Materials handling
☐	Corrosive	☐	Animals	☐	Heat	☐	Demolition	☐	High Pressure Washers
☐	Oxidizer	☐	Plants	☐	Cold	☐	Excavation	☐	Hand and Power Tools
☐	Reactive	☐	Mold/Fungus	☐	Inclement Weather	☐	Pile Driving	☐	Low Illumination
☐	Toxic	☐	Viral/Bacterial	☐	Hot Work	☐	Welding/Cutting/Burn	☐	Drilling & Boring
☐	Inhalation	☐	Density Gauges	☐	Confined Spaces	☐	Hot Surfaces	☐	Striking against/Struck-by
☐	Eyes/Skin	☐	Radiological	☐	Stored hazardous Energy	☐	Hot Materials	☐	Caught-in/Caught between
☐	Pesticides	☐	Ultra-Violet	☐	Elevation	☐	Rough Terrain	☐	Pushing/pulling
☐	Carcinogen	☐	Sunlight	☐	Utilities	☐	Compressed Gases	☐	Falls at same level
☐	Asbestos	☐	Infrared	☐	Machinery	☐	Hazardous Mat. Storage	☐	Falls from elevation
☐	Lead	☐	Lasers	☐	Mobile equipment	☐	Diving	☐	Repetitive motion
☐	UXO/OE/ CWM	☐	XRF	☐	Cranes	☐	Operation of Boats	☐	High (>110v) Electricity
☐	Process Safety	☐	Isotopes	☐	Manual Material Handling	☐	Working Over Water	☐	Slippery surface Ice/Snow
☐	Applying Paint/Coatings	☐		☐	Ladders	☐	Traffic	☐	
☐		☐		☐	Scaffolding	☐	Site Security	☐	
REQUIRED PROTECTION (check applicable)									
Engineering Controls		Administrative Control		PPE			Contingency		
☐	Guard Rails	☐	Qualified for task	☐	Air Supplying Respirator	☐	Tyvek coveralls	☐	Emergency Signal Known
☐	Machine Guards	☐	Trained/Certified	☐	Air Purifying Respirator	☐	Coated Coveralls	☐	Eye wash/shower Location
☐	Sound Barriers	☐	Hot Work Permit	☐	SCBA	☐	Welding leathers	☐	First Aid Kit Location
☐	Enclosure	☐	CSE Permit	☐	Hard Hat	☐	CWM	☐	Fire Extinguisher Location
☐	Elevation	☐	Lockout/Tag Out	☐	Ear Plugs	☐	Safety Shoes/Boots	☐	Spill Kit Location
☐	Isolation	☐	Work Permit	☐	Ear Muffs	☐	Rubber Boots	☐	Severe weather shelter
☐	GFCI	☐	Dig Safe Permit	☐	Safety Glasses	☐	Gloves	☐	Evacuation Routes
☐	Assured Ground Program	☐	Contingency Plan	☐	Goggles	☐	Cooling Suits		
☐	Apply Anti-slip/skid Mat	☐	Critical Lift Plans	☐	Chemical Goggles	☐	Ice Vests		
		☐	Equip. Inspection Sheets	☐	Face Shield	☐	Radiant heat Suits		
				☐	Thermal Shield	☐	Fall Arrest		
				☐	Welding Mask	☐	PFD		
				☐	Cutting Glasses	☐	Electrical insulation		

Site Reconnaissance or Periodic EHS Site Inspection Checklist

Any Modification to Tasks (list)	Other tasks or activities that may affect my activity	Reasons for any changes indicated above
ENVIRONMENTAL COMPLIANCE CONSIDERATIONS:		
☐ Generation of Hazardous Waste*	☐ Shipment of Hazardous Waste off-site*	
☐ Generation of Investigation Derived Waste*	☐ Shipment of Samples in accordance with DOT/IATA	
☐ Treatment, Storage, or Disposal of Hazardous Waste*	☐ Generation of Hazardous Waste*	
☐ Contingency to prevent or contain hazardous materials or oil spills or discharges to drains, body of water, soil*	☐ Generation of Investigation Derived Waste*	
☐ Disturbing of Asbestos Containing Materials (ACM)*	☐ Treatment, Storage, or Disposal of Hazardous Waste*	
☐ Application of Pesticides or Herbicides*	☐ Waste Identification & Manifesting - Marking, Placarding, Labeling	
☐ Work on Above or Under-ground Storage Tanks*	☐ Training & Licensing for Use of Radioactive Materials/Sources	
☐ Transportation, Storage or Disposal of Radioactive Material*	☐ Containers: dated, labeled, closed, full, stored less than 90 days	
☐ Activities producing or generating Air Emissions (or fugitive "fence-line" emissions) requiring either monitoring and/or permit*	☐ Risk of explosion or catastrophic release due to chemical storage or processing involving reactivity, flammables, solvents or explosives	
☐ Excavations, Drilling, Probing or other activities that could impact underground utilities, pipelines, sewer or treatment systems.	☐ Training & Licensing for Asbestos Remediation Activities	
	☐	
	☐	

* Indicates need for an environmental compliance plan.

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Appendix B

Standard Operating Procedures



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 1 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

CONTENTS

1.0	SCOPE AND APPLICATION
2.0	METHOD SUMMARY
3.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE
4.0	INTERFERENCES AND POTENTIAL PROBLEMS
5.0	EQUIPMENT/APPARATUS
5.1	Direct Reading Instruments (Air Monitoring Instruments)
5.2	Air Sampling Equipment and Media/Devices
5.3	Tools/Material and Equipment List
6.0	REAGENTS
7.0	PROCEDURES
7.1	Air Monitoring Design
7.1.1	Initial Surveys
7.1.2	Off-Site Monitoring
7.2	Air Sampling Design
7.2.1	Sampling Plan Design
7.2.2	Sampling Objectives
7.2.3	Location and Number of Individual Sampling Points
7.2.4	Time, Duration and Frequency of Sampling Events
7.2.5	Meteorological and Physical/Chemical Considerations
8.0	CALCULATIONS
9.0	QUALITY ASSURANCE/QUALITY CONTROL
9.1	QA/QC Samples
9.2	Sample Documentation
10.0	DATA VALIDATION
11.0	HEALTH AND SAFETY



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 2 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

CONTENTS (Cont'd)

12.0 REFERENCES

13.0 APPENDICES

Appendix A - Portable Screening Devices and Specialized Analytical Instruments

Appendix B - Air Sampling Equipment and Media/Devices



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 3 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) provides guidance in developing and implementing sampling plans to assess the impact of hazardous waste sites on ambient air. It presents the United States Environmental Protection Agency/Environmental Response Team's (U.S. EPA/ERT's) approach to air sampling and monitoring and identifies equipment requirements. It is not within the scope of this SOP to provide a generic air sampling plan. Experience, objectives, site characteristics, and chemical characteristics will dictate sampling strategy. This SOP does not address indoor air sampling.

Two basic approaches can be used to assess ambient air (also referred to as air pathway assessments): modeling and measurements. The modeling approach initially estimates or measures the overall site emission rate(s) and pattern(s). These data are input into an appropriate air dispersion model, which predicts either the maximum or average air concentrations at selected locations or distances during the time period of concern. This overall modeling strategy is presented in the first three volumes of the Air Superfund National Technical Guidance Series on Air Pathway Assessments^(1,2,3). Specific applications of this strategy are presented in several additional Air Superfund Technical Guidance documents⁽⁴⁾.

The measurement approach involves actually measuring the air impact at selected locations during specific time periods. These measurements can be used to document actual air impacts during specific time intervals (i.e., during cleanup operations) or to extrapolate the probable "worst case" concentrations at that and similar locations over a longer time period than was sampled.

This SOP addresses issues associated with this second assessment strategy. This SOP also discusses the U.S. EPA/ERT's monitoring instruments, air sampling kits, and approach to air sampling and monitoring at hazardous waste sites.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, depending on site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Air monitoring is defined as the use of direct-reading instruments and other screening or monitoring equipment and techniques that provide instantaneous (real-time) data on the levels of airborne contaminants. The U.S. EPA/ERT maintains numerous monitors for real-time measurements. Examples of air monitoring equipment are hand-held photoionization detectors (PID), flame ionization detectors (FID), oxygen/combustible gas detectors, and remote optical sensors.

Air sampling is defined as those sampling and analytical techniques that require either off- or on-site laboratory analysis and therefore do not provide immediate results. Typically, air sampling occurs after use of real-time air monitoring equipment has narrowed the number of possible contaminants and has provided some qualitative measurement of contaminant concentration. Air sampling techniques are used to more accurately detect, identify and quantify specific chemical compounds relative to the majority of air monitoring technologies.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 4 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

In the Superfund Removal Program, On-Scene Coordinators (OSCs) may request the U.S. EPA/ERT to conduct air monitoring and sampling during the following situations: emergency responses, site assessments, and removal activities. Each of these activities has a related air monitoring/sampling objective that is used to determine the potential hazards to workers and/or the community.

- Emergency Response

Emergency responses are immediate responses to a release or threatened release of hazardous substances presenting an imminent danger to public health, welfare, or the environment (i.e., chemical spills, fires, or chemical process failures resulting in a controlled release of hazardous substances). Generally these situations require rapid on-site investigation and response. A major part of this investigation consists of assessing the air impact of these releases.

- Removal Site Assessment

Removal site assessments (referred to as site assessments) are defined as any of several activities undertaken to determine the extent of contamination at a site and which help to formulate the appropriate response to a release or threatened release of hazardous substances. These activities may include a site inspection, multimedia sampling, and other data collection.

- Removal Actions

Removal actions clean up or remove hazardous substances released into the environment. Removal actions include any activity conducted to abate, prevent, minimize, stabilize, or eliminate a threat to public health or welfare, or to the environment.

Personal risk from airborne contaminants can be determined by comparing the results of on-site monitoring and sampling to health-based action levels such as the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs). Residential risk can be determined by comparing the results of off-site monitoring or sampling to health-based action levels such as those developed by the Agency for Toxic Substance and Disease Registry (ATSDR).

The extent to which valid inferences can be drawn from air monitoring/sampling depends on the degree to which the monitoring/sampling effort conforms to the objectives of the event. Meeting the project's objectives requires thorough planning of the monitoring/sampling activities, and implementation of the most appropriate monitoring/sampling and analytical procedures. These issues will be discussed in this SOP.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Preservation, containers, handling and storage for air samples are discussed in the specific SOPs for the technique selected. In addition, the analytical method (i.e., U.S. EPA, National Institute for Occupational Safety and Health [NIOSH], and OSHA Methods) may be consulted for storage temperature, holding times and packaging requirements. After sample collection, the sampling media (i.e., cassettes or tubes) are immediately sealed. The samples are then placed into suitable containers (i.e., whirl bags, resealable bags or culture tubes) which are then placed into a shipping container.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 5 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

Use bubble wrap or Styrofoam peanuts when packing air samples for shipment. DO NOT USE VERMICULITE.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Upwind sources can contribute to sample concentration. Natural sources, such as biological waste, can produce hydrogen sulfide and methane which may contribute to the overall contaminant level. Extraneous anthropogenic contaminants (i.e., burning of fossil fuels; emissions from vehicular traffic, especially diesel; and volatile compounds) from petrochemical facilities; effluvium from smoke stacks) may also contribute. Air sampling stations should be strategically placed to identify contributing sources.

Photoreactivity or reaction of the parameters of concern may occur with nonrelated compounds [i.e., nitrogen compounds and polyaromatic hydrocarbons (PAHs)]. Some sorbent media/samples should not be exposed to light during or after sampling due to photochemical effects (i.e., PAHs).

Various environmental factors, including humidity, temperature and pressure, also impact the air sampling methodology, collection efficiency and detection limit. Since the determination of air contaminants is specifically dependent on the collection parameters and efficiencies, the collection procedure is an integral part of the analytical method.

Detection limits depend on the contaminants being investigated and the particular site situation. It is important to know why the data are needed and how the data will be used. Care should be taken to ensure the detection limits are adequate for the intended use of the final results.

Some equipment may be sensitive to humidity and temperature extremes.

5.0 EQUIPMENT/APPARATUS

5.1 Direct Reading Instruments (Air Monitoring Instruments)

There are two general types of direct reading instruments: portable screening devices and specialized analytical instruments. Generally all these techniques involve acquiring, for a specific location or area, continuous or sequential direct air concentrations in either a real-time or semi-real-time mode. None of these instruments acquires true time-weighted average concentrations. In addition, these instruments are not capable of acquiring simultaneous concentration readings at multiple locations, although several are able to sequentially analyze samples taken remotely from different locations. The document, "Guide to Portable Instruments for Assessing Airborne Pollutants Arising from Hazardous Waste Sites⁽⁵⁾," provides additional information about air sampling and monitoring. The hazard levels for airborne contaminants vary. See the ACGIH TLVs and the OSHA PELs for safe working levels. Common screening devices and analytical instruments are described in Appendix A.

5.2 Air Sampling Equipment and Media/Devices

The U.S. EPA/ERT uses the following analytical methods for sampling: *NIOSH Manual of Analytical Methods*⁽⁶⁾, *American Society for Testing and Materials (ASTM) Methods*⁽⁷⁾, *U.S. EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*^(8,9), and *OSHA Methods*⁽¹⁰⁾.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 6 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

Additional air sampling references include *Industrial Hygiene and Toxicology* (3rd Ed.)⁽¹¹⁾ and *Air Sampling Instruments for Evaluation of Atmospheric Contaminants*⁽¹²⁾. These methods typically specify equipment requirements for sampling. Since air sampling is such a diverse technology, no single method or reference is best for all applications. Common sampling equipment and media/devices are described in Appendix B.

5.3 Tools/Material and Equipment List

In addition to equipment and materials identified in Appendices A and B, the following equipment and materials may be required to conduct air sampling and monitoring at hazardous waste sites:

- Camera
- Site logbook
- Clipboard
- Chain of custody records
- Custody seals
- Air sampling worksheets
- Sample labels
- Small screwdriver set
- Aluminum foil
- Extension cords
- Glass cracker
- Multiple plug outlet
- Whirl bags or culture tubes
- Teflon tape
- Calibration devices
- Tygon and/or Teflon tubing
- Surgical gloves
- Lint-free gloves
- Ice
- Sample container

Use the following additional equipment when decontaminating glassware on site:

- Protective equipment (i.e., gloves, splash goggles, etc.)
 - Appropriate solvent(s)
 - Spray bottles
 - Liquinox (soap)
 - Paper towels
 - Distilled/deionized water
 - Five-gallon buckets
 - Scrub brushes and bottle brushes

6.0 REAGENTS



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 7 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

Impinger sampling involves using reagents contained in a glass vial to absorb contaminants of concern (for example, NIOSH Method 3500 for formaldehyde uses 1% sodium bisulfite solution). Impinger solutions vary and are method-dependent.

Reagents such as acetone and hexane are required to decontaminate glassware and some air sampling equipment. Decontamination solutions are specified in ERT/REAC SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURES

7.1 Air Monitoring Design

7.1.1 Initial Surveys

In general, the initial survey is considered to be a relatively rapid screening process for collecting preliminary data at hazardous waste sites. However, initial surveys may require many hours to complete and may consist of more than one entry.

Some information is generally known about the site; therefore, real-time instrumentation for specific compounds (i.e., detector tubes and electrochemical sensors) can be used to identify hot spots. Sufficient data should be obtained with real-time instruments during the initial entry to screen the site for various contaminants. When warranted, intrinsically safe or explosion-proof instruments should be used. An organic vapor analyzer (OVA) is typically used during this survey. These gross measurements may be used on a preliminary basis to (1) determine levels

of personal protection, (2) establish site work zones, and (3) map candidate areas for more thorough qualitative and quantitative studies involving air sampling.

In some situations, the information obtained may be sufficient to preclude additional monitoring. Materials detected during the initial survey may call for a more comprehensive evaluation of hazards and analyses for specific compounds. Since site activities and weather conditions change, a continuous program to monitor the ambient atmosphere must be established.

7.1.2 Off-Site Monitoring

Typically, perimeter monitoring with the same instruments employed for on-site monitoring is utilized to determine site boundaries. Because air is a dynamic matrix, physical boundaries like property lines and fences do not necessarily delineate the site boundary or area influenced by a release. Whenever possible, atmospheric hazards in the areas adjacent to the on-site zone should be monitored with direct-reading instruments. Monitoring at the fenceline or at varying locations off site provides useful information regarding pollutant migration. Three to four locations downwind of the source (i.e., plume) at breathing-zone height provide a basic fingerprint of the plume. Negative instrument readings off site should not be interpreted as the complete absence of airborne toxic substances; rather, they should be considered another piece of information to assist in the preliminary evaluation. The interpretation of negative readings is instrument-



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 8 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

dependent. The lack of instrument readings off site should not be interpreted as the complete absence of all airborne toxic substances; rather, it is possible that the particular compound or class of compounds to which the monitoring instrument responds is not present or that the concentration of the compound(s) is below the instrument's detection limit.

7.2 Air Sampling Design

7.2.1 Sampling Plan Design

The goal of air sampling is to accurately assess the impact of a contaminant source(s) on ambient air quality. This impact is expressed in terms of overall average and/or maximum air concentrations for the time period of concern and may be affected by the transport and release of pollutants from both on- and off-site sources. The location of these sources must be taken into account as they impact the selection of sampling locations. Unlike soil and groundwater concentrations, air concentrations at points of interest can easily vary by orders of magnitude over the period of concern. This variability plays a major role in designing an air sampling plan.

Downwind air concentration is determined by the amount of material being released from the site into the air (the emission rate) and by the degree that the contamination is diluted as it is transported. Local meteorology and topography govern downwind dilution. Contaminant emission rates can also be heavily influenced by on-site meteorology and on-site activities. All of these concerns must be incorporated into an air sampling plan.

A sampling strategy can be simple or complex, depending on the sampling program objectives. Programs involving characterization of the pollutant contribution from a single point source tend to be simple, whereas sampling programs investigating fate and transport characteristics of components from diverse sources require a more complex sampling strategy. In addition, resource constraints may affect the complexity of the sampling design.

An optimal sampling strategy accounts for the following site parameters:

- Location of stationary as well as mobile sources
- Analytes of concern
- Analytical detection limit to be achieved
- Rate of release and transport of pollutants from sources
- Availability of space and utilities for operating sampling equipment
- Meteorological monitoring data
- Meteorological conditions in which sampling is to be conducted

The sampling strategy typically requires that the concentration of contaminants at the source or area of concern as well as background contributions be quantified. It is important to establish background levels of contaminants in order to develop a reference point from which to evaluate the source data. Field blanks and lot blanks, as well as various other types of QA/QC samples, can be utilized to determine other sources. The impact of extraneous sources on sampling results can frequently be accounted for by



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 9 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

placing samplers upwind, downwind and crosswind from the subject source. The analytical data from these different sampling locations may be compared to determine statistical differences.

7.2.2 Sampling Objectives

The objectives of the sampling must be determined prior to developing the sampling plan. Does the sampling plan verify adequate levels of protection for on-site personnel, or address potential off-site impacts associated with the site or with site activities? In addition, the assumptions associated with the sampling program must be defined. These assumptions include whether the sampling is to take place under "typical," "worst case", or "one-time" conditions. If the conditions present at the time of sampling are different from those assumed during the development of the sampling plan, then quality of the data collected may be affected. The following definitions have been established:

- Typical: routine daily sampling or routine scheduled sampling at pre-established locations.
- Worst case: sampling conducted under the worst meteorological and/or site conditions which would result in elevated ambient concentrations.
- One-time: only one chance is given to collect a sample without regard to time or conditions. Qualitative data acquired under these conditions are usually applicable only to the time period during which the data were collected and may not provide accurate information to be used in estimating the magnitude of an air impact during other periods or over a long time interval.

The sampling objectives also dictate the detection limits. Sampling methods for airborne contaminants will depend upon the nature and state (solid, liquid or gas) of the contaminant. Gases and vapors may be collected in aqueous media or adsorbents, in molecular sieves, or in suitable containers. Particulates are collected by filters or impactors. The volume of sample to be collected is dependent upon an estimate of the contaminant concentration in the air, the sensitivity of the analytical method, and the standard or desired detection limit. A sufficient amount of sample must be collected to achieve the desired detection limit without interference from other contaminants. In addition, the selected method must be able to detect the target compound(s).

7.2.3 Location and Number of Individual Sampling Points

Choose the number and location of sampling points according to the variability, or sensitivity, of the sampling and analytical methods being utilized, the variability of contaminant concentration over time at the site, the level of precision required and cost limitations. In addition, determine the number of locations and placement of samplers by considering the nature of the response, local terrain, meteorological conditions, location of the site (with respect to other conflicting background sources), size of the site, and the number, size, and relative proximity of separate on-site emission sources and upwind sources. The following are several considerations for sampler placement:



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 10 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

- Location of potential on-site emission sources, as identified from the review of site background information or from preliminary on-site inspections.
- Location of potential off-site emission sources upwind of the sampling location(s). Review local wind patterns to determine the location of off-site sources relative to wind direction.
- Topographic features that affect the dispersion and transport of airborne toxic constituents. Avoid natural obstructions when choosing air sampling station locations, and account for channelization around those obstructions.
- Large water bodies, which affect atmospheric stability and the dispersion of air contaminants.
- Roadways (dirt or paved), which may generate dust that could mask site contaminants.
- Vegetation, such as trees and shrubs, which stabilizes soil and retards subsurface contaminants from becoming airborne. It also affects air flow and scrubs some contaminants from the air. Sometimes thick vegetation can make an otherwise ideal air monitoring location inaccessible.

Consider the duration of sampling activities when choosing the location and number of samples to be collected. For example, if the sampling period is limited to a few hours, one or two upwind and several downwind samples would typically be adequate, especially around major emission sources.

A short-term monitoring program ranges from several days to a few weeks and generally includes gathering data for site assessments, removal actions, and source determination data (for further modeling). Activities involved in a short-term sampling strategy must make the most of the limited possibilities for data collection. Consider moving upwind/downwind locations daily based on National Oceanic and Atmospheric Administration (NOAA) weather forecasts. Weather monitoring becomes critical where complex terrain and local meteorological effects frequently change wind direction. Often, a number of alternatives can fulfill the same objective.

Prevailing winds running the length of a valley usually require a minimum number of sampler locations; however, a complex valley may require more sampler locations to account for the wide variety of winds. Ocean/lake effects may require a radical plan to collect enough samples to reach a low detection limit. Two sets of samplers may be placed next to each other: one set would be activated during the sea breeze while the other set is turned off, and vice versa when there is no sea breeze. After the sampling event, the respective upwind and downwind samples would be combined. Another alternative for sampling near a large body of water may be to use automatic, wind-vector-operated samplers, which turn the sampler on only when the wind comes from a specified vector. At sites located on hillsides, wind will move down a valley and produce an upward fetch at the same time. Sampling locations may have to ring the site to measure



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 11 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

the wind's impact.

Off-site sources may affect on-site monitoring. In this case, on-site meteorological data, concurrent with sampling data, is essential to interpreting the acquired data. Also, additional upwind sampling sites may be needed to fully characterize ambient background contaminant levels. Multiple off-site sources may require several monitoring locations, but if the sources are at a sufficient distance, only one monitoring location is needed.

Topography and weather are not the only factors in sampler location; the sampling sites must be secure from vandals and mishap. Secure all sampling locations to maintain chain of custody, and to prevent tampering with samples or loss of sampling units. High-volume sampling methods often require the use of 110 VAC electric power. When portable generators are used, the power quality may affect sampler operation. Also, be aware that the generators themselves could be a potential pollution source if their placement is not carefully considered.

Air quality dispersion models can be used to place samplers. The models incorporate source information, surrounding topography, and meteorological data to predict the general distance and directions of maximum ambient concentrations. Modeling results should be used to select sampling locations in areas of maximum pollutant concentrations.

7.2.4 Time, Duration and Frequency of Sampling Events

After choosing appropriate sampling or monitoring locations, determine the sampling frequency and the number of samples to be collected. The time of day, duration and frequency of sampling events is governed by:

- The effects of site activities and meteorology on emission rates
- The diurnal effect of the meteorology on downwind dispersion
- The time period(s) of concern as defined by the objective
- The variability in the impact from other non-site-related sources
- If defined, the degree of confidence needed for either the mean or maximum downwind concentrations observed
- The precision requirements for single measurements
- Cost and other logistical considerations

The duration of the removal action and the number of hours per day that site work is conducted determine the time, duration, and frequency of samples. Short-term sampling programs may require daily sampling, while long-term programs may require 24-hour sampling every sixth or twelfth day. If the site will be undergoing removal activities 24 hours a day, continuous air sampling may be warranted. However, if the site activities will be conducted for only eight hours a day, and there are no emissions likely to occur during the remaining 16 hours, then sampling would be appropriate prior to the start of daily activities, would continue during operations, and end at the conclusion of the daily activities. An off-peak sample collection can ensure that emissions are not persisting



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 12 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

after the conclusion of daily cleanup activities. For some sites, emissions are still a factor several hours after daily site activities have been completed. Because of the typically decreased downwind dispersion in the evening, higher downwind concentrations than were present during daytime site activities may be detected. For sites where this is possible, the sampling duration needs to be lengthened accordingly.

Sampling duration and flow rate dictate the volume of air collected, and to a major degree, the detection limit. The analytical method selected will provide a reference to flow rate and volume. Flow rates are limited to the capacity of the pumps being employed and the contact time required by the collection media.

The duration or period of air sampling is commonly divided into two categories (1) samples collected over a brief time period are referred to as "instantaneous" or "grab" samples and are usually collected in less than five minutes and (2) average or integrated samples are collected over a significantly longer period of time. Integrated samples provide an average concentration over the entire sampling period. Integrated samples are not suited to determining cyclical releases of contaminants because periodic or cyclical events are averaged out by the proportionally long sampling duration.

Air quality dispersion models can predict the maximum air contaminant concentration expected from a source. The meteorological and site conditions expected to cause the highest concentration are known as worst-case conditions and can be identified by analyzing the modeling results. Depending upon the objective, one may sample when the model predicts worst-case conditions will exist.

7.2.5 Meteorological and Physical/Chemical Considerations

A meteorological monitoring program is an integral part of site monitoring activities. Meteorological data, which define local terrain impacts on air flow paths, are needed to interpret air concentration data. Meteorological data may be available from an existing station located near the site (i.e., at a local airport), otherwise a station should be set up at the site. This data will document the degree that samples actually were downwind and verify whether other worst-case assumptions were met. Meteorological parameters to be monitored are, at a minimum, wind speed, wind direction, and sigma theta (which is the horizontal wind direction standard deviation and an indicator of atmospheric stability). The remaining parameters primarily affect the amount of a contaminant available in the air.

- Wind Speed

When the contaminant of concern is a particulate, wind speed is critical in determining whether the particulate will become airborne, the quantity of the particulate that becomes airborne, and the distance the particulate will travel from the source. Wind speed also contributes to the volatilization of contaminants from liquid sources.

- Wind Direction



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 13 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

Wind direction highly influences the path of airborne contaminants. In addition, variations in wind direction increase the dispersion of pollutants from a given source.

- Atmospheric Stability

Atmospheric stability refers to the degree to which the atmosphere tends to dampen vertical and horizontal motion. Stable atmospheric conditions (i.e., evenings) result in low dispersion, and unstable atmospheric conditions (i.e., hot sunny days) result in higher dispersion.

- Temperature

Higher temperatures increase the rate of volatilization of organic and some inorganic compounds and affect the initial rise of gaseous or vapor contaminants. Therefore, worst-case emission of volatiles and semivolatiles occurs at the hottest time of day, or on the hottest day.

- Humidity

High humidity affects water-soluble chemicals and particulates. Humid conditions may dictate the sampling media used to collect the air sample, or limit the volume of air sampled and thereby increase the detection limit.

- Atmospheric Pressure

Migration of landfill gases through the landfill surface and through surrounding soils are governed by changes in atmospheric pressure. Atmospheric pressure will influence upward migration of gaseous contaminants from shallow aquifers into the basements of overlying structures.

In many cases, the transport and dispersion of air pollutants is complicated by local meteorology. Normal diurnal variations (i.e., temperature inversions) affect dispersion of airborne contaminants. Terrain features can enhance or create air inversions and can also influence the path and speed of air flow, complicating transport and dispersion patterns.

The chemical characteristics of a contaminant (i.e., molecular weight, physical state, vapor pressure, aerodynamic size, temperature, reactive compounds, and photodegradation) affects its behavior and can influence the method used to sample and analyze it.

8.0 CALCULATIONS

Volume is obtained by multiplying the sample time in minutes by the flow rate. Sample volume should be indicated on the chain of custody record. Adjustments for temperature and pressure differences may be required.

Results are usually provided in parts per million (ppm), parts per billion (ppb), milligrams per cubic meter



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 14 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

(mg/m³) or micrograms per cubic meter (µg/m³).

Refer to the analytical method or regulatory guidelines for other applicable calculations.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

The manufacturer's instructions should be reviewed prior to instrument use. Instruments must be utilized in accordance with manufacturer's instructions. Equipment checkout and calibration activities must occur prior to and after monitoring and sampling and must be documented.

9.1 QA/QC Samples

QA/QC samples provide information on the variability and usability of environmental sample results. Various QA/QC samples may be collected to detect error. QA/QC samples are submitted with the field samples for analysis to aid in identifying the origin of analytical discrepancies; then a determination can be made as to how the analytical results should be used. Collocated samples, background samples, field blanks, and lot blanks are the most commonly collected QA/QC field samples. Performance evaluation (PE) samples and matrix spikes provide additional measures of data QA/QC control. QA/QC results may suggest the need for modifying sample collection, preparation, handling, or analytical procedures if the resultant data do not meet site-specific QA or data quality objectives. Refer to ERT/REAC SOP #2005, Quality Assurance/Quality Control Samples, for further details, and suggested frequencies for submittal of QA/QC samples.

9.2 Sample Documentation

All sample and monitoring activities should be documented legibly, in ink. Any corrections or revisions should be made by lining through the incorrect entry and by initialing the error. All samples must be recorded on an Air Sampling Worksheet. A chain of custody record must be maintained from the time a sample is taken to the final deposition of the sample. Custody seals demonstrate that a sample container has not been opened or tampered with during transport or storage of samples. Refer to ERT/REAC SOP #2002, Sample Documentation, for further information.

10.0 DATA VALIDATION

Results for QA/QC samples should be evaluated for contamination. This information should be utilized to qualify the environmental sample results accordingly with data quality objectives.

11.0 HEALTH AND SAFETY

Personal protection equipment (PPE) requirements identified in federal and/or state regulations and 29 Code of Federal Regulations (CFR) 1910.120 for hazardous waste site work must be followed.

The majority of physical precautions involved in air sampling are related to the contaminant sampled. Attention should be given when sampling in potentially explosive, flammable or acidic atmospheres. On rare occasions, the collection media may be hazardous; for example, in the instance where an acidic or basic solution is utilized in an impinger.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 15 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures.

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STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 16 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

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STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 17 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

APPENDIX A
Portable Screening Devices and Specialized Analytical Instruments
SOP #2008
November 1994



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 18 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

PORTABLE SCREENING DEVICES

Where possible, a datalogger should be used to minimize the length of time required for site personnel to be in a potentially contaminated area. Datalogger cable is available from manufacturers for linear output instruments and some nonlinear output instruments. U.S. EPA ERT/REAC has output cables for organic vapor analyzers (i.e., HNU and OVA), toxic gas analyzers (i.e., monitox) and real-time aerosol monitors (i.e., RAM and miniram).

- Total Hydrocarbon Analyzers

Total hydrocarbon analyzers used to detect a variety of volatile organic compounds (VOCs) at hazardous waste sites principally employ either a photoionization detector (PID) or a flame ionization detector (FID). Compounds are ionized by a flame or an ultraviolet lamp. PIDs depend on the ionization potential of the compounds. PIDs are sensitive to aromatic and olefinic (unsaturated) compounds such as benzene, toluene, styrene, xylenes, and acetylene. Greater selectivity is possible by using low-voltage lamps. The ionization potential of individual compounds can be found in the NIOSH Pocket Guide to Chemical Hazards. These instruments are not compound-specific and are typically used as screening instruments. FIDs are sensitive to volatile organic vapor compounds such as methane, propanol, benzene and toluene. They respond poorly to organic compounds lacking hydrocarbon characteristics.

- Oxygen and Combustible Gas Indicators

Combustible Gas Indicators (CGIs) provide efficient and reliable methods to test for potentially explosive atmospheres. CGI meters measure the concentration of a flammable vapor or gas in air and present these measurements as a percentage of the lower explosive limit (LEL). The measurements are temperature-dependent. The property of the calibration gas determines sensitivity. LELs for individual compounds can be found in the NIOSH Pocket Guide to Chemical Hazards. If readings approach or exceed 10% of the LEL, extreme caution should be exercised in continuing the investigation. If readings approach or exceed 25% LEL, personnel should be withdrawn immediately.

CGIs typically house an electrochemical sensor to determine the oxygen concentration in ambient air. Normally, air contains approximately 20.9% oxygen by volume. Oxygen measurements are of particular importance for work in enclosed spaces, low-lying areas, or in the vicinity of accidents that have produced heavier-than-air vapors which could displace ambient air. The meters are calibrated for sea level and may indicate a false negative (i.e., O₂ content) at higher altitudes. Since the air has been displaced by other substances, these oxygen-deficient areas are also prime locations for taking additional organic vapor and combustible gas measurements. Oxygen-enriched atmospheres increase the potential for fires by their ability to contribute to combustion or to chemically react with flammable compounds and promote auto-ignition.

- Toxic Atmosphere Analyzers

The toxic atmosphere analyzer is a compound-specific instrument, designed and calibrated to identify and quantify a specific compound or class of compounds in either gaseous or vapor form. Cross-sensitivity to air pollutants not of interest may lead to erroneous results.

U.S. EPA/ERT has the following toxic atmosphere analyzers: carbon monoxide, phosgene, nitrous oxide, hydrogen cyanide, sulfur dioxide, hydrogen sulfide, and chlorine gas.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 19 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

- Aerosol/Particulate Monitors

A Real-Time Aerosol/Particulate Monitor (RAM) displays readings for total particulates. The instrument employs a pulse light emitting diode which generates a narrow band emission in conjunction with a photovoltaic cell to detect light scattered from particulates.

The U.S. EPA/ERT uses the RAM when the contaminant of concern is associated with particulates, and when responding to fires involving hazardous materials, to identify plume levels. The instrument is very useful in determining the presence of a plume when it is not visible. The U.S. EPA/ERT typically uses RAMs on tripods to obtain particulate concentrations at the breathing zone level. Personal dataloggers are used with the RAMs to document minimum, average and maximum concentrations. This provides real-time data without requiring those in personal protective equipment to be constantly present in the plume.

- Chemical Detector Tubes (Colorimetric Tubes)

A chemical detector tube is a hollow, tube-shaped, glass body containing one or more layers of chemically impregnated inert material. To use, the fused ends are broken off and a manufacturer-specified volume of air is drawn through the tube with a pump to achieve a given detection limit. The chemicals contained within the packing material undergo a chemical reaction with the airborne pollutant present, producing a color change during the intake of each pump stroke. The concentration of a pollutant is indicated by the length of discoloration on a calibrated scale printed on the detector tube.

- Radiation Meters

Radiation meters determine the presence and level of radiation. The meters use a gas or solid ion detection media which becomes ionized when radiation is present. The meters are normally calibrated to one probe. Meters that detect alpha, beta, and gamma radiation are available.

- Gold Film (Hydrogen Sulfide and Mercury Vapor) Monitors

Hydrogen sulfide (H₂S) and Mercury (Hg) monitors operate on the principle that electric resistivity increases across a gold film as a function of H₂S and Hg concentration. The monitors provide rapid and relatively low detection limits for H₂S and Hg in air. After extensive sampling periods or high concentrations of H₂S and Hg, the gold film must be heated to remove contamination and return the monitor to its original sensitivity.

- Infrared Detectors

Infrared detectors such as the Miniature Infrared Analyzer (MIRAN) use infrared (IR) absorption as a function of specific compounds. MIRAN instruments apply to situations where the contaminants are identified but concentrations are not. MIRAN instruments generally require AC power.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 20 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

SPECIALIZED ANALYTICAL INSTRUMENTS

The continuous monitors described above provide qualitative measurement of air contaminants. Quantitative measurements in the field can be obtained using more sophisticated instruments, such as portable Gas Chromatographs, to analyze grab samples.

- Direct Air Sampling Portable Gas Chromatographs (GCs)

Portable GCs use gas chromatography to identify and quantify compounds. The time it takes for a compound to move through a chromatographic column is a function of that specific compound or group of compounds. A trained technician with knowledge of the range of expected concentrations of compounds can utilize a portable GC in the field to analyze grab samples. GCs generally require AC power and shelter to operate. This method is limited by its reliance on a short-term grab sample to be representative of the air quality at a site.

- Remote Optical Sensing

This technique, also referred to as long-path or open-path monitoring, involves transmitting either an infrared or ultraviolet light beam across a long open path and measuring the absorbance at specific wavelengths. The technique is capable of analyzing any preselected organic or inorganic volatile compound that can be resolved from compounds naturally occurring in ambient air. Current projected removal applications include perimeter monitoring during site cleanups and measurement of emission source strengths during site assessments.

- TAGA Direct Air Sampling Mass Spectrometer/Mass Spectrometer

The Trace Atmospheric Gas Analyzer (TAGA), which is operated by the U.S. EPA/ERT, is capable of real-time detection of preselected organic compounds at low parts-per-billion concentrations. The instrument has been successfully used by the U.S. EPA/ERT for isolating individual emission plumes and tracking those plumes back to their sources.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 21 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

APPENDIX B
Air Sampling Equipment and Media/Devices
SOP #2008
November 1994



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 22 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

AIR SAMPLING EQUIPMENT

- High-Volume, Total Suspended Particulate (TSP) Samplers

High-volume TSP samplers collect all suspended particles by drawing air across an 8- by 10-inch glass-quartz filter. The sample rate is adjusted to 40 cubic feet per minute (CFM), or 1134 liters per minute (L/min), and it is held constant by a flow controller over the sample period. The mass of TSPs can be determined by weighing the filter before and after sampling. The composition of the filter varies according to the analytical method and the detection limit required.

- PM-10 Samplers

PM-10 samplers collect particulates with a diameter of 10 microns or less from ambient air. Particulates of this size represent the respirable fraction, and thus are of special significance. PM-10 samplers can be high-volume or low-volume. The high-volume sampler operates in the same manner as the TSP sampler at a constant flow rate of 40 CFM; it draws the sample through a special impactor head which collects particulates of 10 microns or less. The particulate is collected on an 8- by 10-inch filter. The low-volume sampler operates at a rate of approximately 17 L/min. The flow must remain constant through the impactor head to maintain the 10-micron cut-off point. The low-volume PM-10 collects the sample on 37-mm Teflon® filters.

- High-Volume PS-1 Samplers

High-volume PS-1 samplers draw a sample through polyurethane foam (PUF) or a combination foam and XAD-2 resin plug, and a glass quartz filter at a rate of 5-10 CFM (144 to 282 L/min). This system is excellent for measuring low concentrations of semivolatiles, PCBs, pesticides, or chlorinated dioxins in ambient air.

- Area Sampling Pumps

These pumps provide flow-rate ranges of 2-20 L/min and have a telescopic sampling mast with the sampling train. Because of the higher volume, this pump is suitable for sampling low concentrations of airborne contaminants (i.e., asbestos sampling). These pumps are also used for metals, pesticides and PAH sampling which require large sample volumes.

- Personal Sampling Pumps

Personal sampling pumps are reliable portable sampling devices that draw air samples through a number of sampling media including resin tubes, impingers, and filters. Flow rates are usually adjustable from 0.1 to 4 L/min (or 0.01 to .75 L/min with a restrictive orifice) and can remain constant for up to 8 hours on one battery charge or continuously with an AC charger/converter.

- Canister Samplers

Evacuated canister sampling systems use the pressure differential between the evacuated canister and ambient pressure to bleed air into the canister. The sample is bled into the canister at a constant rate over



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 23 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

the sampling period using a critical orifice, a mechanically compensated regulator, or a mass flow control device until the canister is near atmospheric pressure.

Pressure canister sampling systems use a pump to push air into the canister. To maintain a higher, more controlled flow, the pump typically controls the pressure differential across a critical orifice at the inlet of the canister, resulting in a pressurized canister at the completion of sampling.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 24 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

AIR SAMPLING MEDIA/DEVICES

If possible, before employing a specific sampling method, consult the laboratory that will conduct the analyses. Many of the methods can be modified to provide better results or a wider range of results.

- Summa Canisters

Summa canisters are highly polished passivated stainless steel cylinders. The Summa polishing process brings chrome and nickel to the surface of the canisters, which results in an inert surface. This surface restricts adsorption or reactions that occur on the canister's inner surface after collection. At the site, the canister is either placed in a sampler to control sample collection rate, or opened to collect a grab sample. Samples can be collected by allowing air to bleed into or be pumped into the canister. U.S. EPA/ERT uses 6-liter Summa canisters for VOC and permanent gas analysis.

- Passive Dosimeters

Passive dosimeters are clip-on vapor monitors (samplers) in which the diffused contaminants are absorbed on specially prepared active surfaces. Industrial hygienists commonly use dosimeters to obtain time-weighted averages or concentrations of chemical vapors, as they can trap over 130 organic compounds. Selective dosimeters have also been developed for a number of chemicals including formaldehyde, ethylene oxide, hydrogen sulfide, mercury vapor, nitrogen dioxide, sulfur dioxide, and ozone. Dosimeters must be sent to a laboratory for analysis.

- Polyurethane Foam (PUF)

PUF is a sorbent used with a glass filter for the collection of semivolatile organic compounds such as pesticides, PCBs, chlorinated dioxins and furans, and PAHs. Fewer artifacts (chemical changes that occur to collected compounds) are produced than with some other solid sorbents. PUF is used with the PS-1 sampler and U.S. EPA Method TO13. PUF can also be used with personal sampling pumps when sampling for PAHs using the Lewis/McCloud method. Breakthrough of the more volatile PCBs and PAHs may occur when using PUF.

- Sampling Bags (Tedlar)

Sampling bags, like canisters, transport air samples to the laboratory for analysis. Samples are generally pumped into the bags, but sometimes a lung system is used, in which a pump creates a vacuum around the bag in a vacuum box. Then the sample flows from a source into the bag. This method is used for VOCs, fixed gases (CO₂, O₂ and N₂) and methane.

- Impingers

An impinger allows an air sample to be bubbled through a solution, which collects a specific contaminant by either chemical reaction or absorption. For long sampling periods, the impinger may need to be kept in an ice bath to prevent the solution from evaporating during sampling. The sample is drawn through the impinger by using a sampling pump or more elaborate sampling trains with multiple impingers.

- Sorbent Tubes/Cartridges



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 25 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

A variety of sampling media are available in sorbent tubes, which are used primarily for industrial hygiene. A few examples are carbon cartridges, carbon molecular sieves, Tenax tubes and tube containing the XAD-2 polymer. Depending upon the sorbent material, tubes can be analyzed using either a solvent extraction or thermal desorption. The former technique uses standard laboratory equipment and allows for multiple analyses of the same sample. The latter technique requires special, but readily available, laboratory equipment and allows only one analysis per sample. In addition, thermal desorption typically allows for lower detection limits by two or more orders of magnitude. Whenever sorbent tubes are being used for thermal desorption, they should be certified as "clean" by the laboratory doing the analysis.

Thermally Desorbed Media

During thermal desorption, high-temperature gas streams are used to remove the compounds collected on a sorbent medium. The gas stream is injected and often cryofocused into an analytical instrument, such as a GC, for compound analysis:

- Tenax Tubes

Tenax tubes are made from commercially available polymer (p-phenylene oxide) packed in glass or stainless steel tubes through which air samples are drawn or sometimes pumped. These tubes are used in U.S. EPA Method TO1 and VOST for volatile nonpolar organic, some polar organic, and some of the more volatile semivolatile organics. Tenax is not appropriate for many of the highly volatile organics (with vapor pressure greater than approximately 200 mm Hg).

- Carbonized Polymers

The carbonized molecular sieve (CMS), a carbonized polymer, is a commercially available, carbon sorbent packed in stainless-steel sampling tubes through which air samples are drawn or sometimes pumped. These are used in U.S. EPA Method TO2 for highly volatile nonpolar compounds which have low-breakthrough volumes on other sorbents. When high-thermal desorption temperatures are used with CMS, more variability in analysis may occur than with other sorbents.

- Mixed Sorbent Tubes

Sorbent tubes can contain two type of sorbents. Combining the advantages of each sorbent into one tube increases the possible types of compounds to be sampled. The combination of two sorbents can also reduce the chance that highly volatile compounds will break through the sorbent media. An example of a mixed sorbent tube is the combination of Tenax and charcoal with a carbonized molecular sieve. A potential problem with mixed sorbent tubes is the breakthrough of a compound from an earlier sorbent to a later sorbent from which it cannot be desorbed.

Solvent-Extracted Media

Solvent-extracted media use the principle of chemical extraction to remove compounds collected on a sorbent media. The chemical solvent is injected into an instrument, such as a GC, for analysis of compounds. Examples of solvent-extracted media follow:

- Chemically Treated Silica Gel



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 26 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

Silica gel is a sorbent which can be treated with various chemicals. The chemically treated silica gel can then be used to sample for specific compounds in air. Examples include the DNPH-coated silica gel cartridge used with U.S. EPA Method TO11.

- XAD-2 Polymers

XAD-2 polymers usually are placed in tubes, custom-packed sandwich-style with polyurethane foam, and prepared for use with U.S. EPA Method TO13 or the semi-VOST method. The polymers are used for the collection of semivolatile polar and nonpolar organic compounds. The compounds collected on the XAD-2 polymer are chemically extracted for analysis.

- Charcoal Cartridges

Charcoal cartridges, consisting of primary and backup sections, trap compounds by adsorption. Ambient air is drawn through them so that the backup section verifies that breakthrough of the analytes on the first section did not occur, and the sample collection was therefore quantitative. Quantitative sample collection is evident by the presence of target chemicals on the first charcoal section and the absence on the second section. Next, the adsorbed compounds must be eluted, usually with a solvent extraction, and analyzed by GC with a detector, such as a Mass Spectrometer (MS).

- Tenax Tubes

Cartridges are used in OSHA and NIOSH methods in a manner similar to charcoal cartridges but typically for less volatile compounds.

- Particulate Filters

Particulate filters are used by having a sampling pump pass air through them. The filter collects the particulates present in the air and is then analyzed for particulate mass or chemical or radiological composition. Particulate filters are made from different materials which are described below.

- Mixed Cellulose Ester (MCE)

MCE is manufactured from mixed esters of cellulose which are a blend of nitro-cellulose and cellulose acetate. MCE filters are used often for particulate sampling.

- Glass Fiber

Glass fiber is manufactured from glass fibers without a binder. Particulate filters with glass fiber provide high flow rates, wet strength, and high, solid holding capacity. Generally, the filters are used for gravimetric analysis of particulates.

- Polyvinyl Chloride

Particulate filters with polyvinyl chloride are resistant to concentrated acids and alkalis. Their low moisture pickup and light tare weight make them ideal for gravimetric analysis.



STANDARD OPERATING PROCEDURES

SOP: 2008
PAGE: 27 of 27
REV: 0.0
DATE: 11/16/94

GENERAL AIR SAMPLING GUIDELINES

- Teflon

Teflon is manufactured from polytetrafluorethylene (PTFE). Particulate filters with Teflon are easy to handle and exceptionally durable. Teflon filters are used for metal collection.

- Silver

Particulate filters manufactured from pure silver have high collection efficiency and uniform pore size. These filters are used for mercury collection and analysis.

- Cellulose

Particulate filters with cellulose contain less than 0.01% ash. These filters are used to collect particulates.

STANDARD OPERATING PROCEDURE G-1

FIELD DOCUMENTATION

1. SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes procedures for proper field documentation. When samples are collected for chemical or physical characteristics analysis, field surveys or measurements are performed, or oversight of field activities is undertaken, field documentation must be completed. The field logbook serves as a permanent and traceable record of all field activities related to a project and will become a part of the project files. The information presented in this SOP focuses on the completion of field logbooks and/or field forms for documenting field activities conducted by CONTRACTOR.

All data collection will be documented in either a bound field logbook or on appropriate field forms. Field logbooks will be assigned to individual field personnel for daily entries. Notes in the bound field logbooks will be made legibly, written in black or blue ink, and be as detailed and descriptive as possible so that a particular situation may be recalled without reliance on the collector's memory. No blank pages or sections of pages will be allowed. If a page is not completely filled in, a line will be drawn through the blank portion and initialed by the person keeping the log. There should be no erasure or deletions from the field notes. At the end of each day, the logbook will be signed and dated.

2. EQUIPMENT

Field logbooks

Field forms

3. RELATED PROCEDURES

None

4. PROCEDURES

4.1 FIELD LOGBOOK

The field logbook is the primary means of documenting field activities. It must be completed concurrent with field activities and present a thorough but concise summary of the activities conducted. The field logbook should enable the field activities to be reconstructed without relying on the field member's memory. Refer to the Logbook Operating Practices provided at the end of this SOP for detailed descriptions of field logbook entry procedures. Logbooks should be kept in the field member's possession or in a secure place during field work. General provisions for field logbooks include:

- Project name/location and sequential logbook number should appear on the cover.
- Contact information should be recorded inside the front cover in case the logbook is misplaced.
- Write legibly and use a black or blue ink pen for all logbook entries.
- Corrections should be made by crossing out the data with a single strike mark, which will be initialed and dated by the person making the correction. Ensure that the original entry being struck out is still readable.
- Each page of the logbook should be sequentially numbered, dated, and signed by the field team member.
- Time should be recorded in military time (24-hour clock).
- For field sampling or data collection events documented in the logbook, entries should include but not be limited to:
 - Name of author, date, and time of entry.
 - Name, company/agency affiliation, and responsibility of field team members.
 - Names, titles, and arrival/departure times of any site visitors.
 - Weather (e.g., temperature, cloud cover, humidity, wind).
 - Health and safety briefings, personal protection equipment (PPE) level, or changes or issues encountered.

- Calibration of field equipment.
- Description of task.
- Sample or data collection method.
- Number and volume of sample(s) taken.
- Date and time of collection.
- Sample identification number(s).
- Information concerning sampling changes, scheduling modifications, and change orders.
- Details of sampling locations and visual observations of matrix sampled in accordance with ASTM D2488 (e.g., soil description, odors, discolorations).
- Site sketch of sample locations.
- Sample preservation.
- Sample matrix.
- Sample analysis to be performed.
- Field observations.
- Any field measurements made.
- Decontamination procedures.
- Documentation for investigation derived wastes (IDW) (e.g., contents and approximate volume of waste, disposal method).
- Documentation of any scope of work changes required by field conditions.
- Description of photographs taken.
- For oversight activities of consultants and contractors, entries should include, but not be limited to:
 - Name of author, date, and time of entry.
 - Name, company/agency affiliation, and responsibility of field team members.
 - Oversight location and task.

- Names, titles, and arrival/departure times of any site visitors.
- Weather (e.g., temperature, cloud cover, humidity, wind).
- Arrival and departure times of oversight staff.
- Observations of ongoing activities.
- Compliance with or deviation from approved plans.
- Details of sampling locations and visual observations of matrix sampled in accordance with ASTM D2488 (e.g., soil description, odors, discolorations).
- Details of any split samples collected, including location, matrix, field sample IDs.
- Description of photographs taken.

4.2 FIELD FORMS

Various field data collection forms may be used to streamline the documentation of field data. Field forms may also be customized for large data collection efforts. If field data are recorded on a field form, this data entry should be documented in the daily field logbook entry. Field form data entry should be executed with the same quality standards as field logbook data entry. Entries should be neatly written in black or blue ink and corrections made with single line strike-out and initials. Original field forms should be submitted daily to the Task Manager and be incorporated into the project file.

Examples of field forms that may be used for documenting field activities are summarized in the following sections and included in the Sample Forms section at the end of this SOP.

4.2.1 Soil Boring Log

A Soil Boring Log for Direct Push Technology (e.g., Geoprobe) or hollow-stem auger split spoon sampling (see Sample Forms section) may be completed when CONTRACTOR installs or oversees the installation of a soil boring. Information documented on the Soil Boring Log will include:

- Sample depths.

- Penetration/recoveries.
- Analytical sample IDs.
- Blow counts (if applicable).
- Soil classification and lithological description.
- Material origin (natural or fill).
- Observed product, odor, or sheen.
- Instrument readings.

4.2.2 Well Construction Log

In the event that a borehole is completed as a groundwater monitoring well or piezometer, details of the construction may be documented in a Well Construction Log (see Sample Forms section). Information documented on the Well Construction Log includes:

- Total well depth.
- Well diameter.
- Well construction materials.
- Screen interval.
- Construction details.
- Graphic depiction of well construction.

4.2.3 Well Development

Development of a newly installed monitoring well or redevelopment of an existing monitoring well may be documented on a Well Development Form (see Sample Forms section). Information documented on the Well Development Form includes:

- Well ID and construction details.
- Purge rates.
- Headspace readings.
- Turbidity readings.
- Field notes or observations.

4.2.4 Low Flow Groundwater Sampling Record

Low flow groundwater sampling will be documented on a Low Flow Groundwater Sampling Record (see Sample Forms section). Information documented on the sampling record includes:

- Well ID and construction details.
- Times, purge rates, and parameter readings during purging.
- Final parameter values.

- Well condition survey.
- Additional field notes or observations.

4.2.5 Test Pit Log

A Test Pit Log (see Sample Forms section) may be used to record samples collected from test pits, the nature of the soil within the test pit, water entry zones, and types of material observed.

Logbook Operating Practices

Procedure

- Logbooks are permanently bound, all pages numbered.
- Entries should begin on page 1.
- Use only blue or black ink (waterproof).
- Sign entries at the end of the day, or before someone else writes in the logbook.
- If a complete page is not used, draw a line diagonally across the blank portion of the page and initial and date the bottom line.
- If a line on the page is not completely filled, draw a horizontal line through the blank portion.
- Ensure that the logbook clearly shows the sequence of the day's events.
- Do not write in the margins or between written lines, and do not leave blank pages to fill in later.
- If an error is made, draw a single line through the error and initial it.
- Maintain control of the logbook and keep in a secure location.

General Information

- Date on every page.
- Team members and initials listed at beginning of day.
- Other personnel and affiliation (e.g. OSC-Smith, OSC-Jones).
- Written legibly.
- Signatures of author at bottom of every page.
- Signatures when change of recorder.
- Corrections are single lined and corrections are initialed.
- Team members' site entries and exits are documented.
- Chargeable off-site activities are documented.
- Note End of Logbook on last page ("End of Logbook").
- Late entries noted appropriately.

Field Logbooks

- General information.
- Name, location of site, and work order number.
- Name of the Site Manager or Field Team Leader.
- Names and responsibilities of all field team members using the logbook (or involved with activities for which entries are being made).
- Weather conditions.
- Objective narratives written.
- Field observations.
- Names of any site visitors, including entities that they represent.

Sampling

- Time collected.
- Grab/composite.
- Sample location.
- Type of analysis.
- Shipping information.
- Number and types of collected samples.
- Sample location with an emphasis on any changes to documentation in governing documents (i.e., Work Plan, QAPP). This may include measurements from reference points or sketches of sample locations with respect to local features.
- Sample identification numbers, including any applicable cross-references to split samples or samples collected by another entity.
- A description of sampling methodology, or reference to any governing document (i.e., Work Plan, QAPP).

- Summary of equipment preparation and decontamination procedures.
- Sample description including depth, color, texture, moisture content, and evidence of waste material or staining.
- Air monitoring (field screening) results.
- Types of laboratory analyses requested.

Photo Logs

- Camera and PDA (IDs).
- Date of pictures.
- Time of pictures.
- Directions of photos.
- Description of photos.
- Photographer/witness.

Safety

- All safety, accident, and/or incident reports.
- Real-time personnel air monitoring results, if applicable, or if not documented in the HASP.
- Heat/cold stress monitoring data, if applicable.
- Level of protection for tasks.
- Reasons for upgrades or downgrades in personal protective equipment.
- Health and safety inspections, checklists (drilling safety guide), meetings/briefings.
- Equipment make, model, and serial number for monitoring instruments
- Calibration records for monitoring instruments.
- Site safety meeting (time/topics).
- Site objectives/ plan of activities.
- Chemical/physical hazards.
- Personnel attending.
- Special personnel information (allergies, etc.).

Equipment

- Equipment type (make and model).
- Serial nos.
- Calibration records.
- Background readings and locations.
- Monitoring readings and locations.
- Sampler(s) initials.

Contractor Oversight Activities

- Progress and activities performed by contractors including operating times.
- Deviations of contractor activities with respect to project governing documents (i.e., specifications).
- Contractor sampling results and disposition of contingent soil materials/stockpiles.
- Excavation specifications and locations of contractor confirmation samples.
- General site housekeeping and safety issues by site contractors.
- Equipment and personnel on-site.
- Duration of equipment use vs. standby.
- Inventory of shipments received (or verification of items on packing slip).
- Document inspection of disposal trucks arriving at site (e.g., visual observation of clean tankers or truck trailers, etc.).

SAMPLE FORMS



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 1 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

CONTENTS

- 1.0 OBJECTIVE
- 2.0 APPLICABILITY
- 3.0 DESCRIPTION
 - 3.1 Regulatory Background and Options for Management of IDW
 - 3.1.1 Regulatory Preferences
 - 3.1.2 IDW Management Options
 - 3.2 Characterization of IDW
 - 3.2.1 Types of IDW
 - 3.2.2 Hazardous Waste IDW
 - 3.2.3 Polychlorinated Biphenyl (PCB)-Containing Waste
 - 3.2.4 Asbestos-Containing Waste
 - 3.2.5 Non-Hazardous IDW
 - 3.3 Management of IDW
 - 3.3.1 Waste Minimization
 - 3.3.2 Types, Hazards, and Quantities of IDW
 - 3.3.3 On-Site IDW Handling Options
 - 3.3.4 Options Available for Off-Site Disposal of IDW
 - 3.4 Equipment/Apparatus
 - 3.4.1 Waste Disposal
 - 3.4.2 Decontamination Equipment
- 4.0 RESPONSIBILITIES
 - 4.1 Task Leader
 - 4.2 Environmental Health and Safety Manager
 - 4.3 Hazardous Waste Coordinator
- 5.0 APPENDICES
- 6.0 REFERENCES

SUPERSEDES: SOP #2149; Revision 0.0; 10/21/94; U.S. EPA Contract 68-C4-0022

UNCONTROLLED COPY



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 2 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to provide general reference information on the management of investigation-derived waste (IDW) generated during Scientific, Engineering, Response and Analytical Services (SERAS) site investigations.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The anticipated approach and procedures for IDW management will be detailed in the approved QAPP for the site investigation.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

2.0 APPLICABILITY

This SOP is applicable only if the United States (U.S.) Environmental Protection Agency (EPA) On-Scene Coordinator (OSC), Remedial Project Manager (RPM), or other Regional Manager does not have procedures in place for IDW management. Prior to site activities, the SERAS Task Leader (TL) determines if the OSC, RPM, or other Regional Manager has procedures in place for IDW management. This should be done by contacting the Environmental Response Team (ERT) Work Assignment Manager (WAM). If it is determined that procedures are not in place, then the SERAS TL should evaluate IDW handling and management options based on:

- Site contaminants and their concentrations, and total projected volume of IDW
- Media potentially affected (e.g., groundwater, soil) by management options
- Location of the nearest population(s) and likelihood and/or degree of site access
- Potential exposure to workers
- Potential environmental impacts

Every effort must be made to ensure the selection of investigation method(s) that minimize the generation of IDW, contact with contaminants and cost of disposal. It is important that the TL share information about site contaminants and expected IDW with the Environment Health and Safety (EHS) Manager and Hazardous Waste Coordinator well in advance of site startup. This will better ensure that the upfront work can be done to minimize and dispose of IDW efficiently and in compliance with applicable regulations. Efforts made to characterize IDW will be consistent with the scope and purpose of the site investigation.

3.0 DESCRIPTION

3.1 Regulatory Background and Options for Managing IDW

3.1.1 Regulatory References

This SOP provides information that is based on the rules, regulations, and guidance documents summarized in Table 1 of Appendix A.

3.1.2 IDW Management Options

The National Oil and Hazardous Substances Contingency Plan (NCP) requires that



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 3 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

management of IDW generated during site investigations complies with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable unless a waiver is granted. Potentially applicable provisions for IDW management at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites are listed in the following ARARs: the Resource Conservation and Recovery Act (RCRA), Safe Drinking Water Act (SDWA), Clean Air Act (CAA), Toxic Substances Control Act (TSCA), Clean Water Act (CWA), and other state laws.

Typical options for handling IDW include immediate disposal or interim management at the end of which the IDW is either: (1) returned to its source or (2) treated, disposed, or stored elsewhere. The SERAS TL in conjunction with the ERT WAM is required to select options for IDW management that are protective of human health and the environment and comply with or waive the ARARs. The most important general elements of managing IDW are as follows:

- Leaving a site in no worse condition than existed prior to the investigation
- Removing those wastes that pose an immediate threat to human health or the environment
- Leaving on site those wastes that do not require off-site disposal or long-term above-ground containerization
- Complying with federal and state ARARs to the extent practicable
- Planning and coordination for IDW management
- Minimizing the quantity of wastes generated

Office of Emergency Response and Recovery (OERR) Directive 9345.3-02, "Management of Investigation-Derived Wastes During Site Inspections," May 1991.

The specific elements of the approach are as follows:

- Characterizing IDW through the use of existing information (manifests, Safety Data Sheets (SDSs), previous test results, knowledge of the waste generation process, and other relevant records) and best professional judgment.
- Delineating an area of concern (AOC) unit for leaving RCRA hazardous soil cuttings within the unit.
- Containerizing RCRA hazardous groundwater, decontamination fluids, personal protective equipment (PPE), and disposable sampling equipment (if generated in excess of 100 kilograms [kg]/month) and disposing of it at RCRA Subtitle C facilities.
- Leaving on site RCRA nonhazardous soil cuttings, groundwater, and decontamination fluids preferably without containerization and testing.

The U.S. EPA does not recommend the removal of wastes from all sites and, in particular, from those sites where IDW does not pose any immediate threat to human health or the environment.

Based on this information and the guidelines included in the following sections, the SERAS TL should include a plan for handling IDW in the QAPP. Any deviations from or modifications to the plan due to unexpected or unforeseen field conditions must be documented using a field change form and noted in the site logbook.



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 4 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

3.2 Characterization of IDW

3.2.1 Types of IDW

IDW can be divided into investigation-derived environmental media, debris, and other materials. The U.S. EPA uses the term environmental media to describe soil, sediment, surface water, and groundwater or a mixture of such materials (61 Federal Register 18780, 18783; April 29, 1996). Environmental media are not inherently waste but contaminated environmental media becomes a waste if it cannot be returned to its source. The definition of environmental debris found in 40 Code of Federal Regulations (CFR) 268.2(g) includes: solid material, particles that exceed 60 millimeters (mm), and materials intended for disposal. IDW may therefore include, but is not limited to, the following items:

Media

- Soil
- Sediment
- Bedrock
- Surface water
- Drill cuttings
- Purge water
- Development water

Debris

- Concrete, asphalt, building materials, etc.
- Slag
- Used glassware
- Clean trash
- PPE
- Decontamination equipment (buckets, brushes, clothing, tools, etc.)
- Field analytics waste (immunoassay, chlor-n-oil, chlor-in-soil, HACH kits, sample extracts, etc.)
- Dedicated/expendable equipment (bailers, fitters, hose, buckets, XRF cups, etc.)

Other Materials

- Sludge
- Drum solids
- Biological tissue
- Drilling fluids
- Fluid and sludge from the dewatering of drilling mud
- Decontamination fluids

3.2.2 Hazardous IDW

To handle IDW properly, the TL must know whether it contains CERCLA hazardous substances as defined under Section 101(14) and whether those substances are RCRA

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STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 5 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

hazardous wastes or contaminants regulated under other statutes such as TSCA, CWA, CAA, and SDWA. The complete list of CERCLA hazardous substances is found at 40 CFR 302.4. To handle IDW in compliance with regulations, reasonable efforts should be made to characterize it. However, these efforts should be consistent with the scope and purpose of the site investigation.

Contaminated environmental media is not solid waste (i.e. because it was in place and not discarded), cannot be considered RCRA hazardous waste (i.e., because it is not solid waste), but is subject to regulation under RCRA Subtitle C when it contains hazardous waste. The “contained-in” policy requires environmental media to be managed as hazardous waste when it is mixed with listed hazardous constituents (F-, K-, P-, or U-codes identified under 40 CFR 261.31 to 261.33) at concentrations above health-based levels or is mixed with enough hazardous constituents that it exhibits one of four hazardous characteristics (ignitability, corrosivity, reactivity, or toxicity) based on comparison of analytical results to limits established in 40 CFR 261.21 to 261.24. Once the characteristic is eliminated (i.e., through treatment), the environmental media is no longer considered to contain hazardous waste and be subject to RCRA regulations. A formal “contained-out determination” is not required because the determination can be easily made through analytical testing. However, in the case of environmental media that are no longer contaminated by high concentrations of a listed hazardous waste, EPA recommends that the Regions or authorized states make the “contained-out determination” using site-specific health-based standards. Environmental media that contained listed hazardous waste when first generated (i.e., removed from the ground) remain subject to Land Disposal Restriction (LDR) regulations known as Universal Treatment Standards (UTS) following an approved “contained out determination”, except under certain circumstances.

The “contained-in” policy also applies to debris contaminated with RCRA-listed hazardous waste (51 Federal Register 37225, August 18, 1992), which must be handled as hazardous material until it no longer contains hazardous waste at concentrations above health-based levels [40 CFR 261.3(f)(2)]. Hazardous contaminated debris are also subject to LDR standards. Hazardous debris treated to comply with those standards would no longer be subject to RCRA regulation if the debris does not exhibit any hazardous waste characteristics. Agency action is not required; a “contained-out determination” is automatic.

A combination of solid IDW, such as sludge or drum solids, and listed or characteristic waste is considered a mixture under the “mixture rule”. Mixtures of solid IDW and listed wastes are RCRA hazardous wastes under 40 CFR 261.3(a)(2)(iv).

3.2.3 Polychlorinated Biphenyl (PCB)-Containing IDW

Management of IDW contaminated with polychlorinated biphenyls (PCBs) involves compliance with the requirements for PCB remediation waste as specified in the TSCA PCB regulations at 40 CFR 761.50(b)(3) and 761.61. However, PCBs mixed with RCRA hazardous waste become RCRA regulated material. Waste materials containing PCBs as the result of a spill, an intentional or accidental release or uncontrolled discharges of PCBs or other unauthorized disposal of PCBs is called PCB remediation waste which is managed at its “as-found” PCB concentration. Most of the PCB remediation waste encountered during site investigations consists of “bulk PCB remediation waste”



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 6 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

(including, but not limited to, existing piles of soil, in-situ soil, sediments, dredged materials, muds, PCB sewage sludge, and industrial sludge) or “liquid PCBs” (homogeneous, flowable material containing PCBs and no more than 0.5 percent (%) by weight non-dissolved material).

3.2.4 Asbestos-Containing IDW

Asbestos-containing IDW is most likely to be derived from building, landfill, or fill materials during Superfund site investigations. However, soil and rock may also contain naturally-occurring asbestos (NOA) at some sites. Asbestos-containing material (ACM) as defined in the National Emission Standards for Asbestos, found in Subpart M of the National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61, consists of: Category I and Category II nonfriable ACM containing greater than 1 % asbestos as analyzed using polarizing light microscopy (PLM). Office of Solid Waste and Emergency Response (OSWER) Directive 9345.4-05 (Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups, EPA, August 2004) indicated that the 1% definition may not be reliable for assessing potential human health hazards from asbestos-contaminated soils at Superfund sites and that a risk-based, site-specific action level is generally more appropriate. Furthermore, OSWER Directive 9200.0-68 (Framework for Investigating Asbestos-Contaminated Superfund Sites, EPA, September 2008) indicated that accurate quantification is very difficult when the asbestos content of soil is less than 1% PLM and that the results should be interpreted semi-quantitatively.

U.S. EPA does not classify ACM as hazardous waste under RCRA; however, it can be designated a hazardous waste if it is located in a state that regulates asbestos (e.g., California classifies ACM as hazardous waste if it is friable [i.e., can be reduced to powder or dust under hand pressure when dry] and contains 1% or more asbestos). State solid waste regulations generally have asbestos handling and disposal requirements and the states determine which landfills can accept ACM. If the landfills accept regulated ACM (i.e., friable ACM; Category I nonfriable ACM that have become or will become friable or have been subject to grinding, cutting, abrading or burning; or Category II nonfriable ACM that have a high probability of becoming or that have become crumbled, pulverized, or reduced to powder due to work practices used during the course of demolition or renovation), they must comply with Asbestos NESHAP requirements.

3.2.5 Non-Hazardous IDW

Non-hazardous IDW is waste that does not meet the EPA’s definition of hazardous waste.

Even if the IDW does not contain RCRA hazardous waste, the SERAS TL should determine whether the IDW contains other CERCLA hazardous substances. CERCLA hazardous substances include, in addition to RCRA hazardous wastes, substances, elements, compounds, solutions, or mixtures designated as hazardous or toxic under CERCLA itself or under the authority of other laws such as TSCA, CWA, CAA, and SDWA. Therefore, even if RCRA is not applicable, one of these statutes may be.



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 7 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

3.3 Management of IDW

3.3.1 Waste Minimization

The SERAS TL will obtain input from the EHS Manager and Hazardous Waste Coordinator to support selection of site investigation methods that minimize the generation of IDW, particularly TSCA or RCRA hazardous wastes. The site investigation team should limit contact with contaminants and use drilling and decontamination methods (such as steam cleaning) that minimize PPE, disposable equipment, decontamination fluids, and soil cuttings. In particular, the inspection team should minimize the amounts of solvents used for decontamination or eliminate solvents altogether. Minimizing the amount of wastes generated reduces the number of IDW handling problems and costs of disposal.

3.3.2 Types, Hazards, and Quantities of IDW

Extensive testing of the IDW is not warranted in most cases; instead, the nature of the wastes should be assessed by applying professional judgment, using readily available information about the site (such as Safety Data Sheets, manifests, storage reports, process descriptions, preliminary assessments, and results of earlier studies), as well as direct observation of the wastes for discoloration, odor, or other indicators of contamination. Similarly, RCRA procedures for determining whether a waste exhibits RCRA hazardous characteristics do not require testing if the decision can be made by applying knowledge of the characteristic in light of the materials or process used. In most instances, a determination may be made based on available information and professional judgment. This does not mean that IDW can be assumed to be nonhazardous unless clearly proven otherwise. Given the limited information available, the SERAS TL, in conjunction with the ERT WAM, must determine whether it more likely than not that the wastes are hazardous.

To handle IDW properly, the TL must determine the types (such as soil cuttings, groundwater, decontamination fluids, PPE, or disposable equipment), characteristics (whether RCRA hazardous or containing other CERCLA hazardous substances), and quantities of anticipated wastes. As discussed previously, testing will generally not be required to characterize IDW if available information indicates that it does not likely contain hazardous waste or hazardous constituents.

Upon determining the types of anticipated IDW, the SERAS TL should determine IDW characteristics, in particular whether it is expected to be RCRA hazardous or to contain high concentrations of PCBs. For RCRA hazardous IDW (listed or characteristic), the SERAS TL should determine whether it poses an increased hazard to human health and the environment relative to conditions that existed prior to the site investigation. Field analytical screening results, if available, may be helpful indicators of IDW characteristics. However, the SERAS TL must remember that these are not RCRA tests and that the test results usually do not identify RCRA hazardous wastes. The TL must also determine the exact properties of RCRA nonhazardous IDW to select an appropriate disposal facility when the off-site disposal is required.

Upon determining the type and characteristics of IDW to be generated, the TL must



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 8 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

assess the anticipated quantities of waste. This should be done based on past experience with site investigations of similar scope.

3.3.3 On-Site IDW Handling Options

In planning the scope of work, the TL must decide if IDW can be left on site or if it must be disposed off site. Handling of RCRA hazardous IDW and IDW with high PCB concentrations (greater than 50 parts per million [ppm]) may involve either moving the IDW within an AOC unit, or containerization, storage, testing, treatment, and off-site disposal. It is preferable to leave both RCRA hazardous and nonhazardous IDW on site within an AOC unit whenever it complies with regulations, does not pose any immediate threat to human health and the environment, or there is not a high probability of serious community concerns. The TL must determine procedures for handling IDW on site in conjunction with the WAM.

RCRA Nonhazardous IDW

If IDW are RCRA nonhazardous soil or water, they should be left on site unless other circumstances, such as state ARARs or a high probability of serious community concerns, require off-site disposal. RCRA hazardous soil also may be left on site. The on-site handling options available to the TL when IDW are RCRA nonhazardous are listed below.

For soil cuttings:

1. Spread around the well.
2. Put back into the boring.
3. Put into a pit within the AOC.
4. Dispose of at the site's operating treatment/disposal unit (TDU).

For groundwater:

1. Pour onto ground next to well to allow infiltration.
2. Dispose of at the site's TDU.

For decontamination fluids:

1. Pour onto ground (from containers) to allow infiltration
2. Dispose of at the site's TDU.

For decontaminated PPE and disposable equipment:

1. Double bag and deposit the bags on the site or in a U.S. EPA dumpster, or in any municipal landfill.
2. Dispose at the site's TDU if available.

RCRA Hazardous IDW

If IDW are considered RCRA nonhazardous due to lack of information on the waste hazard, the TL should have an alternate plan for handling IDW if field conditions indicate



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 9 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

that these wastes are hazardous. In such a case, there should be an adequate number of containers available for collecting groundwater, decontamination water, soil cuttings, etc.

If IDW consists of RCRA hazardous soils that pose no immediate threat to human health and the environment, the TL should plan on leaving it on site within a delineated AOC unit. However, the TL must consider the proximity of residents and workers in the surrounding area and use best professional judgment to make these decisions. Planning for leaving RCRA hazardous waste on site involves:

- Delineating the AOC unit.
- Determining pit locations close to the borings within the AOC unit for waste burial.
- Covering hazardous IDW in the pits with surficial soil.
- Not containerizing and testing wastes designated to be left on site.

Another alternative for handling RCRA hazardous soil is disposal in a TDU located on the same property as the AOC under investigation. If the TDU is outside the AOC, it must comply with the off-site policy. If any decontamination fluids are generated which are RCRA hazardous wastes, they should be disposed off-site in compliance with the off-site policy or in compliance with the conditionally exempt small quantity generator exemption. Small quantities (i.e., no more than 100 kg/month) of decontamination fluids may be containerized prior to delivery to a hazardous waste facility.

3.3.4 Options Available for Off-Site Disposal of IDW

IDW should be disposed of off-site in the following situations:

- When identified as RCRA hazardous water
- When identified as RCRA hazardous soil that may pose a substantial risk if left at the site
- When identified as RCRA hazardous PPE and disposable equipment
- If leaving them on site would create increased risks at the site

RCRA nonhazardous wastes could be disposed off-site at appropriate RCRA nonhazardous facilities that are in compliance with CERCLA section 121(d)(3) and off-site policy when it is necessary to comply with legally enforceable requirements such as state ARARs that preclude on-site disposal. IDW designated for off-site disposal must be properly containerized, tested, and stored before pick up and disposal. Decontaminated PPE and disposable equipment should be double-bagged if sent to an off-site dumpster or municipal landfill.

Planning for off-site disposal should include the following guidelines:

- Informing the WAM that containerized IDW may be temporarily stored on site while awaiting pick up for off-site disposal
- Initiating the procurement process for IDW testing, pick up and disposal
- Coordinating IDW testing and pick-up activities
- Preparing adequate numbers and types of containers. Drums should be used for collecting small amounts of IDW. Larger amounts of soil and water can be contained in Baker tanks, poly tanks, and bins. PPE and disposable equipment should be double-bagged for disposal at a municipal landfill or collected in drums for



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 10 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

disposal at a hazardous waste facility.

- Designating a storage area (either within the site's existing storage facility, existing fenced area, or within a temporary fence constructed for the site investigation). No humans, children in particular, may have access to the storage area.

All IDW shipped off site, whether RCRA hazardous or not, must go to facilities that comply with the RCRA disposal policy, and the SERAS TL, in conjunction with the SERAS Purchasing Department, must verify that the facilities operate in accordance with this policy.

3.4 Equipment/Apparatus

Equipment, materials, and supplies needed for containerizing IDW are generally selected based on waste characteristics or constituents. Other considerations include the case of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, 5-gallon buckets, plastic bags, etc. can help segregate contaminated materials. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

3.4.1 Waste Disposal

- Trash bags
- Trash containers
- 55-gallon drums or 5-gallon pails
- Metal/plastic buckets/containers for storage and disposal of decontamination solutions

3.4.2 Decontamination Equipment

- Drop cloths of plastic or other suitable materials
- Large galvanized tubs
- Wash solutions
- Rinse solutions
- Long-handled, soft-bristled brushes
- Paper or cloth towels
- Metal or plastic cans or drums
- Soap or wash solution

4.0 RESPONSIBILITIES

4.1 Task Leader

The TL becomes familiar with the available site history, sampling process and the waste(s) generated before and during field activities. Ensures proper storage/containerization of IDW so it is protected from the elements, covered except for when waste is added, and accessible by equipment needed to remove it. Takes samples of waste(s) for analysis if needed. Provides a physical description of the waste(s) and works closely with the hazardous waste coordinator to complete waste profiles. The TL shares site history, known contaminants, information about likely IDWs with the EHS Manager and Hazardous Waste Coordinator well in advance of site mobilization. This would not apply to emergency responses with rapid start-up.



STANDARD OPERATING PROCEDURES

SOP: 2049

PAGE: 11 of 11

REV: 0.1

EFFECTIVE DATE: 10/05/15

INVESTIGATION-DERIVED WASTE MANAGEMENT

4.2 EHS Manager

The EHS Manager works with the Task Leader and Hazardous Waste Coordinator to ensure that IDW management is compliant with applicable regulations. The EHS Manager works with the TL to convene meetings as necessary to ensure necessary parties participate and that necessary investigation and planning are conducted in advance of field work to determine proper disposition of IDWs.

4.3 Hazardous Waste Coordinator

Obtains the federal hazardous waste generator identification number from the USEPA work assignment manager if needed. Contracts a reputable waste disposal service, completes waste profiles, and schedules waste removal. Requests additional analysis if required. Complies with Off-Site Rule 40 CFR 300.440. Reviews all paperwork for accuracy prior to signature by the USEPA work assignment manager. Maintains documentation in an organized file for all IDW removed. Provides USEPA work assignment manager with copies of manifests, Off-Site Rule communications and waste profiles.

5.0 APPENDICES

This section is not applicable to this SOP.

6.0 REFERENCES

U.S. EPA, Management of Investigation-Derived Wastes During Site Inspections, Office of Emergency and Remedial Response Directive 9345.3-02, May 1991.

U.S. EPA, Guide to Management of Investigation Derived Wastes, Office of Solid Waste and Emergency Response Memorandum 9345.3.03FS, January 1992.

Code of Federal Regulations, Title 40, Part 261, Section 23, Section 11 (a) (3), and Section 24 (a) (b).

CFR Proposed Criteria: 51 FR 21685, June 30, 1986 and 51 FR 21450, May 20, 1992.

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 1 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

CONTENTS

- 1.0 SCOPE AND APPLICATION
- 2.0 METHOD SUMMARY
- 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE
- 4.0 INTERFERENCES AND POTENTIAL PROBLEMS
- 5.0 EQUIPMENT/APPARATUS
 - 5.1 Decontamination Tools/Supplies
 - 5.2 Health and Safety Equipment
 - 5.3 Waste Disposal
- 6.0 REAGENTS
- 7.0 PROCEDURES
 - 7.1 Decontamination Methods
 - 7.1.1 Abrasive Cleaning Methods
 - 7.1.2 Non-Abrasive Cleaning Methods
 - 7.2 Field Sampling Equipment Decontamination Procedures
 - 7.2.1 Decontamination Setup
 - 7.2.2 Decontamination Procedures
 - 7.2.3 Post Decontamination Procedures
 - 7.3 Decontamination of Earth Moving Equipment/Drilling Equipment and accessories
 - 7.3.1 Decontamination Setup
 - 7.3.2 Decontamination Procedures
 - 7.3.3 Post Decontamination Procedures
- 8.0 CALCULATIONS
- 9.0 QUALITY ASSURANCE/QUALITY CONTROL
- 10.0 DATA VALIDATION
- 11.0 HEALTH AND SAFETY

UNCONTROLLED COPY



STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 2 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

CONTENTS (cont'd)

12.0 REFERENCES

13.0 APPENDICES

A - Tables
B - Figures

SUPERSEDES: SOP #2006, Rev. 0.0, 08/11/94; US EPA Contract EP-W-09-031

UNCONTROLLED COPY



STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 3 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the methods for preventing or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during environmental investigations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure the methods used are adequate to satisfy the data quality objectives.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the possibility of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. Some equipment may have specific decontamination procedures that do not follow this SOP. Refer to the user manual for each piece of equipment before utilizing this SOP.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes and high and low pressure water cleaning.

The first step is the physical removal of gross contamination on sampling equipment which may include steam or a high pressure water wash. The second step is a soap and water wash that removes the remainder of visible material and residual oils and grease. The third step involves a potable water rinse to remove any detergent, followed by a distilled/deionized water rinse.

For the removal of metals, an acid rinse with a 10% nitric acid solution is used prior to the final distilled/deionized water rinse. For the removal of organics, pesticide grade acetone, methanol or hexane, depending on the specific contaminant of concern, will be applied prior to the final distilled/deionized rinse. Acetone is typically chosen because it is excellent at removing organics, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern or if Target Compound List analysis (which includes acetone) is to be performed, another solvent such as methanol will need to be substituted.

Hexane should be used when the contaminant of concern is polychlorinated biphenyls (PCBs) or in oily media. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

A generalized decontamination procedure is:

1. Physical removal
2. Non-phosphate detergent wash with potable water
3. Potable water rinse
4. Solvent rinse (acetone, hexane, etc.)

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 4 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

5. Air dry
6. 10% nitric acid solution rinse
7. Distilled/deionized water rinse
8. Air dry

In instances in which sampling equipment is being used to collect samples for biological pathogens, the acid is replaced with a 10% bleach solution. Modifications to the standard procedure are required to be documented in the site-specific QAPP, field log book and subsequent reports. All decontamination water is replaced daily at a minimum. If at any point throughout the day the water becomes too dirty, then it is no longer suitable for cleaning and is required to be replaced. All sampling equipment is required to be decontaminated before collecting samples on-site and after use of each piece of sampling equipment.

Waste materials generated from the decontamination processes are referred to as Investigation-Derived Waste (IDW). Management of this waste should be in coordination with SOP#2049, *Investigative-Derived Waste Management*.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample collected, along with the proper sample container type (i.e. glass, plastic), chemical preservation, and storage requirements are dependent upon the matrix sampled and analysis performed. For further information, refer to SERAS SOP #2003, *Sample Storage, Preservation and Handling*.

Sample collection and analysis of decontamination waste generated on-site may be required prior to disposal of decontamination liquids and solids. This should be determined prior to initiation of site activities or as soon as possible thereafter. For more information on handling of IDW, refer to SOP#2049, *Investigative-Derived Waste Management*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Acetone is an excellent solvent since it is miscible with water; however, if volatile organic compounds (VOCs) are to be analyzed, the use of an alternate solvent (methanol, hexane) should be considered since acetone is a compound on the Target Compound List (TCL).

The use of deionized (distilled if only option) water is required for decontamination of sampling equipment. In addition, that water is required to be lab certified, analyte free (specifically for the contaminants of concern). The deionized water must be secured prior to field activities as it is not commonly found local to the site.

The use of solvents and acids on sensitive sampling equipment may cause damage. It is important avoid damaging the equipment. If acids or solvents are utilized, follow health and safety, and waste disposal guidelines.

When decontaminating equipment when temperatures are below freezing, water will freeze in pump spray hoses lines, tanks and in buckets/pails, etc. Additionally, equipment will require longer drying times.

Do not store sampling equipment or reagents used for decontamination near gasoline or any exhaust emissions. Improperly cleaned and prepared sampling equipment can lead to misinterpretation of analytical data due to cross contamination.

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 5 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

Make sure that the decontamination station is set up as not to compromise a clean environment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment is selected based on the type of equipment to be cleaned and anticipated contaminants to be removed. For example, soft-bristle scrub brushes or long-handled bottle brushes are used to remove contaminants. Large galvanized wash tubs, stock tanks, buckets, or children's wading pools hold wash and rinse solutions. Large plastic garbage cans or other similar containers lined with plastic bags help segregate contaminated equipment. Drums are used to store liquid and solid site derived waste.

The following standard materials and equipment are recommended for decontamination activities:

-
- 5.1 Decontamination Tools/Supplies
 - Long and short handled brushes
 - Bottle brushes, composed of nonmetallic material such as nylon
 - Plastic sheeting
 - Paper towels
 - Plastic or galvanized tubs or buckets
 - Pressurized sprayers filled with potable water
 - Spray bottles
 - Aluminum foil
 - Pressure washer
 - Garden hose
 - Electrical cords
 - Work lights (if working in the dark)
 - Generator (if using a submersible pump or lights)
 - Water tank
 - Sump pump

5.2 Health and Safety Equipment

The use of personal protective equipment (PPE), (i.e. safety glasses or splash shield, Tyvek® suits, nitrile gloves, aprons or coveralls, steel toe boots, etc.), is required. Refer to the site-specific Health and Safety Plan (HASP) for site-specific requirements.

5.3 Waste Disposal

- Trash bags
- 55-gallon drums (open and closed top types)
- Metal/plastic buckets/containers for storage and disposal of decontamination solutions

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 6 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

6.0 REAGENTS

Table 1 (Appendix A) lists solvents recommended for the elimination of particular chemicals. In general, solvents typically utilized during the decontamination process are:

- 10% Nitric Acid (HNO_3), typically used for inorganic compounds such as metals
- Acetone (pesticide grade)
- Hexane (pesticide grade)
- Methanol (pesticide grade)
- Deionized/Distilled Water that meets ASTM Type II specifications
- Non-Phosphate Detergent
- Potable Water

7.0 PROCEDURES

A decontamination area should be set up prior to sampling. Weather conditions (i.e. hot, cold, rain, snow, etc.) play an important role in the decontamination process. In hot, cold, rainy or snowy conditions, a tent or canopy may be erected around and over the decontamination area. In cold environments, the decontamination may need to occur inside a building or portable heaters may be needed to warm the area under the tent or canopy. In addition, in cold environments the potable and deionized water may freeze. Plan accordingly and consider your working conditions prior to field sampling activities.

A decontamination plan needs to be implemented and includes:

- The number, location, and layout of decontamination stations
- Decontamination equipment
- Selection of appropriate decontamination methods
- Methods of disposal of all investigative derived waste (i.e. PPE, solid and liquid waste, etc.)
- Work practices that minimize contact with potential contaminants.
- Protection procedures for monitoring and sampling equipment (i.e. covering with plastic, etc.)
- Considerations related to weather conditions
- The use of disposable sampling equipment, when possible

7.1 Decontamination Methods

All samples and equipment removed from site must be decontaminated, removing all contamination that may have adhered to the equipment. Various decontamination methods remove contaminants by washing with water and another physical cleaning action. In addition, solvents and/or acids may be used to decontaminate the equipment.

Physical decontamination methods are grouped into two categories, abrasive and non-abrasive methods, and are listed below:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. It involves the use of metal or nylon brushes. The amount and type of contaminants removed will vary with the brush type, length of time brushed,

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 7 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

degree of brush contact, degree of contamination, nature of the contaminant and surface being cleaned.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with water pressure (i.e. sprayer or pressure washer).

Low-Pressure Water

This method consists of a pressure sprayer filled with water. The user pumps air into the sprayer tank to create pressure. The water is then discharged through a slender nozzle and hose, cleaning the equipment. Scrubbing with a brush is typically used in conjunction with this method.

High-Pressure Water

This method consists of the use of a pressure washer. The operator controls the directional nozzle which is attached to a high-pressure hose. Operating pressure usually ranges from 400 – 600 pounds per square inch (PSI). Scrubbing with large brushes can be used to aid in the decontamination process.

Rinsing

Contaminants and any remaining solvents and/or acids are removed by thorough rinsing. The rinsing is done either by the use of a sprayer or a pressure washer depending on the equipment being cleaned.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps attached to a fence, placed on a drum, or equipment protected by plastic or some other material are not likely to become heavily contaminated.

A damp cloth is used to wipe off any contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set. The use of a different cleaning cloth for each piece of equipment is required. Upon completion, dispose of all cloths with the site derived waste.

7.2 Field Sampling Equipment Decontamination Procedures

7.2.1 Decontamination Setup

The decontamination area is set up by laying out a section of plastic sheeting large enough for the type and amount of equipment to be decontaminated and for the equipment drop and equipment air drying areas.

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 8 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

Stage brushes, pressure sprayers, spray bottles (w/appropriate solvents, acids and deionized water), 5-gallon buckets, plastic/galvanized wash tubs, pressure washer (if required) and detergent. Figure 1 (Appendix B) shows the decontamination area overall layout. Section 7.2.2 discusses the decontamination procedures depending on the contaminants of concern for a Site.

Stage the appropriate amount and type of sample bottles and a cooler, for the collection of rinsate samples. For specific rinsate sample information, refer to SERAS SOP #2005, *Quality Assurance/Quality Control Samples*.

7.2.2 Decontamination Procedures

There are various stations of the cleaning process in which the equipment move through that are designed to remove all visible contamination. Stations 1 and 2 are designed to remove all visible contamination. Additional stations after 1 and 2 remove materials that require dissolution and a final rinse. Once the equipment has passed through all stations, it is laid out to air dry.

Decontamination Process for Metals

Station 1 - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes or pressure washer. When there is no visible residue remaining, transfer to Station 2.

Station 2 - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

Station 3 - Apply the acid solution and air dry on the plastic sheeting, behind Station 3. Once equipment has fully dried, transfer to Station 4.

Station 4 - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area. After drying, the equipment should be wrapped in aluminum foil to prevent contamination of the equipment.

Decontamination Process for Organics

Station 1 - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes. When there is no visible residue remaining, transfer to Station 2

Station 2 - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

Station 3 - Apply the appropriate solvent or solvents and air dry on the plastic sheeting, behind Station 3. Once equipment has fully dried, transfer to Station 4.

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 9 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

Station 4 - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area.

Decontamination process for Metals and Organics

Station 1 - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes. When there is no visible residue remaining, transfer to Station 2.

Station 2 - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

Station 3 - Apply the acid solution and transfer to Station 4.

Station 4 - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to Station 5.

Station 5 - Apply the solvent or solvents and air dry on the plastic sheeting behind Station 5. Once equipment has fully dried, transfer to Station 6.

Station 6 - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area. After drying, the equipment should be wrapped in aluminum foil to prevent contamination of the equipment.

7.2.3 Post Decontamination Procedures

1. Fill out the appropriate labels for the all the various wastes and affix the labels to the drums and/or containers.
2. Clean up the entire work area. Collect solid waste (i.e. nitrile gloves, plastic sheeting, etc.) and store in an appropriate DOT certified drum.
3. Return any remaining unused solvents or acid solutions to their respective labeled containers and properly store.
4. Transfer potable water rinse waste into an appropriate Department of Transportation (DOT) certified drum or container.
5. Transfer the solvent and acid solution rinse water waste into the appropriately labeled DOT certified drums or containers.
6. Using a pressure sprayer, rinse the basins/buckets.
7. Transfer liquid generated from this process into the potable water rinse waste container.
8. Transfer the decontamination brushes into the solid waste container.

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 10 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

9. Empty the pressure sprayer filled with potable water onto the ground.
10. Return all equipment into their carrying cases or shipping containers.
11. Make arrangements for the pickup of all liquid and solid waste.

For further information on waste disposal, refer to SERAS SOP 2049, *Investigation Derived Waste Management*.

7.3 Decontamination of Earth Moving Equipment/Drilling Equipment and Accessories

The decontamination of earth moving and/or drilling equipment and their accessories will require the use of a pressure washer. In addition, an on-site water supply will need to be available. If an on-site water supply is not available, a water tank along with a pump, hoses and a generator will be required. Finally, a designated area on-site needs to be designated as a decontamination area. Some sites already have a concrete pad set-up for this very purpose. If this is not the case, work with the Work Assignment Manager (WAM) to assign a location for these activities to take place on-site.

An area for decontamination can be built with 4x4 lumber or hay bales, heavy duty plastic sheeting and a sump pump. The area will need to extend at least 4 feet beyond the outer dimensions of the equipment being cleaned. Either slope the decontamination area down to one corner or dig a small hole about 2 feet by 2 feet square and about 2 feet deep to allow for the collection of the decontamination water. Cover the decontamination area with plastic sheeting, wrapping the sides around and under the 4 x 4 lumber or bales of hay. If equipment being decontaminated includes equipment with tracks that might tear through the plastic sheeting, appropriate surfaces need to be included for the equipment to drive on. Finally, place a sump pump into this area and periodically empty the water as necessary, into the appropriately labeled liquid waste drum.

7.3.1 Decontamination Set-up Procedures:

1. Move the equipment into the decontamination area.
2. Stage all the decontamination equipment and supplies (i.e. Pressure Washer, Hoses, PPE, etc.)
3. Connect all hoses and fill the pressure washer with fuel.
4. Dress out in the appropriate PPE (refer to the site-specific HASP).

At a minimum, Tyvek®, safety glasses/goggles, steel toe boots, and nitrile gloves must be worn. If handling any equipment (i.e. drill rods, etc.) work gloves must also be worn to prevent possible injury. For site specific requirements refer to the site-specific HASP.

7.3.2 Decontamination Cleaning Procedures:

1. Physically remove as much of the visible material as possible from the heavy equipment after use and prior to steam cleaning. If contaminated material is suspected as determined by visual observations, instrument readings, or other means, collect material in an appropriate waste container.

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 11 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

2. Place the heavy equipment on the decontamination pad in the decontamination area. Verify the decontamination pad has no leaks and the sump pump is functioning properly before beginning the decontamination process.
3. Power on the pressure washer and begin cleaning from the top to the bottom. Thoroughly clean parts of the heavy machinery that come into contact with visible material (such as tires, bucket, augers, drill rods, tracks and the back and underneath of the drill rig). Scrub areas with excessive dirt/debris with large bristle brushes. A flat head shovel can be used to aide in the removal of the dirt/debris. Continue cleaning until all visible contamination has been removed. If required, apply solvents and/or acid solutions, rinse with deionized/distilled water and then let air dry.

The use of solvents and/or acid solutions will depend on site specific conditions. Check with the site-specific HASP for further guidance.

7.3.3 Post Decontamination Procedures

1. Fill out the appropriate labels for the all the various wastes and affix the labels to the drums and/or containers
2. Transfer potable water rinse waste into an appropriate Department of Transportation (DOT) certified drum or container. Transfer water from the decontamination pad to the liquid waste drums using a sump pump.
3. Collect and transfer solid waste (i.e. nitrile gloves, plastic sheeting, etc.) to a DOT-certified drum or container.
4. Transfer the solvent and acid solution rinse water waste into the appropriately labeled DOT-certified drums or containers.
5. Make arrangements for the pickup of all liquid and solid waste.

For further information on waste disposal, refer to SERAS SOP 2049, *Investigation Derived Waste Management*.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Documentation of the decontamination process including date, time and personnel that conducted the decontamination activities must be recorded in a field logbook. Record manufacturer and lot numbers of the reagents used for the decontamination procedures.

A rinsate blank is a specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field. Rinsate blanks are samples obtained by pouring analyte free deionized water over previously

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 12 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

decontaminated sampling equipment, testing for residual contamination. The blank water is then collected in sample containers, processed, shipped and analyzed. The rinsate blank is used to assess possible cross-contamination caused by improper decontamination procedures. The most common frequency of collection is one rinsate blank per day per type of sampling device, to meet definitive data objectives. For further information for each analysis, refer to SERAS SOP #2005, *Quality Assurance/Quality Control Samples*.

For information on sample container types and preservation, refer to SERAS SOP #2003, *Sample Storage, Preservation and Handling*.

If sampling equipment requires the use of Teflon® or polyethylene tubing it is required to be disposed of into the on-site waste container and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. These data are essential to providing an accurate and complete final deliverable. Results of quality control samples will be evaluated for possible cross-contamination of improperly or inadequately decontaminated sampling equipment. This data will be utilized to quantify the sample results in accordance with the project's data quality objectives. The SERAS Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow Occupational Safety and Health (OSHA), U.S. EPA, corporate, and other applicable health and safety procedures.

The decontamination process can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before their use. Decontamination materials may degrade protective clothing or equipment and some solvents can permeate protective clothing. If decontamination materials pose a health hazard, measures are to be taken to protect personnel. Alternatively, substitutions can be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process. Material generated from decontamination activities requires proper handling, storage, and disposal. PPE may be required for these activities.

Safety data sheets (SDS) are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e. acetone, alcohol, etc.).

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, August 2005.

Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 13 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

The Field Branches Quality System and Technical Procedures – Field Equipment Cleaning and Decontamination, USEPA Region IV Science and Ecosystem Support Division, November 2007.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October 1985.

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 14 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

APPENDIX A
Tables
SOP #2006
December 2015

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 15 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

TABLE 1. Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT ⁽¹⁾	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Potable water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazine's) and inorganic compounds.
Dilute Bases	Sodium bicarbonate	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents ⁽²⁾	Acetone Alcohols Ketones Aromatics Alkanes (e.g., hexane) Common petroleum products (i.e. fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent ⁽²⁾	Hexane	PCBs

⁽¹⁾ - Safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

⁽²⁾ - WARNING: Some organic solvents can permeate and/or degrade protective clothing

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STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 16 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

SAMPLING EQUIPMENT DECONTAMINATION

APPENDIX B
Figures
SOP #2006
December 2015

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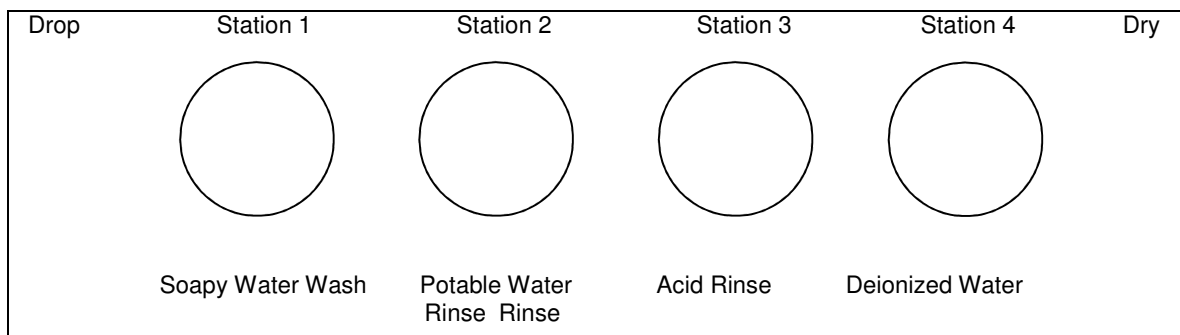
STANDARD OPERATING PROCEDURES

SOP: 2006
PAGE: 17 of 17
REV: 1.0
EFFECTIVE DATE: 12/28/15

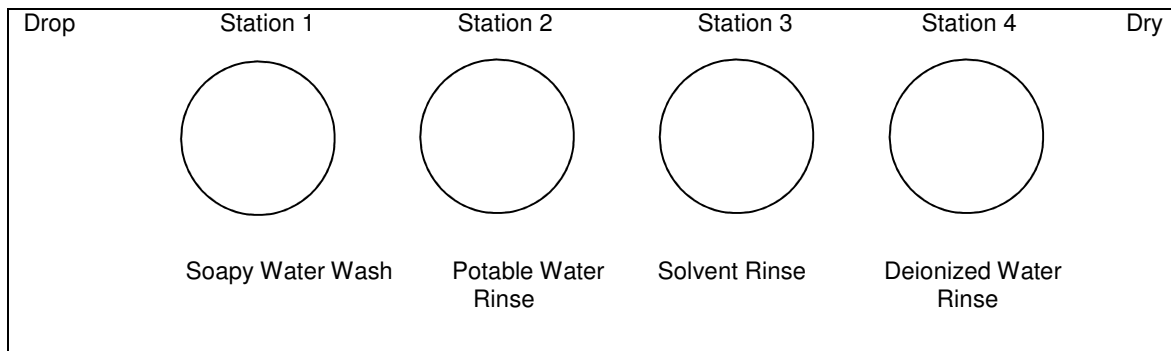
SAMPLING EQUIPMENT DECONTAMINATION

FIGURE 1. Sampling Equipment Decontamination Area

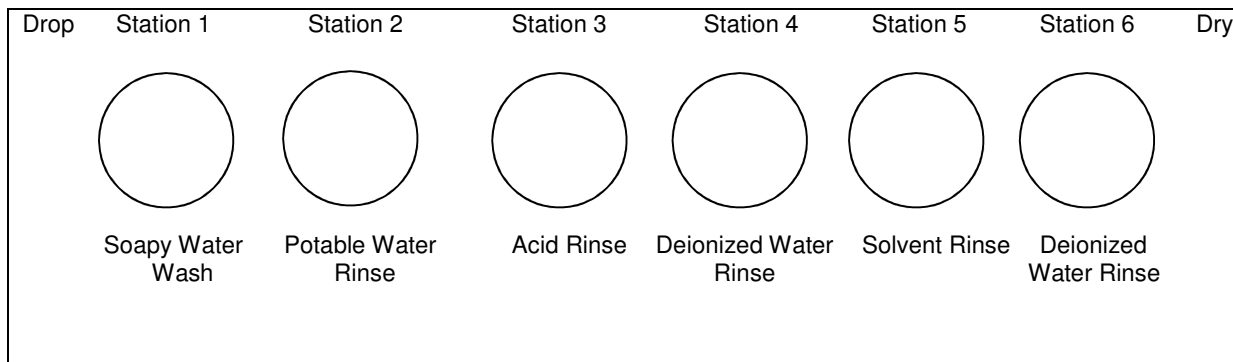
Configuration for the Removal of Metals



Configuration for the Removal of Organics



Configuration for the Removal of Metals and Organics



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STANDARD OPERATING PROCEDURE SS-4

SOIL SAMPLING

1. SCOPE AND APPLICABILITY

Instructions presented in this Standard Operating Procedure (SOP) are for collecting representative soil samples. Soil sampling can be classified into two primary types: surficial and subsurface. Instructions for sampling surficial soil included in this section utilize the spade and scoop. Instructions for sampling subsurface soil included in this section utilize the following techniques: split spoon sampler and thin-walled (Shelby) tube. There are also specific sampling protocols presented for riverbank and/or floodplain sampling using hand augering.

2. EQUIPMENT

Field logbook
Muncell color chart
Grain size card
Hand lens
Clipboard
Folding rule (in feet and tenths)
Pocket penetrometer (if required)
Indelible ink markers
Squirt bottle (with deionized water)
Plastic sheeting
Paper towels
Pens (blue or black)
Eye protection
Work gloves
Surgical gloves
Sample jars
Sample jar labels

Chain-of-custody forms
Photoionization detector (PID)
Decontamination materials
Appropriate sampling device

3. RELATED PROCEDURES

SOP G-1	Field Documentation
SOP G-3	Field Sample Numbering
SOP G-4	Quality Assurance/Quality Control Sampling
SOP G-6	Decontamination
SOP G-7	Management of Investigation Derived Waste (IDW)
SOP G-8	Sample Chain-of-Custody
SOP G-10	Surveying
SOP G-11	MEC Anomaly Avoidance
SOP GW-1	Borehole/Well Abandonment
SOP A-2	Calibration and Use of Air Monitoring Instruments

4. PROCEDURE

4.1 SAMPLING LOCATIONS

Sampling at sites is usually conducted in an attempt to discover contamination and to define its extent and variability. With such an objective, it is most logical to choose sample locations that will yield the most information about site conditions. Because of the nature of the media, soil samples can vary considerably across a site. Physical properties of the soil, including grain size and cohesiveness, may limit the depth from which samples can be collected and the method required to collect them. In most soil, hand-powered equipment can be used only to a depth of approximately 4 to 5 feet. At greater depths, soil sampling is normally performed with a drill rig or other mechanically driven device.

4.2 SAMPLE TYPES

The type of sample should be designated when selecting a sampling method. Application techniques for sample methods include discrete (grab) or composite samples. A discrete (grab) sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected immediately and at one particular point in the sample matrix. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease. Composites are samples composed of two or more specific aliquots (discrete samples) collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask the presence of contaminants by diluting isolated concentrations of analytes that may be present in the environmental matrix.

4.3 SAMPLE COLLECTION

Each sampling technique presents various advantages and disadvantages for its application. For example, sample disturbance, sample volume, chemical/physical reactivity between potential contaminants and sampling tool materials, and ease of decontamination vary from technique to technique. Subsurface soil conditions themselves will restrict the application of certain samples. For example, the thin-walled tube sampler is not applicable for sampling sands.

Presented below are sampling instructions for the most common techniques of collecting soil samples. Prior to sample collection, the soil sampling location and characteristics (e.g., soil type, depth) should be recorded in the field logbook. Selection of soil sampling equipment is usually based on the depth of the samples. Manual techniques are usually selected for surface or shallow subsurface soil sampling. At greater depths, mechanically driven equipment is usually required to overcome torque induced by soil resistance and depth.

4.3.1 Surficial Sampling

4.3.1.1 *Spade and Scoop*

The spade and scoop method is a very accurate, representative method for collecting surface and shallow subsurface soil samples. This method is usually limited to soil depths less than 1 foot.

Method Summary and Equipment

The simplest, most direct method of collecting surface soil samples is to use a spade and stainless steel scoop. A typical garden spade can be used to remove the top cover of soil to the required depth, and the smaller stainless steel scoop can be used to collect the sample.

Sampling Procedure

- Place plastic sheeting on the ground around the sampling location to prevent cross-contamination.
- Carefully remove the top layer of soil to the desired sample depth with a pre-cleaned or decontaminated spade.
- Using a pre-cleaned or decontaminated stainless steel scoop or trowel, collect the sample aliquot for volatile organic compound (VOC) analysis first (if applicable), then homogenize enough soil in a stainless steel bowl for the remaining sample containers.
- Transfer sample into the appropriate sample bottle with a stainless steel laboratory spoon or equivalent.
- Remove any soil clinging to the bottle threads or rim, and secure the cap tightly.
- Label the sample bottle with the appropriate sample label. Complete the label carefully and clearly, addressing all the categories or parameters.
- Place filled sample containers on ice immediately.
- Complete all chain-of-custody documents and record in the field.
- Prepare samples for shipping.
- Decontaminate sampling equipment after use.

4.3.2 Subsurface Sampling

4.3.2.1 Split-Spoon Sampler

The split spoon sampler is used for sampling subsurface soil in cohesive and non-cohesive type soils. It is used extensively for collecting subsurface soil samples for chemical analysis. The split spoon sampler will require a drill rig and crew for collecting samples at a depth greater than 5 feet. The split-spoon sampler will be the primary subsurface sampling device used.

Method Summary and Equipment

The split spoon sampler is typically a 2- or 3-inch-diameter, thick-walled, steel tube that is split lengthwise. If a 2-inch-diameter split spoon sampler is used, then standard penetration tests can be taken to determine the density of the soil (ASTM D1586). A cutting shoe is attached to the lower end; the upper end contains a check valve and is connected to the drill rods. When a boring is advanced to the point that a sample is to be taken, drill tools are removed, and the sampler is lowered into the hole on the bottom of the drill rods. The sampler is driven into the ground in accordance with the standard penetration test.

Sampling Procedure

- Place plastic sheeting on the ground around the sampling location to prevent cross-contamination.
- Assemble the sampler by aligning both sides of the barrel and then screwing the drive shoe on the bottom and the heavier headpiece on top.
- Place the sampler in a perpendicular position on the material to be sampled.
- Drive the tube utilizing a sledge hammer or drill rig if available. Do not drive past the bottom of the headpiece because this will result in compression of the sample.
- Record the length of the tube that penetrated the material being sampled and the number of blows required to obtain this depth. Typically, the number of blows per 6 inches of depth is recorded.
- Withdraw the sampler and open it by unscrewing the drive shoe and head, and splitting the barrel. If split samples are desired, a decontaminated stainless steel knife should be utilized to split the tube contents in half longitudinally.

- Begin sampling with the acquisition of any grab VOC samples, conducting the sampling with as little disturbance as possible to the media.
- If homogenization of the sample location is appropriate for the remaining analytical parameters or if compositing of different locations is desired, the sample is transferred to the stainless steel bowl for mixing.
- Transfer sample into an appropriate sample bottle with a stainless steel laboratory spoon or equivalent.
- Remove any soil clinging to the bottle threads or rim, and secure the cap tightly.
- Label the sample bottle with the appropriate sample label. Be sure to label the bottle carefully and clearly, addressing all the categories or parameters.
- Place filled sample containers on ice immediately.
- Complete all chain-of-custody documents and record in the field.
- Prepare samples for shipping.
- Decontaminate sampling equipment after use and between sampling locations.

4.3.2.2 *Thin-Walled (Shelby) Tube Sampler*

Applicability

Thin-walled tube samplers allow collection of undisturbed samples in cohesive type soil (i.e., clays). They are primarily used for collecting soil samples for certain geotechnical tests. Thin-walled tube samplers are not the ideal container for transporting samples to the laboratory for chemical analysis. The opportunity for describing the soil is diminished because most of the soil is concealed in the tube. The Shelby Tube will be used only in clayey material where an undisturbed sample is required, and the field crew has specifically been instructed to use a Shelby Tube sampler.

Method Summary and Equipment

The thin-walled tube sampler is designed to take undisturbed samples in cohesive type soils. The thin-walled tube sampler is available in brass, galvanized steel, plain steel, or stainless steel, and is manufactured in either 30- or 36-inch lengths. It is available in 2-, 3-, and 5-inch diameters;

however, the 3-inch diameter is the most commonly used. Thin-walled tube samplers are usually used for sampling cohesive soils for geotechnical evaluation, rather than chemical analysis.

Sampling Procedure

- Place plastic sheeting on the ground around the sampling location to prevent cross-contamination.
- Place the sampler in a perpendicular position on the material to be sampled.
- Push the tube into the soil by a continuous and rapid motion, without impact or twisting. In no instance should the tube be pushed further than the length provided for the soil sample.
- When the soil is so hard that a pushing motion will not penetrate the sample sufficiently for recovery, it may be necessary to collect a disturbed sample with the split-spoon sampler. Extremely dense and hard soil may result in damage to the thin-walled tube sampler.
- Before pulling out the tube, rotate the tube at least two revolutions to shear off the sample at the bottom. For geotechnical analysis, seal the ends of the tube with wax or rubber packers to preserve the moisture content. In such instances, the procedures and preparation for shipment should be in accordance with ASTM Method D1587. For chemical samples, seal the ends of the tube with teflon-lined plastic caps or equivalent. Seal each end cap with plastic electrical tape.
- Label the sample tube with the appropriate sample label. Be sure to complete the label carefully and clearly, addressing all the categories or parameters.
- Complete all chain-of-custody documents and record in the field.
- Prepare samples for shipping.
- Decontaminate sampling equipment after use and between sampling locations.

4.3.2.3 Hand Augering—Riverbank and Floodplain Sampling

Instructions presented in this SOP are for collecting representative soil samples at riverbank and/or floodplain locations.

Applicability

Hand augering is an accurate and efficient method for sampling soil. Soil samples are removed at discrete depths. Hand augering proves inefficient where the subsurface contains large gravel, or when the surface and subsurface are frozen.

Method Summary and Equipment

The auger is attached to an auger handle. Typically, there are three standard size augers available for use (with internal diameters of 4, 2, and 1 inch, respectively). A single auger can be used to collect a discrete sample at a specified depth or the augers can be used in succession (from highest to lowest internal diameter) to take three discrete samples at different depths (such as 0 to 6 inches, 12 to 18 inches, and 24 to 30 inches below ground surface (bgs)) at the same location.

Sampling Procedure (discrete samples/different depths)

- Place plastic sheeting on the ground around the sampling location to prevent cross-contamination.
- Attach the 4-inch internal diameter auger on the auger handle.
- Clear the area of any vegetation, if necessary.
- Begin augering at the sample location. Auger to a depth of 6 inches.
- Remove all soil from the auger and place in a clean stainless steel bowl for homogenizing. This is the first sample with a depth of 0 to 6 inches bgs.
- If it is too difficult to auger to a depth of 6 inches, remove soil sequentially until reaching the 6-inch depth.
- After collecting the first sample, use the same auger (4-inch internal diameter) to auger the soil from 6 to 12 inches bgs. Remove the auger from the auger handle and set aside. Be careful to let the soil from the 6- to 12-inch depth remain in the auger.
- Replace surgical gloves (to prevent cross-contamination) and attach a clean 2-inch internal diameter auger to the auger handle.
- Auger from 12 to 18 inches bgs. This is the second sample. Carefully place this soil in a second clean stainless steel bowl for homogenizing.
- Using the same auger, auger to a depth of 24 inches. Remove the auger from the auger handle, again keeping the soil in the auger.

- Replace surgical gloves (to prevent cross-contamination) and attach a 1-inch internal diameter auger on the auger handle and collect the third sample. The third sample is the soil at a depth of 24 to 30 inches. Place this soil in a third clean stainless steel bowl for homogenizing.
- Once the three samples have been collected, place the soil in the first two augers back in the sample location.
- Homogenize the soil in the third bowl. Use a new pair of gloves to avoid cross-contamination. Document the soil description and place soil in desired jars as necessary. Label the jars with the correct sample identifier (ID) number and other necessary information (see **SOP G-3**).
- Place the sample jars in a cooler filled with ice as soon as possible.
- Repeat this procedure for the other two soil samples. If any soil remains, place in the same sampling hole to avoid spreading possible contamination.
- Prepare samples for shipping.
- Decontaminate all sampling equipment after use and between sampling locations.

4.4 FIELD MEASUREMENT PROCEDURES

The purpose of this section is to identify methods for field screening soil. Visual assessment and instrument readings will be used to screen field samples and residual samples. Residual materials may include excess samples, cuttings, and other materials.

4.4.1 Preparation

- Review screening procedures and equipment operation manuals.
- Calibrate field screening instruments in accordance with the manufacturer's instructions and operating procedures (see **SOP A-1**).
- Document calibrations in the field logbook.
- Determine the ambient air temperature. If the ambient air temperature is below 15 °C, select an area where soil samples can be kept warm for head space readings.

4.4.2 Field Screening

Prior to and during collection of a soil or sediment sample, visually observe the sampling area, and sample for signs of releases that include the following:

- Surface discoloration or staining.
- Stressed or discolored vegetation.
- Physical evidence of hydrocarbons or other contamination.

Record visual observations of the sampling area in the field logbook. Include a sketch and dimensions of any area where visual signs of a release are observed.

4.4.3 Instrument Readings

Take instrument readings prior to sampling to monitor ambient air for health and safety purposes. Record this information in the field logbook.

Soil and/or sediment headspace readings are taken in the following manner:

- Place soil/sediment sample in a clean, dry, glass jar so that the jar is not more than half full. Cover the jar with aluminum foil and replace the lid.
- If the ambient temperature is low, bring the jarred samples to an area where they can be warmed.
- Gently shake the jar to aid sample volatilization.
- Remove the lid and insert the probe through the aluminum foil, but not into the sample since this will clog the instrument. Record the instrument reading of the area on the log reserved for headspace readings.
- Do not submit the jarred sample for laboratory analysis.
- Dispose of the jarred sample in accordance with residual management protocols.

4.5 SOIL SAMPLING FOR VOLATILE ORGANIC COMPOUNDS

4.5.1 EnCore™ Sampler

The EnCore Sampler has been approved for collection of samples, and this method is the preferred sampling method for use at the site. The EnCore Sampler (or equivalent) selects a small volume (about 5 grams) of soil that is stored in a chamber that is submitted to the analytical laboratory. *The sample must be received, prepped, and analyzed within 2 days of collection; therefore, all samples must be shipped the day they are collected.*

Two or three EnCore samplers will be required per analytical sample:

- One EnCore sampler for low-concentration analysis.
- One EnCore sampler for high-concentration analysis or low-concentration duplication.
- One EnCore sampler for reparation.
- One volatile organic analyte (VOA) jar with Teflon cap for moisture determination.

The EnCore Sampler is a single use device. It can not be cleaned and/or reused. The following is the procedure for using the EnCore Sampler:

- Hold the coring body and push the plunger rod down until the small o-ring rests against the tabs. This will ensure that the plunger moves freely.
- Depress the locking lever on the EnCore T-Handle. Place the coring body, plunger end first, into the open end of the T-Handle, aligning the two slots on the coring body with the two locking pins in the T-Handle.
- Twist the coring body clockwise to lock the pins in the slots. Check to ensure the sampler is locked in place. The sampler is now ready for use.
- Turn the T-Handle with the T up and the coring body down. This positions the plunger bottom flush with the bottom of the coring body (ensure that the plunger bottom is in position).
- Using the T-Handle, push the sampler into the soil until the coring body is completely filled. When full, the small o-ring will be centered in the T-Handle viewing hole.
- Remove the sampler from the soil and wipe any excess soil from the exterior of the coring body.
- Place a cap on the coring body while it is still in the T-Handle. Push and twist the cap over the bottom until the grooves on the locking arms seat over the ridge on the coring body. The cap must be seated to seal the sampler.
- Remove the capped sampler by depressing the locking lever on the T-Handle while twisting and pulling the sampler from the T-Handle.
- Lock the plunger by rotating the extended plunger rod fully counter-clockwise until the wings rest firmly against the tabs.
- Attach a completed circular label from the EnCore Sampler bag to the cap on the coring body.

- Complete the outside label on the EnCore Sampler bag and add a custody seal.
- Return the full EnCore Sampler to a resealable plastic bag. Seal the bag and place on ice.

It should be noted that EnCore Samplers can be used for all soil sampling activities, i.e., surface soil, sediment, etc., by sub-sampling the sampling device (e.g., shovel, coring device, split spoon). In a soil matrix that is noncohesive, the EnCore Sampler's plunger can be retracted, filled with the required sample volume, and then capped.

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Sub-Slab Soil Vapor Sampling Guide

Montana Department of Environmental Quality

April 22, 2011

Purpose: This sampling guide is intended to assist DEQ and other Environmental Professionals with the collection of sub-slab soil vapor samples. This guide presents one method to collect soil vapor samples. Slight variations on the method presented may also be appropriate and effective sampling methods.

General Equipment

- Measuring tape to measure building dimensions and sample location
- Nitrile gloves
- 1 Environmental Field Book
- Pre-printed sample log forms
- Pre-printed Inhabited Structure Questionnaire sheets and metal clipboard
- 4 indelible ink ball-point pens (NOTE: no solvent-based markers or Sharpie pens will be used for labeling samples, taking field notes, or otherwise used during sampling)
- Clear plastic trash bags
- Digital camera and batteries
- Tool box with wrenches, tubing cutters, mixers for concrete, etc.
- Sample receipts

Sub-slab Soil Vapor Sampling Equipment

- Individually cleaned and certified Summa[®] canisters with individual 200 mL/min flow controllers and individual pressure gauges (supplied by laboratory)
- ¼" Teflon tubing (supplied by laboratory)
- Summa canister fittings and ferules (supplied by laboratory)
- Roto-hammer drill and drill bits (¾" or 7/8", 6" and 12" lengths)
- Small dustpan and broom for cleaning
- Small "garbage" container for drill cuttings and other refuse
- Clean silica sand for bottom of probe point
- Bentonite (sand or powder) for sealing hole annulus while sampling
- Modeling clay for leak sealing (if necessary)
- Low-voc quick-setting cement for sealing top of probe
- DI Water for sealing bentonite and mixing concrete
- Quikcrete, water, and trowel to patch hole after sampling
- Fittings for tubing (supplied by laboratory)
- Plastic zip-lock bags, scissors to snip end to direct concrete into hole
- 60 cc Syringes for purging and evacuating air from tubing
- Helium (ultra high purity or high purity)
- Helium meter
- PID meter
- Plastic bags or plastic sheeting for leak detection shroud
- Hose filled with sand for sealing plastic bags to floor
- Decon brush, spray bottle of Liquinox, spray bottle of deionized water
- Flexible tubing in various sizes for connecting meters to Teflon tubing



Identify your sub-slab sampling location. The sampling location should be a minimum of 5 feet from exterior walls. Note the presence of underground utilities such as electric, gas, sewer lines, or radiant heat. The building owner or their representative should approve the sampling location. Take care to avoid tile, wood flooring, carpet, etc. to the extent practicable. It can be extremely helpful to identify sub-slab sampling locations and any potential underground utilities during pre-sampling building inspections. Take out the roto-hammer, drill bits, and extension cord if necessary.



Begin drilling into the slab with the 6" drill bit. Most slabs are 3-4". You should feel the drill punch through the slab and into the sub-slab material. Ream out the hole with the 6" drill bit.



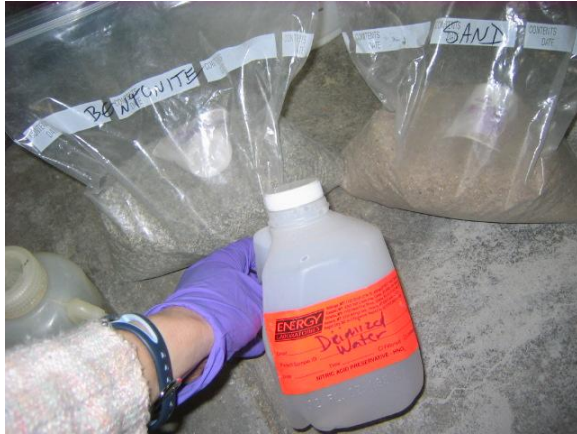
Switch to the 12" drill bit and continue to ream out the hole in the slab in order to create a preferential pathway in the sub-slab material that will allow soil vapor to accumulate.



Clean up the drill cuttings with a dustpan and brush or vacuum. Take care to avoid spilling the cuttings back into the hole that you've created in the slab.



Measure the depth of the hole created beneath the slab and record the slab thickness. A small flashlight is helpful for measuring slab thickness.



Take out the clean silica sand, bentonite, deionized water, and Teflon tubing.



Remove the end cap from the Teflon tubing, straighten by hand, and insert the tubing to the bottom of the hole in the slab. Set the tubing approximately 1/2" above the bottom of the hole in the slab.



Begin adding the silica sand. A small paper cup can be helpful. Fill the hole until sand is visible slightly above the bottom of the concrete slab. A flashlight can be helpful to verify this. Add sand slowly to avoid "bridging" and overfilling.



Put away the sand and begin adding the bentonite. At this point sand already should be above the bottom of the slab so there should only be 2-3" of void space in the hole, unless the slab is unusually thick. Add bentonite to approximately 1" below the top of the slab.



Put away the bentonite. LIGHTLY hydrate the bentonite with the de-ionized water. A pipet or similar may be helpful to avoid adding too much water. The idea is to add just enough water to allow the bentonite to expand and seal the hole, but not so much that it percolates through the bentonite and into the sand below. If water is pulled through the sampling train, it will ruin the sample.



Add low VOC, quick setting hydraulic cement to a plastic zip-lock bag. Hydrate with the de-ionized water until the proper consistency is reached. The cement can be mixed in other vessels, but zip-lock bags are recommended due to ease of mixing, cleanup, and disposal.



Cut the corner of the ziplock bag and squeeze cement into the final 1" of void space in the hole. Mound cement above the top of the slab and tightly around the tubing.



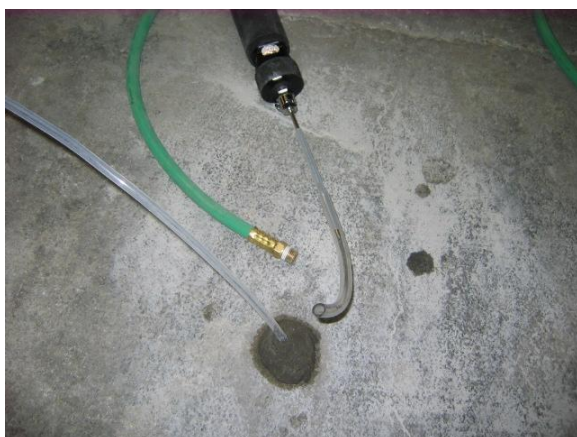
Cut the Teflon tubing, leaving approximately 3-4' of tubing above the top of the slab (enough for easy connection to the Summa canister). Place the end cap on the tubing. Allow the hydraulic cement to set for approximately 20 minutes or until hard to the touch.



While the cement is setting, connect the flow controller to the Summa canister. Place the brass cap from the top of the Summa canister on top of the flow controller and tighten. Briefly open the Summa canister valve (no more than 5 seconds) and then close it to verify the negative pressure in the canister (between -23" Hg and -30" Hg, depending on elevation). If the pressure does not hold, tighten the valve and fittings and try again. If you cannot get the pressure to hold, you may have a leak between the flow controller and the canister, and you will need to use a different canister. Leave the brass cap on.



Turn on the Helium meter, the PID meter (calibrated), and connect the helium canister to its flow regulator and hose.



Place the helium meter tubing and hose from the helium canister adjacent to the sub-slab sampling point.



Place the clear plastic shroud (the garbage bag) around the sub-slab sampling point, encompassing the helium canister hose and the helium meter tubing. The end of the sub-slab sampling train Teflon tubing should remain outside of the shroud. Throughout the leak check and sample collection, try not to disturb the seal between the cement mound and the probe tubing in order to maintain the integrity of the seal.



Place the sand filled hose around the edges of the shroud, weighting it down. The sealed sub-slab sampling point, helium meter tubing and helium gas hose should be contained inside the shroud with only the end of the Teflon sampling tubing extending outside of the shroud (held in hand in photo). Turn on the helium gas and slowly inflate the shroud to a minimum of 20% helium gas content (as measured by the helium meter). Record high and low helium gas concentration beneath shroud on sampling form.



Calculate the volume of soil vapor necessary to purge from the sampling train (a 1/4" inside diameter tube has 9.65 ml/ft). A minimum of three times the volume of the sampling train should be purged. Take the 60ml syringe and connect to the Teflon tubing with flexible tubing. Purge 60ml over 20 second intervals to avoid purging at too great a rate (0.2L/min is standard).



Remove the end of the helium meter tubing from beneath the shroud carefully so as to avoid losing helium from the shroud, allow to "zero", and connect to the Teflon probe tubing. Allow the meter to run until it reaches a stable reading. The concentration of helium in the sampling train should be a maximum of 10% of the minimum concentration beneath the shroud. If your concentration is above 10%, remove the shroud, reseal the sampling point with additional hydraulic cement or modeling clay and redo the purge and leak test.



Connect the PID meter to the Teflon tubing sampling train. Allow meter to reach a stable reading and record on the sampling form.



Remove the shroud. Put away the PID meter, but keep the helium meter running. Place the laboratory supplied hardware (ferrule and hex nut) on the Teflon tubing as shown.



Connect the tubing to the top of the flow controller and tighten firmly using 9/16" and 1/2" wrenches.



Place the tubing for the helium meter and helium hose next to the Summa canister and surround with the shroud. Weight the shroud down with the sand and refill the shroud with helium to a minimum concentration of 20%. Open the Summa canister by twisting it open through the shroud and record initial vacuum again on the field form. Watch the helium concentrations beneath the shroud and add additional helium if necessary. Also watch the vacuum readings for the Summa canister. Close the canister once the vacuum is approximately -5"Hg, so as to maintain negative pressure in the canister.



Double check that the Summa canister is tightly closed and remove the shroud. Use the wrenches to remove the flow controller from the canister and replace the brass nut on top of the Summa canister. Remove tubing from the slab by simply pulling it out. Make sure that all relevant information has been documented on the tags on the Summa canister, and that it matches the information on the field forms.



Put away all the equipment. Remove the concrete surface seal with a hammer and chisel. Using a finger or the end of a tool, compact the sand and bentonite in the sub-slab hole so as to avoid settling later.



Mix quickcrete cement or hydraulic cement and add to the sub-slab sampling point. Smooth with trowel. Take a photo to document the condition of the slab upon completion. If the building owner or representative is present, ask them to verify that the slab has been repaired to their satisfaction.

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FORMER HENRY'S HIDEAWAY TANK REMOVAL

SAMPLING AND ANALYSIS PLAN TROUT CREEK, MONTANA

**Prepared for
Montana Department of Environmental Quality**

**Prepared by
Herrera Environmental Consultants, Inc.**



Note:

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FORMER HENRY'S HIDEAWAY TANK REMOVAL

SAMPLING AND ANALYSIS PLAN TROUT CREEK, MT

**Prepared for
Montana Department of Environmental Quality
1520 East Sixth Avenue
Helena, Montana 59601**

**Prepared by
Herrera Environmental Consultants, Inc.
101 East Broadway, Suite 610
Missoula, Montana 59801
Telephone: 406-998-6760**

March 17, 2022

CONTENTS

Introduction.....	1
Purpose	1
Site Description.....	1
Project Tasks and Schedule.....	3
Tank, Dispenser, and Piping Removal, Handling, and Disposal Methods	5
Preliminary Items.....	5
Removal and Handling Methods	5
Disposal Methods	6
Sampling Design and Rationale	9
Sample Locations and Analysis.....	9
UST Excavation, and Dispenser Excavation Samples	9
Stockpile Sample	10
Sample Location Summary.....	10
Field Procedures	11
Sample Designation	11
Soil Screening Procedures	11
Soil Sampling Procedures	12
Sample Handling, Custody, and Disposal	12
Petroleum-Specific Analyses.....	14
Equipment Decontamination.....	15
Release Reporting.....	17
Suspected Release	17
Confirmed Release.....	17
Project Reporting	19
Data Validation Procedures.....	21
Quality Assurance Project Plan (QAPP).....	21
Data Quality	21
Data Type, Analytical Level, and Use	21
Quality Assurance Objectives	22
Measurement Quality Objectives.....	22

Precision	22
Accuracy	23
Representativeness.....	24
Completeness	24
Comparability	24
Target Reporting Limits	24
Sample Documentation and Custody	25
Analytical Procedures	25
Data Reduction, Validation, and Reporting.....	25
Data Reduction	26
Evaluation of Completeness.....	26
Evaluation of Compliance	26
Data Reporting.....	27
Corrective Action Procedures.....	27
Laboratory Analysis Plan (LAP).....	28
Laboratory Data Reporting.....	29
Laboratory Quality Control Procedures.....	30
Laboratory Method Blanks	30
Laboratory Control Sample	30
Matrix Spike Sample	30
Duplicate Sample	31
Other Laboratory QC Samples	31
Analytical Methods.....	31
References.....	33

APPENDICES

Appendix A	Health and Safety Plan
Appendix B	Laboratory Method QA/QC Parameters

TABLES

Table 1. Anticipated Soil Sample Locations.	10
Table 2. Sample Analysis Summary, Preservation, and Holding Times.	14
Table 3. Default RBSLs for VPH, Lead Scavenger, and EPH Compounds at UST Sites.....	14
Table 4. Summary of Data Quality Objectives, Former Henry’s Hideaway Tank Removal.	21

FIGURES

Figure 1. Site Vicinity Map.....	2
Figure 2. DEQ Purge Water Disposal Flowchart.....	7

INTRODUCTION

This sampling and analysis plan (SAP) describes the technical approach and procedures to be used by Herrera Environmental Consultants (Herrera) to oversee removal of four underground storage tanks (USTs), associated piping, and associated dispensers from the Former Henry's Hideaway Property (DEQ Facility ID 45-13738) located at 4093 MT HWY 200, Trout Creek, Montana 59874 (Figure 1). The Montana Department of Environmental Quality (DEQ) issued Task Order #4 for Herrera to perform this work under DEQ Contract No. 421017. The specific scope of services to be performed is provided in the Task Order dated October 27, 2021. A Herrera staff person will perform the work in general accordance with guidelines set forth in the DEQ UST Closure Permit, the Montana DEQ Summary of Underground Storage Tank Systems Closure Requirements, and the site specific Health and Safety Plan (HASP) included as Appendix A.

Ken Griffin from Nwestco of Kalispell, MT is subcontracted under Herrera to provide the UST and contaminated soil removal services. Nwestco will provide personnel licensed for tank removal to perform the work. Energy Laboratories of Helena, MT will provide analytical services.

PURPOSE

The SAP identifies probable sample locations, field screening procedures for soil, sample collection methods, sample containers, sample storage and transport procedures, analytical procedures, and expected sample turnaround times for analysis.

SITE DESCRIPTION

The former Henry's Hideaway Property operated as a gas station in the 1990s and early 2000s. Based on DEQ UST permitting and compliance records, there are presently two 10,000-gallon compartmented USTs located on site. Tank tags 4568 (4,000-gallon diesel), 4569 (6,000-gallon gas), 4570 (2,000-gallon diesel), and 4571 (8,000-gallon gas) have been assigned to each of the compartments. Tank material of construction is cathodically protected steel and pressurized piping material includes fiber-glass reinforced plastic. While the tank system is presently in a Temporary-Out-Of-Use status, three dispensers and piping remain and are presumed to be in operating condition.



LEGEND



10,000 Gallon Compartmentalized UST



Fuel Dispenser

FIGURE 1. – SITE VICINITY MAP.

4093 MT HIGHWAY 200
TROUT CREEK, MT 59874
(Former Henry's Hideaway)

In September of 2015 a 24-hour Release notification was reported to DEQ due to the discovery of 1,600 gallons of water in the regular unleaded tank. Follow up tank tightness testing completed in December of 2015 indicated that the tanks continued to hold pressure. Based on the results of the tank tightness testing the Release was placed in a "Suspect Resolved" Status. Although the tanks have passed tightness testing, other accounts of the presence of water have been made at the facility. Additionally, no environmental sampling of soils or groundwater near the fueling system has been made to date.

PROJECT TASKS AND SCHEDULE

The project will include locating and removing USTs, dispensers, and piping; determining if there is a petroleum release associated with the UST system; and restoring the site to pre-existing conditions. As part of this work, the following tasks will be completed:

- Task 1 – Development of a Phase II ESA Sampling and Analysis Plan (January 2022)
- Task 2 – Coordination for Removal (February/March 2022)
- Task 3 – Removal, Sampling, and Disposal (March 2022, weather depending)
- Task 4 – Project Reporting (March - April 2022)

TANK, DISPENSER, AND PIPING REMOVAL, HANDLING, AND DISPOSAL METHODS

PRELIMINARY ITEMS

Herrera will coordinate field activities with DEQ, the current property owner, and subcontractors. Prior to initiation of field activities, the following preliminary items will be completed:

- Submit a permit application to Waste and Underground Tank Management Bureau (WUTMB) for the removal of underground storage tanks and any associated underground product piping (including vent lines).
- Identify soil backfill and disposal facility and complete all required paperwork for proper disposal of petroleum contaminated soil.
- Confirm that the access agreements from the current property owner are signed.

Prior to UST removal activities, Herrera will schedule a one-call utility locate to identify underground utilities along the property boundaries, and a private utility locate to identify underground utilities within the proposed tank and dispenser island excavation areas. Utility locates will include underground sprinklers that may be present in the vicinity.

REMOVAL AND HANDLING METHODS

Removal will begin with removal of the existing concrete pad that is located above the tanks and piping. Since the existing concrete will be used as backfill, the pad will be broken up and stockpiled onsite. Next, the piping will be uncovered, samples will be taken as indicated below in the Sample Locations and Analysis section, an air compressor will be used to blow any remaining fuel from the lines back into the tank, and the piping will be removed. Next, the tanks will be inerted and any remaining fuel will be pumped out of the tanks. Then excavation will begin along one side of the tank, which will then be rolled out and pulled out. Samples from 1 to 2 feet below the tanks will be collected as indicated in the Sample Locations and Analysis section.

Removal will be in accordance with permits and ARM 17.56.702.

DISPOSAL METHODS

Disposal of investigation derived waste (IDW) will be in accordance with applicable permits and disposal of liquid IDW will be in compliance with DEQ's purge water disposal flowchart (Figure 2).

Excavated soil will be stockpiled on site and petroleum-impacted soils will be segregated based on soil screening procedures described in sections below. A composite sample from stockpiled soil will be collected and submitted to the laboratory for analytical analysis, and appropriate disposal methods for the excavated soil will be determined by these analytical results.

The stockpiled soils will be used as backfill if analytical results determine the soils are not petroleum-impacted and are suitable to be reused on site. If analytical results determine the excavated soils are petroleum-impacted, they will be disposed of at a licensed solid waste disposal facility.

Tanks will be hauled offsite to a Nwestco yard in Kalispell.

General trash and incidental waste (e.g., used nitrile gloves) will be cleansed of any gross soil accumulation and will be placed in plastic garbage bags, double-bagged, and disposed of at a licensed solid waste disposal facility.

**DISPOSAL OF UNTREATED PURGE WATER FROM
MONITORING WELLS**

7/27/2015

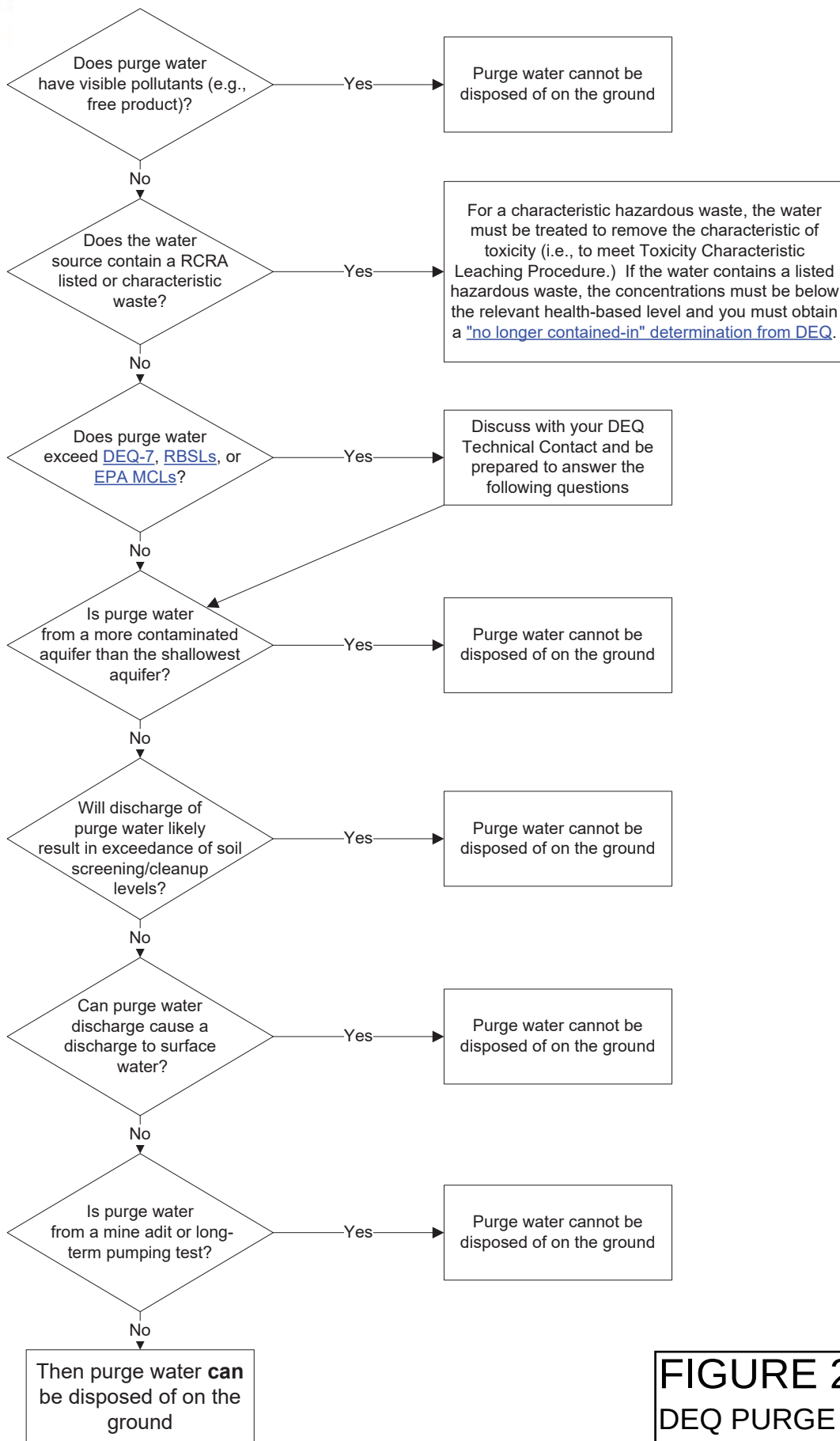


FIGURE 2.
DEQ PURGE WATER
DISPOSAL FLOWCHART

SAMPLING DESIGN AND RATIONALE

The following sampling plan was developed to determine if there is a petroleum release at the Site associated with the petroleum storage tank system in accordance with applicable permits and ARM 17.56.703.

SAMPLE LOCATIONS AND ANALYSIS

Grab samples will be collected from the backhoe bucket during soil removal from the tank and dispenser excavations and field screened for potential petroleum contamination. Field screening consists of visual (soil staining), olfactory observations, photoionization detector (PID) readings, and sheen testing. Soil that appears to be contaminated based on field screening results will be stockpiled separately from non-contaminated soil.

Following UST removal, Herrera will identify soil sample locations within the excavations from the UST and dispensers, as well as beneath product piping between the two areas. The numbers of samples to be collected, the chemical analysis to be performed on each sample, and the methods used to select each sample location are described below.

UST EXCAVATION, AND DISPENSER EXCAVATION SAMPLES

After the tanks, associated piping, dispensers, and any visually petroleum-contaminated soil surrounding the tanks and dispensers have been removed, discrete soil samples will be collected as follows:

- Four samples will be collected from the UST excavation; two samples will be collected from beneath each of the tanks. Samples will be collected from at least 1 to 2 feet below each end of the tanks, or at the suspected worst-case location.
- One sample will be collected beneath the product piping every 20 feet, and at elbows where leaks typically occur.
- Three samples will be collected from the dispensers, with one sample collected from at least 1 to 2 feet beneath each dispenser.
- If contaminated soil is removed from the excavation site, at least one composite sample of contaminated soil will be collected for analysis for disposal purposes.
- If ground water is encountered in the excavation, dewatering will not be performed. No ground water samples will be collected from the excavation for analysis, and soil samples

will be collected from the soil/water interface. If a sheen or free product is visible on the water, DEQ will be contacted immediately.

The soil samples will be submitted for chemical analysis to confirm that concentrations of Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH) are below Montana DEQ Risk Based Screening Levels (RBSL) and no petroleum release has occurred.

STOCKPILE SAMPLE

Excavated soils will be stockpiled on Site and at least one composite sample will be collected and submitted for analysis. The stockpiled soils will be covered and remain at the Site while awaiting analytical results from the laboratory.

SAMPLE LOCATION SUMMARY

Table 1 provides a summary of the anticipated sample locations.

Table 1. Anticipated Soil Sample Locations.		
Sample #	Sample Location	Analysis^{a,b}
Below Dispensers		
1	Dispenser 1 (North)	VPH, EPH screen, Dry Weight/Moisture Content
2	Dispenser 2 (Middle)	VPH, EPH screen, Dry Weight/Moisture Content
3	Dispenser 3 (South)	VPH, EPH screen, Dry Weight/Moisture Content
Below Tanks		
4	Tank 4568 (4,000 gallon diesel) – Sample 1	VPH, EPH screen, Dry Weight/Moisture Content
5	Tank 4568 (4,000 gallon diesel) – Sample 2	VPH, EPH screen, Dry Weight/Moisture Content
6	Tank 4569 (6,000 gallon gas) – Sample 1	VPH, EPH screen, Dry Weight/Moisture Content
7	Tank 4569 (6,000 gallon gas) – Sample 2	VPH, EPH screen, Dry Weight/Moisture Content
8	Tank 4570 (2,000 gallon diesel) – Sample 1	VPH, EPH screen, Dry Weight/Moisture Content
9	Tank 4570 (2,000 gallon diesel) – Sample 2	VPH, EPH screen, Dry Weight/Moisture Content
10	Tank 4571 (8,000 gallon gas) – Sample 1	VPH, EPH screen, Dry Weight/Moisture Content
11	Tank 4571 (8,000 gallon gas) – Sample 2	VPH, EPH screen, Dry Weight/Moisture Content
Below Piping (1 discreet sample/20 ft of piping)		
12	Piping Sample 1 (gas)	VPH, EPH screen, Dry Weight/Moisture Content
13	Piping Sample 2 (diesel)	VPH, EPH screen, Dry Weight/Moisture Content
Additional Locations^c		
14	Composite Stockpile Sample	VPH, EPH screen, Dry Weight/Moisture Content

^a EPH fractionation will be analyzed for samples with EPH screen results greater than 200 ppm.

^b At least one sample will be analyzed for 1,2-Dichloroethane (DCA) using EPA Method 8260B. The sample submitted for 1,2-DCA analysis will be identified as the sample most likely to be petroleum-impacted, or the sample expected to be the most petroleum-impacted, as determined by field screening procedures.

^c Additional locations may be sampled as necessary if contaminated soils are encountered.

FIELD PROCEDURES

SAMPLE DESIGNATION

Soil samples collected from the UST excavation will have a "UST" prefix followed by either a "N, S, E, W, or B" to indicate the sample was collected from the north, south, east, or west sidewall, or bottom of the excavation, respectively. Samples from the excavation bottom will also have a number "1, 2, 3, or 4" following the "B" to denote each subsequent bottom sample collected. Each sample will also have a suffix denoting the approximate depth below ground surface from which the sample was collected. For example, "UST-N-3" would be the sample collected from the north excavation sidewall at 3 feet below ground surface and "UST-B2-10" would be the second excavation bottom sample collected at a depth of 10 feet below ground surface.

Soil samples collected beneath product piping will have a "PIPE" prefix followed by a "1" or a "2" to denote the first or second piping sample if more than one piping sample is collected, and a suffix denoting the approximate depth below ground surface from which the sample was collected. For example, "PIPE-1-2" would be the first product piping sample collected at 2 feet below ground surface.

Soil samples collected beneath the product dispensers will have a "DIS" prefix followed by either a "N, M, or S" to indicate the sample was collected beneath the north, middle, or south dispenser. Each sample will also have a suffix denoting the approximate depth below ground surface from which the sample was collected. For example, "DIS-N-3" would be the sample collected beneath the north dispenser at 3 feet below ground surface.

The composite sample collected from the stockpile will have a "STOCK" prefix followed by a number indicating how many samples were collected from the stockpile. For example, "STOCK-1" would be the first sample collected from the stockpile.

SOIL SCREENING PROCEDURES

Grab samples will be collected from the backhoe bucket during soil removal from the tank and dispenser excavations for field screening for potential petroleum contamination by Herrera field staff. Field screening will consist of visual (soil staining) and olfactory observations, photoionization detector (PID) readings, and sheen testing. Grab samples collected from the backhoe bucket will be placed in plastic bags and heated to a reasonable temperature to allow for a heated head-space reading by the PID. The PID will be calibrated prior to soil screening activities, and a target PID reading of 50 parts per million (ppm) will be used along with visual and olfactory observations to determine the extent of the excavation required to remove petroleum-impacted soils and for segregating "petroleum-impacted" from "clean" soils.

SOIL SAMPLING PROCEDURES

For each soil sample collected, Herrera field staff will wear a fresh pair of nitrile gloves and collect discrete samples by hand directly into laboratory-provided samples jars. Soil samples will be collected from the middle of the backhoe bucket; staff will not enter the UST or dispenser excavations. Soil samples collected from each excavation for chemical analysis will be visually inspected for indications of contamination (oily sheen, odor, sheen testing), soil classification using the Unified Soil Classification System (USCS), and observations of moisture content; complete soil descriptions and observations will be recorded in a field notebook, along with PID readings and sheen test results, and a vertical profile of lithology.

Soil samples for VPH and EPH analysis will be collected in accordance with the Montana Method for Volatile Petroleum for Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH). This method is based on the Massachusetts Department of Environmental Protection (MADEP) Method for the Determination of Volatile Petroleum Hydrocarbons (MADEP May 2004, Revision 1.1) and The Method for the Determination of Extractable Petroleum Hydrocarbons Extractable Petroleum Hydrocarbons (MADEP May 2004, Revision 1.1) and includes collecting soil/sediment samples in 4 oz (120 mL) wide-mouth glass jars with Teflon-lined screw caps. Each sample jar will be labeled and immediately placed in an ice-filled cooler. Samples will be maintained at a temperature of 4°C (+/- 2°C). If the EPH Screen of a sample exceeds 200 mg/kg, the sample shall be fractionated without PAHs.

SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Sample labels will be made of self-adhering, waterproof material. An indelible pen will be used to fill out each label. Each sample label will contain:

- Project name
- Sample identification number
- Date of collection (day/month/year)
- Time of collection (24-hour format)
- Analysis requested
- Preservative (as applicable)
- Company name and sampler initials (for example, Herrera, MF).

Table 2 provides sample preservation, holding time and required containers for samples. All samples will be stored in insulated coolers and preserved by cooling with ice to a temperature of 4°C (+/- 2°C). Field personnel and the analytical and testing laboratories will adhere strictly to

the maximum sample holding and extraction times. For shipment to fixed laboratories, jars will be prepared in the following manner:

- Package and ship samples in accordance with US Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24.
- Place sample containers in plastic Ziploc bubble-pack bags or wrap sample containers in bubble pack and secure with packaging tape.
- Prepare an empty insulated cooler by placing three to four ice packs in a sealable plastic bag at the bottom of the cooler; place sample containers in a sealable plastic bag and fill with the sample bottles. Add additional bags of ice as needed to surround the bag containing the samples.
- Enclose chain-of-custody forms in a sealable plastic bag and tape to the inside lid of the cooler.
- Seal the cooler with strapping tape and a custody seal.

Samples for chemical analyses will be shipped to the analytical laboratory at completion of sample collection, accompanied by the chain-of-custody record that identifies the shipment contents. The chain-of-custody form will be signed by the individual relinquishing samples to the laboratory representative. Upon receipt of samples at the laboratory, the receiver will break the shipping container seal and will record the condition of the samples. The field personnel will be responsible for the following:

- Packaging the samples.
- Signing the chain-of-custody form before placing it inside the cooler to be sealed.
- Applying a shipping label, a waybill, a custody seal, and strapping tape to the cooler.
- Shipping the samples in accordance with the maximum holding time allowed for the analyses to be performed.
- Notifying the laboratory of when the samples are shipped.
- Confirming the laboratory's receipt of the samples and that the samples were received in good condition.
- All samples will be retained for a minimum of 6 months from the time they were received using standard laboratory handling procedures. They may be removed from the laboratory prior to the end of the 6-month period only at the direction of the Herrera Project Manager.

Table 2. Sample Analysis Summary, Preservation, and Holding Times.				
Medium	Analytical Parameters/Method	Sample Preservation	Holding Time	Sample Container(s)
Soil	VPH/Montana Method VPH	Cool to 4°C	Extract within 7 days of collection; analyze within 28 days of collection	4-oz wide-mouth amber glass jar with Teflon-lined screw caps
Soil	EPH Screen/Montana Method EPH	Cool to 4°C	Extract within 14 days of collection; analyze within 40 days of extraction	4-oz wide-mouth amber glass jar with Teflon-lined screw caps
Soil	EPH Fractionation with PAHs/Montana Method (PAHs: 8270)	Cool to 4°C	Extract within 14 days of collection; analyze within 40 days of extraction	4-oz wide-mouth amber glass jar with Teflon-lined screw caps
Soil	Lead Scavenger (1,2-DCA)/EPA Method 8260B	Acidify with HCl to pH < 2, cool to 4°C. Remove chlorine with ~4 drops of 10% Sodium Thiosulfate (Na ₂ S ₂ O ₃)	Analysis within 14 days	Six 40 ml vials

PETROLEUM-SPECIFIC ANALYSES

Samples collected from the Site will be sent to a laboratory for petroleum-specific analyses. For VPH compounds at UST sites, default RBSLs are used to determine if a release has occurred at a site and apply to the entire soil column. For EPH compounds, the 200 ppm EPH screen concentration is used to determine if additional analysis (fractionation without PAH) is needed. Table 3 presents the default RBSLs for UST sites.

Table 3. Default RBSLs for VPH, Lead Scavenger, and EPH Compounds at UST Sites.			
Chemical	Default RBSL^a (mg/kg)	Laboratory Reporting Limit (mg/kg)	Reporting Limit is Below RBSL
For Gasoline and Light Hydrocarbons measured using the Massachusetts Method for Volatile Petroleum Hydrocarbons (VPH)			
C5–C8 Aliphatics	52	2	Yes
C9–C12 Aliphatics	77	2	Yes
C9–C10 Aromatics	130	2	Yes
MTBE	0.078*	0.1	No
Benzene	0.07	0.05	Yes
Toluene	21	0.05	Yes
Ethylbenzene	6.4	0.05	Yes
Xylenes	72	0.05	Yes
Naphthalene	2.2 ^b	0.1	Yes

Table 3 (continued). Default RBSLs for VPH, Lead Scavenger, and EPH Compounds at UST Sites.			
Chemical	Default RBSL^a (mg/kg)	Laboratory Reporting Limit (mg/kg)	Reporting Limit is Below RBSL
Lead Scavengers			
1,2-Dichloroethane (DCA)	0.019	0.005	Yes
For Diesel and Heavy Hydrocarbons measured using the Massachusetts Method for Extractable Petroleum Hydrocarbons (EPH)^c			
EPH Screen, Fractionate	200	10	Yes
C9–C18 Aliphatics	110	10	Yes
C19–C36 Aliphatics	24,000	10	Yes
C11–C22 Aromatics	370	10	Yes

^a Default Risk Based Screening Levels (RBSLs) from Table 1 (DEQ, 2018).

^b Updated interim 2020 default Risk Based Screening Level (RBSL) for Naphthalene (DEQ, 2020).

^c If the EPH Screen of a sample exceeds 200 mg/kg, the sample shall be fractionated without PAHs.

* The best achievable practical quantitation limit (0.20) is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.

** The best achievable practical quantitation limit (0.33) is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.

EQUIPMENT DECONTAMINATION

Dedicated soil sampling equipment (e.g., nitrile gloves) will be used to collect all soil samples at the site. Backhoe decontamination will be performed (rinsing the bucket with a solution of Liquinox and cleaning with a scrub brush, followed by tap water rinse). Rinsate water will be spread over the backfilled excavation.

RELEASE REPORTING

The following sections describe procedures for reporting a release.

SUSPECTED RELEASE

If soil screening activities detect evidence of petroleum-impacted soils, DEQ will be notified of a suspected release as soon as is practicable and within 24-hours. Evidence of petroleum-impacted soils may include but is not limited to the following: soil staining, petroleum odors, sheen, and PID readings above 50 ppm.

DEQ notification will be made by a phone call to one of the following numbers, in order of priority:

1. DEQ Project Manager Brandon Kingsbury: (406)444-6547
2. Release Reporting Hotline: 1-800-457-0568
 - a. Monday through Friday, 8 am to 5 pm
3. After Hours and Holiday Reporting Hotline: (406)324-4777

CONFIRMED RELEASE

If a release is confirmed from laboratory analysis of samples collected from the Site, the release will be reported to DEQ within seven days of receiving analytical results from the Laboratory.

PROJECT REPORTING

Following completion of sampling and UST removal activities, a UST Closure Report and a Phase II ESA Report will be prepared and submitted to DEQ. The UST Closure Report will include data from removal compliance sampling and be submitted within 30 days of closure.

The Phase II ESA Report will provide a detailed description of the assessment, analysis of data, and conclusions based on data analysis. The report will compare analytical data to multiple DEQ RBSLs and discuss findings based on exceedances. The following DEQ RBSLs will be compared to analytical results and discussed in the report:

- Default RBSLs
 - Residential RBSLs for direct contact and leaching, 0-2 ft bgs, < 10 feet to groundwater
- Commercial RBSLs for direct contact and leaching, 0-2 ft bgs, < 10 feet to groundwater
- Construction RBSLs for direct contact and leaching, > 2 ft bgs, < 10 feet to groundwater

Impacts to receptors will be described in the report based on concentrations and locations of samples, and recommendations based on the development of a conceptual site model will be provided. Recommendations for future investigation or cleanup actions will be included if applicable. The report will also include field sampling data sheets and digital pictures, and laboratory analytical data, data validation forms, and a Release Closure Plan, if applicable, will be appended to the report.

DATA VALIDATION PROCEDURES

The following sections describe procedures for data validation.

QUALITY ASSURANCE PROJECT PLAN (QAPP)

The purpose of Quality Assurance Project Plan (QAPP) is to provide confidence in project data results through a system of quality assurance (QA) performance checks associated with data collection methods. This section presents the QA procedures to ensure that the investigation data results are defensible and usable for their intended purpose. Relevant criteria for soil are included as Appendix B.

DATA QUALITY

The data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support field activities. The DQOs were prepared using EPA guidance for the DQO process (EPA 2006). All laboratory data will be subject to EPA Level II QA/QC standards.

Data Type, Analytical Level, and Use

Table 4 presents DQOs for measurement, location of that measurement, analytical method, analytical support level, sample media, and the data use. The following general analytical support level will be used:

- Level II—appropriate for regulatory action or compliance and supports engineering studies using non-standard EPA-approved procedures.

Table 4. Summary of Data Quality Objectives, Former Henry's Hideaway Tank Removal.					
Analysis	Location	Analysis Method	Analytical Support Level	Media	Data Use
VPH	Laboratory	Montana Method	II	Soil	Site Characterization
EPH	Laboratory	Montana Method	II	Soil	Site Characterization
1,2-DCA	Laboratory	EPA 8260B	II	Soil	Site Characterization
Dry Weight/Moisture content	Laboratory	ASTM D2974	II	Soil	Site Characterization

VPH = Volatile Petroleum Hydrocarbons

EPH = Extractable Petroleum Hydrocarbons

1,2-DCA = 1,2-Dichloroethane

QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to produce well-documented data of known quality. Meeting this objective involves establishing and meeting goals for precision, accuracy, completeness, representativeness, comparability, and target reporting limits for the analytical methods. The Herrera QA manager for the Phase II Environmental Assessment: Former Henry's Hideaway project will be responsible for communicating QA objectives and expectations with the project laboratory and working with the DEQ project manager to meet designated QA standards.

If analytical data fail to meet the QA objectives described in this section, Herrera will explain in the Closeout Report the data failed to meet the objectives (i.e., because of matrix interferences), and will describe the limitations and usability of the data. The following corrective actions may be taken for data that do not meet QA objectives: (1) verify that the analytical measurement system was in control, (2) thoroughly check all calculations, (3) use data qualifiers, and (4) assuming a sufficient quantity of sample is available, reanalyze the affected samples, if authorized by the DEQ project manager. Corrective actions for internal QA and QC are presented in detail in the *Corrective Action Procedures* section.

Measurement Quality Objectives

Measurement quality objectives (MQOs) that will be evaluated for the laboratory data include precision, accuracy, representativeness, completeness, comparability, and reporting limits. The following sections discuss the calculation of each MQO. The specific MQOs and required reporting limits for this project are included in Appendix B.

Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value, usually stated in terms of standard deviation or coefficient of variation. It also may be measured as the relative percent difference (RPD) between two values. Precision includes the interrelated concepts of instrument or method detection limits (MDLs) and field sample variance. Sources of this variance include sample heterogeneity, sampling error, and analytical error.

Precision will be assessed based on the analyses of laboratory and field duplicates, and matrix spike duplicates (MSDs). Precision in these samples will be evaluated based on their RPD:

$$RPD = \frac{(MS - MSD)}{0.5(MS + MSD)} \times 100\%$$

Where: RPD = relative percent difference

MS = Matrix spike

MSD = Matrix spike duplicate

Specific MQOs for laboratory and field duplicates are defined by analytical method in Table 5.

Accuracy

Accuracy measures the bias of the measurement system. Sources of this error include the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis. Data interpretation and reporting may also be significant sources of error. Typically, analytical accuracy is assessed through the analysis of spiked samples and may be stated in terms of percent recovery or the average (arithmetic mean) of the percent recovery. Blank samples are also analyzed to assess sampling and analytical bias (i.e., sample contamination). Background measurements similarly assess measurement bias.

Accuracy will be assessed based on analyses of method blanks, matrix spikes (MSs), and laboratory control standards (LCS). Accuracy in MS and LCS will be quantified based on percent recovery or the average (arithmetic mean) of the percent recovery. Percent recovery for MS will be calculated using the following equation:

$$\%R = \frac{(S - U)}{C_{sa}} \times 100\%$$

Where: %R = percent recovery

S = measured concentration in spike sample

U = measured concentration in unspiked sample

C_{sa} = actual concentration of spike added.

Percent recovery for LCS will be calculated using the following equation:

$$\%R = \frac{M}{T} \times 100\%$$

Where: %R = percent recovery

 M = measured value

 T = true value

Specific MQOs for MS and LCS are defined in Table 5 by analysis method.

Representativeness

Representativeness expresses the degree to which data represent a characteristic of a population, a parameter variation at a sampling point, or an environmental condition. Representativeness is a qualitative parameter, which is most concerned with proper design of the measurement program. Sample/measurement locations may be biased (judgmental) or unbiased (random or systematic). For unbiased schemes, the sampling must be designed not only to collect samples that represent conditions at a sample location, but also to select sample locations that represent the total area to be sampled. Sample representativeness will be ensured by employing consistent and standard sampling procedures.

Completeness

Completeness for sample collection is defined as the percentage of specified samples listed in the plan that are actually collected and analyzed. Completeness for acceptable data is defined as the percentage of acceptable data out of the total amount of data generated. The completeness goal shall be 90 percent. Acceptable data includes data that passes all QC criteria or data that may not pass all of the QC criteria but have appropriate corrective actions taken.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set may be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through the use of standard techniques to collect and analyze samples. The results will be tabulated in standard spreadsheets to facilitate comparison with other study results and project goals.

Target Reporting Limits

Target reporting limits (TRLs) for analyses are listed in Table 5. The TRL is defined as the lowest concentration that needs to be reported for undiluted samples to obtain project objectives. The

laboratory will try to achieve the lowest reporting limits possible for all measurements and will notify the Herrera QA Manager if the reporting limits for the samples significantly exceed the TRLs. If samples are diluted to qualify constituents present at high concentration levels or to reduce matrix interferences, the reporting limit will be calculated as the reporting limit multiplied by the dilution factor. The actual matrix reporting limits for each sample will vary depending on the concentration of analytes present and the presence of any interference.

SAMPLE DOCUMENTATION AND CUSTODY

The possession and handling of each sample will be properly documented to promote timely, correct, and complete analysis for all required parameters. To promote sample integrity, each sample will be traceable from the point of collection through analysis and final disposition. Sample documentation and custody procedures are presented in the *Sampling Handling, Custody, and Disposal* section.

ANALYTICAL PROCEDURES

The field and laboratory analytical methods to be used are listed in Table 2. Laboratory analysis of samples will be performed by Energy Laboratories, Inc. (Energy) in Helena, Montana. Energy has established QA protocols that meet or exceed EPA guidelines. The EPA methods will be used whenever they are available for the target analyte.

DATA REDUCTION, VALIDATION, AND REPORTING

Herrera and the laboratory will validate all laboratory data by comparing the QC data to the criteria listed in the analytical method or in the National Functional Guidelines for Inorganic Data Review (EPA 2017). If data fail the review, the laboratory will be contacted and the data will be reanalyzed, qualified, or unqualified with an explanation. Herrera will summarize data quality in a Data Review Memorandum as an appendix to the Closeout Report.

Laboratory data packages will be provided for the chemistry data to allow independent data verification and validation. The data packages will consist of the sample results followed by a cover letter describing procedures used, analytical problems encountered, and qualifiers used. Dilution volumes, sample sizes, percent moisture, and surrogate recoveries will be presented on each summary sheet with the analytical results. A similar package is also assembled for each QC sample (e.g., method blank).

The following types of data will be reviewed:

- Analytical laboratory summary reports including QC summary data for surrogates, method blanks, LCSs, and MS/duplicate samples. Acceptance and performance criteria

will be developed from the current laboratory control limits even if those limits differ from the limits listed in Table 5.

- Field data, such as sample identifications and sample dates, will be checked against the laboratory report.

After receipt from the laboratory, project data will be validated as described in the following section.

Data Reduction

In accordance with standard document control procedures, Energy will maintain on file the original copies of all data sheets and logbooks containing raw data, signed, and dated by the responsible analyst. Separate instrument logs will also be maintained by the laboratory to enable a reconstruction of the run sequences for individual instruments.

The laboratory will store all residual samples. For the first 60 days after the laboratory receives the samples, samples and sample extracts will be stored in a refrigerator at 4°C. After that time, they may be stored at room temperature.

Evaluation of Completeness

The QA Manager will verify that the laboratory information matches the field information and that the following items are included in the data package:

- Chain-of-custody forms.
- Case narrative describing any out-of-control events and summarizing analytical procedures.
- Data report forms.
- QA/QC summary forms.
- If the data package is incomplete, the QA Manager will contact the laboratory, which must provide all missing information within 1 business day.

Evaluation of Compliance

The actual data validation follows the procedures that are briefly outlined below:

- Review the data to check field and laboratory QC results to verify that holding time, acceptance and performance criteria were met, and to note any anomalous values.

- Ensure all analytical problems and corrections are reported in the case narrative and that appropriate laboratory qualifiers are added.
- For any problems identified, review concerns with the laboratory, obtain additional information if necessary, and check all related data to determine the extent of the error.
- Apply data qualifiers to the analytical results to indicate potential limitations on data usability.

Qualification of data will follow applicable method guidelines. If method guidelines exist, then applicable EPA national data review guidelines will be used (EPA 2017).

Data Reporting

The project chemist/QA manager will perform the following reporting functions:

- Alert the Herrera project manager to any QC problems, obvious anomalous values, or discrepancies between the field and laboratory data, and resolve any issues.
- Review the laboratory electronic data deliverable, enter the data qualifiers into the database, and prepare analytical data summary tables for inclusion in the Closeout Report.
- At the completion of all field and laboratory efforts, the project chemist will prepare a Data Review Memorandum.

The Data Review Memorandum will discuss whether the final data meet the original project QA objectives and include:

- A summary of samples collected, and parameters analyzed.
- Findings of quality control procedures review including custody, preservation, holding times, completeness, reporting limits, method blanks, LCS samples, MS analyses, and laboratory.
- Data qualification, corrective actions, and an explanation of the impact on the evaluation of the project objectives.

Corrective Action Procedures

Corrective actions will be taken when any problems are identified in the program that affects product quality. The laboratory project manager and the QA manager, or their designees, are responsible for identifying the causes of the problems and developing a solution.

The cause of the problem must first be determined so that the effect of the problem on the overall program can be identified. The field team (and if necessary, the DEQ project manager) will then develop a plausible corrective action. The effects of the action will be examined to determine whether the problem is addressed.

Procedures for laboratory corrective actions and data outside control limits are presented below.

Laboratory Corrective Actions

The laboratory QA manager will review laboratory procedures to identify conditions or procedures that may have an adverse impact on data quality. The QA manager will then assess the impact on the quality of the associated data, and then identify the corrective actions to be implemented. All conditions or procedures that may have an adverse impact on data quality will be included in the laboratory reports.

Data Outside Control Limits

The way data outside of control limits are handled will depend on where the nonconformance is discovered. If QC checks performed by the laboratory fail to meet acceptance criteria, the data will be flagged and the nonconformance will be discussed in the case narrative. Herrera's QA manager will then review and assign data to one of the following three categories:

1. Valid-Unqualified—The data meets all QC criteria (no flags) and is considered usable.
2. Valid-Qualified—The data is valid, but usefulness may be limited in certain situations. These data may be qualified as "estimated," which is indicated by use of a "J" flag, or by the use of a specific flag that conveys information about the limitations of the data.
3. Invalid or Rejected—Data are considered invalid and flagged with an "R" and are considered to be unusable for any purpose.

Data will be validated using EPA guidance documents and the specific requirements of this QAPP. If certain data appear to be borderline between two categories, the data validator may seek the advice of the individuals cited in the project management plan as having a QA function.

LABORATORY ANALYSIS PLAN (LAP)

The purpose of Laboratory Analysis Plan (LAP) is to provide confidence in project data results through a system of quality assurance performance checks associated with laboratory analysis, data reporting, and appropriate corrective actions to achieve compliance with established performance and data quality criteria. The above QAPP section presents QA procedures performed by Herrera while this section presents laboratory specific QA procedures to ensure that the investigation data results are defensible and usable for their intended purpose. Laboratory analytical quality criteria are provided in Table 5.

Analytical performance is monitored through QC samples and spikes, such as laboratory method blanks, QC check samples, matrix spikes (MSs), matrix spike duplicates (MSDs) and duplicate samples. All QC samples are evaluated on the basis of a laboratory batch. Two basic types of batches are used: the preparation batch and the run (i.e., analytical) batch. The preparation batch includes all samples processed as a unit during metals digestion or wet chemistry preparation. Preparation batches do not exceed 20 samples excluding associated QC samples. The QC samples associated with sample preparation include method blanks, laboratory control samples (LCSs), matrix spikes, and duplicates. The run batch includes all samples analyzed together in the run sequence. The run sequence is typically defined by the analytical method. For some analyses, the run batch is equivalent to the preparation batch. The QC samples associated with the run sequence include calibration standards, instrument blanks, and reference standards.

Instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achieving the detection limits or associated QC target criteria. In such instances, data will not be rejected a priori but will be examined on a case-by-case basis. The laboratory will report the reason for deviations from these detection limits or noncompliance with QC criteria in the case narrative.

LABORATORY DATA REPORTING

Laboratory data will be reported in standard units as described in the analytical methods. The laboratory project manager will be responsible for review and approval of the laboratory report. The laboratory will provide all raw data necessary to fully validate the data. The Herrera project chemist/QA manager will check that each data package will include the following items:

- Case narrative including a statement of samples received, description of any deviation from standard procedures, explanation of any data qualifiers used, and any problems encountered during analysis.
- A QC summary report including applicable surrogate recoveries, MS and laboratory duplicate recoveries, method blank results, and laboratory control sample recoveries. This report must identify all QC outliers and describe their impact on data quality and usability.
- Chain-of-custody records.
- Reporting limits.
- Laboratory accuracy and precision limits.
- All values below reporting limits and above method detection limits.
- Date of analysis.

LABORATORY QUALITY CONTROL PROCEDURES

Laboratory Method Blanks

A laboratory method blank is an analyte-free material processed in the same manner and at the same time as a project sample. The laboratory method blanks serve to demonstrate a contamination free environment in the laboratory. The goal is for method blanks to be free of contamination. Low-level contamination may be present but must be less than the practical quantitation limit (PQL) as defined by the method standard operating procedures (SOPs). If contamination is greater, the samples are reanalyzed. If contaminants are present in the method blank but not in project samples, no further action is required. All sources of contamination that are not common laboratory contaminants as defined in the method SOPs must be investigated as part of the corrective action process. Sample results must not be blank-subtracted unless specifically required by the analytical method.

Laboratory Control Sample

A laboratory control sample (LCS) consists of a method blank spiked with target compounds of interest near the midpoint of the calibration range. The LCS is processed by the same sample preparation, standard addition, and analysis as the project samples. The recovery of target analytes in the LCS is an estimation of method accuracy.

LCS recovery must be within the control limits to demonstrate acceptable method performance. If the LCS recovery values are outside QC criteria for the target analytes, recovery values are significantly low, or the compounds were not detected in the samples, then corrective action is required. After corrective action is complete, sample re-analysis is required for the failed parameters. For any deviations from the LCS control limits that cannot be resolved by sample re-analysis within holding times, the QC manager must be notified immediately. If critical samples are affected, the project manager may determine that re-sampling is required.

Matrix Spike Sample

A matrix spike sample consists of a project sample split into two parts and processed as two separate samples in a manner identical to that of the rest of the samples. In addition to the regular addition of monitoring standards (internal standards, surrogate), spiking analytes are added to the sample aliquot. Generally, all method target analytes, if compatible, are added. A subset of target analytes may be used if indicated in the method SOPs and approved during review of the SOPs. A matrix spike sample must be prepared for every batch of 20 samples (or fewer) for a given matrix if enough sample is available. The laboratory must analyze a site-specific matrix spike sample for every batch that contains samples from the site, even if the batch contains samples from other sites.

Matrix spike sample recovery values are a measure of the performance of the method on the sample being analyzed. Matrix spike sample recovery values outside the control limits applied to the LCS indicate matrix effects. Sample cleanup procedures may be warranted for samples with severe matrix effects. The laboratory should notify the QC manager of such instances to determine an appropriate corrective action.

Duplicate Sample

A duplicate sample consists of a set of two samples obtained in an identical manner and from the same project sample. Collecting duplicate samples from a heterogeneous matrix requires homogenization to ensure that representative portions are analyzed.

The duplicate is prepared for methods that typically show concentrations of target analytes above method detection limits, such as metals and wet chemistry analytes. The relative percent difference (RPD) values between the recovery values in the original and duplicate measure the precision of the analytical method on the actual project samples.

Other Laboratory QC Samples

The laboratory performs analysis of other QC samples or standards, depending on the analytical method. Standard QC samples or standards are documented in the specific method SOP. Method-specific QC samples or standards include internal standard spikes for gas chromatography/mass spectrometry (GC/MS) methods, post-digestion spikes and serial dilutions for metals analysis, and interference check samples for inductively-plasma analysis. Results of all associated QC should be reported.

Analytical Methods

Analytical methods required for this project are summarized in Table 2.

REFERENCES

DEQ. 2018. Montana Risk-Based Corrective Action Guidance for Petroleum Releases. Montana Department of Environmental Quality. May.

DEQ. 2020. Risk-Based Corrective Action (RCBA) Risk-Based Screening Level (RBSL) Changes Memorandum. Montana Department of Environmental Quality. July.

ARM 17.56.72.

APPENDIX A

Health and Safety Plan

SITE-SPECIFIC HEALTH AND SAFETY PLAN

**FORMER HENRY'S HIDEAWAY
4093 MONTANA HIGHWAY 200,
TROUT CREEK, MONTANA**

**Prepared for
Montana Department of Environmental
Quality**

**Prepared by
Herrera Environmental Consultants, Inc.**



SITE-SPECIFIC HEALTH AND SAFETY PLAN

**FORMER HENRY'S HIDEAWAY
4093 MT HIGHWAY 200, TROUT CREEK
TROUT CREEK, MONTANA**

**Prepared for
Montana Department of Environmental Quality
1520 East 6th Avenue
Helena, Montana 59601**

**Prepared by
Herrera Environmental Consultants, Inc.
101 East Broadway, Suite 610
Missoula, Montana 59802
Telephone: 406-721-4204**

March 2022

HEALTH AND SAFETY PLAN REVIEW AND APPROVAL

Client:	<u>Montana DEQ</u>	Site Name:	<u>Former Henry's Hideaway</u>
Project Name:	<u>Phase 2 ESA</u>	Project No.:	<u>20-07287-003</u>
Start Date:	<u>3/11/2022</u>	End Date:	<u>7/1/2022</u>
Plan Expiration Date:	<u>7/1/2022</u>		

(Last day of expected fieldwork or no longer than 6 months).

The following individuals have reviewed this Health and Safety Plan and have approved its use for the dates specified.

<u>Matt Fidler</u>	<u></u>	<u>2/1/2022</u>
Plan Completed by	Signature	Date
<u>Heidi Houck</u>	<u></u>	<u>2/1/2022</u>
Project Manager	Signature	Date
<u>Rob Zisette</u>	<u></u>	<u>3/9/2022</u>
Corporate Health and Safety Officer	Signature	Date
<u>Matt Fidler</u>	<u></u>	<u>2/1/2022</u>
Site Health and Safety Officer	Signature	Date

This Health and Safety Plan (HASP) is based on federal (29 CFR Part 1910.120) and state regulations, which address practices conducted at sites associated with hazardous substances. This HASP is applicable only to employees of Herrera Environmental Consultants, Inc. Consultants, subconsultants, and contractors other than Herrera working at this jobsite are responsible for the health and safety of their own employees and are required to develop their own health and safety plan. Other contractor personnel, who provide site-specific information, may review this HASP; however, Herrera assumes no responsibility or liability for the use of this document by other parties.

Due to the potentially hazardous nature of this site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this site. The health and safety guidelines in this Plan were prepared specifically for this site based on site conditions, purposes, dates, and personnel specified, and must be amended if these conditions change. This HASP should not be used on any other site without prior research by trained health and safety specialists.

CONTENTS

Health and Safety Plan Review and Approval	i
Abbreviations and Acronyms	vii
Introduction.....	1
Safety Policy	1
Scope of Work and Site Description.....	1
Detailed Description of Specific Tasks Planned.....	1
Potential Hazards Associated with Field Tasks	1
Potential Chemical Hazards	1
Potential Physical Hazards.....	2
Potential Biological Hazards	2
Initial Site Entry	2
Excavation and/or Trenching Activities.....	2
Sewers or Other Areas of Potentially Containing Explosive Gases or Vapors.....	3
Hazardous Materials	3
Site Status	3
Site Map.....	5
Site Control and Security.....	6
Site Background Information.....	6
Local Emergency and Project Telephone Numbers	7
Site Address and Phone Number.....	7
Local Emergency Phone Numbers.....	7
Project Personnel Phone Numbers	7
Hospital Location and Route Map.....	9
Emergency Routes.....	10
Emergency Response Plan.....	11
Injury or Exposure	11
Site Incident	11
General Site Requirements and Background Information.....	13
Health and Safety Plan Organization and Responsibilities	13
Key Personnel	13

Minimum Training, Immunization, and Medical Surveillance Requirements for Site	
Personnel.....	15
Training	15
Medical Surveillance	15
Immunizations.....	15
General Field Safety.....	17
General Field Safety Requirements	17
Work Limitations and Restrictions.....	17
Hazard Identification	19
Potential Chemical Hazards	19
Regulatory Action Levels.....	19
Exposure Pathways and Permissible Exposure Limits (PELs)	20
Predominant Potential Site Chemical Hazards	21
General Procedures for Air Monitoring	23
Action Level Table for Chemical Monitoring	24
Potential Physical Hazards.....	25
Heat and Cold Stress	28
General Procedures Associated with Excavation and Trenching Activities	28
Noise	30
Buried/Overhead Utility Hazards.....	31
Potential Biological Hazards	32
Stinging Insect Allergies	32
Personal Protective Equipment Requirements	35
Level of Protection.....	35
Personal Protective Equipment.....	35
Safety Equipment.....	37
Decontamination.....	39
Personnel Decontamination.....	39
Sampling Equipment Decontamination	39
Heavy Equipment Decontamination.....	40
Waste Characteristics.....	41
Waste Generation	41
Packaging Requirements for Waste Material	41
Disposal and/or Treatment Methods Proposed.....	41

Employee Training, Immunization, and Medical Clearance	43
Health and Safety Plan — Acknowledgement and Agreement Form.....	45

ATTACHMENTS

Attachment 1	Injury/Exposure Report and Site Incident Report
Attachment 2	Daily Tailgate Health and Safety Meeting Form and Utility Clearance Log
Attachment 3	Personnel Training Certificates
Attachment 4	Air Monitoring Equipment Calibration/Check Log and Air Monitoring Log

ABBREVIATIONS AND ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
BTEX	benzene, toluene, ethylbenzene, and xylenes
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CSO	combined sewer overflow
DOSH	Washington State Division of Occupational Safety and Health
Ecology	Washington Department of Ecology
ERP	Emergency Response Plan
ESCBA	escape self-contained breathing apparatus
FID	flame ionization detector
HASP	health and safety plan
HAZWOP	Hazardous Waste Operations
HEPA	high efficiency particulate air
IDLH	immediately dangerous to life and health
LEL	lower explosive limit
LFC	lowest feasible concentration
mg/m ³	milligrams per cubic meter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MSDS	Material Safety Data Sheet
MTCA	Washington Model Toxics Control Act
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	permissible exposure limit

PID	photoionization detector
PPE	personal protective equipment
PPL	personal protection level (A, B, C, D)
ppm	parts per million
REL	recommended exposure limit
SCBA	self-contained breathing apparatus
SHSO	site health and safety officer
STEL	short-term exposure limit
SVOC	semi-volatile organic compound
TLV	threshold limit value
TWA	time weighted average
VOC	volatile organic compound
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
WAC	Washington Administrative Code
WWTP	wastewater treatment plant

INTRODUCTION

This site-specific health and safety plan applies to field work associated with sites that have either potential or documented release of hazardous substance(s) to the environment. Herrera expects that all employees, for company-approved field work or personal use, will follow safety procedures and regulations set forth in this safety plan.

SAFETY POLICY

Herrera's Safety Policy is that health and safety of the staff is of paramount importance. Activities performed under potentially hazardous conditions shall be acknowledged and planned to mitigate personal injury. Herrera's Safety Policy shall apply during company-approved field work only.

SCOPE OF WORK AND SITE DESCRIPTION

The former Henry's Hideaway Property (Facility) operated as a gas station in the 1990's and early 2000's. The scope of work included under this HASP includes locating and removing underground storage tanks (USTs), dispensers, and piping in accordance with DEQ UST Closure Permit requirements, collecting soil samples for laboratory analysis to determine if there is a petroleum release at the Facility associated with the petroleum storage tank system, and returning the site to pre-existing conditions.

DETAILED DESCRIPTION OF SPECIFIC TASKS PLANNED

List each separate task in order of progression:

Task No.	Task Description
Task 1.	Remove USTs, dispensers, and piping
Task 2.	Collect soil samples for laboratory analysis
Task 3.	Return site to pre-existing conditions

POTENTIAL HAZARDS ASSOCIATED WITH FIELD TASKS

Potential Chemical Hazards

- Petroleum contaminants associated with leaking USTs

Potential Physical Hazards

- Soil sample collection with excavator bucket
- Open excavation
- Encountering underground utilities

Potential Biological Hazards

- Stinging/biting insects

INITIAL SITE ENTRY

- Has this been performed by Herrera?

Yes: ☐ No: ☒

If yes, describe:

EXCAVATION AND/OR TRENCHING ACTIVITIES

- Will work involve excavation and/or trenching activities?

Yes: ☒ No: ☐

- Work will be done around heavy equipment (e.g., backhoe, earth-moving equipment, etc.):

Yes: ☒ No: ☐

If yes to either question, describe activities and include proposed dimensions, and whether entry may be required.

Work will include excavation and working around heavy equipment. Samples will be collected from machinery bucket and no entry will be made into the excavation.

SEWERS OR OTHER AREAS OF POTENTIALLY CONTAINING EXPLOSIVE GASES OR VAPORS

- Will any field work be done sewers or other areas containing explosive gas/vapors?

Yes: ☐ No: ☒

HAZARDOUS MATERIALS

- Will any hazardous materials (chemicals) be used on site (including decontamination)?

Yes: ☐ No: ☒

- Will any field work be done on a site with known or suspected release of hazardous materials?

Yes: ☐ No: ☒

SITE STATUS

- Site Status: Occupied?

Yes: ☒ No: ☐

If yes, describe site activities and relationship to field work: The site is occupied by an operating restaurant, The River Roadhouse. Field work will be coordinated with the owners.

SITE MAP



SITE CONTROL AND SECURITY

- Any site access requirements and special considerations?

Yes: ☒ No: ☐

Site is located on the property of an operating business and field work will must be coordinated with the owners.

- Work will be done in daylight hours?

Yes: ☒ No: ☐

- Barricades, fencing, or other equipment to be used to mark the perimeter of the site?

Yes: ☐ No: ☒

- Require work area security (on- and off-hours) to be used?

Yes: ☐ No: ☒

SITE BACKGROUND INFORMATION

Based on MTDEQ Underground Storage Tank (UST) permitting and compliance records, there are presently two 10,000-gallon compartmented USTs located on site. Tank tags 4568 (4,000-gallon diesel), 4569 (6,000-gallon gas), 4570 (2,000-gallon diesel), and 4571 (8,000-gallon gas) have been assigned to each of the compartments. Tank material of construction is cathodically protected steel and pressurized piping material includes fiberglass reinforced plastic. While the tank system is presently in a Temporary-Out-Of-Use status, three dispensers and piping remain and are presumed to be in operating condition.

In September of 2015, a 24-hour Release notification was reported to DEQ due to the discovery of 1,600 gallons of water in the regular unleaded tank. Follow up tank tightness testing completed in December of 2015 indicated that the tanks continued to hold pressure. Although the tanks have passed tightness testing, other accounts of the presence of water have been made at the facility. Additionally, no environmental sampling of soils or groundwater near the fueling system has been made to date.

LOCAL EMERGENCY AND PROJECT TELEPHONE NUMBERS

SITE ADDRESS AND PHONE NUMBER

Site Address: 4093 Montana Highway 200

Site Phone Number: Current Business – The River Roadhouse (406)827-7487

LOCAL EMERGENCY PHONE NUMBERS

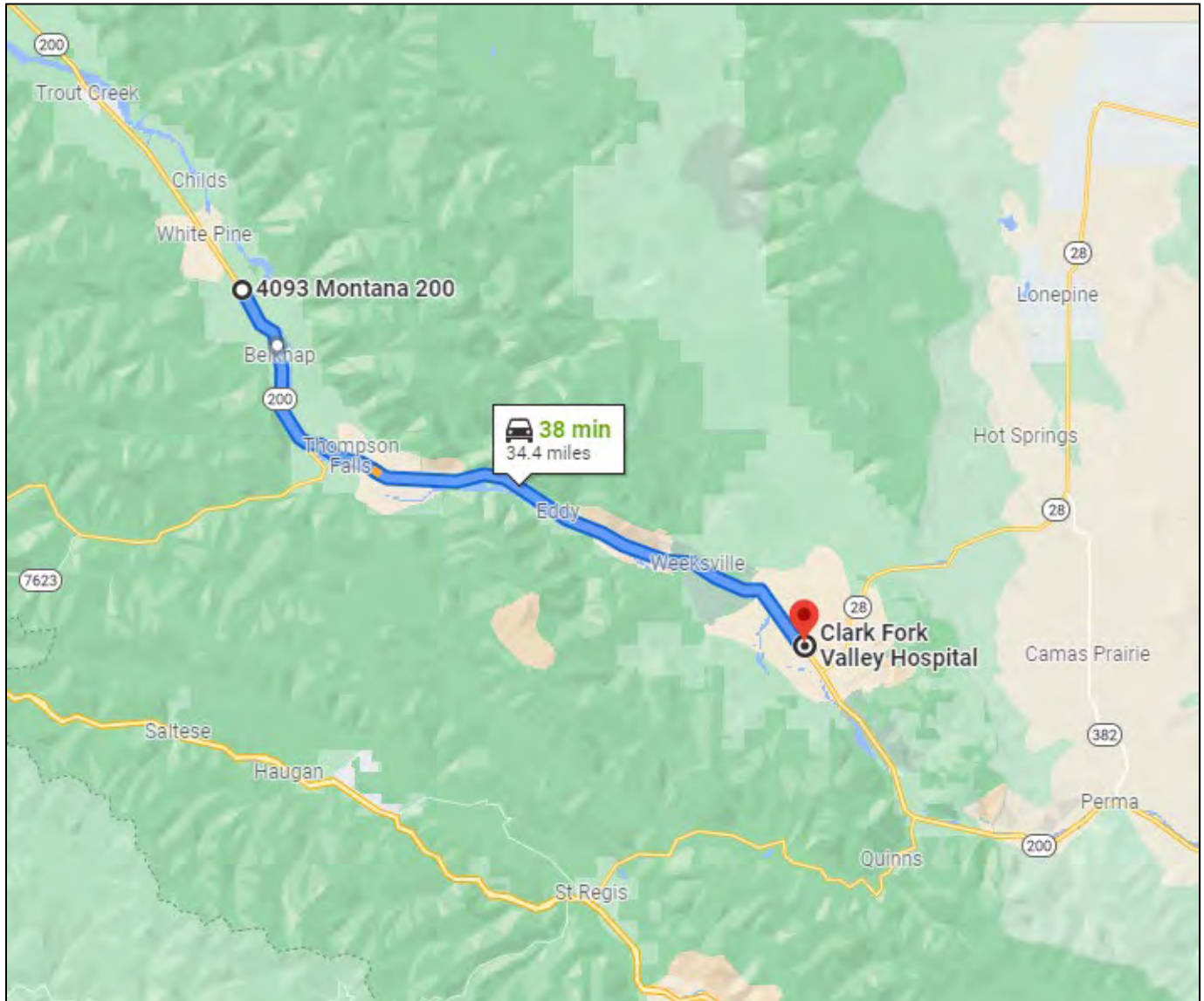
Agency	Name	Telephone No. ^a
Hospital	Clark Fork Valley Hospital	(406)826-4800
Ambulance	Thompson Falls Ambulance	(406)827-4536
Police/Sheriff	Sanders County Sherriff's Office	(406)827-3584
Fire	Trout Creek Rural Fire Dept.	(406)827-4010

^a Include phone numbers other than "911."

PROJECT PERSONNEL PHONE NUMBERS

Role	Name	Telephone No.
Site Health and Safety Officer	Matt Fidler	(928)499-2620
Project Manager	Heidi Houck	(206)355-6445
Principal-in-Charge	Michael Spillane	(206)909-4343
Client Contact	Brandon Kingsbury	(406)444-6547
Corporate Health and Safety Officer	Rob Zisette	(206)930-6585
Nwestco Contact	Ken Griffin	(406)498-5057

HOSPITAL LOCATION AND ROUTE MAP



EMERGENCY ROUTES

Prior to field work, conduct a drive-by from the work area to the hospital to check for any obstacles (i.e., road closure due to construction, etc.) and change the emergency route(s) to the hospital accordingly.

Hospital Name: Clark Fork Valley Hospital

Hospital Address: 10 Kruger Rd., Plains, MT 59859

Hospital Phone Number: (406)826-4800

Refer to the previous page for the Hospital Location and Route Map. The route from the onsite work area to the hospital is:

- Head southeast on MT-200 toward Finlay Flats Rd/NF-2654 for 34.1 miles
- Turn left onto Kruger Rd.
- After 0.2 miles take the first right into the hospital parking lot.

EMERGENCY RESPONSE PLAN

INJURY OR EXPOSURE

If an injury or exposure occurs, take the following actions:

- Get first aid for the person immediately.
- Notify the Site Health and Safety Officer (SHSO). The SHSO is responsible for immediately notifying the Project Manager, and preparing and submitting an Injury/Exposure Report (Attachment 1) to the Corporate Health and Safety Officer within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge. If a subcontractor employee is injured, the Subcontractor Field Supervisor will also complete their own injury/exposure investigation and submit a copy of their report to the Corporate Health and Safety Officer as well.
- The SHSO will assume charge during a medical emergency.

SITE INCIDENT

If an incident (e.g., theft, car accident, property damage) occurs, take the following action:

- Notify the SHSO immediately. The SHSO is responsible for immediately notifying the Project Manager, and preparing and submitting a Site Incident Report (Attachment 1) to the Corporate Health and Safety Officer within 24 hours.

GENERAL SITE REQUIREMENTS AND BACKGROUND INFORMATION

HEALTH AND SAFETY PLAN ORGANIZATION AND RESPONSIBILITIES

Key Personnel

Herrera Principal-in-Charge:	Michael Spillane
Corporate Health and Safety Officer:	Rob Zisette
Herrera Project Manager:	Heidi Houck
Herrera Site Health and Safety Officer:	Matt Fidler
Herrera Field Personnel:	Matt Fidler
Client Project Manager:	Brandon Kingsbury

Principal-in-Charge

The Principal-in-Charge provides a point of contact if the Project Manager cannot be accessed during emergency situations.

Project Manager

The Project Manager provides technical support to the Site Health and Safety Officer (SHSO) for health and safety decision-making. Prior to beginning onsite work, the Project Manager will ensure that employee training and medical clearance is current and up-to-date, and that site-specific safety and health concerns including, but not limited to, traffic control, boat safety issues, diving issues, have been addressed prior to field work. It is the responsibility of the Project Manager or designate to take all reasonable steps to ensure that:

- Employee training is current and up-to-date
- Each participant is informed of the known risks and physical requirements

- Each participant is shown where remote communication devices are kept (e.g., satellite phone, mobile cell phone, radios)
- Each participant has read this HASP
- Has determined what safety clothing and equipment is appropriate for this project
- All company and personal equipment taken into the field is thoroughly checked for safety and in good working condition by a qualified person before it is used
- Each participant is instructed in field safety, wearing of safety clothing (e.g., chemical resistant PPE, high-visibility reflective clothing, etc.), and safe use of equipment
- Site-specific health and safety concerns (including but not limited to: known or suspected chemical hazards, etc.) have been addressed prior to field work

Site Health and Safety Officer

The Site Health and Safety Officer (SHSO) shall be responsible for coordinating emergency response measures during this project. All workers shall report to the SHSO in the event of an emergency. Within 24 hours of the end of fieldwork, the SHSO will submit the completed (signed) HASP to the Corporate Health and Safety Officer.

The SHSO will oversee the overall Plan. He/she has the authority to stop work or prohibit any personnel from working on the site at any time for not complying with any aspect of the Plan.

Field Lead

Depending on the activity (i.e., installation, monitoring, sampling, demobilization), one member of the field team will be designated as Field Lead for each field task. The Field Lead is responsible for preventing unauthorized entry onto the site, ensuring all appropriate equipment is available and ready for use, and knowing who is on site at all times.

Subcontractor Field Supervisor

The Subcontractor Field Supervisor is responsible for implementing the Plan for his/her own employees.

All Onsite Personnel

Each person on the site has responsibility for their own health and safety, as well as assisting others in carrying out the Plan. Any person observed to be in violation of the Plan should be assisted in complying with the Plan, or reported to the Project Manager, the SHSO, or the Subcontractor Field Supervisor.

Any site personnel may shut down field activities if there is a real or perceived immediate danger to life or health.

MINIMUM TRAINING, IMMUNIZATION, AND MEDICAL SURVEILLANCE REQUIREMENTS FOR SITE PERSONNEL

Training

All field workers have received health and safety training required by OSHA (29 CFR 1910.120), including some or all of the following:

- 40 hours Hazardous Waste Operations training (HAZWOP)
- 8 hours Annual HAZWOP Refresher training
- First Aid and CPR training
- Annual Respirator Fit Testing
- Hazard Communication Training Related to Biological Hazards in Sewer Work
- Confined Space Entry Training
- Annual Medical Clearance

Copies of personnel training certifications are presented in Attachment 4 of this HASP.

Medical Surveillance

The Herrera medical surveillance program is described in the corporate health and safety plan. In summary, all Herrera employees potentially exposed to hazardous substances or health hazards for 30 days or more a year will participate in the program. The medical surveillance program includes a determination of fitness for each individual to work in hazardous environments, including use of various levels of personal protective equipment. Medical examinations are conducted on a regular basis (usually annually) and each person's condition reviewed at that time. The Corporate Health and Safety Officer maintains medical records in a designated file and are available for review by each affected employee.

Immunizations

In accordance with recommendations provided by the U. S. Centers for Disease Control (CDC) regarding immunizations for sewage workers, Tetanus/Diphtheria (Td) immunizations shall be administered to all field personnel prior to field work potentially associated with sewage.

GENERAL FIELD SAFETY

The SHSO is responsible for establishing and coordinating procedures for evacuation of all onsite personnel, including non-Herrera personnel, prior to commencement of work. This plan will be reviewed at the site safety meeting conducted at the beginning of the first day of work (and at subsequent site safety meetings as warranted by changing conditions and addition of new site workers). A Daily Tailgate Health and Safety Meeting Form is to be completed and signed by all personnel who attended the site safety meetings (see Attachment 2).

In the event of a potential emergency, as determined by any onsite worker, the SHSO will be notified and all site personnel assembled at an area designated during the site safety meeting. The Project Manager, with the aid of the SHSO and other site workers, will decide the appropriate response depending onsite conditions.

GENERAL FIELD SAFETY REQUIREMENTS

- Prior to working on site, a general inspection of hazards will be made by the SHSO. SHSO is responsible for preventing unauthorized entry onto the site and for knowing who is on site at all times.
- If an onsite command post is necessary, ensure that it is located upwind from source areas, given prevailing winds, and identify on the Site Map (page 5).
- Onsite field personnel must have a communication device (i.e., cell phone, satellite phone) capable of connecting to an emergency contact (i.e., Herrera office, local emergency service).
- Designate at least one vehicle for emergency use.
- High-visibility reflective safety vests, shirt, or jacket that is fluorescent yellow-green, orange-red, or red in color; steel-toed boots; and hard hats will be worn on construction sites, around heavy equipment, when working in or around traffic, or during hours of darkness.

WORK LIMITATIONS AND RESTRICTIONS

- Be aware of unstable soil conditions adjacent to excavation, steep slopes, or similar conditions.
- No eating or drinking is allowed in the work area.

- No smoking or lighting of matches or lighters is allowed in the work area.
- No rings, watches, bracelets, necklaces, or other jewelry that could trap chemical or biological contamination, or get caught in moving equipment.
- If respiratory protection is required, no facial hair present that would interfere with respirator fit.
- Employees will use the "buddy system," which requires at least two people, at all times in working in Level C PPE, working around heavy equipment, or working on a boat.

HAZARD IDENTIFICATION

Hazards may exist in a number of forms on the site and shall be classified among three general categories: chemical, physical, and biological. The following list is meant to convey the general hazard classes that may be encountered on the site.

Chemical Hazards		Physical Hazards		Biological Hazards	
	Asbestos	X	Climatic Hazards		Coliform Bacteria
	Flammable Liquids/Gases	X	Heavy Equipment Operations		CSO Effluent, Untreated Sewage, WWTP Sludges
	Metals		Drilling Rigs		Hospital Waste
	PCBs		Heavy Lifting	X	Stinging/Poisonous Insects
	Pesticides/Herbicides	X	Falling Hazards		Bacterial/Viral Agents
X	Petroleum Hydrocarbons		Confined Space Entry		Rodents/Vermin
X	Volatiles	X	Electrical Hazards		Large Predatory Animals
	Semi-Volatiles		Explosives		Poisonous Snakes
	Toxic Liquids/Gases		Radioactive Isotopes		
	Dioxins/Furans	X	Traffic Hazards		
	Oxygen Deficiency		Water Hazards		
	Decontamination chemicals				

POTENTIAL CHEMICAL HAZARDS

Chemical hazards will be evaluated both by visual examination of site conditions, as well as by use of monitoring equipment. Visual indications of potential chemical hazards include evidence of dead or dying vegetation, dead animals, discolored vegetation or soil, sheens on water, nonaqueous liquids, etc. Monitoring equipment to be used at this site is discussed in under General Procedures for Air Monitoring section of this health and safety plan.

Regulatory Action Levels

The following table provides information regarding the relative toxicity of chemicals that may be found at the site based on established state or federal cleanup levels.

Petroleum Products			Volatiles		
Chemical	Matrix	Regulatory Action Level	Chemical	Matrix	Regulatory Action Level
Petroleum Hydrocarbons	S	2000 mg/kg diesel	Benzene	S	0.03 mg/kg
Petroleum Hydrocarbons	S	30 mg/kg gasoline	Toluene	S	7 mg/kg
			Ethylbenzene	S	6 mg/kg
			Xylenes	S	9 mg/kg

Semi-Volatiles			Metals		
Chemical	Matrix	Regulatory Action Level	Chemical	Matrix	Regulatory Action Level
Naphthalenes	S	5 mg/kg			

Pesticides/PCBs			Other		
Chemical	Matrix	Regulatory Action Level	Chemical	Matrix	Regulatory Action Level

References:

Exposure Pathways and Permissible Exposure Limits (PELs)

The following is a list of potential exposure pathways, and the PELs and TWAs for chemical and biological hazards that may be encountered on the site. The potential exposure pathways are not limited to those listed. Acute systems of exposure along with odor thresholds and descriptions are given when that information is known. Odor thresholds are not exact and vary with susceptibility or sensitivity involved.

Predominant Potential Site Chemical Hazards

Chemical (or Class)	Exposure Limits (TWA)			Other Pertinent Limits	Warning Properties/ Description	Routes of Exposure Or Irritation	Acute Health Effects	Chronic Health Effects/Target Organs
	OSHA PEL	NIOSH REL	STEL					
Benzene	1 ppm	0.1 ppm Carcinogenic	OSHA = 1 ppm NIOSH = 5 ppm	IDLH = 500 ppm Carcinogenic	Aromatic odor	Inhalation, absorption, ingestion, skin and/or eye contact	Irritated eyes, skin, nose, and respiratory system; dizziness, headache, nausea, staggered gait, weakness, exhaustion, anorexia, dermatitis	Carcinogen A1 – Eyes, skin, respiratory system, blood, central nervous system, bone marrow (leukemia)
Ethyl benzene	100 ppm (435 mg/m³)	100 ppm (435 mg/m³)	125 ppm (545 mg/m³)	IDLH = 800 ppm (10% LEL)	Aromatic odor	Inhalation, ingestion, skin and/or eye contact	Irritated eyes, skin, and mucous membranes; dermatitis, headache, narcosis, coma	Eyes, skin, respiratory system, central nervous system
Toluene	200 ppm	100 ppm (375 mg/m³)	NIOSH = 150 ppm (560 mg/m³)	IDLH = 500 ppm CEILING (OSHA) = 300 ppm; 500 ppm (10 min. max. peak)	Sweet, pungent, benzene-like odor	Inhalation, absorption, ingestion, skin and/or eye contact	Irritated eyes, nose, weakness, exhaustion, confusion, dizziness, headache, dilated pupils, discharge of tears, nervousness, anxiety, muscle fatigue, insomnia, paresthesia	Eyes, skin, respiratory system, central nervous system, liver, and kidney damage
Xylenes	100 ppm (435 mg/m³)	100 ppm (435 mg/m³)	150 ppm (655 mg/m³)	IDLH = 900 ppm	Aromatic odor	Inhalation, absorption, ingestion, skin and/or eye contact	Irritated eyes, skin, nose, and throat; dizziness, excitement, drowsiness, incoordination, staggering gait, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys
Gasoline		LFC Carcinogenic		Carcinogenic	Fuel petroleum/aromatic odor	Inhalation, absorption, ingestion, skin and/or eye contact	Irritated eyes, skin, mucous membranes; headache, weakness, exhaustion, blurred vision, dizziness, slurred speech, confusion, convulsion, chemical pneumonia	Carcinogen A1 – Eyes, skin, respiratory system, central nervous system, muscular neurological systems, liver, and kidney cancer (benzene maximum of 3%)
Diesel	500 ppm			ACGIH TLV = 100 ppm	Fuel petroleum odor	Inhalation, ingestion, skin	Irritated eyes and respiratory system, headaches, dizziness, drowsiness, pulmonary function changes	Carcinogen A4 – Eyes, respiratory system, muscular neurological systems, cancer
Naphthalene	10 ppm (50 mg/m³)	10 ppm (50 mg/m³)	15 ppm (75 mg/m³)	IDLH = 250 ppm	Colorless to brown solid with mothball-like odor	Inhalation, absorption, ingestion, skin and/or eye contact	Irritated eyes; headache, confusion, excitement, malaise, nausea, vomiting, abdominal pain, irritated bladder, profuse sweat, jaundice, blood in urine, hemoglobinuria, renal shutdown, dermatitis, optical neuritis, corneal damage	Carcinogen A4 – Eyes, skin, blood, liver, kidneys, central nervous system

Chemical (or Class)	Exposure Limits (TWA)			Other Pertinent Limits	Warning Properties/ Description	Routes of Exposure Or Irritation	Acute Health Effects	Chronic Health Effects/Target Organs
	OSHA PEL	NIOSH REL	STEL					
Ethylene dibromide [1,2-Dibromoethane; (1,2- DBA)]	20 ppm	0.045 ppm Carcinogenic		IDLH = 100 ppm Carcinogenic CEILING (OSHA) = 30 ppm; 50 ppm (5 min. max. peak) CEILING (NIOSH) = 0.13 ppm (15 min.)	Colorless liquid or solid with a sweet odor	Inhalation, absorption, ingestion, skin and/or eye contact	Irritated eyes, skin; respiratory system, dermatitis with vesiculation	Carcinogen A2 – Eyes, skin, respiratory system, liver, heart, spleen, kidney damage, reproductive system

PEL-TWA = Permissible Exposure Limit-Time Weighted Average (8 hours).
REL-TWA = Recommended exposure limit – time weighted average.
TLV-TWA = Threshold Limit Value-Time Weighted Average (8 hours).
STEL = Short Term Exposure Limit (15 minutes).
IDLH = Immediately Dangerous to Life or Health.
LFC = Lowest feasible concentration (no-effect exposure)
CEILING = Ceiling Limit (not to be exceeded, even instantaneously).
References: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. 93-94.
NIOSH Pocket Guide to Chemical Hazards, US Department of Health and Human Services, September 2005.
NIOSH Safety and Health Topic: Focus on Coal Mining – Safety Hazards, Health Hazards, and Mine Rescue, 2006.

Carcinogenicity Status (ACGIH)
A1 – Confirmed human carcinogen
A2 – Suspected human carcinogen
A3 – Animal carcinogen
A4 – Not classified as a human carcinogen

GENERAL PROCEDURES FOR AIR MONITORING

When ambient air monitoring equipment is used as a general survey tool to indicate the presence of potential airborne contamination, it will be used prior to the beginning of work and periodically throughout the work period. When intrusive (i.e., ground breaking) work is performed, measurements are taken in the breathing zone. If measurements exceed action levels, engineering controls are considered first, and then appropriate PPE and respirator cartridges selected for use. The following air monitoring equipment may be used:

- **Photoionization detector (PID):** Monitors the presence of ionizable volatile organic vapors (not including methane) by measuring relative concentrations in parts per million (ppm). The PID features a 10.8 eV lamp and is calibrated daily using 100 ppm isobutylene calibration gas. Used for characterizing sample media and for determining whether volatile organic vapors present in the breathing zone at sample locations.

Air monitoring equipment shall be operated according to manufacturer's instructions and applied to site decision-making according to Herrera standard operating procedures (SOPs). If air monitoring is conducted, an Air Monitoring Equipment Calibration/Check Log and Air Monitoring Log (Attachment 4) are to be completed. Action levels for chemical monitoring are listed in the following table. These action levels are general guidelines derived from the USEPA emergency response action levels and are minimum action levels to be observed during field work. However, field workers may don respiratory protection at any time if air quality is questionable.

Action Level Table for Chemical Monitoring

Monitoring Instrument	Chemical (or Class)	Action Level		Monitoring Frequency/Location	Level For Respirator Use	Level For Work Stoppage
☒ PID ☐ FID ☐ TVA 1000	Volatile organics	Unknown vapors: Background to 1 ppm above background: Level D. 1 to 5 ppm above background (short-term exposure anticipated): Level C. 5 to 500 ppm above background: Level B.	Contaminant-Specific:	Conduct initial monitoring at the beginning of task activities, during opening and sampling of drums, or if conditions change (e.g., increase in ambient temperature, visual observation of suspect contaminant, detection of suspect odors). Monitor breathing zone at least 15 minutes or less if PID alarm sound, indicating ionizable volatile organic vapors above background levels or 10 ppm	> 5 ppm in breathing zone (continuous exposure).	10 ppm in breathing zone. 50 ppm (in Level C PPE). NA in Level B PPE.
☐ Four gas/LEL explosimeter (H ₂ S, CO, O ₂ , LEL)	Explosive atmosphere, toxic gases	Oxygen: <19.5% or >22.0%: Evacuate area; eliminate ignition sources; reassess conditions. 19.5% to 22.0%: Continue work in accordance with action levels for other instruments.	Explosivity: ≤10% LEL: Continue work in accordance with action levels for other instruments; monitor continuously for combustible atmospheres. >10% LEL: Evacuate area; eliminate ignition sources; reassess conditions.	Before entering any trench during active trenching. At least every 30 minutes in trench when actively trenching. In the morning and afternoon when installing system in completed trench.	NA	H ₂ S = 5 ppm CO = 20 ppm O ₂ <19.5% or 22% LEL >10% NA in Level B PPE.
☐ Mini-Ram particulate meter	Semi-volatiles, metals, PCBs, asbestos	General/Unknown: Evaluate health and safety measures when dust levels exceed 2.5 mg/m ³ .	Contaminant-Specific:	Continuous monitoring if visual observation indicates continued potential chemical presence. Signs of visible contamination and airborne dust shall be used as an indication of potential chemical presence.	When visible air-borne dust is present. 1 mg/m ³	10 mg/m ³ (in Level C PPE). NA in Level B PPE.
☐ Low-flow personal air monitor and PCM cassettes	Asbestos	Visible observation of air-borne dust shall be used as an indication of potential asbestos fibers present.		May be worn by inspectors during asbestos surveys and sampling. Cassettes are analyzed for 8-hour TWA and 30-minute STEL.	In crawl spaces where asbestos may potentially exist, and where damaged friable materials exist.	NA
☐ HCN/H ₂ S (Monitox) cyanide monitor	Cyanide	≥4 ppm: Evacuate area and inform SHSO.		Conduct cyanide monitoring during opening and sampling drums of if conditions change (e.g., increase in ambient temperature, visual observation of contaminant, detection of suspect odors through other monitoring equipment).	Upgrade to Level B PPE if any detection from monitor.	NA
☐ Radiation Alert Monitor (Mini-Rad)	Radiotope Isotopes	<0.1 mR/hr: Continue work in accordance with action levels for other instruments. ≥0.1 mR/hr: Evacuate area; reassess work plan and contact a radiation safety specialist.		During XRF calibration, radiation monitoring will be conducted (beginning, middle, and end of the day) or if conditions change with XRF usage (e.g., the XRF is dropped).	NA	Radiation detected at greater than two times background.

Complete Air Monitoring Equipment Calibration/Check Log and Air Monitoring Log (Attachment 4).

POTENTIAL PHYSICAL HAZARDS

"X" If Applicable	Hazards	Hazard Control Measures
X	Motor Vehicle Driving	• Drive defensively. • If you need to place or receive a phone call, pull off the road to a safe location and stop the vehicle before using your cell phone. Allow voicemail to handle your calls. • Be aware of weather and road conditions when driving (i.e., heavy rain, snow; large puddles in roadway, black ice). • Driver and passengers must wear seatbelts.
X	Weather Extremes	• Establish site-specific contingencies for severe weather situations. • Provide for frequent weather broadcasts. • Weatherize safety gear, as necessary (e.g., ensure eye wash units do not freeze, etc.) • Identify special PPE needs. • Discontinue work during severe weather.
X	Heat Stress	• Provide cool break area and adequate breaks. • Provide cool non-caffeinated beverages. • Promote heat stress awareness. • Use active cooling devices (e.g., cooling vests) where specified.
X	Sunburn	• Apply sunscreen. • Wear hats/caps and long-sleeve shirts.
X	Cold Exposure	• Provide warm break area and adequate breaks. • Provide warm non-caffeinated beverages. • Promote cold stress awareness.
X	Overhead Utilities: Telephone Lines	• Identify/locate existing overhead utilities prior to work. • Ensure that overhead utility lines are at least 15 feet away from project activities. • Contact utility companies to confirm locations, as necessary. • Complete Utility Clearance Log (Attachment 2)
X	Underground Utilities: Former utilities associated with fueling areas	• Identify/locate and mark existing underground utilities prior to work. • Ensure that underground utility lines are at least 5 feet away from project activities. • Contact utility companies to confirm locations, as necessary. • Complete Utility Clearance Log (Attachment 2)
X	Heavy Equipment Operation	• Define equipment routes, traffic patterns, and site-specific safety measures. • Maintain line of sight between equipment operators and ground personnel and that both are informed of proper hand signals and communication protocols prior to field operations. • Ensure that lifting capacities, load limits, etc., are not exceeded. • Ensure that field personnel do not work in close proximity to operating equipment.

"X" If Applicable	Hazards	Hazard Control Measures
	Drilling (i.e., hollow-stem auger, push probe, etc.)	- Identify/locate underground utilities prior to drilling activities. Complete Utility Clearance Log (Attachment 2). - Wear hard hat, steel-toe boots, and noise protection. - Maintain line of sight between drillers and field personnel.
X	Excavation/Trenching	- Ensure that any required sloping or shoring systems are approved as per 29 CFR 1926 Subpart P. - Identify/locate underground utilities prior to excavation/trenching activities. Complete Utility Clearance Log (Attachment 2). - Identify special PPE and monitoring needs if personnel are required to enter approved excavated areas or trenches. - Maintain line of sight between equipment operators and personnel in excavations/trenches. - Suspend or shut down operations at signs of cave in, excessive water, defective shoring, changing weather, or unacceptable monitoring results.
X	Noise	- Establish noise level standards for onsite equipment and operations. - Inform personnel of hearing protection requirements. - Define site-specific requirements for noise monitoring.
	Compressed Gas Cylinders	- Use caution when moving or storing cylinders. - A cylinder is a projectile hazard if it is damaged or its neck is broken. - Store cylinders upright and secure them with chains or other means.
	Heights (scaffolding, ladders, etc.)	- Personal fall arrest system (i.e., full body harness, lanyards, anchor, etc.) is required by personnel when using powered elevated platforms. - Discontinue work during severe weather (windy conditions more than 40 miles per hour). - Identify special safety equipment needs (e.g., guardrails, safety nets, etc.). - Eliminate impalement hazards below the work area. - Use the buddy system, with one of the personnel serves as a safety monitor or "spotter," give verbal warning to personnel in elevated work area of possible fall hazards.
X	Slips, Trips, Falls	- Be aware of obstacles, such as cords, tools, and other equipment that may be present on the ground in the work area. - Identify and mark areas that are potentially slippery (e.g., wet or oily surfaces) with spray paint or flagging and walk around them. - Use handholds. - Wear boots with good traction.
X	Holes, Ditches, Excavations	- Mark off the edge of holes, ditches, or excavations with barricades or flagging. - Field personnel shall remain several feet back from the edge of the excavation. - Provide for possible emergency egress (e.g., ladder, full body harness, tripod) if entering holes, ditches, or excavations is required. - Use appropriate safety gear (e.g., lanyard) to minimize the potential of falling into holes, ditches, or excavations, if needed.

"X" If Applicable	Hazards	Hazard Control Measures
	Steep Grades	• Mark off the edge of the ravine with barricades or flagging.
	Confined Space	• Ensure compliance with 29 CFR 1910.146. • Complete a confined space entry form. • Attach permit for confined space entry.
	Oxygen Deficiency	• Monitor oxygen level in work zone. • Do not enter area if oxygen level is less than 19.5 percent. • Use SCBA if area has less than 19.5 percent oxygen.
X	Electrical	• Locate and mark energized lines. • De-energize lines as necessary. • Ground all electrical circuits. • Guard or isolate temporary wiring to prevent accidental contact. • Evaluate potential areas of high moisture or standing water and define special electrical needs.
	Fire/Explosion	• Inform personnel of the locations(s) of potential fire/explosion hazards. • Establish site-specific procedures for working and handling around flammables. • Ensure that appropriate fire suppression equipment and systems are available and in good working order. • Do not drive or park vehicles on dry vegetation during the dry season (April through October). • Define requirements for intrinsically safe equipment. • Identify special monitoring needs. • Remove ignition sources from flammable atmospheres. • Coordinate with local fire-fighting groups regarding potential fire/explosion conditions. • Establish contingency plans and review daily with team members.
X	Traffic Hazards	• Establish a traffic control plan; contact local agencies for permits. • Wear bright orange reflective vests, hard hats, and steel-toed boots when working within or alongside traffic. • Barricade off work area and provide traffic signs as necessary, to direct traffic away from work area.
	Water Hazards (boats)	• Establish a Float Plan and conduct a Boater's Pre-Departure Checklist (Attachment) prior to departure. • Wear an USCG-approved PFD at all times in boats less than 16 feet long. • Take extra care entering and exiting boats. • Be aware of adjacent boat traffic.
	Water Hazards (streams)	• Wear an USCG-approved PFD if wading in deep water. • Buddy system when working in streams. • Wear boots or waders with good traction when wading instream. • Maintain voice or visual contact with each team member. • Each team member carries an audible alarm device.
	Other: 	•

Heat and Cold Stress

The SHSO will monitor weather broadcasts before the start of outdoor work each day, and more frequently as necessary. No work will be done outdoors during hazardous weather conditions (e.g., lightning storms).

For Heat Stress

- For temperatures above 75°F, each person will take their pulse at rest. At breaks, the pulse should be less than 110 beats per minute after one minute. Before returning to work, the pulse should be no more than 10 beats greater than the resting pulse.
- If the air temperature is greater than 89°F, work should be done for 30 minutes with a rest break of 10 minutes for Level 'D'. For Level 'C', work should be done for 20 minutes, with a rest break of 10 minutes. At least 8 ounces (1 cup) of non-caffeinated drinks, such as cool potable water, Gatorade-type drink, or dilute fruit juice should be consumed at each rest break or at least 1 cup every 20 minutes. At least 1 quart of cool liquids per employee per one hour is to be readily accessible at all times.
- Work should stop if any of the following symptoms occur: muscle spasm and/or pain in the limbs or abdomen (heat cramps); weak pulse, heavy sweating, dizziness, and/or fatigue (heat exhaustion); or rapid pulse, no sweating, nausea, dizziness, and/or confusion (heat stroke). Provide first aid immediately.
- Use sunscreen on unprotected skin to protect against ultraviolet exposure as necessary.

For Cold Stress

- For temperatures below 40°F, adequate insulating clothing must be worn. If the temperature is below 20°F, workers will be allowed to enter a heated shelter at regular intervals. Warm sweet drinks should be available. Coffee intake should be limited.
- No one should begin work or return to work from a heated shelter with wet clothes. Workers should be aware of signs of cold stress such as heavy shivering, pain in the fingers or toes, drowsiness, or irritability. Onsets of any of these signs are indications for immediate return to a heated shelter.

General Procedures Associated with Excavation and Trenching Activities

This section applies to all excavation and trenching work including, but not limited to, excavation and trenching activities for equipment installation, embankments, exploratory test pits, and all other construction work involving excavations.

A number of hazards are inherent to excavation work such as cave-ins, falling and rolling objects, falls, heavy equipment, buried utilities, hazardous atmospheres, etc. All field personnel must use extreme caution when working near excavations to minimize the potential for accidents. Excavations greater than four feet in depth require sloping or protective systems to prevent cave-ins. Field personnel will avoid entering excavations whenever possible. When soil sampling at excavation sites, samples will be collected from backhoe buckets or from soil sampling tools fitted to extension rods whenever possible to avoid entering excavations.

Field personnel participating in excavation and trenching projects shall familiarize themselves with these standards. The following section presents a summary of 12 general protection requirements established for excavation and trenching work:

1. **Surface encumbrances.** Surface encumbrances (obstructive objects) shall be removed as necessary to safeguard workers.
2. **Underground installations.** All underground utility installations shall be located prior to commencement of excavation work. Utility companies or owners shall be contacted prior to excavation work, advised of the work to be performed, and asked to locate utilities prior to excavation work. Where immediately present, underground utilities will be exactly located and shall be protected, supported, or removed as necessary to safeguard employees.
3. **Access and egress.** A means of egress (stairway, ladder, ramp, or other) shall be provided every 25 feet in excavations more than 4 feet in depth. A qualified person shall design ramps.
4. **Exposure to vehicles.** When working in the presence of vehicular traffic, employees shall wear high visibility or reflective warning vests or other suitable garments.
5. **Falling loads.** Employees shall not be permitted beneath loads handled by lifting or digging equipment and shall stand away during loading and unloading activities to avoid being struck by spilling or falling materials.
6. **Warning systems for mobile equipment.** When mobile equipment is operated adjacent to an excavation and the operator does not have a clear view of the edge, a warning system such as barricades, signals, or stop logs shall be utilized.
7. **Hazardous Atmospheres.** Appropriate monitoring and protective measures will be implemented to protect employees from oxygen deficient, explosive, and toxic atmospheres. Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or basket stretcher, shall be readily available when hazardous condition are or may be present. Action levels for protective measures, such as evacuation, breathing apparatus, or ventilation, include the following:

Oxygen	<19.5 percent, >22.0 percent

Flammable gases >10 percent LEL

Site specific (specify)

8. **Accumulation of water.** Employees shall not work in excavations where water is present or is accumulating unless adequate precautions have been taken such as water removal measures, or use of a safety harness and lifeline. Use of water removal equipment or other protective measures will be monitored at all times by a qualified person.
9. **Stability of adjacent structures.** Employees shall not work in excavations where the stability of buildings, walls, sidewalks, pavement, or other structures may be endangered by excavation operations unless support systems are provided to support such structures. Excavation below the base or footing of any foundation or retaining wall except when: a support system is provided; the excavation is in stable rock; or a professional engineer has determined the structure will not affect the building or will not pose a threat to employees.
10. **Loose rock or soil.** Employees shall not enter or work in excavations without adequate protective measures where loose rock or soil could pose a hazard by falling or rolling from an excavation face. Protective measures may include scaling loose material or installing protective barricades. Employees also shall not enter excavations where equipment or stockpile material could pose a hazard by falling or rolling. Stockpiled material and equipment shall be kept a minimum of two feet from the edge of the excavation unless retaining devices are used.
11. **Inspections.** Excavations and the immediate surrounding area shall be inspected daily by a competent person for indications of conditions that could result in cave-ins, failure of protective systems, hazardous atmospheres, or other hazardous conditions. Inspections shall be made at the start of each day, periodically throughout the work shift, and after every rainstorm. HEC employees shall not enter excavations where potentially hazardous conditions have been determined to exist.
12. **Fall Protection.** Employees shall not cross over excavations unless adequate bridges or walkways with standard handrails have been provided. Adequate physical barrier protection will be provided at remotely located excavations.

Noise

A noise hazard exists when working in the immediate vicinity of backhoe, drill rig, and other heavy machinery operations, as well as along busy roads and highways. In addition to the potential for hearing damage, noise may interfere with critical communication and recognition of other potential hazards at the work site, such as moving vehicles. To minimize potential injuries, field employees will utilize hearing protection devices, (ear plugs, headphones), as necessary, and maintain a high level of alertness at all times.

Buried/Overhead Utility Hazards

In addition to the direct hazards associated with drilling, excavation, and/or other invasive field activities, indirect hazards may also be present in the surrounding environment, such as buried and overhead utilities and soil gas. Explosion may result from damage to buried natural gas pipelines. Electrocution may occur from contact with buried or overhead electrical wires. Damage to these and other utilities during drilling, excavation, or other invasive field activities may also result in expensive repair work. To avoid potential injury and damage from these hazards, a utility locate will be conducted prior to initiating field activities. Field personnel shall review all site plans prior to commencement of invasive field activities. When soil conditions permit, a hand auger or post-hole digger shall be used to inspect the upper five feet of a borehole prior to drilling or an area prior to excavating to verify that unmarked utilities are not present. Overhead areas shall be inspected to verify clearances when using backhoes or other heavy equipment that could reach and damage overhead structures, power lines, etc.

POTENTIAL BIOLOGICAL HAZARDS

Biological Hazard	Matrix
Stinging insects	

Stinging Insect Allergies

Allergic Reaction Symptoms

The majority of stinging insects in the United States include bees, yellow jackets, hornets, and wasps (fire ants are also considered stinging insects, but are prevalent in the southeastern U.S.). The degree of allergy varies widely. Most people who are not allergic to insect stings generally experience localized pain, itching, swelling, and redness at the sting site (localized reaction). A single bite or sting may result in a localized reaction, but multiple bites or stings may lead to more severe allergic reactions (systemic reaction, where the entire body is affected). The most serious is called anaphylaxis, which can be life-threatening if left untreated immediately. Severe allergic reactions are suspected if a person experiences any of the following symptoms:

- Hives (intense itching at sites other than the sting site)
- Difficulty breathing and/or swallowing
- Hoarseness
- Swelling of the tongue
- Vomiting and/or nausea
- Dizziness and/or fainting

These reactions usually occur within minutes of the sting, but have been known to be delayed up to 24 hours. Persons who have allergic reactions to stinging insects will have a worsened reaction to every subsequent sting. Prompt treatment is essential and emergency help is often needed.

Field personnel who have severe allergic reactions to stinging insects should wear a Medic Alert bracelet or necklace describing their allergy. They should also be prepared when going into the field by carrying with them a bee sting kit (a doctor-prescribed self-injection device with epinephrine [adrenaline]; i.e., Epi-Pen). **Inform team members of your allergy and how to use the bee sting kit before heading out into the field.**

Avoid Getting Stung

The US Department of Agriculture recommends the following:

- When walking single-file on a trail, allow enough space between the front person and the next person, so that if the front person disturbs an insect nest, the next person does not run into agitated insects.
- Avoid wearing brightly colored, white, or pastel clothing. Studies have found that bees find black color very irritating, and blue is comforting to them.
- Don't use cosmetics, hairspray, perfume, or cologne, as well as insect repellent when in the field.
- Food odors attract insects, especially yellow jackets, so be alert when eating outdoors. Avoid open food, as in garbage cans, dumps, and open picnic areas.
- Avoid disturbing likely beehive sites, such as large trees, tree stumps, logs, and large rocks. Yellow jackets nest in the ground and in walls. Hornets and wasps often nest in bushes, trees, and under roofs. Use caution with unusual forms in walls and mounds on the ground.
- If a colony is disturbed, run and find cover as soon as possible. Running in zigzag pattern may be helpful.
- Cover as much of the head and face as possible, without obscuring vision, while running.
- Never stand still or crawl into a hole or other space with no way out.
- Do not slap at the bees. Bees are generally not aggressive and will usually not sting unless disturbed or injured.
- Once clear of stinging insects, remove stingers and seek medical care.

If Stung by a Stinging Insect:

1. **Call emergency medical services if:**
 - o Field personnel have a history of severe reactions to insect stings
 - o Experiencing any severe symptoms listed above
 - o Multiple stings, even for persons not known to have allergic reactions
 - o Stung in the mouth or nose, even for persons not known to have allergic reactions to stings, since they can lead to swelling and interfere with breathing

2. **Determine if the stinger is still present** (look for a small black dot at the sting site) and remove it immediately if is visible. Bee stingers are barbed stingers with a venom sac attached; it takes 2-3 minutes to release all of its venom, so prompt removal of the stinger can reduce the severity of the sting. Avoid removing the stinger by pinching it; otherwise, more venom is injected into the skin. Use a hard object like a credit card or blunt knife to swipe over the area to remove ("flick") the stinger. Wasps, yellow jackets, and hornets have stingers without barbs that are usually retracted upon stinging; these insects can sting people multiple times.
3. **Apply ice or cold packs** to the area to reduce the body's inflammatory response.
4. **Clean the area with soap and water**, then apply hydrocortisone cream to the site to decrease the severity of the reaction. Alternative treatments include applying a paste of meat tenderizer and water or baking soda and water.
5. **Administer an antihistamine**, such as Benadryl (diphenhydramine) and/or non-prescription pain relievers such as ibuprofen or acetaminophen.

PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

LEVEL OF PROTECTION

- **Level B:** Self-contained breathing apparatus (SCBA) or supplied-air respirator with an escape bottle, chemically resistant suit.
- **Level C:** Full-face air-purifying respirator, chemically resistant PPE.
- **Level D:** No respiratory protection. Safety glasses, hard hat, steel-toe boots, long-sleeved shirt and pants. Hearing protection, gloves, and other PPE as required.

To protect workers from potential contaminants in sample media, protective clothing will be worn during sampling activities, including Tyvek coveralls, protective eyewear, and chemical resistant boots and gloves. Protective clothing will be discarded or decontaminated between uses.

The following levels of protection (LOPs) have been selected for each work task based on an evaluation of the potential or known hazards, the routes of potential hazard, and performance specifications of the PPE. Onsite monitoring results and other information obtained from onsite activities will be used to modify LOPs and PPE as necessary to ensure sufficient personnel protection.

Work Task Number	D	C	B	Modifications Allowed
1	X			
2	X			
3	X			

Note: Use "X" for initial levels of protection. Use "(X)" to indicate LOPs that may be used as site conditions warrant.

PERSONAL PROTECTIVE EQUIPMENT

All personnel who perform work on site will be minimally required to meet the protective clothing and safety equipment requirements for Level D (minimum required PPE for Level D in the following table is marked by an "*"). Level D status will apply to fieldwork on the site unless the trigger mechanism(s) to Level C or B are activated. The SHSO must notify the Corporate Health and Safety Officer prior to work if Level "C" or "B" will be used.

PPE	Task 1	Task 2	Task 3
*Safety glasses/goggles	X	X	X
*Cotton coveralls/long-sleeved shirt and pants	X	X	X
*Hard hat (required at all construction sites)	X	X	X
*Steel-toed safety boots (as per ANSI Z41)	X	X	X
*Work gloves)	X	X	X
Neoprene safety boots (as per ANSI Z41)			
Solvex or nitrile gloves (for sample handling)		X	
Ear plugs/muffs	X	X	X
Reflective safety vest	X	X	X
Insulated coveralls			
Chemical resistant suit: ☐ Tyvek ☐ Saranex ☐ Other:			
Chemical resistant boots or boot covers			
Inner gloves: ☐ Cotton ☐ Nitrile ☐ Other:			
Outer gloves: ☐ Nitrile ☐ Neoprene ☐ Rubber ☐ Other:			
Full-face air-purifying respirator (APR)			
Cartridges: ☐ Organic vapors ☐ P100 (99.97% filter efficiency for particulates) ☐ GMA-P100 (organic vapors and particulates) ☐ GMB-P100 (acid gases and particulates) ☐ GMC-P100 (organic vapors, acid gases, particulates) ☐ GME-P100 (multiple gases and particulates) ☐ Other:			
Powered APR			
Positive-pressure, full-face SCBA			
Spare air tanks (Grade D air)			
Positive-pressure, full-face, supplied-air system			
Cascade system (Grade D air)			
Manifold system			
10-minute Escape self-contained breathing apparatus (ESCBA)			

* Represents minimum required PPE for Level D work (i.e., work on hazardous waste sites, construction sites, around heavy equipment, in or around traffic, or other physical hazardous conditions).

SAFETY EQUIPMENT

The safety equipment in the following table that is marked by an “*” shall be maintained on site at all times. Use an “X” to indicate safety equipment needed for each work task.

PPE	Work Task Number		
	Task 1	Task 2	Task 3
*First-aid kit	X	X	X
*Emergency eye wash	X	X	X
*Fire extinguisher (Class A, B, C)	X	X	X
Photoionization detector	X	X	
Flame ionization detector			
US Coast Guard-certified fire extinguisher			
Visual distress signal (VDS), (flashlight or orange flag)			
Tripod/winch/full body harness			
Waterproof flashlight			
Small backpack first aid kit			
Walkie talkies			

* Represents safety equipment that shall be maintained on site at all times.

DECONTAMINATION

Following are the decontamination procedures that will be employed to prevent contamination of personnel and to prevent cross contamination of sampling equipment during the collection of samples.

PERSONNEL DECONTAMINATION

Decon Solutions:	Liquinox detergent, tap water
Decon Method:	Remove and dispose of Tyvek, rain gear, or coveralls; clean boots (if muddy) with Liquinox solution and tap water; remove and dispose gloves; wash and rinse hands and face with soap and water.
Exposure Monitoring:	None
Level of Protection:	D
Location:	Support zone

SAMPLING EQUIPMENT DECONTAMINATION

Decon Solutions:	Liquinox detergent, distilled water
Decon Method:	<u>Bowls and spoons:</u> Scrub with Liquinox/water solution, rinse with tap water, rinse with distilled water, air dry. <u>Shovels and other digging equipment:</u> Scrub with Liquinox/water solution, rinse with distilled water, air dry.
Exposure Monitoring:	None
Level of Protection:	D
Location:	Support zone Bowls and spoons: at the site. Shovels and other digging equipment: at the site.

HEAVY EQUIPMENT DECONTAMINATION

Decon Solutions:	Water
Decon Method:	Hose down excavator bucket.
Exposure Monitoring:	None
Level of Protection:	D
Location:	Support zone

WASTE CHARACTERISTICS

WASTE GENERATION

Waste Anticipated:

Yes: ☒ No: ☐

Waste Type	Description	Quantity
Solid	Excavated material, concrete from excavation area	125-175 cubic yards, used for backfill
Liquid		
Sludge		
Incidental	Used disposable gloves, paper towels	Garbage bag
Other		

PACKAGING REQUIREMENTS FOR WASTE MATERIAL

Plastic trash bag: Incidental waste

Other:

DISPOSAL AND/OR TREATMENT METHODS PROPOSED

Waste	Disposal and/or Treatment
Incidental waste	Disposed trash bag to the nearest dumpster as solid waste.
Tanks	Tanks will be hauled to NWestco Yard in Kalispell. Disposal options will be identified pending sampling results

Herrera and NWestco will be responsible for characterizing, packaging, labeling, storing, and disposing of suspected or known waste.

EMPLOYEE TRAINING, IMMUNIZATION, AND MEDICAL CLEARANCE

The following is a summary of training, immunization, and/or medical clearance information for personnel who will perform work on the site. Copies of personnel training certificates are presented in Attachment 3.

1. Name: Matt Fidler Title: SHSO Approved PPL: _____

Field Responsibilities: Sample collection

Training	Dates (Month/Year)
Current 8-Hour Refresher	February/2022
40-Hour Hazardous Waste	January/2020
Supervisor	
First Aid; CPR	February/2022
Confined Space Entry	
Medical Clearance	
Immunization: Tetanus/Diphtheria	
Other:	

2. Name: Heidi Houck Title: PM Approved PPL: _____

Field Responsibilities: _____

Training	Dates (Month/Year)
Current 8-Hour Refresher	February/2022
40-Hour Hazardous Waste	February/2009
Supervisor	
First Aid; CPR	February/2022
Confined Space Entry	April/2006
Medical Clearance	
Immunization: Tetanus/Diphtheria	
Other:	

3. Name: _____ Title: _____ Approved PPL: _____

Field Responsibilities: _____

Training	Dates (Month/Year)
Current 8-Hour Refresher	
40-Hour Hazardous Waste	
Supervisor	
First Aid; CPR	
Confined Space Entry	
Medical Clearance	
Immunization: Tetanus/Diphtheria	
Other:	

HEALTH AND SAFETY PLAN — ACKNOWLEDGEMENT AND AGREEMENT FORM

The following field personnel have read this health and safety plan and understand the potential and actual hazards present on the site and shall abide by its strictures.

_____ Name	_____ Signature	_____ Company	_____ Date
_____ Name	_____ Signature	_____ Company	_____ Date
_____ Name	_____ Signature	_____ Company	_____ Date
_____ Name	_____ Signature	_____ Company	_____ Date
_____ Name	_____ Signature	_____ Company	_____ Date
_____ Name	_____ Signature	_____ Company	_____ Date
_____ Name	_____ Signature	_____ Company	_____ Date
_____ Name	_____ Signature	_____ Company	_____ Date
_____ Name	_____ Signature	_____ Company	_____ Date

ATTACHMENT 1

Injury/Exposure Report and Site Incident Report

INJURY/EXPOSURE REPORT

(Attach additional documentation as necessary.)

Date of Incident: _____ Case No. _____ Time of Day _____
 Employee Name _____ Date of Birth _____
 Home Address _____ Phone No. _____
 Sex Male _____ Female _____ Age _____ Job Title _____ Social Security No. _____
 Office Location _____ Date of Hire _____
 Where did incident occur? (include address) _____

On employer's premises? Yes _____ No _____ Project Name/No. _____
 What was employee doing when incident occurred? (be specific) _____

How did the incident occur? (describe fully) _____

What steps could be taken to prevent such an incident? _____

Object or substance that directly caused incident? _____

Describe the injury or exposure _____

Part of body affected _____

Name and address of physician _____

If hospitalized, name and address of hospital _____

Loss of one or more days of work? Yes _____ No _____ If yes, date last worked _____

Has employee returned to work? Yes _____ No _____ If yes, date returned _____

Did employee die? Yes _____ No _____ If yes, date _____

Completed by (print) _____ Employee signature _____
 (Supervisor or Site Health & Safety Officer) Date _____

Signature _____ PIC Signature _____

Date _____ Date _____

This report must be completed by the employee's supervisor or Site Health and Safety Officer immediately upon learning of the incident. The completed report must be reviewed and signed by the Principal-in-Charge and transmitted to Corporate Health and Safety Officer within 24 hours of the incident, even if employee is not available to review and sign. Employee or employee's doctor must submit a copy of the doctor's report to Corporate Health and Safety Officer within 24 hours of the initial exam and any subsequent exams. For field injuries, submit a copy of the Health and Safety Plan.

SITE INCIDENT REPORT

(Attach additional documentation as necessary.)

Date of Incident: _____ Time of Incident: _____

Location of Incident: _____

Project Name: _____ Project No.: _____

Type of Incident* (check those that apply):

☐ "Near Miss"	☐ Vehicle Accident
☐ Underground Property Damage	☐ Fire
☐ Aboveground Property Damage	☐ Evacuation
☐ Theft	☐ Regulatory Agency Inspection or Violation
☐ Other (describe) _____	

*Submit copy of Health and Safety Plan and attachments for field-related incidents.

Description of Incident: _____

Cause of Incident: _____

Action Taken: _____

Future Corrective Action: _____

Estimated Amount of Damage: _____

Investigator Name _____ Signature _____ Date _____

Principal-in-Charge _____ Signature _____ Date _____

cc: Site Health and Safety Officer, Corporate Health and Safety Officer, and Human Resources within 24 hours of incident.

ATTACHMENT 2

Daily Tailgate Health and Safety Meeting Form and Utility Clearance Log

Daily Tailgate Safety Meeting Form

FIRST DATE OF ACTIVITY: _____ TIME: _____ SITE LOCATIONS: _____

1. ☐ Discussed activities planned for the day
2. ☐ Individual activities are clear to each crew member
3. ☐ Chemical hazards discussed
 - a. ☐ Action levels are known and understood
 - b. ☐ Frequency and procedures for air monitoring are known and understood
4. ☐ Physical hazards discussed

a. ☐ Heat stress	e. ☐ Overhead utilities
b. ☐ Cold stress	f. ☐ Underground utilities
c. ☐ Slip, trip, and fall hazards	g. ☐ Moving and emptying drums
d. ☐ Drilling operations	h. ☐ Heavy equipment operations
5. ☐ Personal protective equipment (PPE) discussed
 - a. ☐ Head protection (hard hat)
 - b. ☐ Eye protection (safety glasses must have side shields)
 - c. ☐ Hearing protection (at all times when drill rig/heavy equipment operating, in close proximity to traffic)
 - d. ☐ Foot protection (steel toes and shanks for work boots)
 - e. ☐ Splash (solvent rinse)
 - f. ☐ Gloves
 - i. ☐ Chemical hazard (diluting standards for GC)
 - ii. ☐ Environmental conditions (cold)
 - iii. ☐ Protection against cross-contamination (disposal after each use)
 - iv. ☐ Physical hazard (cut, puncture, and abrasion)
6. ☐ Decontamination procedures discussed

a. ☐ Drilling equipment	b. ☐ Sampling equipment
7. ☐ Emergency procedures discussed
 - a. ☐ Route to hospital from site locations(s) above
 - b. ☐ Evacuation procedures
 - c. ☐ Cellular phone, map to hospital, first aid kit, and eyewash with onsite geologist
8. ☐ Special conditions/procedures

a. ☐ Escort required	b. ☐ Locked gates, permits, passes, etc.
9. ☐ Questions/concerns addressed
10. ☐ Other:

Meeting attended by (sign and date for each day of work on site; **USE BACK IF ADDITIONAL SPACE IS REQUIRED**):

(Print Name)	(Signature)	(Date)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Meeting conducted by: _____ (Title) _____

Utility Clearance Log

PROJECT NAME: _____ DATE _____

PROJECT NUMBER: _____

“ONE-CALL” CONFIRMATION NUMBER AND DATE CONTACTED _____

“ONE-CALL” EXPIRATION DATE _____

SUBCONTRACTOR LOCATING FIRM AND INVOICE NUMBER _____

FACILITY CONTACT PERSON & TELEPHONE NUMBER _____

FACILITY DRAWINGS REVIEWED _____

VERBAL/WRITTEN SIGN-OFF OF CLEARANCE BY FACILITY CONTACT _____

PRESSURIZED LINES/SHUT-OFF VALVES IDENTIFIED* _____

UNDERGROUND UTILITIES/LINES IDENTIFIED* _____

UNDERGROUND UTILITIES/LINES MARKED ONSITE BY _____

OVERHEAD UTILITIES/LINES IDENTIFIED* _____

OVERHEAD UTILITIES/LINES MARKED ONSITE BY _____

*Mark on copy of facility drawing or site sketch in HASP.

Clearance Contact:

NAME (HERRERA EMPLOYEE ONLY)

SIGNATURE

DATE

Clearance Reviewed By:

NAME (HERRERA PROJECT MANAGER)

SIGNATURE

DATE

ATTACHMENT 3

Personnel Training Certificates

SAFETY & HEALTH SERVICES

CERTIFIES THAT

Matt Fidler

HAS SUCCESSFULLY COMPLETED

40-HOUR OSHA 1910.120
HAZARDOUS WASTE OPERATIONS &
EMERGENCY RESPONSE COURSE

January 27-30, 2020

DATE

#X052

CERTIFICATE NUMBER

Safety & Health Services- Butte, MT

LOCATION

Tony Olson
INSTRUCTOR

Safety & Health Services . 12 Redwood Drive . Butte, MT . (406) 494-7710

SAFETY & HEALTH SERVICES

CERTIFIES THAT

Matthew Fidler
HAS SUCCESSFULLY COMPLETED

8-HOUR OSHA 1910.120
HAZARDOUS WASTE OPERATIONS &
EMERGENCY RESPONSE REFRESHER COURSE

February 9, 2021

DATE

#Y609

CERTIFICATE NUMBER

Safety & Health Services-Butte, MT

LOCATION

Tony Olson

INSTRUCTOR

Safety & Health Services . 12 Redwood Drive . Butte, MT . (406) 494710

SAFETY & HEALTH SERVICES

CERTIFIES THAT

Matt Fidler

HAS SUCCESSFULLY COMPLETED

8-HOUR OSHA 1910.120
HAZARDOUS WASTE OPERATIONS &
EMERGENCY RESPONSE REFRESHER COURSE

February 8, 2022

DATE

Safety & Health Services – Butte, MT

LOCATION

#Z082

CERTIFICATE NUMBER

Tony Olson
INSTRUCTOR

Safety & Health Services . 12 Redwood Drive . Butte, MT . (406) 494-7710

HEARTSAVER

Heartsaver® First Aid CPR AED



American
Heart
Association.

Matthew Fidler

**has successfully completed the cognitive and skills evaluations
in accordance with the curriculum of the American Heart Association
Heartsaver First Aid CPR AED Program.**

Optional modules completed:

Heartsaver Total, Child CPR AED, Infant CPR, Exam

Issue Date

2/24/2022

Training Center Name

International Heart Institute of MT

Training Center ID

MT15543

Training Center City, State

Missoula, MT

**Training Center Phone
Number**

(406) 329-5668

Renew By

02/2024

Instructor Name

Danielle Pettry

Instructor ID

06150337364

eCard Code

226013140414

QR Code



To view or verify authenticity, students and employers should scan this QR code with their mobile device or go to www.heart.org/cpr/mycards.

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ATTACHMENT 4

Air Monitoring Equipment Calibration/Check Log and Air Monitoring Log



AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

Project Name: _____

Project Number:

[illegible]



AIR MONITORING LOG*

Project Name: _____

Project Number:

[illegible]

***Notify the Site Health and Safety Officer immediately if a PEL, TLV, or other limit is exceeded.**

APPENDIX B

Laboratory Method QA/QC Parameters

Energy Laboratories, Inc.
Standard Operating Procedure

ELI SOP 50-206-07
Revision Date: May 4, 2021

ATTACHMENT 17.2 METHOD QA/QC Parameters Volatile Petroleum Hydrocarbons (VPH) per Massachusetts Method				
QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Surrogate Recovery	All samples and QC	%Rec = 70-130%	1. Re-analyze sample 2. Re-extract sample 3. Prepare new standard 4. Look for sample matrix interference	VPH surrogates monitor method performance for each individual sample. Trifluorotoluene is used
Instrument Calibration (ICAL)	A 5 Point calibration precedes analyses. Use average response factors. Certain compounds are selected for FID calibration and other compounds are used for PID calibration.	1. Low cal standard must be $\leq$ RL 2. %RSD $\leq$ 25% for each target analyte	1. Correct problem. 2. Prepare new standards. 3. Recalibrate.	Establishes calibration curve over a range of analyte concentrations to quantify analytes of interest. Calibration of instrument and check of response linearity. Analysis cannot proceed until a valid calibration is produced. RE (Residual Error) = Calculated as % Recovery in Omega
Initial Calibration Verification (ICV)	Follows valid initial calibration	%Rec = 80-120%	1. Correct problem. 2. Re-analyze ICV once. 3. Re-calibrate and rerun ICV.	Evaluates calibration accuracy and method performance. Must be prepared from second source standard.
Continuing Calibration Verification (CCV)	Every 24 hours and at the end of every analytical sequence	%Rec = 75-125% for CCV preceding sample analyses	1. Correct problem. 2. Re-analyze CCV. 3. Recalibrate and re-analyze all samples since last valid calibration check.	Evaluates instrument drift throughout analytical sequence. Typically uses midpoint calibration standard or ICV.
Method Blank	Before samples, and at least one MB every 24 hours. Soils-1/prep batch	$\frac{1}{2}$ of PQL for target analytes	1. Repeat analyses once. 2. Correct problem. 3. Re-extract and re-analyze all samples associated with failing method blank.	Evaluates overall method including possible contamination in reagents and glassware utilized in preparatory batch. Soil method blanks use clean sand.
Matrix Spike and Matrix Spike duplicate (MS/MSD)	Each batch of 20 samples/matrix or when there is a change of reagents, whichever is more frequent.	%Rec = 70-130% %RPD $\leq$ 20%	1. Repeat analyses. 2. Re-extract and re-analyze MS/MSD (if sufficient sample).	Evaluates effect of matrix on method performance. Must use a second source standard MSD also evaluates method precision.
Lab Control Sample (LCS)	Minimum 1/20 samples	%Rec = 70-130%	1. Repeat analyses. 2. Prepare new standards. 3. Recalibrate. 4. Re-extract and re-analyze all samples associated with failing LCS (laboratory fortified blank).	Evaluates overall method precision and accuracy. Method specifies 70-130. Must use second source standard Soils are prepared using a blank sand matrix.

Energy Laboratories, Inc.
Standard Operating Procedure

ELI SOP 50-206-07
Revision Date: May 4, 2021

ATTACHMENT 17.2 METHOD QA/QC Parameters Volatile Petroleum Hydrocarbons (VPH) per Massachusetts Method				
QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Analyte Confirmation in samples	1. As suspected by analyst after thorough examination of data. 2. If detection is > ½ MCL 3. As requested by client	QC pertaining to confirmation method.	None	Past sample history can be used to verify MTBE / Naphthalene detects.
MDL	Initial MDL: <u>Samples:</u> Analyze at least 7 MDL samples over at least 3 calendar days. <u>Study:</u> Initial study required for new method and whenever method changes might reasonably be expected to affect sensitivity. Ongoing MDL: <u>Samples:</u> Analyze at least 2 ongoing MDL spikes for each quarter samples are analyzed. <u>Study:</u> Annually, recalculate MDL spike and MDL blank from overall historical data.	MDL Samples: All results are quantitative (above zero and meet the qualitative identification criteria of the method; e.g., recognizable spectra, signal to noise requirements, and presence of qualifier ions). MDL Studies: MDL = whichever is higher of MDL spike or MDL blank. < PQL	1) If the result for any individual analyte from the MDL spiked samples does not meet the method qualitative criteria or does not provide a numerical result greater than zero, repeat the spiked samples at a higher concentration. 2) Repeat initial MDL spike and MDL blank study or adjust reporting limit to > 2X of calculated MDL.	Per CFR Part 136 The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.
LOD Verification	Annually based on MDL	Positive Result, (Above background)	1) Examine method or preparatory steps. 2) Verify MDL study. 3) Repeat analysis. 4) Consult QA.	Spike at 1-4X calculated MDL. Required to verify calculated MDL.
LOQ Verification	Initial LOQ: <u>Samples:</u> Analyze at least 7 LOQ samples over at least 3 calendar days. <u>Verification:</u> Initial verification required for new method and whenever method changes might reasonably be expected to affect sensitivity. Ongoing LOQ: <u>Samples:</u> Analyze at least 1 ongoing MDL spikes for each quarter samples are analyzed. <u>Study:</u> Annually, verify that acceptance criteria is met.	LOQ Sample: Quantitative (above zero and meet the qualitative identification criteria of the method; e.g., recognizable spectra, signal to noise requirements, and presence of qualifier ions). % Rec = Statistical or set LOQ Verification: > Calculated MDL	1) Correct method or instrument performance and repeat the verification. 2) Evaluate and correct established statistical acceptance criteria. 3) Adjust reporting limit.	If MDL samples meet the LOQ acceptance criteria, the MDL samples can be used as LOQ Samples.

Energy Laboratories, Inc.
Standard Operating Procedure

ELI SOP 50-206-07
Revision Date: May 4, 2021

ATTACHMENT 17.2 METHOD QA/QC Parameters Volatile Petroleum Hydrocarbons (VPH) per Massachusetts Method				
QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Retention Time Windows	Update as needed when maintenance is performed, new column installed, or flows are adjusted	Peaks must fall within RT windows.	1. Identify problem 2. Confirm RTs are stable	Calculate according to method
External PE Samples	Semi-annually, LPTP/UST study samples.	PT sample defined acceptance limits (Must pass 2 out of last 3 PT studies)	1. Complete corrective action report. 2. Repeat with another make-up study (for failure of 2 out of 3).	External review of analytical method accuracy.
Control Charting	Annual statistical review of method.	Data statistically within control limits.	1) Trend Analysis/ Method Review 2) Correct method/instrument problem. 3) Replace analyst.	For statistical process control.
Demonstration of Capability (DOC)	Initially for each new analyst, annually thereafter	4 passing LCS (or other second source QC), passing PT study results, or qualifying statement from supervisor. Method requirements for initial DOCs and ongoing DOCs must be met.	1) Provide additional training 2) Replace analyst.	Demonstrates proficiency to perform the method and obtain acceptable results for each analyst.
Preparatory Batch	Soils: 20 samples or less over a maximum of 7 days. Waters: Samples ran within a 24-hour period not to exceed 20	Must pass all method QC criteria.	1. Re-analyze batch or qualify results 2. Re-extract soil batch	Each batch must contain the same reagents throughout.

Energy Laboratories, Inc.
Standard Operating Procedure

ELI SOP 50-248-08
Revision Date: October 1, 2021

ATTACHMENT 17.2 METHOD QA/QC PARAMETERS Extractable Petroleum Hydrocarbons (EPH) per Massachusetts Method 2004 Revision				
QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Initial Calibration (ICAL)	Annually or after significant instrument maintenance. 5 point initial calibration each for aliphatics and aromatics, (external standardization option of method chosen) Aliphatic Standard Solution Aromatic Standard Solution Range: 1.5, 5,50,200,500,and 1000 ug/mL. To precede sample analyses.	25% RSD MnRF 25%RSD each component. RE = Generally same as CCV requirements. Lowest point may be set statistically.	1. Repeat once 2. Correct problem 3. Prepare new standards 4. Recalibrate	Used to Calibrate instrument, evaluates chromatographic separation effectiveness, and instrument response linearity. RE (Residual Error) = Calculated as % Recovery in Omega
Initial Calibration Verification (ICV)	The first LCS analyzed following calibration must pass its acceptance criteria.	LCS: TEH %Recovery: 60-140% Fractions: % Recovery of target analytes: 40-140% (30-140% for nonane) Surrogate: 40-140% OR ICV: 80-120% Recovery for each component	1. Repeat once 2. Prepare fresh standards and reanalyze. 3. Recalibrate and re-analyze all affected samples.	Evaluates accuracy of calibration standards. ICV is required if a separate source standard is NOT used for the LCS. LCS utilized in method is second source and used as the ICV.
Continuing Calibration Verification (CCV)	Analyzed at the beginning of every analysis sequence, after every 20 samples or every 24 hours, whichever comes first	75% - 125% Recovery for each component, excluding n-nonane. N-nonane : 70%-130% recovery Final CCV: four compounds may have percent differences greater than 25% but less than 40%	1. Repeat once 2. Correct problem 3. Re-calibrate and re-analyze all samples since last valid CCV	Verifies instrument calibration and evaluates instrument drift throughout analytical sequence. Mid-level standard
Chromatography Resolution	1) Each ICAL or CCV-Resolution is verified 2) Retention Time Windows – Use RRT and analyst discretion for instrument stability.	Chromatographic resolution: Monitored against historical performance levels. 50% separation of phenanthrene and anthracene.	1. Repeat once 2. Adjust column conditions 3. Perform instrument maintenance 4. Replace GC column	Verifies that gas chromatographic system is operating properly. Resolution criteria for two selected PAH pairs are not met as per method specifications.
System Solvent Blank	As indicated, such as after a heavily contaminated extract. A method blank analysis can be substituted for an instrument blank.	< Lowest reporting limit	1. Repeat analyses once 2. Perform Instrument maintenance 3. Re-analyze all associated samples in sequence where contamination level may affect result.	Measures and evaluates possible contamination in gas chromatographic analysis system.
Method Blank	One per analytical batch	< Lowest reporting limit Surrogate: 40-140%	1. Re-analyze sample on instrument 2. Re-extract and re-analyze all samples associated with the corresponding analytical batch. 3. Qualify sample data	Evaluates overall method including possible contamination in reagents and glassware utilized in preparatory batch.

Energy Laboratories, Inc.
Standard Operating Procedure

ELI SOP 50-248-08
Revision Date: October 1, 2021

Laboratory Control Standard (LCS)	One per analytical batch	TEH %Recovery: 60-140% Fractions: % Recovery of target analytes: 40-140% (30-140% for nonane) Surrogate: 40-140%	1. Re-analyze sample on instrument 2. Prepare new standards 3. Recalibrate 4. Re-extract and re-analyze all samples associated the corresponding analytical batch.	Evaluates overall method accuracy/bias for the Preparatory Batch. Must be second source. If prepared the same as MS/MSD will evaluate the spiking technique.
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per analytical batch	Corrected TEH %Recovery: 40-140% Fractions: % Recovery of target analytes: 40-140% (30-140% for nonane) Surrogate: 40-140% %RPD = 50% (advisory)	1. If matrix interference suspected, report as found 2. Re-analyze on instrument 3. Re-extract and reanalyze MS/MSD, (if sufficient sample) or select another sample to MS.	Evaluates effect of individual matrix on method performance and method precision. Poor MS/MSD QC performance does not necessarily reject extraction batch group. Control limits are advisory due to sample matrix effects.
Extraction Surrogates	Added to all samples and QC prior to extraction . Ortho-Terphenyl (PAH fraction) and 1-Chloro-octadecane (Aliphatic fraction).	%Recovery: 40-140% Control limits are advisory due to possible sample matrix effects.	1. Re-analyze sample on instrument 2. Evaluate for matrix effects 3. Re-extract samples if method batch performance is suspected.	Evaluates extraction performance on each individual sample analyzed. Water samples containing sediment may have reduced analyte and surrogate extraction efficiency. Extraction performance alone can be evaluated from an EPH screening result.
Fractionation Surrogates	Surrogates added to sample extract prior to fractionation. 2-Bromonaphthalene and 2-Fluorobiphenyl.	%Recovery: 40-140% in Aromatic fraction. Control limits are advisory due to possible sample matrix effects.	1. Re-analyze sample on instrument 2. Evaluate for matrix effects 3. Re-fractionate samples if method batch performance is suspected.	Evaluates the effectiveness of the aliphatic/aromatic separation step. Proportional level of presence of either surrogate in the aliphatic fraction suggests incomplete separation of the more volatile PAH's from the aliphatic fraction.
Fractionation Check	Per each Lot # of Silica gel	Effective separation of target analytes into appropriate fraction. %Recovery: 40-140% except the more volatile target analytes with >20% recovery.	1. Repeat once 2. Correct problem (adjust elution volumes) 3. Prepare new standards 4. Recalibrate	Uses aliphatic and aromatic hydrocarbon standards in hexane. The more volatile aromatic and aliphatic compounds may have lower recoveries than method specified limits.
PAH Target Analyte	: Water and Soil: PAH analyses performed by 8270 per MTDEQ guidance.	Meets 8270 analyses criteria	1. Repeat analyses to meet all 8270 method QC criteria	Accurately quantitates PAH levels in aromatic extract. 8270 method is considered less sensitive to false positives than the EPH method.

Energy Laboratories, Inc.
Standard Operating Procedure

ELI SOP 50-248-08
Revision Date: October 1, 2021

MDL	Initial MDL: <u>Samples:</u> Analyze at least 7 MDL samples over at least 3 calendar days. <u>Study:</u> Initial study required for new method and whenever method changes might reasonably be expected to affect sensitivity. Ongoing MDL: <u>Samples:</u> Analyze at least 2 ongoing MDL spikes for each quarter samples are analyzed. <u>Study:</u> Annually, recalculate MDL spike and MDL blank from overall historical data.	MDL Samples: All results are quantitative (above zero and meet the qualitative identification criteria of the method; e.g., recognizable spectra, signal to noise requirements, and presence of qualifier ions). MDL Studies: MDL = whichever is higher of MDL spike or MDL blank. < PQL	1) If the result for any individual analyte from the MDL spiked samples does not meet the method qualitative criteria or does not provide a numerical result greater than zero, repeat the spiked samples at a higher concentration. 2) Repeat initial MDL spike and MDL blank study or adjust reporting limit to > 2X of calculated MDL.	Per CFR Part 136 The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.
LOD Verification	Annually, following the MDL study. LOD is spiked at 1-4X the MDL.	Positive result, above background	1. Examine method or preparatory steps 2. Verify MDL study 3. Repeat analysis 4. Consult QA	Verifies the calculated MDL for each matrix.
LOQ Verification	Initial LOQ: <u>Samples:</u> Analyze at least 7 LOQ samples over at least 3 calendar days. <u>Verification:</u> Initial verification required for new method and whenever method changes might reasonably be expected to affect sensitivity. Ongoing LOQ: <u>Samples:</u> Analyze at least 1 ongoing MDL spikes for each quarter samples are analyzed. <u>Study:</u> Annually, verify that acceptance criteria is met.	LOQ Sample: Quantitative (above zero and meet the qualitative identification criteria of the method; e.g., recognizable spectra, signal to noise requirements, and presence of qualifier ions). % Rec = Statistical or set LOQ Verification: > Calculated MDL	1) Correct method or instrument performance and repeat the verification. 2) Evaluate and correct established statistical acceptance criteria. 3) Adjust reporting limit.	If MDL samples meet the LOQ acceptance criteria, the MDL samples can be used as LOQ Samples.
External PE Samples	Semi-Annually	PT sample defined acceptance limits (must pass 2 out of last 3 PT studies)	1. Complete corrective action report 2. Repeat with another make-up study (for failure of 2 out of 3)	External review of analytical method accuracy.
Control Charting	Annual statistical review of method.	Data statistically within control limits.	1) Trend Analysis/ Method Review 2) Correct method/instrument problem. 3) Replace analyst.	For statistical process control.



Energy Laboratories, Inc.
Standard Operating Procedure

ELI SOP 50-248-08
Revision Date: October 1, 2021

Demonstration of Capability (DOC)	Initially for each new analyst, annually thereafter	4 passing LCS (or other second source QC), passing PT study results, or qualifying statement from supervisor. Method requirements for initial DOCs and ongoing DOCs must be met.	1) Provide additional training 2) Replace analyst.	Demonstrates proficiency to perform the method and obtain acceptable results for each analyst.
Batch Definition	Each batch of 20 samples/matrix extracted within a 7-day time frame or when there is a change of reagents, whichever is more frequent	Must pass all method QC criteria	Re-analyze batch or qualify results	A group of samples and associated QC

Energy Laboratories, Inc.
Standard Operating Procedure

ELI SOP 50-126-04
Revision Date: May 7, 2020

ATTACHMENT 17.2

<u>METHOD QA/QC PARAMETERS</u>				
DETERMINATION OF PERCENT SOLIDS AND PERCENT MOISTURE IN SOLID AND SEMISOLID SAMPLES				
ELI SOP 50-126-04				
QA/QC SAMPLE INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Duplicate Sample (DUP)	1/10 samples	RPD = $\leq 20\%$	1) Reanalyze sample pair. 2) Re-prepare and reanalyze the batch	Evaluates method precision.
External PE Samples	NAPT, ERA	PT sample defined acceptance limits (Must pass 2 out of last 3 PT studies)	1) Complete corrective action report 2) Repeat with another make-up study (for failure of 2 out of 3)	External review of extraction and analytical method accuracy.
Control Charting	Annual statistical review of method.	Data statistically within control limits.	1) Trend Analysis/ Method Review 2) Correct method/instrument problem. 3) Replace analyst.	For statistical process control.
Demonstration of Capability (DOC)	Initially for each new analyst, annually thereafter	4 passing LCS (or other second source QC), passing PT study results, or qualifying statement from supervisor. Method requirements for initial DOCs and ongoing DOCs must be met.	1) Provide additional training 2) Replace analyst.	Demonstrates proficiency to perform the method and obtain acceptable results for each analyst.
Batch Definition	20 samples	Must pass all method QC criteria	Re-analyze batch or qualify results.	A group of samples and associated QC

Final Sampling and Analysis Plan

Phase II Environmental Site Assessment

Memorial Apartments

40 East Lyndale Avenue, Helena, Montana

Revision Date: January 15, 2019
Tetra Tech Project No. 117-8217006

PRESENTED TO

Montana Dept of Environmental Quality
PO Box 200901
Helena, MT 59620

PRESENTED BY

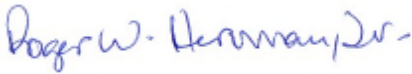
Tetra Tech	P +1-406-443-5210
825 West Custer Avenue	F +1-406-442-7182
Helena, MT 59602	tetrattech.com

Prepared by:



Nicholas S. Sovner
Tetra Tech Project Manager

Reviewed by:



Roger Herman, Jr.
Industrial Hygiene Services Manager

Reviewed by:



William Craig, L.G., L.H.G.
Tetra Tech QA Officer

TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 Key Personnel.....	1
1.2 Site Location and History	2
1.3 Health and Safety.....	2
1.4 Contaminants of Concern	3
1.5 Project Scope of Work and Schedule	3
1.6 Project Objectives	3
2.0 PROJECT DATA QUALITY OBJECTIVES.....	4
2.1 Triad Investigation Approach	4
2.2 Quality Assurance/Quality Control	4
2.2.1 Problem Statement.....	4
2.2.2 Decision Statement	5
2.2.3 Decision Inputs	6
2.2.4 Study Boundary	6
2.2.5 Decision Rule	6
2.2.6 Tolerable Limits of Decision Errors	6
2.2.7 Sampling Design	7
3.0 REGULATORY CRITERIA	8
3.1 Asbestos	8
3.2 Lead	8
3.2.1 Lead Based Paint	8
3.2.2 Lead in Soil.....	9
3.3 Mercury, PCB, and Freon	10
3.3.1 Mercury.....	10
3.3.2 PCBs.....	10
3.3.3 Freon	10
4.0 SAMPLING APPROACH	11
4.1 Asbestos Sampling	11
4.1.1 Friable Surfacing Material.....	11
4.1.2 Thermal System Insulation	11
4.1.3 Miscellaneous Material	12
4.1.4 Non-Friable Suspected Material.....	12

4.2 Lead Sampling	12
4.2.1 Lead Based Paint	12
4.2.2 Lead Waste Characterization for Disposal	12
4.2.3 Lead in Soil	12
4.3 Mercury, PCB's, and Freon	13
4.3.1 Mercury	13
4.3.2 PCB's	13
4.3.3 Freon	13
4.4 Field QA	13
4.4.1 Asbestos Sampling	13
4.4.2 Lead Based Paint Sampling	14
5.0 REPORTING	15
6.0 REFERENCES	16

LIST OF TABLES

Table 1 - Key Project Personnel.....	1
Table 2 - Contaminant Release, Exposure, and Management	5
Table 3 - Summary of Asbestos Definitions	8
Table 4 - Friable Surfacing Material Sampling Protocols	11

LIST OF FIGURES

FIGURE 1 – Location Map

FIGURE 2 – Site Map

APPENDICES

APPENDIX A – Health and Safety Plan

APPENDIX B – Personnel Certifications

APPENDIX C – Sample Data Validation Summary Form

APPENDIX D – Standard Operating Procedures

APPENDIX E – Laboratory Chain of Custody Forms

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ACM	Asbestos Containing Materials
ACBM	Asbestos Containing Building Materials
ASHERA	Asbestos Hazard Emergency Response Act
ARM	Administrative Rules of Montana
ASTM	American Society of Testing and Materials
BTV	Background Threshold Value
CFR	Code of Federal Regulations
COPC	Contaminants of Potential Concern
DEQ	Montana Department of Environmental Quality
DQO	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HUD	U.S. Department of Housing and Urban Development
IH	Industrial Hygiene
LBP	Lead-Based Paint
NESHAP	National Emissions Standards for Hazardous Air Pollutants
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl
PLM	Polarized Light Microscopy
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance / Quality Control
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
TCLP	Toxicity Characteristic Leaching Procedure
XRF	X-Ray Florescence

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) was prepared for the Montana Department of Environmental Quality (DEQ) with funding from a U.S. Environmental Protection Agency (EPA) Brownfields 128(a) grant. Tetra Tech is performing this work under DEQ Contract 414033 and Task Order No. 42. A programmatic Quality Assurance Project Plan (QAPP) has been developed by DEQ (DEQ, 2015) that is available under separate cover. In the event of differences between the QAPP and this SAP, the SAP takes precedence.

This SAP has been prepared to guide the sampling associated with a Phase II Environmental Site Assessment (ESA) of the Memorial Apartments property located at 40 East Lyndale Avenue in Helena, Lewis and Clark County, Montana (the Site). The Site has been vacant since 2016. Contaminants of potential concern (COPC) under this SAP include asbestos containing building materials (ACBM), lead based paint (LBP), polychlorinated biphenyls (PCBs) in electrical transformers, mercury containing electrical components, and Freon containing appliances.

This SAP is organized as follows: Section 1 presents the introduction, Section 2 presents the project data quality objectives, Section 3 presents the regulatory criteria, Section 4 presents the sampling approach, Section 5 discusses reporting requirements, and Section 6 presents references. **Figure 1** presents a Location Map and **Figure 2** presents a Site Map. **Appendix A** presents the site-specific Health and Safety Plan (HASP), **Appendix B** presents copies of the asbestos inspector's certifications, **Appendix C** presents a copy of the data validation summary form, **Appendix D** presents Tetra Tech Standard Operating Procedures (SOPs) for industrial hygiene (IH) related services, and **Appendix E** presents sample laboratory chain of custody forms.

1.1 KEY PERSONNEL

This section presents the key personnel directly involved with this project and a description of their roles. **Table 1**, below, presents key project personnel with their contact information and responsibilities. The DEQ programmatic QAPP presents any additional administrative personnel (DEQ, 2015).

Table 1 - Key Project Personnel

Title	Entity	Name	Phone/Email	Responsibilities
Brownfields Coordinator	Montana DEQ	Jason Seyler	(406) 444-6447, jseyler@mt.gov	Project decision making, contract management, budgeting, grant management, and reviews all project related deliverables.
Consultant Project Manager	Tetra Tech	Nicholas S. Sovner	(406) 437-9858, nicholas.sovner@tetratech.com	Coordinates the Tetra Tech contract and field activities, prepares project documents, and ensures Tetra Tech safety policies are adhered to for field IH staff. Mr. Sovner has the ability to stop work if conditions become unsafe.
Consultant Quality Assurance (QA) Officer	Tetra Tech	William Craig, L.G., L.H.G.	(406) 327-5228, bill.craig@tetratech.com	Provides QA during project activities and preparation of documents, reviews analytical data to meet current standards for accuracy and precision. Although employed by the same entity to ensure continuity of institutional knowledge, the Consultant QA Officer is independent of the Project Manager and any data generating activities.

Title	Entity	Name	Phone/Email	Responsibilities
Data Validator	Tetra Tech	Rhianna Reed	(406) 437-9857, rhianna.reed@tetrattech.com	Evaluates laboratory analytical reports for QA purposes and prepares a data validation summary report. The data validator is not involved in the collection of the sample data.
Contractor Industrial Hygiene (IH) Services Manager	Tetra Tech	Roger Herman, Jr.	(406) 384-0297, roger.herman@tetrattech.com	Is the technical lead for IH projects and reviews documents, the health and safety plan, and is the direct supervisor for field staff. Mr. Herman has the ability to stop work if conditions become unsafe.
Field Inspector	Tetra Tech	Connor McHugh	(406) 443-5210, connor.mchugh@tetrattech.com	Conducts inspection activities and reports back to Mr. Sovner or Mr. Herman on project status. The field inspector has the ability to stop work if conditions become unsafe.
Field Inspector	Tetra Tech	Cody Knowlton	(406) 248-9161, cody.knowlton@tetrattech.com	Conducts inspection activities and reports back to Mr. Sovner or Mr. Herman on project status. The field inspector has the ability to stop work if conditions become unsafe.

1.2 SITE LOCATION AND HISTORY

The project is located at 40 East Lyndale Avenue in Helena, Lewis and Clark County, Montana. The legal description is described as: Central Addition No. 3, S30, T10 N, R03 W, Block 53, Lot 1 - 11, & 30' x 122' Closed Jackson Street (**Figures 1 and 2**). This ESA is only addressing building materials and potentially surface soil immediately adjacent to the foundation or beneath the exterior drip line and does not address subsurface features such as soil or groundwater.

The Memorial Apartments were originally constructed in 1935 and consist of an approximately 17,300-square foot, single story, apartment complex with 35 units. They were first used as motel rooms under the name Bell Motel and later used as a rest home for senior citizens. The current owners, Buck and Jeri Lynn Rea, purchased the property in 2000 and used it as a Section 8 rental property for qualified low-income tenants. The City of Helena deemed the property uninhabitable in 2016 due to the age and condition of the sprinkler fire suppression system and the Site has been vacant ever since (Helena Independent Record, 2016). The Rea's applied for a Montana Brownfields Assessment through DEQ's Brownfields 128(a) Grant program in 2018.

1.3 HEALTH AND SAFETY

It is the responsibility of each Tetra Tech Office's Occupational Health and Safety Coordinator and the IH Services Manager to provide appropriate training to field staff and maintain up-to-date certification records. Hard copy and electronic copies of certifications will be maintained at each office. Tetra Tech field personnel will maintain current 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) and 8-hour HAZWOPER Annual Refresher certification. Field inspectors also have Asbestos Inspector Training per EPA's Model Accreditation Plan, under 40 Code of Federal Regulations (CFR) 763, Subpart E, Appendix C and Administrative Rules of Montana (ARM) 17.74.364 - 368 and 17.74.403 and 404. A copy of the project specific HASP is presented in **Appendix A**, and copies of asbestos inspector certifications are presented in **Appendix B**.

The maximum personal protective equipment (PPE) required for this project Level C – air purified respirator and chemical resistant clothing (e.g. Tyvek suit).

1.4 CONTAMINANTS OF CONCERN

Tetra Tech has identified the following COPCs for the site:

- ACBM in structure building materials.
- LBP on building surfaces and/or as dust.
- Lead in soil along the building drip line.
- Mercury associated with facility fixtures and equipment.
- PCBs associated with facility fixtures and equipment.
- Freon associated with refrigerants.

1.5 PROJECT SCOPE OF WORK AND SCHEDULE

This SAP is to be implemented upon final DEQ approval during the winter months (January through February) of 2019 for the following scope of work:

- Perform a room-by-room ACBM assessment as well as evaluate exterior building materials by collecting samples for analysis.
- Perform a room-by-room LBP inspection as well as evaluate exterior building materials by using X-Ray Florescence (XRF).
- If necessary, collect soil samples from along the building drip line for lead analysis.
- Evaluate the buildings to determine if there are mercury containing thermostats, lighting, or other equipment that may present disposal issues.
- Evaluate the buildings to determine if the lighting systems, door dampers, or electrical transformers contain PCBs that may present disposal issues.
- Evaluate the building for appliances that may contain sources of Freon.
- Prepare a Phase II ESA and Cost Estimate Report to document hazardous substances identified at the Site.

1.6 PROJECT OBJECTIVES

The objectives of this Phase II ESA are to complete an assessment of the Site's COPCs to identify materials that may need to be removed or handled appropriately during Site building demolition. This includes evaluating whether exterior surfaces containing lead have impacted surface soils and whether the Site building poses a risk of exposure from ACBM, lead, mercury, PCBs, or Freon that could create a health concern for adjacent properties or construction workers.

2.0 PROJECT DATA QUALITY OBJECTIVES

This section presents the data quality objectives (DQOs) for this Phase II ESA.

2.1 TRIAD INVESTIGATION APPROACH

The Triad investigation approach is a technical practice supported by EPA to foster modernization of characterizing and remediating contaminated sites (EPA, 2004). The goal of the Triad approach is to manage decision uncertainty and increase confidence that project decisions (about contaminant presence, location, fate, exposure, and risk reduction choices and design) are made correctly and cost-effectively. This approach establishes a foundation for site-related decisions that are both correct and optimized (from a cost-benefit standpoint) using all available historical and current information to estimate:

- Where contamination is (or might be) located;
- How much is (or might be) there;
- How variable concentrations may be and how much spatial patterning may be present;
- What is happening to contaminants as far as fate and migration;
- Who might be exposed to contaminants or harmful degradation products; and
- What might be done to manage risk by mitigating exposure.

The Triad investigation approach will be utilized during this Phase II ESA.

2.2 QUALITY ASSURANCE/QUALITY CONTROL

A QAPP (DEQ, 2015) was developed to define project DQOs, guide data acquisition, and data validation activities. Personnel involved with field activities, evaluation of data, and reporting will use the QAPP as a guide for quality assurance and quality control (QA/QC) during the project. QA/QC samples collected and analyzed during cleanup activities may include field duplicates and field blanks.

Tetra Tech will utilize field notebooks, photograph logs, and analytical data to evaluate for completeness and to ensure that applicable standards of care are maintained. Based on this information, if Tetra Tech believes that data is not representative of site conditions then the data may be rejected, and additional sampling may be recommended.

Tetra Tech will perform data validation per DEQ Waste Management and Remediation Division – Data Validation Summary Form (Version 1.3.0, revision date 1/26/18). After this review, a statement will be made to evaluate whether the data supports the DQOs for the project. A copy of the Data Validation Summary Form is presented in **Appendix C**.

2.2.1 Problem Statement

This SAP covers sampling methodologies that are used during assessment work practices and the data will be used to guide cleanup decisions. Prior to building demolition, standard redevelopment practice is to conduct an IH inspection to identify and characterize hazardous substances such as ACBM and LBP. In some instances, such as where LBP is identified on exterior building materials, soil must also be sampled. Once hazardous substances are identified, an abatement plan must be in place in order ensure that removal and disposal of the hazardous substances is conducted in compliance with state and federal regulations. Where brownfields funding is utilized, this process is required.

The media that may be investigated in buildings includes walls, ceilings, floors, counters, cabinets, doors and windows, utilities, air ducts, piping runs, insulation, foundations, and surface soil. **Table 2** below, presents a summary of COPC release mechanisms and exposure pathways.

Table 2 - Contaminant Release, Exposure, and Management

Contaminant	Release Mechanism	Exposure Pathway	Risk Management	Applicable Regulations
Asbestos Containing Building Materials (ACBM)	Friable material to air	Inhalation by occupants, construction, or abatement workers	Removal and disposal according to state and federal guidelines	(1) Administrative Rules of Montana (ARM) 17.74.354; (2) Asbestos Hazard Emergency Response Act (AHERA), National Emissions Standards for Hazardous Air Pollutants (NESHAP); as promulgated in Title 40, Code of Federal Regulations, Part 763 (40 CFR 763)
Lead Based Paint (LBP) and Lead in Soil	Leaching, flaking of paint chips	Dermal contact, inhalation, ingestion of solids by occupants, construction, or abatement workers	Removal and disposal according to state and federal guidelines	(1) U.S. Department of Housing and Urban Development (HUD) EPA Title 40 Code of Federal Regulations (40 CFR), Part 745 (2)
Mercury, PCBs, and Freon	Destruction of building fixtures and equipment	Dermal contact or ingestion by occupants, construction, or abatement workers	Removal and disposal according to state and federal guidelines	(1) Liquid mercury or mercury vapor in components is identified as a characteristic hazardous waste (0009) under 40 CFR.261.24. Mercury-containing fixtures and equipment must be disposed of at a registered hazardous waste facility. Management and disposal of mercury-containing bulbs are regulated under the Resource Conservation and Recovery Act, Universal Waste Rule, and Subtitle C hazardous waste regulations. (2) Transport and disposal of PCBs must comply with 40 CFR 761.62, and applicable Department of Transportation requirements. (3) EPA regulates the emission of Freon gas into the atmosphere through Title VI, Stratospheric Ozone Protection, of the Clean Air Act Amendments of 1990

2.2.2 Decision Statement

This project includes collecting environmental data to support abatement for the purpose of demolition at the Site. Abatement methods focus on removal of routes of exposure to contamination by human receptors. To assess the

feasibility of demolition and/or remodeling of each unit, Tetra Tech will evaluate available data and make decisions based on the following decision statements:

- Have an adequate number of samples been collected from each area to characterize the contaminant concentrations, if present?
- Do concentrations of COPCs meet or exceed regulatory standards or screening levels?
- Do the results indicate that the Site is ready for demolition, or if hazardous materials are identified what are the potential costs of remedial action?
- Are there other areas of the site that may have been contaminated based on historic use or renovations that need to be characterized?

2.2.3 Decision Inputs

Data required to address the decision statements may include the evaluation of physical and chemical characteristics of building materials. Tetra Tech will use data from previous investigations, if available and of acceptable quality, during final recommendations with respect to additional site characterization or cleanup. All data collected and evaluated during inspections will be used to identify discrete or potential areas of contamination that present a potential risk to human health and the environment. Field and/or laboratory analytical results will be compared to applicable state and federal screening levels and standards.

2.2.4 Study Boundary

The study boundary consists of all building materials located at the Site, and air inside and down-wind of the site. The study area may also include potentially impacted soil surrounding site structures, depending on site history and demolition and abatement work required.

2.2.5 Decision Rule

Regulatory standards will be used to evaluate asbestos and lead data collected by Tetra Tech personnel. A comparison of site data to state and federal screening levels will be completed to make recommendations for any necessary abatement or soil removal work. For areas where LBP is present, a representative sample of the building material will be collected by combining proportions of the building components which will be analyzed for lead using Toxicity Characteristic Leaching Procedures (TCLP). TCLP is used to determine whether lead concentration in the total waste stream constitutes a characteristic hazardous waste. For areas of the Site where exterior LBP surfaces indicate that lead in soil exists, sampling of soil for total lead may be required to determine future risk of exposure to construction or abatement workers. Where lead in soil is present above DEQ and EPA screening levels, samples will be submitted for TCLP analysis as well as Synthetic Precipitation Leaching Procedure (SPLP) which is used to determine whether lead concentrations present a risk of leaching to groundwater.

2.2.6 Tolerable Limits of Decision Errors

Decision errors are incorrect conclusions about a site caused by using data that are not representative of site conditions due to sampling or analytical error. Limits on decision error are typically established to control the effect of sampling and measurement errors on decisions regarding a site, thereby reducing the likelihood that an incorrect decision is made.

Acceptance of decision errors is relevant when decisions will be made based on the collected data and outcome of statistical hypothesis tests performed on the data. The following defines the decision-making problems (EPA 2006):

- Null Hypothesis – Data provides sufficient evidence to allow a baseline condition to be rejected in favor of a specified alternative condition (alternative hypothesis);

- False Rejection – Rejection of the null hypothesis due to the limited nature and/or underlying variability of the data collected when the baseline condition should have been accepted.
- False Acceptance – Acceptance of the baseline conditions when in fact, the conditions are false and the null hypothesis should have been rejected.

Using acceptable levels of uncertainty is relevant when the collected data will be used to make conclusions that do not necessarily result in decision-making in situations such as during modeling or estimating population parameters. Estimation problems arise when using the collected data to estimate some unknown population parameter together with a reported measure of uncertainty in the estimate (e.g., standard error or confidence interval). The magnitude of variability will be in absolute or relative terms in relation to the estimate. Uncertainty in the estimate is inevitable. Therefore, a maximum level of uncertainty is generally specified to represent an acceptable level (e.g. Upper Confidence Limit of 90%).

Formal limits on decision error are not necessary in areas where the goal of the assessment is to define the boundaries of known contamination. This SAP identifies specific field and laboratory methods and sampling strategies that reduce sampling error. The total study error will be reduced by collecting an appropriate number of samples deemed necessary. The sampling program is designed to reduce sampling error by specifying an adequate number and distribution of samples to meet project objectives.

2.2.7 Sampling Design

The sampling design is based on a review of historical information and the redevelopment goals which in this instance the building is slated for demolition and redevelopment of unencumbered parcels for residential or commercial development. The sample design is presented in Section 4 and will detail the following information:

- Design strategy
- Type and total number of samples anticipated
- Where samples will be collected
- Alternative methods where necessary
- Critical information
- Variability reconciliation

3.0 REGULATORY CRITERIA

This section presents the regulatory criteria regarding the COPCs addressed in this SAP.

3.1 ASBESTOS

Worker exposure to asbestos during sampling operations including asbestos containing material (ACM) removal is regulated under:

- Title 29 CFR, Part 1926.1101 - Asbestos; Construction Industry Standard; Final Rule, August 24, 2006.
- Title 29CFR, Part 1910.1001, Asbestos; General Industry Standard; Final Rule, August 24, 2006.

The Occupational Safety and Health Administration (OSHA) has established worker protection measures during the removal of asbestos from the facilities including, but not limited to: training and medical monitoring requirements for personnel engaging in the oversight and removal of ACM, exposure limits, respiratory protection, PPE, work practices, engineering controls, and storage of wastes.

The removal and disposal of ACM is regulated under National Institute of Occupational Safety and Health (NIOSH) 40 CFR Part 61, Subpart M - National Emission Standard for Asbestos; Final Rule, November 20, 1990, revised June 19, 1995. **Table 3** below presents a summary of pertinent EPA definitions under CFR 763.83, as administered by DEQ.

Table 3 - Summary of Asbestos Definitions

Type	Definition
Asbestos-Containing Materials (ACM)	Materials containing more than one percent (1%) asbestos.
Asbestos-Containing Building Materials (ACBM)	Surfacing ACBM, thermal system insulation ACBM, or miscellaneous ACBM that is found in or on interior structural members or other parts of a public or commercial building.
Assumed Asbestos-Containing Materials	ACM that remains un-sampled, but is considered suspect for asbestos content, and must be treated as ACBM until proven negative for asbestos content by laboratory analysis or by documentation (e.g., product Safety Data Sheet).
Friable Asbestos-Containing Materials	Ability of material to be crumbled, pulverized or reduced to powder when dry with hand pressure as determined by physical touching by asbestos building inspector.

3.2 LEAD

3.2.1 Lead Based Paint

LBP is defined as surface coatings with a lead concentration greater than or equal to 1.0-milligrams per square centimeter (mg/cm²) or 0.5 percent by weight (40 CFR Part 745). Deteriorated LBP can cause elevated lead

levels in dust, flake off to contaminant surrounding soils along the exterior of the building walls if present as an exterior coating, and create exposure risks to building occupants.

The followings items represent the list of regulations associated with the sampling and handling of LBP:

- Title 40 CFR, Part 745, Lead; Requirements for Lead-Based Paint Activities in Target Housing and Child Occupied Facilities; Final Rule, August 29, 1996, revised January 5, 2001.
- Title 24 CFR Part 35 and Title 40, Part 745, Lead; Requirements for Disclosure of Know Lead-Based Paint and/or Lead-Based Paint Hazards in Housing; Final Rule, March 6, 1996.
- Title 40 CFR, Part 260, Hazardous Waste Management System; General; Final Rule, July 1, 2012.
- Title 40 CFR, Part 261, Identification and Listing of Hazardous Waste; Final Rule, July 1, 2012.
- Title 40 CFR, Part 262, Standards Applicable to Generators of Hazardous Waste; Final Rule, July 1, 2012.
- Title 40 CFR, Part 263, Standards Applicable to Transporters of Hazardous Waste; Final Rule, July 1, 2012.
- Title 40 CFR, Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities; Final Rule, July 1, 2012.
- Title 40 CFR, Part 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities; Final Rule, July 1, 2012.
- Title 40 CFR, Part 268, Land Disposal Restrictions; Final Rule, July 1, 2012.
- Title 29 CFR, Part 1926.62, Occupational Health and Environmental Controls, Final Rule May 4, 1993, revised March 26, 2012
- Housing and Community Development Act, Residential Lead-Based Paint Hazard Reduction Act, Title X, 1992.
- Housing and Urban Development (HUD), Guidelines for the Control of Lead-Based Paint Hazards in Housing, June 1995, revised 1997 and 2000.

Worker exposure to lead hazards in construction is regulated under CFR 29.1926.62. OSHA has established provisions for worker protection including, but not limited to training and medical monitoring requirements for personnel engaging in the oversight and removal of LBP, exposure limits, respiratory protection, PPE, work practices, engineering controls, and storage of wastes.

The handling storage, transport, and disposal of lead or lead-contaminated waste must be conducted in accordance with 40 CFR 260-265, and building owners must comply with land disposal restriction notification requirements as required by 40 CFR 268. For disposal purposes, under 40 CFR 261.24, lead hazardous waste is defined as products that have test results above 0.5 milligrams per liter of lead in the TCLP extract.

3.2.2 Lead in Soil

Composite soil samples will be submitted for laboratory analysis of total lead in soil which will be compared with the EPA's generic leaching to groundwater screening level of 140 mg/kg (EPA, 2018) and the DEQ residential direct contact risk screening level of 154 mg/kg (DEQ, 2018). Samples will be sieved at the laboratory prior to analysis. At a minimum, the frequency of total lead sampling in soil shall follow DEQ guidelines for one composite sample per 625 square feet of exposed soil; however, Tetra Tech may elect to sample at a higher frequency based upon where the LBP is observed on external building surfaces and the building demolition plans. TCLP and/or SPLP analysis will be performed for the purpose of soil disposal during Site demolition and evaluating the risk of leaching to groundwater, if necessary.

3.3 MERCURY, PCB, AND FREON

3.3.1 Mercury

Free (liquid) mercury or mercury vapor in components can be a source of mercury leaching into the environment and is identified as a characteristic hazardous waste (0009) under 40 CFR.261.24. Based on the identification as a hazardous waste, mercury-containing fixtures and equipment must be disposed of at a registered hazardous waste facility.

Management and disposal by businesses of fluorescent light bulbs and other mercury-containing bulbs are regulated under the Resource Conservation and Recovery Act, Universal Waste Rule, and Subtitle C hazardous waste regulations.

3.3.2 PCBs

PCBs in ballasts and electrical components can be a dermal hazard and a source of PCBs leaching into the soil. Transport and disposal of PCBs must comply with 40 CFR 761.62, and must comply with applicable Department of Transportation requirements.

3.3.3 Freon

Freon gas includes a number of gaseous, colorless chlorofluorocarbons that are commonly used as refrigerants. The EPA regulates the emission of Freon gas into the atmosphere due to its ozone depleting capabilities. Through Title VI, Stratospheric Ozone Protection, of the Clean Air Act Amendments of 1990, the EPA regulates Freon gas and requires mandatory recycling and a ban on the intentional venting or releasing of refrigerants.

4.0 SAMPLING APPROACH

This section presents the applicable sampling methodologies for the hazardous substances identified in Table 2, Section 2.2.1. The following SOPs will be followed and are presented in **Appendix D**:

- Asbestos Inspections
- LBP Inspections
- Mercury visual inspections
- PCB visual inspections

Field personnel will mobilize out of Tetra Tech offices in Helena and Billings, Montana, with the necessary equipment to complete sampling tasks. Tetra Tech SOPs for soil sampling and sample handling are on file with DEQ.

4.1 ASBESTOS SAMPLING

Suspected ACMs are grouped as homogeneous areas if the material is uniform in appearance and texture. If the inspector decides that a material is not similar in appearance and texture to other materials in the building, then the inspector will distinguish the material as unique and collect samples of each. Bulk samples are collected in plastic bags, labeled, and sealed immediately upon collection. Sampling instruments are wiped clean with moist towelettes after the collection of each sample to prevent cross-contamination between samples. A unique sample identification number is assigned to each sample that includes a reference to the material type, location, and batch.

Upon completion of sampling activities, the bulk samples will be delivered, along with completed chain-of-custody documentation, to Crisp Analytical Labs (Crisp) of Carrollton, Texas. Crisp is accredited by the American Industrial Hygiene Association for bulk asbestos sample analysis. Bulk asbestos sample analysis will be performed using polarized light microscopy (PLM) in accordance with the EPA Interim Method 600/R-93/116, for identification of mineral forms of asbestos. The quantification of asbestos in the sample is intended to be a visual estimate only. The limit of detection for this method is 1 percent by volume. A copy of the Crisp chain-of-custody form is presented in **Appendix E**.

4.1.1 Friable Surfacing Material

The number of samples collected from friable surfacing material was determined based on the following protocol developed under AHERA.

Table 4 - Friable Surfacing Material Sampling Protocols

Surface Area	No. of Samples
1,000 square feet or less	Three bulk samples
1,000 to 5,000 square feet	Five bulk samples
Over 5,000 square feet	Seven bulk samples

4.1.2 Thermal System Insulation

Thermal system insulation will be sampled in a randomly distributed manner, with at least three bulk samples collected from each homogeneous material. At least one bulk sample will be collected from each homogeneous material of patched thermal system insulation that was not assumed to be ACBM.

Bulk samples will also be collected from each insulated mechanical system where cement or plaster was used on fittings, such as tees, elbows, or valves. The number of samples was sufficient to determine whether the material is asbestos containing. Generally, three samples were collected from each homogenous area.

Bulk samples will not be collected from any homogeneous material where the inspector determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-asbestos containing building material.

4.1.3 Miscellaneous Material

Bulk samples will be collected from each miscellaneous material. The number of samples will be sufficient to determine whether the material is asbestos containing. Generally, three samples were collected from each homogenous area.

4.1.4 Non-Friable Suspected Material

The number of samples collected from non-friable suspect ACM was sufficient to determine whether the material was asbestos containing. Generally, three samples were collected from each homogenous area.

4.2 LEAD SAMPLING

4.2.1 Lead Based Paint

LBP inspections include documenting types of painted building components and substrate materials. Typical building components tests include walls, door units, window units, ceilings and structural members. Substrate materials typically consisted of metal and concrete. Building components are cataloged based on location, specific component type, and substrate material. The EPA and HUD define a lead inspection as a surface-by-surface investigation to determine the presence of LBP per HUD LBP inspection guidelines. Tetra Tech uses field XRF methodology to determine the presence or absence of LBP as XRF is identified as the recommended method to determine lead in paint (HUD, 2000). For these inspections, Tetra Tech personnel utilize a Niton XLP, Spectrum Analyzer XRF, which automatically calculates measurable amounts of lead in paint by correcting for substrate conditions.

4.2.2 Lead Waste Characterization for Disposal

Tetra Tech will collect one representative composite sample of lead containing building components per American Society for Testing and Materials (ASTM) Method E1908-10. The samples will be transported under standard chain of custody protocol to International Asbestos Testing Laboratories, Inc. (IATL) of Mount Laurel, New Jersey for TCLP lead analysis. The tests will be conducted in accordance with SW846 "Test Methods for Evaluating Solid Waste," 3rd Edition, updates I, II, IIA, IIB, III, which will determine the classification status of the materials; the lead concentration of materials disposed of in Class II landfills may not exceed 5 milligrams per liter when tested using the TCLP method.

4.2.3 Lead in Soil

If LBP is observed on external building surfaces than samples will be collected for XRF analysis from beneath the building drip line in 1-foot increments to determine the appropriate sample distance from the building. Samples will be placed in Ziplock baggies and brought to the Tetra Tech Helena office for XRF screening. Sample distances exhibiting the highest reading will then be selected for further testing. Five-point composite surface soil samples from alongside the building drip line will be collected at the appropriate distance. At least one composite sample will be collected from each side of the building at a frequency of 1 per 625 square feet of exposed soil. Sub-samples will be transferred to a decontaminated stainless-steel container and spade and mixed until soil consistency becomes homogenous. Each composite sample will be placed in a labeled laboratory supplied

container and submitted for laboratory analysis of total lead by EPA method 6020 which includes using soil that passes through a No. 60 mesh sieve. Per consultation with DEQ, if samples exceed the leaching to groundwater screening level of 140 mg/kg (EPA, 2018) the samples will be analyzed by the SPLP (method is SW846-1312) for potential for leaching to groundwater. If laboratory results exceed the direct contact screening level of 154 mg/kg than soil samples will be further analyzed by the TCLP (EPA method is SW846-1311) to characterize the material for disposal. All soil samples will be hand delivered to Energy Laboratories, Inc. (Energy) of Helena, Montana per Tetra Tech SOPs on file with DEQ.

4.3 MERCURY, PCB'S, AND FREON

4.3.1 Mercury

Mercury has properties that have led to its use in many different products. It conducts electricity, forms alloys with other metals, and expands in response to changes in temperature and pressure. While some manufacturers have reduced or eliminated their use of mercury in products, there are still many existing items in the marketplace that contain mercury.

An experienced industrial hygiene technician will visually evaluate the buildings to determine if there are visible signs of mercury-containing light fixtures, thermostats, batteries or other equipment. No samples will be collected under this SAP. The purpose of this assessment is to provide recommendations for removal and disposal of mercury-containing equipment, if necessary.

4.3.2 PCB's

PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties ranging from oily liquids to waxy solids. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; in pigments, dyes, and carbonless copy paper and many other applications.

The Site will be evaluated to determine if the presence of PCB-containing equipment such as lighting systems, door dampers, electrical transformers, and/or generators. Visual observations of fluorescent light fixtures in the facility will be made to collect data on the ballasts which can be compared to manufacturer information on known PCB-containing equipment. No samples will be collected for PCBs under this SAP. The purpose of this assessment is to provide recommendations for removal and disposal of PCB-containing equipment, if necessary.

4.3.3 Freon

Freon gas includes a number of gaseous, colorless chlorofluorocarbons that are commonly used as refrigerants. Tetra Tech will visually evaluate the building to determine if there are visible signs of Freon containing equipment. The evaluation will document the estimated number of presumed Freon containing equipment. The location of suspected Freon equipment will be recorded on a drawing.

4.4 FIELD QA

4.4.1 Asbestos Sampling

Approximately 140 asbestos samples and 9 soil composite samples are anticipated to be collected at the Site. In addition, 7 asbestos field duplicates and one soil field duplicate sample are anticipated for field QA/QC samples to achieve 5% sampling ratio (1 duplicate per 20 natural samples).

4.4.2 Lead Based Paint Sampling

During the evaluation for LBP, the inspector will carry a test strip with a known quantity of lead in parts per million. The inspector will take at least three calibration check readings prior to the commencement of the lead-based paint inspection. These calibration check readings should be repeated every four hours, every time the XRF is turned on, or at the end of the sampling job, whichever is more frequent. The XRF is also sent to the manufacturer for annual calibration or when test strip results indicate impaired accuracy, whichever comes first.

The XRF calibration check readings are then taken on the red 1.02 mg/cm² Standard Reference Material paint film, developed by the National Institute of Standards and Technology. The red film is placed on top of a 12-inch piece of styrofoam or some other lead-free material as recommended by the manufacturer before taking readings. Each time calibration check readings are made, three nominal-time readings are taken on the red film and the results recorded. The average of the three calibration check readings is also recorded.

Large differences of calibration check reading averages from 1.02 mg/cm² may alert the inspector to problems in the instrument's performance. The calibration check reading averages should not differ from 1.02 mg/cm² by more than the calibration check tolerance specified in the XRF Performance Characteristics Sheet for the specific instrument used. If the observed calibration check average minus 1.02 mg/cm² is greater than the calibration check tolerance, the instructions provided by the manufacturer should be followed in order to bring the instrument back into control before any more XRF testing is done. All readings taken by the suspended instrument since the last successful calibration check test should be repeated.

5.0 REPORTING

At the completion of each cleanup project Tetra Tech will prepare a Phase II ESA and Cost Estimate Report that summarizes the findings of the hazardous substance investigation with a summary of methods, any deviations from this SAP, analytical results, conclusions, and recommendations for further action, if needed. If further action is needed such as abatement work a detailed cost estimate will be prepared. The report will contain any relevant tables, figures, and attachments including field notes, photographs, laboratory analytical reports, data validation reports, and any other pertinent information.

6.0 REFERENCES

- Helena Independent Record, 2016. *Helena to lose 35 affordable housing units with closure of Memorial Park Apartments*. April 28. [https://helenair.com/news/local/helena-to-lose-affordable-housing-units-with-closure-of-memorial/article_f3de5cb7-e3ca-5b29-89e3-c8824ec9ba8c.html]
- Montana Department of Environmental Quality (DEQ), 2015. *Quality Assurance Program Plan for Environmental Data Operations for the Montana Department of Environmental Quality's Brownfields Program, Revision 0.0*. Helena, MT.
- Montana Department of Environmental Quality (DEQ), 2018. *Surface and Subsurface Soil Screening Flowchart, Parts 1 and 2*. Helena, MT.
- U.S. Environmental Protection Agency (EPA), 2004. *Summary of the Triad Approach*. Deana M. Crumbling. Office of Superfund Remediation and Technology Innovation.
- U.S. Environmental Protection Agency (EPA), 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4*. Office of Environmental Information. EPA/240/B-06-001.
- U.S. Environmental Protection Agency (EPA), 2018. *Regional Screening Levels - Generic Tables*. November [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>]
- U.S. Department of Housing and Urban Development (HUD). 2000. *Guidelines for the Control of Lead-Based Paint Hazards in Housing*, June 1995, revised 1997 and 2000.

FIGURES



Date: 12/27/2018

Figure 1

**40 East Lyndale Ave
Helena, Montana
Memorial Apartments**



SCALE IN FEET



0

2,000



Site



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Date: 12/27/2018



SCALE IN FEET



Site Property Boundary

Figure 2
40 East Lyndale Ave
Helena, Montana
Memorial Apartments

APPENDIX A – HEALTH AND SAFETY PLAN



HEALTH AND SAFETY PLAN (HASP)

PREPARED BY TETRA TECH
FOR SERVICES PROVIDED TO

Montana Department of Environmental Quality

SITE NAME: Memorial Apartments Phase II ESA

SITE LOCATION: 40 East Lyndale Ave, Helena, MT

DATE PREPARED: December 26, 2018

EMERGENCY CONTACT INFORMATION

NOTE: Information entered into the emergency section of this HASP will automatically be entered onto this cover page.

24 Hour Ambulance: 911

Police Department: 911

Fire Department: 911

US Poison Control Centers: 1-800-222-1222

Tt Project Emergency Contact: Nick Sovner 406-202-0466
Roger Herman 406-670-4844

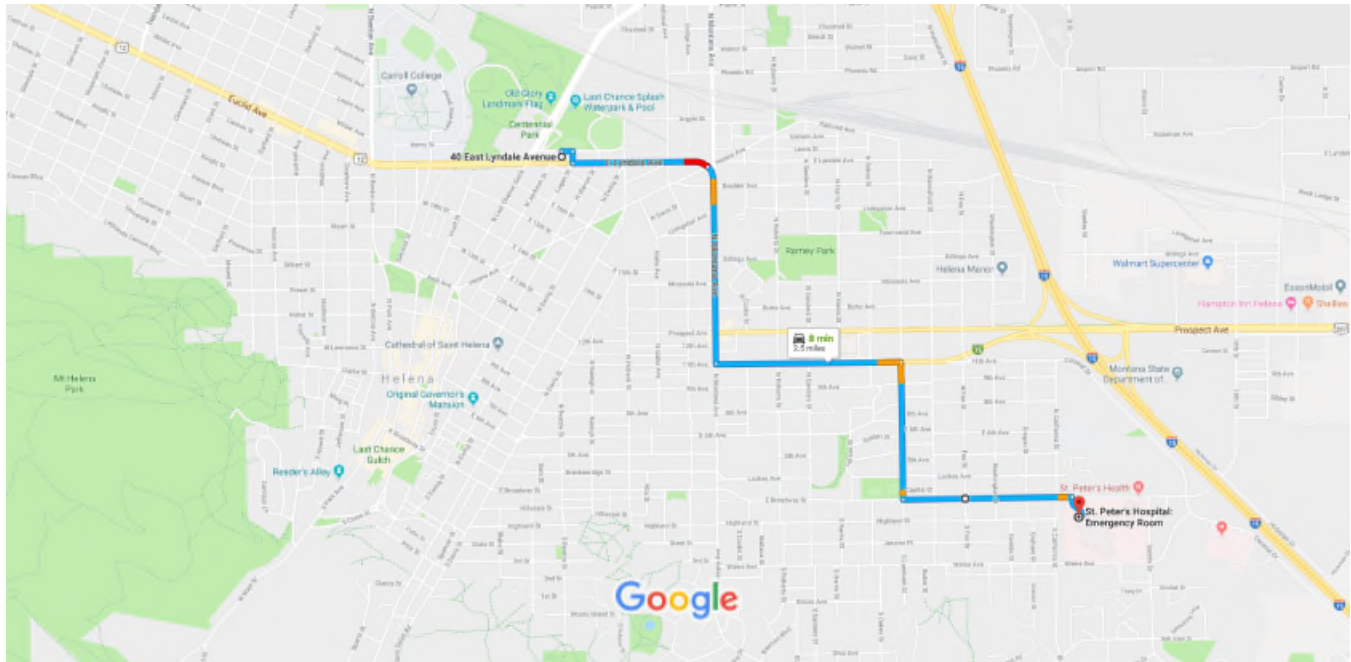
Tt Corporate Emergency Contact: Yvonne Freix
Mobile: 715-297-2476

Name of Closest Hospital: Saint Peters Hospital
Route: Head East onto Lyndale Avenue/Highway 12 follow along Montana Avenue South and 11th Avenue East for approx 1.5 miles. Turn right (south) onto Lamborn St and left (east) on Broadway Ave until reaching destination on right.



40 E Lyndale Ave, Helena, MT 59601 to St. Peter's Hospital: Emergency Room

Drive 2.5 miles, 8 min



Map data ©2018 Google 1000 ft

40 E Lyndale Ave

Helena, MT 59601

Take Logan St to E Lyndale Ave

22 s (351 ft)

1. Head east on Memorial Dr toward Logan St

171 ft

2. Turn right onto Logan St

180 ft

Take N Montana Ave and US-12 E/11th Ave to N Lamborn St

4 min (1.5 mi)

3. Turn left onto E Lyndale Ave

0.4 mi

4. Continue onto N Montana Ave

0.6 mi

5. Use the left 2 lanes to turn left onto US-12 E/11th Ave (signs for I-15 E/US-287 E)

0.5 mi

Follow N Lamborn St and E Broadway St to your destination

3 min (0.9 mi)

-  6. Turn right onto N Lamborn St

0.4 mi
-  7. Turn left onto E Broadway St

0.5 mi
-  8. Turn right
 Destination will be on the right

331 ft

St. Peter's Hospital: Emergency Room

2525 E Broadway St, Helena, MT 59601

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.



TABLE OF CONTENTS

SECTION DESCRIPTION	PAGE NUMBER
Project Identification	1
Site Regulatory Status	1
Review and Approval Documentation	1
Project Dates	1
Tetra Tech Representatives/Responsibilities	2
Tetra Tech Subcontractors	2
Client / Tetra Tech / Subcontractor H&S Program & Policy Bridging Section	3
Site Specific Health and Safety Personnel	3
Tasks Covered Under the Plan	4
Types and Sources of Hazards	4
Chemicals of Concern	5
Hazard Evaluation of Chemicals of Concern	6
Chemicals of Concern/Precautions	7
Physical/Construction Hazards of Concern	8
Task Based Risk Analysis and Protection Plan	9
Personal Protective Equipment Level Definitions	13
Cartridge Changeout Schedule	13
Decontamination Plan	14
Contingency Plan	15
Response Plans - Medical, Fire, Spill, Security, Weather and Disaster	16
Site Control Measures	17
Site Personnel and Certification Status	18
Training and Briefing Topics	19
Drilling Considerations	20
Intrusive Activities Checklist	21
Procedures for Ensuring Unknown Subsurface Structures Identified	22
Required PPE and Equipment Checklist	23
Field Audits	23
Hazardous Materials / Dangerous Goods Packaging and Shipping	24
Confined Spaces	24
Traffic Control Plan	24
Fatigue Management	25
Provisions for Lone Workers	25
Tetra Tech Approval/Signoff Form	26
Subcontractor Approval/Signoff Form	27

Note: The sections highlighted in yellow are required for all health and safety plans with the other sections optional depending on the project, tasks and associated hazards. If this template is used for sites without chemical hazards, the following sections may be eliminated as well; H&S Evaluation Chemicals of Concern, Hazard Evaluation of Chemicals of Concern and Precautions for Chemicals of Concern; and Decontamination Plan.

Forms Attached

Worker / Visitor Sign-In Form	√
Daily Tailgate Meeting Form	√
Field Audit Form	√
Air Monitoring Results - Total Organic Vapors and Toxic Gases	√
Air Monitoring Results - Detector Tubes	√
Equipment Calibration Form	√
Chemical/MSDS Inventory	√
Drill Rig Pre-Shift Inspection Form	√
Subcontractor Project Specific Requirements Verification Form	√
Other _____	√
Other _____	√
Other _____	√

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Prepared By:	Nick Sovner 825 West Custer Avenue	Date:	December 26, 2018
		Tt Project No:	117-8217006
Project Identification:			
Service Type:	Industrial Hygiene	Site Name:	Memorial Apartments Phase II ESA
Client Name:	Montana Department of Envir	Site Location:	40 East Lyndale Ave, Helena, MT
Client Contact:	Jason Seyler	Client Phone No:	406.444.6447
Site History:	Site is an abandoned 35-unit apartment complex formerly used as motel, rest home, and section 8 housing.		
Scope of Work:	Brownfields QEP services include investigation of ACBM, LBP, mercury, PCB, and Freon		
Site Regulatory Status:			
CERCLA/SARA	RCRA	OSHA	OTHER FEDERAL
US EPA: Y	US EPA: Y	1910: Y	Dept of Energy (DOE): N
State: Y	state: Y	1926: Y	Dept of Trans (DOT): N
NPL site: N	NRC	state: Y	USATHAMA: N
	10CFR20: N		Air Force: N
NPL - US EPA National Priorities List NRC - Nuclear Regulatory Commission USATHAMA - US Army Toxic and HazMat Agency		OSHA 1910 - General Industry Standards and Regulations OSHA 1926 - Construction Standard and Regulations OSHA state - site located in a state that has its own OSHA regulations	
Review and Approval Documentation			
Reviewed By:			
Name: Roger Herman		Signature: 	
Title: IH Services Manager		Date: 12/28/2018	
Name:		Signature:	
Title:		Date:	
Reviewer signature also certifies that the PPE selected for this project was based on a hazard assessment of the tasks to be performed and selected according to the requirements established by OSHA in 29 CFR 1910.132 (d).			
Project Dates		HASP Amendment Dates:	
Project Start Date:	January 1, 2019	1	Enter date
Project End Date:	February 28, 2019	2	Enter date
This site HASP must be reissued/reapproved for		3	Enter date
activities conducted after:	December 31, 2019	4	Enter date

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Tetra Tech Representatives		
Branch Address and Phone	Name/Title	Role and Responsibilities
Tetra Tech 406-202-0466 825 W Custer Ave Helena MT 59602	Nick Sovner	Project Manager
Tetra Tech 406-670-4844 618 S 25th St Billings, MT 59101	Roger Herman Various	IH Services Manager Inspectors, Contractor Supervisors
Tetra Tech Subcontractors		
Organization/Address and Phone	Name/Title	Role and Responsibilities
NA		
Scope of Work		

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Client / Tetra Tech / Subcontractor H&S Program & Policy Bridging Section		
Identify which specific H&S programs will be followed for the designated scope of work.		
H&S Program	Specify Program To Be Used	Comments
Emergency Evacuation Procedures	☐ Client ☒ Tetra Tech ☐ Sub ☐ Other	All site personnel will follow the evacuation procedures detailed by the client for this products terminal
Drilling and subsurface structure locates	☐ Client ☒ Tetra Tech ☐ Sub ☐ Other	The ERD Safety Guidance Document will be utilized for identifying potential subsurface structures prior to drilling
Permit Required Confined Space Entry	☐ Client ☒ Tetra Tech ☐ Sub ☐ Other	Sub ABC confined space program for task 1
Lockout / Tagout	☐ Client ☐ Tetra Tech ☐ Sub ☐ Other	
Other	☐ Client ☐ Tetra Tech ☐ Sub ☐ Other	
Other	☐ Client ☐ Tetra Tech ☐ Sub ☐ Other	
Other	☐ Client ☐ Tetra Tech ☐ Sub ☐ Other	
Other	☐ Client ☐ Tetra Tech ☐ Sub ☐ Other	
Tetra Tech's policy is to provide a safe working environment for all employees and contractors so that work may be conducted in a safe and efficient manner. Tetra Tech employees and subcontractor employees working at the specific project covered by this HASP shall adopt and adhere to this HASP and the above referenced programs/policies by following all requirements stated in the safe work practices applicable to their work. No work is so urgent or important that we cannot take the time to do it safely. ALL personnel on site including subcontractor's have the right and responsibility to stop the work if they feel a safety protocol is not being followed or if they feel an unsafe condition exists.		
Site Specific Health and Safety Personnel		
Connor McHugh has been designated Site Health and Safety Coordinator (SHSC) for activities to be conducted at this site. The SHSC has total responsibility for ensuring that the provisions of this HASP are adequate and implemented in the field. Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as SHSCs are experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120. Cody Knowlton has (have) been designated as the alternate SHSC(s).		

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Activities Covered Under This Plan			
Task	1	Schedule: Duration	
Industrial Hygiene Inspection		Inspection and sampling of ACBM, LBP, mercury, PCBs, and Freon	
Types and Sources of Hazards			
Physiochemical	Radiation		Chemically Toxic
Flammable: N	Ionizing: No	Inhalation: Y	
Explosive: N	Non-Ionizing: No	Ingestion: Y	
Corrosive: N	Other		Absorption: Y
Reactive: N	Physical Hazards: Y	Carcinogen: Y	
O2 Rich: N	Construction Activities: Y	Mutagen: N	
O2 Deficient: N			Teratogen: N
Biological			OSHA listed: Y
Etiological Agent: N	Specific OSHA Standards: Asbestos 1910.1001		
Other: N			
(plant, insect, animal)			
Etiological - disease causing agent		Chemical toxicity information (such as routes of entry and whether or not a chemical is carcinogenic, mutagenic, etc) can be found in the Chem worksheet of this template, on the chemicals of concern page under target organs, or in the NIOSH pocket guide.	
Direct Sources of Hazards		Indirect Sources (Describe)	
Air: Y	Other: N	Building Materials	
Groundwater: N	list if others		
Soil: Y	list if others		
Surface Water: N			

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Health and Safety Evaluation - Chemicals of Concern				
Chemical Name	Entry Route	Carc*	Symptoms	Target Organs
Asbestos	Inh, Ing,	Y	Generally no immediate symptoms occur, but exposure could latently result in scarring of the lungs (asbestosis), lung cancer (mesothelioma), or gastrointestinal cancers.	Lungs, gastrointestinal system
Lead (elemental and other compounds as Pb)	Inh, Ing, Con	n	Weakness, exhaustion, insomnia, facial pallor, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, tremor, wrist and ankle paralysis, encephalopathy, kidney disease, eye irritation, hypotension.	Eyes, GI tract, central nervous system, kidneys, blood, gingival tissue.
Mercury (elemental and inorganic compounds as Hg)	Inh, Abs, Ing, Con	n	Irritant (eyes, skin), cough, chest pain, dyspnea, bronchial pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, proteinuria, GI disturbance, anorexia, weight loss.	Eyes, skin, respiratory system, central nervous system, kidneys.
Polychlorinated Biphenyls (PCB's) - Chlorodiphenyl 42% chlorine (54% chlorine)	Inh, Abs, Ing, Con	y	Irritant (eye and skin), chloracne, liver damage, reproductive effects cancer.	Skin, eyes, liver, reproductive system. In animals; tumors of the pituitary gland and liver, leukemia.

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Health and Safety Evaluation - Hazard Evaluation of Chemicals of Concern					
Chemical Name	LEL/UEL (%)	Flam	OT (ppm)	IDLH	Exposure Limits
Asbestos	NA	n	-	Not Determined	OSHA-PEL-TWA = 0.1 fiber/cm ³ ; OSHA 30-min Excursion = 1 fiber/cm ³ ACGIH-TLV-TWA = 0.1 fiber/cm ³ ;
Lead (elemental and other compounds)	NA	n	-	100 mg/m3	OSHA-PEL-TWA = 0.05 mg/m3; ACGIH-TLV-TWA = 0.05 mg/m3; NIOSH-REL-TWA = 0.05 mg/m3
Mercury (elemental and inorganic compounds)	NA	n	-	10 mg/m3	OSHA-PEL-TWA = 0.1 mg/m3; ACGIH-TLV-TWA = 0.025 mg/m3 (skin); NIOSH-REL-TWA = 0.05 mg/m3 (skin); NIOSH-REL-Ceiling = 0.1 mg/m3 (skin)
Health and Safety Evaluation - Chemicals of Concern / Precautions					
<u>PRECAUTIONS</u> INGESTION: All listed chemicals have the potential for accidental ingestion, however in work place settings it is not considered a primary route of entry. All accidental ingestions should be addressed by referring to the MSDS and seeking immediate medical attention. INHALATION: Listed chemicals capable of inhalation routes of entry should be maintained below the established exposure limits. If there is indication that the exposure limits are being exceeded, appropriate respiratory protection should be used. If appropriate PPE has not been planned for, work should cease and the SHSC should be contacted. ABSORBANCE/CONTACT: Listed chemicals presenting an absorbance or contact hazards should be handled only with the use of appropriate PPE. NOTE: Overexposure to any chemical via any route of entry should be addressed by referring to the MSDS and seeking immediate medical attention. Avoid contact with all chemical hazards when possible and consult MSDS before any exposure may occur. <u>OTHER PRECAUTIONS</u> NA					

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

ABBREVIATIONS

LEL= Lower Explosive Limit

UEL = Upper Explosive Limit

ppm = parts per million

mg/m3 = milligram per cubic meter

TWA = Time Weighted Average

STEL = Short Term Exposure Limit

Flam = Flammable

IDLH = Immediately Dangerous to Life and Health

OT = Odor Threshold

NOTE: Odor Thresholds were obtained from the American Industrial Hygiene Association's (AIHA) publication on Odor Thresholds. The listed thresholds are best estimates based on existing experimental data. (d) indicates the threshold for detection and (r) indicates the threshold for recognition.

NOTE: * In 1989, OSHA published new exposure limits (in most cases lower) for some chemical compounds. However, in 1993, under a court decision, these newly established limits were vacated and reverted back to the previous limit or to none if a limit was not previously established for the chemical compound. The limits listed in the table are the older, enforceable OSHA limits. It is recommended that the most conservative exposure limit listed be used in assessing exposures and determining controls and safety measures.

Health and Safety Evaluation - Physical / Construction Hazards of Concern

For the hazards that apply to this site, indicate the task(s) to which each particular hazard applies. For the hazards that do not apply to this site, delete the "1" in the Task No(s) column.

HAZARD	Task No(s)	Protection Procedure
Noise	1	Wear hearing protection during high noise activities
Heat - Ambient Air	1	Frequent intake of fluids and adequate work-rest schedule
Cold	1	Warm clothing; if symptoms develop - go to warm area
Rain	1	Wear rain gear; watch footing on wet surfaces
Snow	1	Warm clothing - watch footing on slippery surfaces
Electrical Storms	1	Discontinue operations
Heavy Lifting / Moving	1	Utilize proper lifting techniques
Rough Terrain	1	Watch footing
Housekeeping	1	Maintain order
Structural Integrity	1	Have integrity of structure verified before work begins
Neighborhood	1	Awareness of area; comply with contingency / ER plans
Remote Area	1	Buddy system; comply with contingency / ER plans
Traffic	1	Obey traffic regulations; implement traffic control
Heavy Equipment Operation	1	Only qualified operators; inspections and back-up alarms
Lifting Equipment Operation	1	Only licensed operators; equipment inspections required
Manlifts	1	Only trained users; equipment inspections required
Working At High Elevations	1	Utilize appropriate fall protection
Using Ladders	1	Verify integrity of ladders; support and tie off
Using Scaffolding	1	Verify integrity of scaffolding; periodic training required
Materials Handling	1	Determine safest physical means of handling material
Demolition	1	Awareness of specific exposures; hard hat, steel toes
Utilities - Overhead	1	Keep objects more than 20 feet from power lines
Electrical - General	1	See Tt Safe Work Practice; Comply with OSHA regulations
Electrical - High Voltage	1	See Tt Safe Work Practice; Comply with OSHA regulations
Hand Tools	1	Use appropriate tools for the task-inspect prior to use
Powered Hand Tools	1	Follow operating instructions - use PPE

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Task Based Risk Analysis and Protection Plan		
The preceding tables have identified the known and suspected hazards to be present in performing the tasks required to complete this project. Below is a breakdown by task of the hazards, likelihood of exposures, and protective protocols to be used to minimize risk.		
Task:	1	Industrial Hygiene Inspection
Associated Hazards:	CHEMICAL	None
	PHYSICAL	Physical hazards associated with a construction site such as slips trips, overhead hazards, poorly lit environments, power tools.
	BIOLOGICAL	Bites from insects or rodents living inside the building
	OTHER	Asbestos exposure via inhalation
Exposure Potential:	CHEMICAL	Moderate
	PHYSICAL	Moderate
	BIOLOGICAL	Moderate
	OTHER	Moderate
PPE:	Level	Field personnel are required to wear HEPA purified air mask, tyvek suites, heavy steel toe shoes, work gloves, eye protection, and hearing protection if power equipment is operating.
	C	
Air Monitoring Plan	NA	
Air Monitoring Equipment	NA	
Precautions:	CHEMICAL	Do not handle equipment that may contain mercury, PCBs or freon.
	PHYSICAL	Wear appropriate PPE, maintain situational awareness
	BIOLOGICAL	Wear appropriate PPE, maintain situational awareness
	OTHER	Follow all Tetra Tech SOPs for asbetsos work and ahere to OSHA work practices

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Personal Protective Equipment Level Definitions

Level D	Level D protection is assigned when minimal protection is warranted. Level D offers protection from nuisance contamination only and is made up of a typical work uniform for the work to be performed. Level D protection includes the following: Hard hat, safety glasses, hearing protection (as required), gloves, and steel toe boots.
Level C	Level C protection is assigned when the type(s) and concentration(s) of contaminants is known and the criteria for using an air-purifying respirator are met. Level C is an upgrade from level D and in addition to the requirements of level D, the following requirements must be met: Level D plus Full-face or half-mask air purifying canister/cartridge equipped respirator, hooded chemical resistant clothing, and inner and outer chemical resistant gloves.
Level B	Level B protection is assigned when the type(s) and concentration(s) of contaminants is unknown or is known and warrants the highest level of respiratory protection with a lesser level of skin protection. Level B is an upgrade from level C and in addition to level C requirements, the following requirements must be met: Level C plus pressure-demand full-face SCBA or pressure demand supplied air respirator with escape SCBA.
Level A	Level A protection is assigned when the atmosphere is IDLH (Immediately Dangerous to Life and Health) and warrants the highest degree of respiratory protection and skin protection. Level A is an upgrade from level B and in addition to level B requirements, the following requirements must be met: Level B plus totally encapsulating chemical-protective suit.

CARTRIDGE CHANGEOUT SCHEDULE

Cartridge Changeout Schedule: A minimum of daily changeout or more frequently if becomes clogged

Method Used to Determine Schedule: Air passage becomes difficult, reduced

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Decontamination Plan
Personal Decontamination
The section outlining task by task risk assessment and protection plan specifies the level of protection required for each task. Consistent with the level of protection required, step by step procedures for decontamination for each level of protection are given below. Follow standard decontamination procedures, carefully remove PPE upon exiting the work area and dispose of in contractor style trash bags.
Levels of Protection Required for Decontamination Personnel
The level of protection required for a person assisting with decontamination is: LEVEL: D Modification: (upgrade or downgrade) will be made under the following conditions: Indicate the conditions that will trigger the upgrade or downgrading of PPE worn by personnel assisting in decontamination. Example: Upgrading and downgrading of personal protective equipment for personnel designated as decon personell will follow the requirements for that of the workers involved.
Disposition of Wastes (Contaminated, General, Recyclable)
The following outlines the protocol to be followed for contaminated wastes that are encountered: Disposable sampling and PPE equipment should be incorporated with abatement waste for proper disposal
Sampling Equipment Decontamination
The following outlines the protocol to be followed for decontamination of sampling equipment: Reusable sampling equipment will be cleaned with moist towelettes
Non-Sampling Equipment Decontamination
The following outlines the protocol to be followed for decontamination of non-sampling equipment: Reusable non-sampling equipment will be cleaned with moist towelettes

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Contingencies			
Emergency Contacts and Phone Numbers			
Agency		Contact	Phone Number
Tt Project Emergency Contact		Nick Sovner	406-202-0466
24 Ambulance Service		911	911
Fire Department		911	911
Police Department		911	911
US Poison Control Center		NA	1-800-222-1222
Onsite Coordinator		Various	
Site Telephone		NA	
Nearest Telephone		Personal	
In the event of an incident, the TT-MM reporting protocol requires that a corporate contact be notified as soon as possible.	Yvonne Freix	Office: NA Mobile: 715-297-2476	
	Michelle Gillie	Office: 832-251-5189 Mobile: 610-348-7197	
	Michael Hatten	Office: 406-443-5210 Mobile: 406-459-2551	
	Jen Fullmer	Office: 801-971-1381 Mobile: 801-712-5425	
Name of Hospital:		Saint Peters Health Medical Group	Distance: 2.0 mile
Address:		3330 Ptarmigan Ln, Helena, MT	Time: 6 min
Type of Service:		Urgent Care, Occupational Health	
Route:		Head East onto Lyndale Avenue/Highway 12 follow along Montana Avenue South and 11th Avenue East for approx 1.5 miles. Turn right (south) onto Lamborn St and left (east) on Broadway Ave until reaching destination on right.	
In the case of a SERIOUS OR LIFE-THREATENING EVENT (any injury, accident or near-miss event): 1. Seek emergency medical treatment immediately 2. Once the injured person(s) is appropriately cared for, call a corporate contact listed on the emergency wallet card and update the employee's supervisor and project manager as soon as possible.			
Secondary Provider (Occupational Health Clinic)			
Name of Occ Clinic:		Bozeman Health	Distance: 25 mi
Address:		915 Highland Blvd, Bozeman, Montana	Time: 27 min
Type of Service:		Emergency and Trauma/Urgent Care	
Route:		Head west on Memorial Drive and turn right onto N Last Chance Gulch for approx 0.4 mi, then turn left (north) onto Montana Ave. Turn Left onto Ptarmigan Ln after approximately 1 mi.	
In the case of a NON-EMERGENCY/NON-LIFE THREATENING INCIDENT (any injury, accident or near-miss event) call one of the corporate contacts listed on the wallet card (and above) prior to an Employee visiting a physician and implementing the following procedure: 1. Administer first aid immediately. 2. Tetra Tech employees call WorkCare (Tetra Tech contracted physicians) at 1-800-455-6155 for a triage call/discussion with an Occupational Health Nurse (OHN). 3. Mention that this is regarding an injury. At this point the nurse/physician will assist the employee/supervisor/H&S Coordinator to determine the best treatment plan. For example, he/she will recommend first aid or urgent care. 4. WorkCare will require the following information when a call is placed: Name of person calling, phone number, location, name of person injured, Social Security number, date and type of injury.			

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Response Plans	
Medical - General	
First Aid Kit:	Type: vehicle Location: vehicle
Eye Wash:	Required?: Y Location: vehicle
Safety Shower:	Required?: N Location: NA
Special Procedures:	Consult MSDS for appropriate first aid measures related to chemical exposures. Seek immediate medical attention when incidents warrant anything beyond minor first aid response. NA
Fire/Explosion	
Special Procedures:	Use available fire extinguisher to extinguish small fires. For any fire beyond the control of a portable fire extinguisher contact the local firefighting authorities as listed in the emergency contact section of this plan.
Fire Extinguisher:	Type: ABC Location: Vehicle
Spill Response	
Special Procedures:	NA
Special Gear:	Type: NA Location: NA
Weather/Natural Disaster Emergency	
Special Procedures:	Cease work immediately and head for home base (define where home base is). If travel is not possible seek immediate shelter as available.

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Site Control Measures		
Work Zones		
Exclusion Zone:	In this section describe the exclusion zone including where it is located, approximate dimensions, unique situations, who will be allowed in the exclusion zone etc.	
Decon Zone:	In this section describe the decontamination zone including where it is located, approximate dimensions, access to the decon zone from the exclusion and support zones etc.	
Support Zone:	In this section describe the specific details associated with the support zone	
Other Zones:	In this section describe any other established zones or areas including staging areas, equipment storage and location, other unique facilities or areas of the site that site personnel should be aware of.	
Methods for Delineating Zones		
Work Zone Delineation Plan	In this section describe in detail the plan for delineating the zones and the site and for preventing unauthorized access to various areas of the site. Include the specifics on what will be used (fencing, cones, signage, etc.)	
Delineation Equipment	In this section list the specific equipment and supplies that need to be available on the site as dictated by the delineation plan above. This may include but not be limited to traffic cones, flags, fencing, specific signs etc.	
Security Measures		
In this section describe any additional security measures that will be taken at the site including details on locking and securing the site after hours, third party professional security if appropriate, client specific security that might be in place, etc.		
Security Related Contacts		
Agency	Contact Name	Phone Number
Site Map		
See Attached		

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Site Personnel and Certification Status			
Name:	Various		Medical Current: Y
Title:	Field Inspector		HAZWOPER Current: Y
Task(s):	Give task number(s) SSE? NA		Fit Test Current: Y
CPR/First Aid:	Y		
Other:	HAZWOPER, MT Cert Asbestos Inspectors and Contractor Supervisors		
Name:			Medical Current:
Title:			HAZWOPER Current:
Task(s):	SSE? y or no or NA		Fit Test Current:
CPR/First Aid:			
Other:			
Name:			Medical Current:
Title:			HAZWOPER Current:
Task(s):	SSE? y or no or NA		Fit Test Current:
CPR/First Aid:			
Other:			
Name:			Medical Current:
Title:			HAZWOPER Current:
Task(s):	SSE? y or no or NA		Fit Test Current:
CPR/First Aid:			
Other:			
Name:			Medical Current:
Title:			HAZWOPER Current:
Task(s):	SSE? y or no or NA		Fit Test Current:
CPR/First Aid:			
Other:			
Medical Current:	All personnel, including visitors entering the exclusion or contamination reduction zones must be certified as medically fit to work and to wear a respirator if appropriate.		
Training Current:	All personnel, including visitors entering the exclusion or contamination reduction zones must have certifications of completion of training in accordance with OSHA 29 CFR 1910.120.		
Fit Test Current:	All personnel, including visitors entering any area requiring the use or potential use of any negative pressure respirator must have at a minimum, a qualitative fit test administered in accordance with OSHA 29 CFR 1910.134 or ANSI within the last 12 months. If site conditions require the use of a full face negative pressure air purifying respirator for protection against asbestos or lead, employees must have a qualitative fit test in accordance with OSHA 20 CFR 1910.1002 or 1025 within the last 6 months. * Bearded workers, who can not be fit-tested for a tight face fitting respirator, are required to wear a powered air purifying respirator (PAPR).		
Note:	These requirements should be verified for any subcontractor personnel assigned to the site.		

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Training and Briefing Topics		
Note: The following topics will be covered as indicated (i.e., the initial site training, daily, monthly or periodically). Delete the X's corresponding to the topics that do not apply to this site. Indicate the frequency for the topics that do apply.		
Site characterization and analysis (29 CFR 1910.120 i)	X	Daily
Physical Hazards	X	Daily
Chemical Hazards	X	Daily
Site Control (29 CFR 1910.120 d)	X	Daily
Engineering Controls and Work Practices (29 CFR 1910.120 g)	X	Daily
Tools	X	Daily
Ladders (29 CFR 1910.27 d)	X	Daily
Scaffolds	X	Daily
Overhead and Underground Utilities	X	Daily
Structural Integrity	X	Daily
PPE (29 CFR 1910.120 g; and 1910.134)	X	Daily
Respiratory Protection (29 CFR 1910.120 g; and 1910.134)	X	Daily
Level C - Personal Protective Equipment	X	Daily
Level D - Personal Protective Equipment	X	Daily
Air Monitoring (29 CFR 1910.120 h)	X	Daily
Decontamination (29 CFR 1910.120 k)	X	Daily
Shipping and Transportation (49 CFR 172.101)	X	Daily

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Drilling Considerations	
Unfilled Bore-holes	
Will bore-holes be drilled and need to be left unfilled for a period of time?	N
If yes, length of time before filled or well installed.	NA
Safe guarding requirements:	NA
Filling Bore-holes	
Will bore-holes be drilled which require filling?	N
Procedure for backfilling of bore-holes	NA
Other Site Specific Drilling Concerns:	
NA	

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Intrusive Activities Checklist			
Will intrusive activities be performed for work under this HASP?		Y	
If yes, describe the type(s) of intrusive activity.		Intrusive sampling of building materials may be necessary	
<u>Subsurface Structures Present</u>			
Type	Present?	Located ?	Method Used/To Be Used for Locating
Electrical	Y	NA	NA
Gas	Y	NA	NA
Water	Y	NA	NA
Product Line	N	NA	NA
Product Tank	N	NA	NA
Other			
<u>Shut-Offs Located</u>			
Type	Location of Shut-Off		
Electrical	Responsibility of primary demolition contractor		
Gas	Responsibility of primary demolition contractor		
Water	Responsibility of primary demolition contractor		
Product	NA		
Other	NA		
<u>Emergency Contacts for Subsurface Structure Repair</u>			
Type	Appropriate Contact for Emergency Repair of Specific Subsurface Structure Type/Material		
Electrical	NA		
Gas	NA		
Water	NA		
Product	NA		
Other	NA		

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Procedure for Ensuring Unknown Substructures Identified		
Although potential known and unknown subsurface structures are identified per the above sections, there is always the potential for unknown subsurface structures to be encountered during intrusive activities. Therefore, a protocol needs to be established for each particular site. For this site, the following procedures will be followed for the intrusive activities identified above: (Delete the X's in front of the procedure(s) that do not apply to this site.)		
X	"One Call" or equivalent utility locate per the local system for the site will be made (this is mandatory on all sites)	
X	Follow up with one-calls (i.e. document who will be contacted with respect to the one call service along with their phone numbers and place and document calls to those organizations that did not respond). Form for one call follow up is attached.	
X	Line locate using a geophysical subcontracted service (should be considered for intrusive work on all private properties where there is the potential for unidentified subsurface structures)	
X	Daylighting (one type indicated below should be selected for all projects. Most ConocoPhillips sites require mechanical daylighting - determine this in conjunction with client representatives.)	
	X	Hander augering will be required to the following depth.
		Feet bgs
If this depth is not achievable, offset the boring location appropriate based on previous subsurface locates or contact the PM and/or client representative to determine further actions before proceeding with intrusive activities.		
	X	Mechanical daylighting will be conducted via the following means to the designated depth..
		Method of mechanical daylighting that will be utilized (i.e. hydrovac, air-knifing, etc.)
		Feet bgs
Other Specific Subsurface Identification Requirements for this Site NA		

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Required PPE and Equipment Checklist		
Delete the X's corresponding to the PPE/Equipment that does not apply to this site.		
HEALTH AND SAFETY BINDER / HASP, SITE CHECK IN/OUT PROCEDURES, ETC.	X	
RELATED MSDS's	X	
SAFETY GLASSES WITH SIDE SHIELDS	X	
FACE SHIELD	X	
HARD HAT	X	
STEEL-TOED BOOTS	X	
GLOVES TYPE: Leather	X	
COVERALLS TYPE: Tyvek	X	
RESPIRATOR TYPE: 1/2 or full face	X	
RESPIRATOR CARTRIDGES TYPE: HEPA	X	
HEARING PROTECTION TYPE:	X	
HIGH VISIBILITY WEAR TYPE:	X	
WASTE DISPOSAL BAGS / LABELS	X	
FIRE EXTINGUISHER	X	
EYE WASH BOTTLE	X	
FIRST AID KIT	X	
FLASHLIGHT	X	
DRINKING WATER AMOUNT: 2L/dy	X	
TOOL KIT ITEMS: Standard sampling kit	X	
SURVIVAL KIT ITEMS: Jump cables	X	

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

FIELD AUDITS	
A field auditing program should be determined for the project based on the scope of work, duration of the project and degree of hazards associated with the tasks involved.	
During the course of this project a minimum number of field audits will be conducted as follows:	max 1
The following person is responsible for ensuring the audits and associated corrective actions are completed:	PM
HAZARDOUS MATERIALS / DANGEROUS GOODS PACKAGING AND SHIPPING	
Will known or suspect hazardous materials / dangerous goods be packaged and shipped?	Y
If shipping materials classified or suspected as hazardous materials or dangerous goods attach and follow SWP 5.38 entitled "SHIPPING HAZARDOUS MATERIALS". NOTE: DOT HAZMAT training is required to package, label, prepare paper work and ship hazardous materials. TtMM personnel typically do not maintain this training and therefore these tasks typically need to be subcontracted to trained personnel.	
CONFINED SPACES	
Are there any identified or potential confined spaces associated with the project?	Y
Will the project involve any confined space entry?	N
If confined space entry is involved in the project, a confined space entry and permitting procedure needs to be identified here and attached to this HASP. If there are confined spaces present but they will not be entered, the spaces should be identified here and an indication provided as to how they will be labeled/marked to prevent entry. If neither apply, both answers can be indicated as no and an NA entered in this field.	
TRAFFIC CONTROL	
Is there exposure to traffic at this site during any of the designated work activities?	N
For which task(s) will traffic be an issue of concern ?	NA
Will the project require an extensive or formal traffic control plan?	N
NA	
Traffic Control Sketch	
NA	

HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

FATIGUE MANAGEMENT	
Is the work extensive or out of the ordinary typical work schedule with the potential to result in worker fatigue that could increase the potential for incidents to occur during work tasks or travel to/from the site?	Y
Describe situations or circumstances that have to potential to significantly impact worker fatigue.	
Extreme temperatures, inability to eat or drink while in the exclusion zone	
Define precautions that will be taken to minimize worker fatigue and eliminate/minimize its impact on safety.	
dress appropriately with warm clothing, stay hydrated prior to entering exclusion zones, take snack breaks	
PROVISIONS FOR LONE WORKERS	
Will Tetra Tech employees or subcontractor employees be required to or have the potential to work alone?	Y
For which task(s) will a site worker be or have the potential to be working alone?	1
List the type of employees that will be permitted to work alone and under what conditions:	Tetra Tech
Mobilizing to the site, sampling	
Note: Personnel should not be allowed to work alone if there is high hazard potential associated with the site and/or task they will be performing, including but not limited to high physical hazard potential (such as heavy equipment operation, high voltage, intrusive activities, etc.), potential for extreme acute chemical exposure, high crime areas, remote sites, etc.	
Lone Worker Check-In Procedure	
Detail a daily check-in procedure for all site personnel who will be working alone. Note: There may be a need to detail different check-in procedures for different tasks, personnel etc.	
Form of communication to be used for check-in:	phone
Primary check-in person:	Roger Herman
Alternate check-in person:	Nick Sovner
Check-In Schedule	
X	Initial Check-In: Prior to leaving the office
X	Periodic Check-In: Once while conducting field activities
X	Final Check-Out: upon returning to the office



HEALTH AND SAFETY PLAN (HASP)

Memorial Apartments Phase II ESA AT 40 East Lyndale Ave, Helena, MT

Tetra Tech Compliance Agreement Form

PROJECT SCOPE: Brownfields QEP services include investigation of ACBM, LBP, mercury, PCB, and Freon

PROJECT NUMBER:

117-8217006

I have read, understood, and agree with the information set forth in this Health and Safety Plan along with any related attachments and discussed in the Personnel Health and Safety briefing.

[illegible]



TETRA TECH - Daily Project/Tailgate Safety Meeting Form

By signing this form I am acknowledging that I understand the information discussed during the meeting. I have had the opportunity to ask and have questions answered and understand that I have the responsibility to stop work if something has changed or if I feel there is an unsafe condition that has not been addressed.

MEETING DETAILS	SIGNED BY ALL IN ATTENDANCE
PROJECT NO. _____ NO. OF PEOPLE ATTENDING: _____	1. _____
JOB LOCATION: _____	2. _____
MEETING DATE: _____ TIME OF MEETING: _____	3. _____
MEETING CONDUCTED BY: _____	4. _____
TOPICS DISCUSSED: _____	5. _____
_____	6. _____
_____	7. _____
ACCIDENTS REVIEWED: _____	8. _____
_____	9. _____
_____	10. _____
TASKS FOR THE DAY: _____	11. _____
_____	12. _____
_____	13. _____
POTENTIAL HAZARDS: _____	14. _____
_____	15. _____
_____	17. _____
PRECAUTIONS TO TAKE: _____	18. _____
_____	19. _____
_____	20. _____
_____	21. _____
MONITORING REQUIRED: _____	22. _____
_____	23. _____
COMMENTS: _____	24. _____
_____	25. _____

APPENDIX B – ASBESTOS INSPECTOR CERTIFICATIONS

CODY KNOWLTON

has met the requirements of Montana Administrative Rule
17.74.362 and/or 17.74.363 for accreditation in the following
asbestos occupation(s) through the specified expiration date(s).

Asbestos Inspector
Project Contractor/Supervisor

02/12/2019
01/04/2019



JLL

MT DEQ Asbestos Control Program

CONNOR J MCHUGH

has met the requirements of Montana Administrative Rule
17.74.362 and/or 17.74.363 for accreditation in the following
asbestos occupation(s) through the specified expiration date(s).

Asbestos Inspector

MTA-4259

02/12/2019

MT DEQ Asbestos Control Program

APPENDIX C – DATA VALIDATION SUMMARY FORM

Montana DEQ - Waste Management and Remediation Division

Data Validation Summary Form (Version 1.3.0, Revised 1/26/18)

Please fill out the information below, using one form for each lab batch (one form can be used for multiple analytical methods). The form will grow and adjust, based on your responses. Please include a discussion regarding the sampling event in the report that is sent to DEQ with this form. For additional instructions, please click the Open Complete Instructions button.

[Open Complete Instructions](#)

Basic Questions

[View example \(Note: example optimized for viewing in Chrome browser\)](#)

1. Site/Facility name			
2. Site code or facility ID (if applicable)			
3. Release ID (if applicable)			
4. Sample delivery group			
5. Name of DEQ-approved sampling plan			
6. Date DEQ approved the sampling plan		M/D/YY	
7. Name of data validator			
8. Phone			
9. Date validated		M/D/YY	

Field Collection Questions

[View example \(Note: example optimized for viewing in Chrome browser\)](#)

10. Sample matrix	☐ Soil	☐ Sediment	☐ Surface water	☐ Groundwater	
	☐ Tap water	☐ Air (including soil gas)	☐ Other		
11. Sample collection start date		M/D/YY			
12. Sample collection end date		M/D/YY			
13. Analytical methods used	Add Method	Analytical Method(s)			
Use Add Method button to list multiple methods. Enter any other methods in the field manually.	Delete Method				

Laboratory-related Questions

[View example \(Note: example optimized for viewing in Chrome browser\)](#)

14. Laboratory name and location				
15. Laboratory project ID				
16. Were samples received in good condition and at appropriate temperature, chain-of-custody forms complete, and all samples analyzed within holding times?	Yes ☐	No ☐	See Below ☐	Comments
16a. Were chain-of-custody forms complete?	Yes ☐	No ☐	Comments 	

16b. Were samples received in good condition, preserved, and at appropriate temperature (VOA no headspace, appropriate pH, temperature 4° C +/- 2° for most samples)?	Yes ☐	No ☐	Comments
16c. Were the samples analyzed within method-specified or technical holding times?	Yes ☐	No ☐	Comments
17. Were all laboratory quality control procedures complied with and is data validated without qualifiers?	Yes ☐	No ☐	See Below ☐ Comments
17a. Were all calibration verification results within acceptable limits?	Yes ☐	No ☐	Comments
17b. Were laboratory (method) blank samples free of contamination?	Yes ☐	No ☐	Comments
17c. Are the percent recoveries and relative percent differences of matrix spike and matrix spike duplicates within quality control limits?	Yes ☐	No ☐	Comments
17d. Are the laboratory control samples the same matrix as the samples and prepared the same as associated samples?	Yes ☐	No ☐	Comments
17e. Were laboratory control samples and laboratory control sample duplicate percent recoveries and relative percent differences within laboratory control limits?	Yes ☐	No ☐	Comments
17f. Were surrogate recoveries within laboratory quality control limits?	Yes ☐	No ☐	Comments
17g. Were the laboratory duplicate relative percent differences within data validation quality control limits?	Yes ☐	No ☐	Comments
18. Were the total number of lab method blanks at least 5% of the total number of samples, or as required by the method?	Yes ☐	No ☐	Comments
19. Were the total number of lab matrix spike samples prepared at least 5% of the total number of samples, or as required by the method?	Yes ☐	No ☐	Comments
20. Please list any project samples used for matrix spike/matrix spike duplicates.			
Add Sample	Lab ID	Field Sample ID	Comments
Delete Sample			

21. Is the total number of laboratory control samples at least 5% of the total number of samples?	Yes ☐	No ☐	Comments

Consultant/Validator Questions [View example \(Note: example optimized for viewing in Chrome\)](#)

22. Are the detection limits appropriate for the project (i.e. at or below screening levels)?	Yes ☐	No ☐	Comments

23. Are the reported units appropriate for the sample matrix (i.e. water results in ug/L, not mg/kg)?	Yes ☐	No ☐	Comments

24. Do the analytical methods comply with project requirements (e.g. in the SAP, work plan, or QAPP)?	Yes ☐	No ☐	Comments

25. Do the laboratory reports include all constituents requested to be analyzed on the chain-of-custody or under the sampling plan or other applicable document?	Yes ☐	No ☐	Comments

26. Is the number of sample blanks (e.g. equipment, trip, or field blanks) equal to at least 10% of the total number of samples, or as otherwise required?	Yes ☐	No ☐	Comments

27. Are field blanks free from contamination, duplicates collected as required, and field duplicate percent differences within data validation quality control limits?	Yes ☐	No ☐	See Below ☐	Comments

27a. Were all blank samples free of analyte contamination?	Yes ☐	No ☐	Comments

27b. Were field duplicates collected as required?	Yes ☐	No ☐	Comments

27c. Are field duplicate relative percent differences within data validation quality control limits?	Yes ☐	No ☐	Comments

28. Please provide an Excel or CSV file to the DEQ project manager (via e-mail or CD) that lists all samples evaluated in this summary and lists any qualified data. ☐

Please use the following format:

Lab ID	Field Sample ID	Qualifiers	Comments (indicate whether the issue biases the results high or low)
Example 48310-2.31E	Example GW-1	R	Sample dropped in lab and unrecoverable
Example 48310-2.32D	Example GW-2		

Please use the following format for qualifiers. See EPA's National Functional Guidelines for more information on qualifiers for unique samples such as dioxins.

Qualifier	Explanation
C	Pesticide and Arochlor results confirmed with GC/MS
J-	Estimated value, may be biased low
J	Analyte identified, but concentration is estimated
J+	Estimated value, may be biased high
NJ	Tentatively identified compound
R	Sample result rejected
U	Analyte analyzed for, but not detected above quantitation limit
UJ	Analyte not detected above CRQL, but CRQL may be inaccurate
X	Pesticide and Arochlor results attempted using GC/MS, but unsuccessful

If you wish to manually enter qualified sample results, please use the table below.

Add Sample	Lab ID	Field Sample ID	Qualifiers	Comments (indicate whether the issue biases the results high or low)
Delete Sample				

29. What is the percent completeness (samples planned versus valid samples collected)?				Comments
30. Was the completeness goal met?		Yes ☐ No ☐		Comments
31. Does all data conform to analytical methods and data quality objectives specified for this project?		Yes ☐ No ☐		Comments
32. Other general comments or observations?				

Split Samples

33. Did DEQ collect split samples?		Yes ☐ No ☐		Comments

Print Form

Save As

Open Instructions

Hide Instructions

APPENDIX D – STANDARD OPERATING PROCEDURES



TETRA TECH

Standard Operating Procedures

for

Asbestos Inspections

Prepared By:

Tetra Tech

7100 Commercial Avenue, Suite 4
Billings, Montana 59101

January 2019

complex world

CLEAR SOLUTIONS™

TABLE OF CONTENTS

1.0	INTRODUCTION	2
2.0	EQUIPMENT	3
3.0	PLANNING AND PREPARATION	4
4.0	SAMPLING	5
4.1	Inspection	5
4.2	Number of Samples	5
4.3	Selection of Samples	6
4.4	Identification of Samples	7
4.5	Collecting Samples	7
4.6	Sample Handling and Analysis	8
4.7	Quality Assurance	9
5.0	DOCUMENTATION.....	10
5.1	Field Notes.....	10
5.2	Photographs	10
5.3	Figures.....	11
5.4	Final Report	11
6.0	REFERENCES.....	12

LIST OF APPENDICES

Appendix A:	EPA AHERA Regulations
Appendix B:	EPA NESHAP Regulations
Appendix C:	MDEQ Regulations
Appendix D:	Inspection Checklist Sheet
Appendix E:	Homogeneous Area Summary Sheet
Appendix F:	Building Information Sheet
Appendix G:	Suspect ACBM Room by Room Sheet
Appendix H:	Random Number Diagrams
Appendix I:	Suspect Material List
Appendix J:	Chain-of-Custody Sheet

1.0 INTRODUCTION

In order to insure that each U.S. Environmental Protection Agency (EPA) and Montana Department of Environmental Quality (MDEQ) certified asbestos inspector working for Tetra Tech is conducting the inspection of asbestos using current standards under the Asbestos Hazard Emergency Response Act (AHERA) Asbestos-Containing Materials in Schools (40 CFR 763), National Emission Standard for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) and Administrative Rules of Montana 17.74.354, this Standard Operating Procedure (SOP) for asbestos inspections has been developed. This SOP is intended as a guide for new inspectors as well a reminder for experienced inspectors. Anyone performing asbestos inspections must have successfully completed a MDEQ Asbestos Inspector Course.

Please take time to read through this SOP to be sure that you are conducting asbestos inspections according to EPA AHERA, NESHAPS and State of Montana regulations. The EPA AHERA regulation is included in Appendix A and the EPA NESHAPS regulation is included in Appendix B and MDEQ regulations is included in Appendix C. Each inspector should have received a copy of the above referenced regulations in their inspector course, which were provided during the Initial Asbestos Inspector training course they attended.

2.0 EQUIPMENT

- Ladder to access areas.
- Flashlight to aid in visibility.
- Air tight sampling containers (film canisters, centrifuge tubes, zip lock baggies).
- Spray mister bottle with water to spray the area to be sampled.
- Plastic drop cloth to spread beneath the area to be sampled.
- Knife, linoleum cutter, or other tools appropriate for extracting samples.
- Caulking gun and compound for filling holes once a sample has been extracted.
- Spray acrylic or adhesive to encapsulate sample extractions.
- Duct tape for repairing thermal system insulation jackets.
- Cloth (pre-moistened) for cleaning up debris and tools.
- Vacuum cleaner equipped with high efficiency particulate air (HEPA) filters.
- Indelible ink pen for field forms and labeling sample containers.
- Camera for photographic documentation.
- Disposable protective clothing, gloves and bootees.
- Personal respirator, either a negative pressure full or half mask with HEPA (P100) cartridges.
- Safety Equipment required for the particular site (safety glasses, hearing protection, hard hat, steel-toed boots, etc.).

3.0 PLANNING AND PREPARATION

Prior to commencing building inspection activities, the following tasks should be performed.

- Contact management of the facility to inform them as to what will take place during the inspection.
- Determine the hours of operation for the facility.
- Develop a project schedule agreeable to the management of the facility including arrival time at the site and time of initial meeting with site personnel.
- Review existing as-built drawings, if available to become familiar with the facility as to the mechanical system layout, and materials used in construction. Develop drawings from as-built drawings, if provided by the management of the facility, for use in the inspection.
- Review any previous asbestos inspections that may have been conducted in the past.
- Collect all materials necessary for the inspection.

4.0 SAMPLING

4.1 Inspection

Inspections should be performed using the currently recognized standard protocol developed under EPA AHERA rules. General guidelines for conducting the inspection are as follows:

- Conduct on-site informational meetings with facility personnel to inform them of what will transpire during the inspection. Discuss bulk sampling protocol with facility personnel and determine sampling locations that will be acceptable to the management of the facility.
- Perform an initial walk through of the building.
- Observe the building layout and whether the building was built in phases or all at once.
- Observe where the divisions are between construction phases.
- Locate all mechanical areas.
- Document location of and access to all pipe chases, pipe tunnels, crawl spaces, attics, and roof(s).
- Walk completely around the outside of the building.
- Fill out asbestos inspection checklist sheet (Appendix C).
- Fill out homogeneous area summary sheet (Appendix D).
- Fill out building information sheet (Appendix E).
- Fill out room by room sheets (Appendix F).
- Prepare a building diagram.

4.2 Number of Samples

Inspections shall be performed using the currently recognized standard protocol under EPA. The following sampling protocol for friable and non-friable materials needs to be collected as required by EPA AHERA Rules.

Friable Surfacing Material

The number of samples collected from friable surfacing material was determined based on the following protocol developed under AHERA.

1,000 square feet or less	Three bulk samples
1,000 to 5,000 square feet	Five bulk samples
Over 5,000 square feet	Seven bulk samples

Thermal System Insulation

Thermal system insulation will be sampled in a randomly distributed manner, with at least three bulk samples collected from each homogeneous material. At least one bulk sample will be collected from each homogeneous material of patched thermal system insulation that was not assumed to be ACBM.

Bulk samples will also be collected from each insulated mechanical system where cement or plaster was used on fittings, such as tees, elbows, or valves. The number of samples was sufficient to determine whether the material is asbestos containing. Generally, three samples were collected from each homogenous area.

Bulk samples will not be collected from any homogeneous material where the inspector determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-asbestos containing building material.

Miscellaneous Material

Bulk samples will be collected from each miscellaneous material. The number of samples will be sufficient to determine whether the material is asbestos containing. Generally, three samples were collected from each homogenous area.

Non-friable suspected ACBM

The number of samples collected from non-friable suspect ACBM was sufficient to determine whether the material was asbestos containing. Generally, three samples were collected from each homogenous area.

4.3 Selection of Samples

Sample locations are selected so that they are representative of the sample area. When nine samples are collected, they are distributed evenly throughout the sampling area. If fewer than nine samples are collected, a random sampling scheme is used to determine their location. Choosing sample locations according to personal judgment produces samples which may not be representative and can lead to an incorrect determination about the presence or absence of asbestos. The sampling scheme described here avoids this problem and reduces the likelihood of biased results.

- Divide the sampling area into nine equally sized sub areas. This is done by dividing the length and breadth of the sampling area into three equal lengths and drawing a grid over the diagram (see Appendix G). This can be done carefully by eye. Exact measurements are not needed.

- If the sampling area does not easily fit into a rectangular shape, parts of the grid might not be in the sampling area. This is not a problem in most cases. If, however, a large part of the grid falls outside the sampling area, it is advisable to divide the sampling area into two or more separate sampling areas, each of which is approximately rectangular, and select sample locations by applying the sampling scheme to each sampling area. If three samples are going to be collected, take them from the sub areas marked 1,2,3,4, and 5, and so on.

For each sampling area, use a new diagram. If you have more than 18 sampling areas, start again at the top of the random number diagram (sample area #1) to determine sampling locations for sampling area 19.

4.4 Identification of Samples

Assign a unique sample ID number to each sample location. This ID number will be on the sampling container when it goes to the certified laboratory for analysis. Record the ID number and the sample location on the sample area diagrams and also on room by room summary sheets. This must be done carefully so that there is no uncertainty about the location and identity of each sample collected. Make sure that no two samples have the same ID number. Non-sequential numbers are used to prevent the laboratories from knowing which samples come from the same sample areas or the same buildings. On the other hand, non-sequential ID numbers make organizing the analytical results by homogeneous area much more difficult. A suspect material list sheet is provided in Appendix H.

4.5 Collecting Samples

- Personal protective equipment should be utilized. Since inhalation of asbestos fibers during hundreds of asbestos inspections and sampling projects may pose a serious health hazard, the use of personal protective equipment by building inspectors is crucial during the sampling process. As a level of protection, inspectors should wear a respirator, either a negative pressure full or half mask with HEPA cartridges. Disposable clothing should be worn during sampling if the sampling operation is likely to dislodge pieces of suspect material or if the environment is extremely dusty. Inspectors should have plastic bags, tape, and labels with them to handle the disposal of cartridges, protective clothing, wet cloths, and debris. These waste materials should be stored pending survey results. If laboratory reports establish the presence of asbestos-containing materials, these waste materials should be disposed of as asbestos containing waste.
- If possible, collect samples after hours or when the building is not in use.
- Spread the plastic drop cloth and set up other equipment.
- Put on protective equipment.
- Mark the location of the sample on the sampling diagram and record the sample identification number on the plan diagram as well.
- Moisten area where sample is to be extracted (spray the immediate area with water).

- Extract sample using a clean knife to cut out or scrape off a small piece of the material. Be sure to penetrate all layers of material. Be careful not to disturb adjacent material.
- Place sample in a container and tightly seal it.
- Label containers with its ID, sample location, and type of material sampled on a sample data form. Always place the label on the container itself. If using ridged containers always place the ID on the container, not on the lid, as lids can be inadvertently switched by a laboratory when handling numerous sample containers.
- Wipe the exterior of the container with a wet wipe to remove any material which may have adhered to it during sampling.
- Clean your tools with wet wipes and wet mop or vacuum area with a HEPA vacuum to clean all debris.
- Fill hole with caulking compound on highly friable material and/or spray with an encapsulant (to minimize subsequent fiber release) or for appearance.
- Repeat the above steps at each sample location. Place sample containers in plastic bags.
- Discard protective clothing, wet wipes and rags, filter cartridges, and drop cloth in a labeled plastic bag.

4.6 Sample Handling and Analysis

To preserve the quality and integrity of samples from the time of collection until the time of analysis, sample preparation, preservation, storage, and shipment procedures have been established. Procedures and methods for accomplishing these tasks are described below.

- After placing a sample in a container according to the procedures outlined earlier, enter the ID number on the Chain-of-Custody Sheet. A sample Chain-of-Custody Sheet is located in Appendix I.
- Upon receipt of samples from the inspector, the laboratory should check and sign the Chain-of-Custody Sheet(s), copy same and return original(s) to the inspector. It is important that this or a similar arrangement for sample accountability be agreed upon by the laboratory prior to sending samples for analysis.
- Each individual or laboratory engaged in asbestos identification shall participate in the Proficiency Analytical Testing Program, the Asbestos Analyst Registry or equivalent.
- Polarized light microscopy (PLM) is the EPA-approved method for analyzing bulk materials for asbestos. This method of analysis is relatively inexpensive. PLM utilizes a light microscope equipped with polarizing filters. The identification of asbestos fiber bundles is determined by the visual properties displayed when the sample is treated with various dispersion staining liquids. Identification is substantiated by the actual structure of the fiber and the effect of polarized light on the filter, all of which is viewed by the trained technician. The limit of detection of asbestos by PLM is about 1% by area. Samples containing lower levels of asbestos are not reliably detected by this technique.

4.7 Quality Assurance

Quality assurance / quality control samples will be collected during the investigation. Duplicate samples will be collected at a rate of 1 duplicate per 100 field samples. Duplicate samples will be packaged, and sealed in the same manner described for the filed bulk samples (above). A separate sample number will be assigned to each duplicate, and it will be submitted blind to the laboratory.

After inspection is completed perform a field quality assurance program as indicated by the following tasks.

- Review all inspection forms for completeness. (Remember a physical address is required by EPA AHERA Regulations).
- Walk through building a final time to verify that you have identified all the suspect homogeneous areas.
- Review Chain-of-Custody document for completeness and verify the number of samples and sample numbers for the suspect materials collected during the inspection.

5.0 DOCUMENTATION

5.1 Field Notes

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be completed and accurate enough to permit reconstruction of field activities. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual(s) making the entries. Language will be factual, objective, and free of personal opinions. At a minimum, the following information will be recorded, if applicable, during the collection of each sample.

- Inspector's name(s)
- Date and time of inspection
- Type of component
- Location of component
- Field observations and details related to condition and/ or status of component

In addition to inspection information, the following specifics may also be recorded in the field logbook for each day of inspection:

- Team members and their responsibilities
- Time of arrival on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with any potentially responsible parties, or representatives of any federal, state, or other regulatory agency
- Deviations from inspection plans or site safety plan procedures
- Changes in personnel and responsibilities, as well as reasons for the change
- Levels of safety protection
- Record of photographs

5.2 Photographs

Photographs will be taken at representative inspection locations. They will verify information entered in the field logbook. When a photograph is taken, the following information will be written on the logbook or will be recorded in the field photography log:

- Date, location
- Description of the subject photographed

- Name of person taking the photograph

5.3 Figures

If present, Asbestos -containing components will be identified on field drawings completed at the time of inspection. Following the conclusion of inspection services, field drawings will be utilized to derive Computer Aided Design (CAD) figures that depict the location of identified components.

5.4 Final Report

A final report will be provided documenting the findings of the inspection services. The report will be utilized to generate abatement designs/ specifications on an as needed basis.

6.0 REFERENCES

Code of Federal Regulations (CFR), Title 29, Part 1910.1001, Asbestos; General Industry Standard; Final Rule, August 24, 2006.

Code of Federal Regulations (CFR), Title 29, Part 1926.1101, Asbestos; Construction Industry Standard; Final Rule, August 24, 2006.

Code of Federal Regulations (CFR), Title 40, Part 763, Asbestos; Asbestos-Containing Materials in Schools; Final Rule, October 30, 1987.

Code of Federal Regulations (CFR), Title 40, Part 61, Subpart M – National Emission Standard for Asbestos; Final Rule, November 20, 1990, revised June 19, 1995.

APPENDIX A

AHERA Regulations

Environmental Protection Agency

§ 763.80

(c) Record all testing parameters and experimental conditions from the successful validation study into a standard operating procedure (SOP) for reference whenever the decontamination procedure is used. Include in the SOP the identity of the soaking solvent, the length of time of the soak, and the ratio of the soak solvent to contaminated surface area during the soaking process. Also include in the SOP the maximum concentration of PCBs in the spilled material and the identity of the spilled material, and/or the measured maximum surface concentration of the contaminated surface used in the validation study. Record and keep the results of the validation study as an appendix to the SOP. Include in this appendix, the solvent used to make the spiking solution, the PCB concentration of the spiking solution used to contaminate the surfaces in the validation study, and all of the validation study testing parameters and experimental conditions.

[63 FR 35473, June 29, 1998, as amended at 72 FR 57241, Oct. 9, 2007; 74 FR 30235, June 25, 2009]

PART 763—ASBESTOS

Subparts A–D [Reserved]

Subpart E—Asbestos-Containing Materials in Schools

Sec.

- 763.80 Scope and purpose.
- 763.83 Definitions.
- 763.84 General local education agency responsibilities.
- 763.85 Inspection and reinspections.
- 763.86 Sampling.
- 763.87 Analysis.
- 763.88 Assessment.
- 763.90 Response actions.
- 763.91 Operations and maintenance.
- 763.92 Training and periodic surveillance.
- 763.93 Management plans.
- 763.94 Recordkeeping.
- 763.95 Warning labels.
- 763.97 Compliance and enforcement.
- 763.98 Waiver; delegation to State.
- 763.99 Exclusions.

APPENDIX A TO SUBPART E—INTERIM TRANSMISSION ELECTRON MICROSCOPY ANALYTICAL METHODS—MANDATORY AND NON-MANDATORY—AND MANDATORY SECTION TO DETERMINE COMPLETION OF RESPONSE ACTIONS

APPENDIX B TO SUBPART E [RESERVED]

APPENDIX C TO SUBPART E—ASBESTOS MODEL ACCREDITATION PLAN
APPENDIX D TO SUBPART E—TRANSPORT AND DISPOSAL OF ASBESTOS WASTE
APPENDIX E TO SUBPART E—INTERIM METHOD OF THE DETERMINATION OF ASBESTOS IN BULK INSULATION SAMPLES

Subpart F [Reserved]

Subpart G—Asbestos Worker Protection

- 763.120 What is the purpose of this subpart?
- 763.121 Does this subpart apply to me?
- 763.122 What does this subpart require me to do?
- 763.123 May a State implement its own asbestos worker protection plan?

Subpart H [Reserved]

Subpart I—Prohibition of the Manufacture, Importation, Processing, and Distribution in Commerce of Certain Asbestos-Containing Products; Labeling Requirements

- 763.160 Scope.
- 763.163 Definitions.
- 763.165 Manufacture and importation prohibitions.
- 763.167 Processing prohibitions.
- 763.169 Distribution in commerce prohibitions.
- 763.171 Labeling requirements.
- 763.173 Exemptions.
- 763.175 Enforcement.
- 763.176 Inspections.
- 763.178 Recordkeeping.
- 763.179 Confidential business information claims.

AUTHORITY: 15 U.S.C. 2605, 2607(c), 2643, and 2646.

Subparts A–D [Reserved]

Subpart E—Asbestos-Containing Materials in Schools

SOURCE: 52 FR 41846, Oct. 30, 1987, unless otherwise noted.

§ 763.80 Scope and purpose.

(a) This rule requires local education agencies to identify friable and nonfriable asbestos-containing material (ACM) in public and private elementary and secondary schools by visually inspecting school buildings for such materials, sampling such materials if they are not assumed to be ACM, and having samples analyzed by appropriate techniques referred to in this rule. The rule requires local education

agencies to submit management plans to the Governor of their State by October 12, 1988, begin to implement the plans by July 9, 1989, and complete implementation of the plans in a timely fashion. In addition, local education agencies are required to use persons who have been accredited to conduct inspections, reinspections, develop management plans, or perform response actions. The rule also includes recordkeeping requirements. Local education agencies may contractually delegate their duties under this rule, but they remain responsible for the proper performance of those duties. Local education agencies are encouraged to consult with EPA Regional Asbestos Coordinators, or if applicable, a State's lead agency designated by the State Governor, for assistance in complying with this rule.

(b) Local education agencies must provide for the transportation and disposal of asbestos in accordance with EPA's "Asbestos Waste Management Guidance." For convenience, applicable sections of this guidance are reprinted as Appendix D of this subpart. There are regulations in place, however, that affect transportation and disposal of asbestos waste generated by this rule. The transportation of asbestos waste is covered by the Department of Transportation (49 CFR part 173, subpart J) and disposal is covered by the National Emissions Standards for Hazardous Air Pollutants (NESHAP) (40 CFR part 61, subpart M).

§ 763.83 Definitions.

For purposes of this subpart:

Act means the Toxic Substances Control Act (TSCA), 15 U.S.C. 2601, *et seq.*

Accessible when referring to ACM means that the material is subject to disturbance by school building occupants or custodial or maintenance personnel in the course of their normal activities.

Accredited or *accreditation* when referring to a person or laboratory means that such person or laboratory is accredited in accordance with section 206 of Title II of the Act.

Air erosion means the passage of air over friable ACBM which may result in the release of asbestos fibers.

Asbestos means the asbestiform varieties of: Chrysotile (serpentine); crocidolite (riebeckite); amosite (cummingtonite); anthophyllite; tremolite; and actinolite.

Asbestos-containing material (ACM) when referring to school buildings means any material or product which contains more than 1 percent asbestos.

Asbestos-containing building material (ACBM) means surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a school building.

Asbestos debris means pieces of ACBM that can be identified by color, texture, or composition, or means dust, if the dust is determined by an accredited inspector to be ACM.

Damaged friable miscellaneous ACM means friable miscellaneous ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate or which for any other reason lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

Damaged friable surfacing ACM means friable surfacing ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or which has delaminated such that its bond to the substrate (adhesion) is inadequate, or which, for any other reason, lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury

on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

Damaged or significantly damaged thermal system insulation ACM means thermal system insulation ACM on pipes, boilers, tanks, ducts, and other thermal system insulation equipment where the insulation has lost its structural integrity, or its covering, in whole or in part, is crushed, water-stained, gouged, punctured, missing, or not intact such that it is not able to contain fibers. Damage may be further illustrated by occasional punctures, gouges or other signs of physical injury to ACM; occasional water damage on the protective coverings/jackets; or exposed ACM ends or joints. Asbestos debris originating from the ACBM in question may also indicate damage.

Encapsulation means the treatment of ACBM with a material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent the release of fibers, as the encapsulant creates a membrane over the surface (bridging encapsulant) or penetrates the material and binds its components together (penetrating encapsulant).

Enclosure means an airtight, impermeable, permanent barrier around ACBM to prevent the release of asbestos fibers into the air.

Fiber release episode means any uncontrolled or unintentional disturbance of ACBM resulting in visible emission.

Friable when referring to material in a school building means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously nonfriable material after such previously nonfriable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.

Functional space means a room, group of rooms, or homogeneous area (including crawl spaces or the space between a dropped ceiling and the floor or roof deck above), such as classroom(s), a cafeteria, gymnasium, hallway(s), designated by a person accredited to prepare management plans, design abatement projects, or conduct response actions.

High-efficiency particulate air (HEPA) refers to a filtering system capable of trapping and retaining at least 99.97 percent of all monodispersed particles 0.3 μm in diameter or larger.

Homogeneous area means an area of surfacing material, thermal system insulation material, or miscellaneous material that is uniform in color and texture.

Local education agency means:

(1) Any local educational agency as defined in section 198 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 3381).

(2) The owner of any nonpublic, non-profit elementary, or secondary school building.

(3) The governing authority of any school operated under the defense dependent's education system provided for under the Defense Dependents' Education Act of 1978 (20 U.S.C. 921, et seq.).

Miscellaneous ACM means miscellaneous material that is ACM in a school building.

Miscellaneous material means interior building material on structural components, structural members or fixtures, such as floor and ceiling tiles, and does not include surfacing material or thermal system insulation.

Nonfriable means material in a school building which when dry may not be crumbled, pulverized, or reduced to powder by hand pressure.

Operations and maintenance program means a program of work practices to maintain friable ACBM in good condition, ensure clean up of asbestos fibers previously released, and prevent further release by minimizing and controlling friable ACBM disturbance or damage.

Potential damage means circumstances in which:

(1) Friable ACBM is in an area regularly used by building occupants, including maintenance personnel, in the course of their normal activities.

(2) There are indications that there is a reasonable likelihood that the material or its covering will become damaged, deteriorated, or delaminated due to factors such as changes in building use, changes in operations and maintenance practices, changes in occupancy, or recurrent damage.

Potential significant damage means circumstances in which:

(1) Friable ACBM is in an area regularly used by building occupants, including maintenance personnel, in the course of their normal activities.

(2) There are indications that there is a reasonable likelihood that the material or its covering will become significantly damaged, deteriorated, or delaminated due to factors such as changes in building use, changes in operations and maintenance practices, changes in occupancy, or recurrent damage.

(3) The material is subject to major or continuing disturbance, due to factors including, but not limited to, accessibility or, under certain circumstances, vibration or air erosion.

Preventive measures means actions taken to reduce disturbance of ACBM or otherwise eliminate the reasonable likelihood of the material's becoming damaged or significantly damaged.

Removal means the taking out or the stripping of substantially all ACBM from a damaged area, a functional space, or a homogeneous area in a school building.

Repair means returning damaged ACBM to an undamaged condition or to an intact state so as to prevent fiber release.

Response action means a method, including removal, encapsulation, enclosure, repair, operations and maintenance, that protects human health and the environment from friable ACBM.

Routine maintenance area means an area, such as a boiler room or mechanical room, that is not normally frequented by students and in which maintenance employees or contract workers regularly conduct maintenance activities.

School means any elementary or secondary school as defined in section 198 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 2854).

School building means:

(1) Any structure suitable for use as a classroom, including a school facility such as a laboratory, library, school eating facility, or facility used for the preparation of food.

(2) Any gymnasium or other facility which is specially designed for athletic

or recreational activities for an academic course in physical education.

(3) Any other facility used for the instruction or housing of students or for the administration of educational or research programs.

(4) Any maintenance, storage, or utility facility, including any hallway, essential to the operation of any facility described in this definition of "school building" under paragraphs (1), (2), or (3).

(5) Any portico or covered exterior hallway or walkway.

(6) Any exterior portion of a mechanical system used to condition interior space.

Significantly damaged friable miscellaneous ACM means damaged friable miscellaneous ACM where the damage is extensive and severe.

Significantly damaged friable surfacing ACM means damaged friable surfacing ACM in a functional space where the damage is extensive and severe.

State means a State, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the Northern Marianas, the Trust Territory of the Pacific Islands, and the Virgin Islands.

Surfacing ACM means surfacing material that is ACM.

Surfacing material means material in a school building that is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

Thermal system insulation means material in a school building applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain, or water condensation, or for other purposes.

Thermal system insulation ACM means thermal system insulation that is ACM.

Vibration means the periodic motion of friable ACBM which may result in the release of asbestos fibers.

§ 763.84 General local education agency responsibilities.

Each local education agency shall:

Environmental Protection Agency

§ 763.85

(a) Ensure that the activities of any persons who perform inspections, re-inspections, and periodic surveillance, develop and update management plans, and develop and implement response actions, including operations and maintenance, are carried out in accordance with subpart E of this part.

(b) Ensure that all custodial and maintenance employees are properly trained as required by this subpart E and other applicable Federal and/or State regulations (e.g., the Occupational Safety and Health Administration asbestos standard for construction, the EPA worker protection rule, or applicable State regulations).

(c) Ensure that workers and building occupants, or their legal guardians, are informed at least once each school year about inspections, response actions, and post-response action activities, including periodic reinspection and surveillance activities that are planned or in progress.

(d) Ensure that short-term workers (e.g., telephone repair workers, utility workers, or exterminators) who may come in contact with asbestos in a school are provided information regarding the locations of ACBM and suspected ACBM assumed to be ACM.

(e) Ensure that warning labels are posted in accordance with § 763.95.

(f) Ensure that management plans are available for inspection and notification of such availability has been provided as specified in the management plan under § 763.93(g).

(g)(1) Designate a person to ensure that requirements under this section are properly implemented.

(2) Ensure that the designated person receives adequate training to perform duties assigned under this section. Such training shall provide, as necessary, basic knowledge of:

(i) Health effects of asbestos.

(ii) Detection, identification, and assessment of ACM.

(iii) Options for controlling ACBM.

(iv) Asbestos management programs.

(v) Relevant Federal and State regulations concerning asbestos, including those in this subpart E and those of the Occupational Safety and Health Administration, U.S. Department of Labor, the U.S. Department of Trans-

portation and the U.S. Environmental Protection Agency.

(h) Consider whether any conflict of interest may arise from the interrelationship among accredited personnel and whether that should influence the selection of accredited personnel to perform activities under this subpart.

§ 763.85 Inspection and reinspections.

(a) *Inspection.* (1) Except as provided in paragraph (a)(2) of this section, before October 12, 1988, local education agencies shall inspect each school building that they lease, own, or otherwise use as a school building to identify all locations of friable and nonfriable ACBM.

(2) Any building leased or acquired on or after October 12, 1988, that is to be used as a school building shall be inspected as described under paragraphs (a) (3) and (4) of this section prior to use as a school building. In the event that emergency use of an uninspected building as a school building is necessitated, such buildings shall be inspected within 30 days after commencement of such use.

(3) Each inspection shall be made by an accredited inspector.

(4) For each area of a school building, except as excluded under § 763.99, each person performing an inspection shall:

(i) Visually inspect the area to identify the locations of all suspected ACBM.

(ii) Touch all suspected ACBM to determine whether they are friable.

(iii) Identify all homogeneous areas of friable suspected ACBM and all homogeneous areas of nonfriable suspected ACBM.

(iv) Assume that some or all of the homogeneous areas are ACM, and, for each homogeneous area that is not assumed to be ACM, collect and submit for analysis bulk samples under §§ 763.86 and 763.87.

(v) Assess, under § 763.88, friable material in areas where samples are collected, friable material in areas that are assumed to be ACBM, and friable ACBM identified during a previous inspection.

(vi) Record the following and submit to the person designated under § 763.84 a copy of such record for inclusion in

§ 763.86

40 CFR Ch. I (7–1–11 Edition)

the management plan within 30 days of the inspection:

(A) An inspection report with the date of the inspection signed by each accredited person making the inspection, State of accreditation, and if applicable, his or her accreditation number.

(B) An inventory of the locations of the homogeneous areas where samples are collected, exact location where each bulk sample is collected, dates that samples are collected, homogeneous areas where friable suspected ACBM is assumed to be ACM, and homogeneous areas where nonfriable suspected ACBM is assumed to be ACM.

(C) A description of the manner used to determine sampling locations, the name and signature of each accredited inspector who collected the samples, State of accreditation, and, if applicable, his or her accreditation number.

(D) A list of whether the homogeneous areas identified under paragraph (a)(4)(vi)(B) of this section, are surfacing material, thermal system insulation, or miscellaneous material.

(E) Assessments made of friable material, the name and signature of each accredited inspector making the assessment, State of accreditation, and if applicable, his or her accreditation number.

(b) *Reinspection.* (1) At least once every 3 years after a management plan is in effect, each local education agency shall conduct a reinspection of all friable and nonfriable known or assumed ACBM in each school building that they lease, own, or otherwise use as a school building.

(2) Each inspection shall be made by an accredited inspector.

(3) For each area of a school building, each person performing a reinspection shall:

(i) Visually reinspect, and reassess, under § 763.88, the condition of all friable known or assumed ACBM.

(ii) Visually inspect material that was previously considered nonfriable ACBM and touch the material to determine whether it has become friable since the last inspection or reinspection.

(iii) Identify any homogeneous areas with material that has become friable

since the last inspection or reinspection.

(iv) For each homogeneous area of newly friable material that is already assumed to be ACBM, bulk samples may be collected and submitted for analysis in accordance with §§ 763.86 and 763.87.

(v) Assess, under § 763.88, the condition of the newly friable material in areas where samples are collected, and newly friable materials in areas that are assumed to be ACBM.

(vi) Reassess, under § 763.88, the condition of friable known or assumed ACBM previously identified.

(vii) Record the following and submit to the person designated under § 763.84 a copy of such record for inclusion in the management plan within 30 days of the reinspection:

(A) The date of the reinspection, the name and signature of the person making the reinspection, State of accreditation, and if applicable, his or her accreditation number, and any changes in the condition of known or assumed ACBM.

(B) The exact locations where samples are collected during the reinspection, a description of the manner used to determine sampling locations, the name and signature of each accredited inspector who collected the samples, State of accreditation, and, if applicable, his or her accreditation number.

(C) Any assessments or reassessments made of friable material, the name and signature of the accredited inspector making the assessments, State of accreditation, and if applicable, his or her accreditation number.

(c) *General.* Thermal system insulation that has retained its structural integrity and that has an undamaged protective jacket or wrap that prevents fiber release shall be treated as nonfriable and therefore is subject only to periodic surveillance and preventive measures as necessary.

§ 763.86 Sampling.

(a) *Surfacing material.* An accredited inspector shall collect, in a statistically random manner that is representative of the homogeneous area, bulk samples from each homogeneous area of friable surfacing material that

Environmental Protection Agency

§ 763.88

is not assumed to be ACM, and shall collect the samples as follows:

(1) At least three bulk samples shall be collected from each homogeneous area that is 1,000 ft² or less, except as provided in § 763.87(c)(2).

(2) At least five bulk samples shall be collected from each homogeneous area that is greater than 1,000 ft² but less than or equal to 5,000 ft², except as provided in § 763.87(c)(2).

(3) At least seven bulk samples shall be collected from each homogeneous area that is greater than 5,000 ft², except as provided in § 763.87(c)(2).

(b) *Thermal system insulation.* (1) Except as provided in paragraphs (b) (2) through (4) of this section and § 763.87(c), an accredited inspector shall collect, in a randomly distributed manner, at least three bulk samples from each homogeneous area of thermal system insulation that is not assumed to be ACM.

(2) Collect at least one bulk sample from each homogeneous area of patched thermal system insulation that is not assumed to be ACM if the patched section is less than 6 linear or square feet.

(3) In a manner sufficient to determine whether the material is ACM or not ACM, collect bulk samples from each insulated mechanical system that is not assumed to be ACM where cement or plaster is used on fittings such as tees, elbows, or valves, except as provided under § 763.87(c)(2).

(4) Bulk samples are not required to be collected from any homogeneous area where the accredited inspector has determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-ACBM.

(c) *Miscellaneous material.* In a manner sufficient to determine whether material is ACM or not ACM, an accredited inspector shall collect bulk samples from each homogeneous area of friable miscellaneous material that is not assumed to be ACM.

(d) *Nonfriable suspected ACBM.* If any homogeneous area of nonfriable suspected ACBM is not assumed to be ACM, then an accredited inspector shall collect, in a manner sufficient to determine whether the material is ACM or not ACM, bulk samples from the homogeneous area of nonfriable

suspected ACBM that is not assumed to be ACM.

§ 763.87 Analysis.

(a) Local education agencies shall have bulk samples, collected under § 763.86 and submitted for analysis, analyzed for asbestos using laboratories accredited by the National Bureau of Standards (NBS). Local education agencies shall use laboratories which have received interim accreditation for polarized light microscopy (PLM) analysis under the EPA Interim Asbestos Bulk Sample Analysis Quality Assurance Program until the NBS PLM laboratory accreditation program for PLM is operational.

(b) Bulk samples shall not be composited for analysis and shall be analyzed for asbestos content by PLM, using the "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" found at appendix E to subpart E of this part.

(c)(1) A homogeneous area is considered not to contain ACM only if the results of all samples required to be collected from the area show asbestos in amounts of 1 percent or less.

(2) A homogeneous area shall be determined to contain ACM based on a finding that the results of at least one sample collected from that area shows that asbestos is present in an amount greater than 1 percent.

(d) The name and address of each laboratory performing an analysis, the date of analysis, and the name and signature of the person performing the analysis shall be submitted to the person designated under § 763.84 for inclusion into the management plan within 30 days of the analysis.

[52 FR 41846, Oct. 30, 1987, as amended at 60 FR 31922, June 19, 1995]

§ 763.88 Assessment.

(a)(1) For each inspection and reinspection conducted under § 763.85 (a) and (c) and previous inspections specified under § 763.99, the local education agency shall have an accredited inspector provide a written assessment of all friable known or assumed ACBM in the school building.

(2) Each accredited inspector providing a written assessment shall sign and date the assessment, provide his or

§ 763.90

40 CFR Ch. I (7–1–11 Edition)

her State of accreditation, and if applicable, accreditation number, and submit a copy of the assessment to the person designated under § 763.84 for inclusion in the management plan within 30 days of the assessment.

(b) The inspector shall classify and give reasons in the written assessment for classifying the ACBM and suspected ACBM assumed to be ACM in the school building into one of the following categories:

- (1) Damaged or significantly damaged thermal system insulation ACM.
- (2) Damaged friable surfacing ACM.
- (3) Significantly damaged friable surfacing ACM.
- (4) Damaged or significantly damaged friable miscellaneous ACM.
- (5) ACBM with potential for damage.
- (6) ACBM with potential for significant damage.
- (7) Any remaining friable ACBM or friable suspected ACBM.

(c) Assessment may include the following considerations:

- (1) Location and the amount of the material, both in total quantity and as a percentage of the functional space.
- (2) Condition of the material, specifying:
 - (i) Type of damage or significant damage (e.g., flaking, blistering, water damage, or other signs of physical damage).
 - (ii) Severity of damage (e.g., major flaking, severely torn jackets, as opposed to occasional flaking, minor tears to jackets).
 - (iii) Extent or spread of damage over large areas or large percentages of the homogeneous area.
- (3) Whether the material is accessible.
- (4) The material's potential for disturbance.
- (5) Known or suspected causes of damage or significant damage (e.g., air erosion, vandalism, vibration, water).
- (6) Preventive measures which might eliminate the reasonable likelihood of undamaged ACM from becoming significantly damaged.
- (d) The local education agency shall select a person accredited to develop management plans to review the results of each inspection, reinspection, and assessment for the school building and to conduct any other necessary ac-

tivities in order to recommend in writing to the local education agency appropriate response actions. The accredited person shall sign and date the recommendation, provide his or her State of accreditation, and, if applicable, provide his or her accreditation number, and submit a copy of the recommendation to the person designated under § 763.84 for inclusion in the management plan.

§ 763.90 Response actions.

(a) The local education agency shall select and implement in a timely manner the appropriate response actions in this section consistent with the assessment conducted in § 763.88. The response actions selected shall be sufficient to protect human health and the environment. The local education agency may then select, from the response actions which protect human health and the environment, that action which is the least burdensome method. Nothing in this section shall be construed to prohibit removal of ACBM from a school building at any time, should removal be the preferred response action of the local education agency.

(b) If damaged or significantly damaged thermal system insulation ACM is present in a building, the local education agency shall:

- (1) At least repair the damaged area.
- (2) Remove the damaged material if it is not feasible, due to technological factors, to repair the damage.
- (3) Maintain all thermal system insulation ACM and its covering in an intact state and undamaged condition.

(c)(1) If damaged friable surfacing ACM or damaged friable miscellaneous ACM is present in a building, the local education agency shall select from among the following response actions: encapsulation, enclosure, removal, or repair of the damaged material.

(2) In selecting the response action from among those which meet the definitional standards in § 763.83, the local education agency shall determine which of these response actions protects human health and the environment. For purposes of determining which of these response actions are the least burdensome, the local education

Environmental Protection Agency

§ 763.90

agency may then consider local circumstances, including occupancy and use patterns within the school building, and its economic concerns, including short- and long-term costs.

(d) If significantly damaged friable surfacing ACM or significantly damaged friable miscellaneous ACM is present in a building the local education agency shall:

(1) Immediately isolate the functional space and restrict access, unless isolation is not necessary to protect human health and the environment.

(2) Remove the material in the functional space or, depending upon whether enclosure or encapsulation would be sufficient to protect human health and the environment, enclose or encapsulate.

(e) If any friable surfacing ACM, thermal system insulation ACM, or friable miscellaneous ACM that has potential for damage is present in a building, the local education agency shall at least implement an operations and maintenance (O&M) program, as described under § 763.91.

(f) If any friable surfacing ACM, thermal system insulation ACM, or friable miscellaneous ACM that has potential for significant damage is present in a building, the local education agency shall:

(1) Implement an O&M program, as described under § 763.91.

(2) Institute preventive measures appropriate to eliminate the reasonable likelihood that the ACM or its covering will become significantly damaged, deteriorated, or delaminated.

(3) Remove the material as soon as possible if appropriate preventive measures cannot be effectively implemented, or unless other response actions are determined to protect human health and the environment. Immediately isolate the area and restrict access if necessary to avoid an imminent and substantial endangerment to human health or the environment.

(g) Response actions including removal, encapsulation, enclosure, or repair, other than small-scale, short-duration repairs, shall be designed and conducted by persons accredited to design and conduct response actions.

(h) The requirements of this subpart E in no way supersede the worker pro-

tection and work practice requirements under 29 CFR 1926.58 (Occupational Safety and Health Administration (OSHA) asbestos worker protection standards for construction), 40 CFR part 763, subpart G (EPA asbestos worker protection standards for public employees), and 40 CFR part 61, subpart M (National Emission Standards for Hazardous Air Pollutants—Asbestos).

(i) Completion of response actions. (1) At the conclusion of any action to remove, encapsulate, or enclose ACBM or material assumed to be ACBM, a person designated by the local education agency shall visually inspect each functional space where such action was conducted to determine whether the action has been properly completed.

(2)(i) A person designated by the local education agency shall collect air samples using aggressive sampling as described in appendix A to this subpart E to monitor air for clearance after each removal, encapsulation, and enclosure project involving ACBM, except for projects that are of small-scale, short-duration.

(ii) Local education agencies shall have air samples collected under this section analyzed for asbestos using laboratories accredited by the National Bureau of Standards to conduct such analysis using transmission electron microscopy (TEM) or, under circumstances permitted in this section, laboratories enrolled in the American Industrial Hygiene Association Proficiency Analytical Testing Program for phase contrast microscopy (PCM).

(iii) Until the National Bureau of Standards TEM laboratory accreditation program is operational, local educational agencies shall use laboratories that use the protocol described in appendix A to subpart E of this part.

(3) Except as provided in paragraphs (i)(4), and (i)(5), of this section, an action to remove, encapsulate, or enclose ACBM shall be considered complete when the average concentration of asbestos of five air samples collected within the affected functional space and analyzed by the TEM method in appendix A of this subpart E, is not statistically significantly different, as determined by the Z-test calculation found in appendix A of this subpart E,

from the average asbestos concentration of five air samples collected at the same time outside the affected functional space and analyzed in the same manner, and the average asbestos concentration of the three field blanks described in appendix A of this subpart E is below the filter background level, as defined in appendix A of this subpart E, of 70 structures per square millimeter (70 s/mm²).

(4) An action may also be considered complete if the volume of air drawn for each of the five samples collected within the affected functional space is equal to or greater than 1,199 L of air for a 25 mm filter or equal to or greater than 2,799 L of air for a 37 mm filter, and the average concentration of asbestos as analyzed by the TEM method in appendix A of this subpart E, for the five air samples does not exceed the filter background level, as defined in appendix A, of 70 structures per square millimeter (70 s/mm²). If the average concentration of asbestos of the five air samples within the affected functional space exceeds 70 s/mm², or if the volume of air in each of the samples is less than 1,199 L of air for a 25 mm filter or less than 2,799 L of air for a 37 mm filter, the action shall be considered complete only when the requirements of paragraph (i)(3) or (i)(5), of this section are met.

(5) At any time, a local education agency may analyze air monitoring samples collected for clearance purposes by phase contrast microscopy (PCM) to confirm completion of removal, encapsulation, or enclosure of ACBM that is greater than small-scale, short-duration and less than or equal to 160 square feet or 260 linear feet. The action shall be considered complete when the results of samples collected in the affected functional space and analyzed by phase contrast microscopy using the National Institute for Occupational Safety and Health (NIOSH) Method 7400 entitled “Fibers” published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987, show that the concentration of fibers for each of the five samples is less than or equal to a limit of quantitation for PCM (0.01 fibers per cubic centimeter (0.01 f/cm³) of air). The method is available for public

inspection at the Non-Confidential Information Center (NCIC) (7407), Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency, Room B-607 NEM, 401 M St., SW., Washington, DC 20460, between the hours of 12 p.m. and 4 p.m. weekdays excluding legal holidays or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. The method is incorporated as it exists on the effective date of this rule, and a notice of any change to the method will be published in the FEDERAL REGISTER.

(6) To determine the amount of ACBM affected under paragraph (i)(5) of this section, the local education agency shall add the total square or linear footage of ACBM within the containment barriers used to isolate the functional space for the action to remove, encapsulate, or enclose the ACBM. Contiguous portions of material subject to such action conducted concurrently or at approximately the same time within the same school building shall not be separated to qualify under paragraph (i)(5), of this section.

[52 FR 41846, Oct. 30, 1987, as amended at 53 FR 12525, Apr. 15, 1988; 60 FR 31922, June 19, 1995; 60 FR 34465, July 3, 1995; 69 FR 18803, Apr. 9, 2004]

§ 763.91 Operations and maintenance.

(a) *Applicability.* The local education agency shall implement an operations, maintenance, and repair (O&M) program under this section whenever any friable ACBM is present or assumed to be present in a building that it leases, owns, or otherwise uses as a school building. Any material identified as nonfriable ACBM or nonfriable assumed ACBM must be treated as friable ACBM for purposes of this section when the material is about to become friable as a result of activities performed in the school building.

Environmental Protection Agency

§ 763.91

(b) *Worker protection.* Local education agencies must comply with either the OSHA Asbestos Construction Standard at 29 CFR 1926.1101, or the Asbestos Worker Protection Rule at 40 CFR 763.120, whichever is applicable.

(c) *Cleaning*—(1) *Initial cleaning.* Unless the building has been cleaned using equivalent methods within the previous 6 months, all areas of a school building where friable ACBM, damaged or significantly damaged thermal system insulation ACM, or friable suspected ACBM assumed to be ACM are present shall be cleaned at least once after the completion of the inspection required by § 763.85(a) and before the initiation of any response action, other than O&M activities or repair, according to the following procedures:

(i) HEPA-vacuum or steam-clean all carpets.

(ii) HEPA-vacuum or wet-clean all other floors and all other horizontal surfaces.

(iii) Dispose of all debris, filters, mopheads, and cloths in sealed, leak-tight containers.

(2) *Additional cleaning.* The accredited management planner shall make a written recommendation to the local education agency whether additional cleaning is needed, and if so, the methods and frequency of such cleaning.

(d) *Operations and maintenance activities.* The local education agency shall ensure that the procedures described below to protect building occupants shall be followed for any operations and maintenance activities disturbing friable ACBM:

(1) Restrict entry into the area by persons other than those necessary to perform the maintenance project, either by physically isolating the area or by scheduling.

(2) Post signs to prevent entry by unauthorized persons.

(3) Shut off or temporarily modify the air-handling system and restrict other sources of air movement.

(4) Use work practices or other controls, such as, wet methods, protective clothing, HEPA-vacuums, mini-enclosures, glove bags, as necessary to inhibit the spread of any released fibers.

(5) Clean all fixtures or other components in the immediate work area.

(6) Place the asbestos debris and other cleaning materials in a sealed, leak-tight container.

(e) *Maintenance activities other than small-scale, short-duration.* The response action for any maintenance activities disturbing friable ACBM, other than small-scale, short-duration maintenance activities, shall be designed by persons accredited to design response actions and conducted by persons accredited to conduct response actions.

(f) *Fiber release episodes*—(1) *Minor fiber release episode.* The local education agency shall ensure that the procedures described below are followed in the event of a minor fiber release episode (i.e., the falling or dislodging of 3 square or linear feet or less of friable ACBM): 5

(i) Thoroughly saturate the debris using wet methods.

(ii) Clean the area, as described in paragraph (e) of this section.

(iii) Place the asbestos debris in a sealed, leak-tight container.

(iv) Repair the area of damaged ACM with materials such as asbestos-free spackling, plaster, cement, or insulation, or seal with latex paint or an encapsulant, or immediately have the appropriate response action implemented as required by § 763.90.

(2) *Major fiber release episode.* The local education agency shall ensure that the procedures described below are followed in the event of a major fiber release episode (i.e., the falling or dislodging of more than 3 square or linear feet of friable ACBM):

(i) Restrict entry into the area and post signs to prevent entry into the area by persons other than those necessary to perform the response action.

(ii) Shut off or temporarily modify the air-handling system to prevent the distribution of fibers to other areas in the building.

(iii) The response action for any major fiber release episode must be designed by persons accredited to design response actions and conducted by persons accredited to conduct response actions.

[52 FR 41846, Oct. 30, 1987, as amended at 65 FR 69216, Nov. 15, 2000]

§ 763.92

40 CFR Ch. I (7–1–11 Edition)

§ 763.92 Training and periodic surveillance.

(a) *Training.* (1) The local education agency shall ensure, prior to the implementation of the O&M provisions of the management plan, that all members of its maintenance and custodial staff (custodians, electricians, heating/air conditioning engineers, plumbers, etc.) who may work in a building that contains ACBM receive awareness training of at least 2 hours, whether or not they are required to work with ACBM. New custodial and maintenance employees shall be trained within 60 days after commencement of employment. Training shall include, but not be limited to:

(i) Information regarding asbestos and its various uses and forms.

(ii) Information on the health effects associated with asbestos exposure.

(iii) Locations of ACBM identified throughout each school building in which they work.

(iv) Recognition of damage, deterioration, and delamination of ACBM.

(v) Name and telephone number of the person designated to carry out general local education agency responsibilities under § 763.84 and the availability and location of the management plan.

(2) The local education agency shall ensure that all members of its maintenance and custodial staff who conduct any activities that will result in the disturbance of ACBM shall receive training described in paragraph (a)(1) of this section and 14 hours of additional training. Additional training shall include, but not be limited to:

(i) Descriptions of the proper methods of handling ACBM.

(ii) Information on the use of respiratory protection as contained in the EPA/NIOSH *Guide to Respiratory Protection for the Asbestos Abatement Industry*, September 1986 (EPA 560/OPPTS-86-001), available from the Director, Environmental Assistance Division (7408), Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency, Room E-543B, 1200 Pennsylvania Ave., NW., Washington, DC 20460, Telephone: (202) 554-1404, TDD: (202) 544-0551 and other personal protection measures.

(iii) The provisions of this section and § 763.91, Appendices A, C, and D of this subpart E of this part, EPA regulations contained in 40 CFR part 763, subpart G, and in 40 CFR part 61, subpart M, and OSHA regulations contained in 29 CFR 1926.58.

(iv) Hands-on training in the use of respiratory protection, other personal protection measures, and good work practices.

(3) Local education agency maintenance and custodial staff who have attended EPA-approved asbestos training or received equivalent training for O&M and periodic surveillance activities involving asbestos shall be considered trained for the purposes of this section.

(b) *Periodic surveillance.* (1) At least once every 6 months after a management plan is in effect, each local education agency shall conduct periodic surveillance in each building that it leases, owns, or otherwise uses as a school building that contains ACBM or is assumed to contain ACBM.

(2) Each person performing periodic surveillance shall:

(i) Visually inspect all areas that are identified in the management plan as ACBM or assumed ACBM.

(ii) Record the date of the surveillance, his or her name, and any changes in the condition of the materials.

(iii) Submit to the person designated to carry out general local education agency responsibilities under § 763.84 a copy of such record for inclusion in the management plan.

[52 FR 41846, Oct. 30, 1987, as amended at 60 FR 34465, July 3, 1995; 65 FR 69216, Nov. 15, 2000]

§ 763.93 Management plans.

(a)(1) On or before October 12, 1988, each local education agency shall develop an asbestos management plan for each school, including all buildings that they lease, own, or otherwise use as school buildings, and submit the plan to an Agency designated by the Governor of the State in which the local education agency is located. The plan may be submitted in stages that cover a portion of the school buildings under the authority of the local education agency.

Environmental Protection Agency

§ 763.93

(2) If a building to be used as part of a school is leased or otherwise acquired after October 12, 1988, the local education agency shall include the new building in the management plan for the school prior to its use as a school building. The revised portions of the management plan shall be submitted to the Agency designated by the Governor.

(3) If a local education agency begins to use a building as a school after October 12, 1988, the local education agency shall submit a management plan for the school to the Agency designated by the Governor prior to its use as a school.

(b) On or before October 17, 1987, the Governor of each State shall notify local education agencies in the State regarding where to submit their management plans. States may establish administrative procedures for reviewing management plans. If the Governor does not disapprove a management plan within 90 days after receipt of the plan, the local education agency shall implement the plan.

(c) Each local education agency must begin implementation of its management plan on or before July 9, 1989, and complete implementation in a timely fashion.

(d) Each local education agency shall maintain and update its management plan to keep it current with ongoing operations and maintenance, periodic surveillance, inspection, reinspection, and response action activities. All provisions required to be included in the management plan under this section shall be retained as part of the management plan, as well as any information that has been revised to bring the plan up-to-date.

(e) The management plan shall be developed by an accredited management planner and shall include:

(1) A list of the name and address of each school building and whether the school building contains friable ACBM, nonfriable ACBM, and friable and nonfriable suspected ACBM assumed to be ACM.

(2) For each inspection conducted before the December 14, 1987:

(i) The date of the inspection.

(ii) A blueprint, diagram, or written description of each school building that

identifies clearly each location and approximate square or linear footage of any homogeneous or sampling area where material was sampled for ACM, and, if possible, the exact locations where bulk samples were collected, and the dates of collection.

(iii) A copy of the analyses of any bulk samples, dates of analyses, and a copy of any other laboratory reports pertaining to the analyses.

(iv) A description of any response actions or preventive measures taken to reduce asbestos exposure, including if possible, the names and addresses of all contractors involved, start and completion dates of the work, and results of any air samples analyzed during and upon completion of the work.

(v) A description of assessments, required to be made under § 763.88, of material that was identified before December 14, 1987, as friable ACBM or friable suspected ACBM assumed to be ACM, and the name and signature, State of accreditation, and if applicable, accreditation number of each accredited person making the assessments.

(3) For each inspection and reinspection conducted under § 763.85:

(i) The date of the inspection or reinspection and the name and signature, State of accreditation and, if applicable, the accreditation number of each accredited inspector performing the inspection or reinspection.

(ii) A blueprint, diagram, or written description of each school building that identifies clearly each location and approximate square or linear footage of homogeneous areas where material was sampled for ACM, the exact location where each bulk sample was collected, date of collection, homogeneous areas where friable suspected ACBM is assumed to be ACM, and where nonfriable suspected ACBM is assumed to be ACM.

(iii) A description of the manner used to determine sampling locations, and the name and signature of each accredited inspector collecting samples, the State of accreditation, and if applicable, his or her accreditation number.

(iv) A copy of the analyses of any bulk samples collected and analyzed, the name and address of any laboratory

§ 763.93

40 CFR Ch. I (7–1–11 Edition)

that analyzed bulk samples, a statement that the laboratory meets the applicable requirements of § 763.87(a) the date of analysis, and the name and signature of the person performing the analysis.

(v) A description of assessments, required to be made under § 763.88, of all ACBM and suspected ACBM assumed to be ACM, and the name, signature, State of accreditation, and if applicable, accreditation number of each accredited person making the assessments.

(4) The name, address, and telephone number of the person designated under § 763.84 to ensure that the duties of the local education agency are carried out, and the course name, and dates and hours of training taken by that person to carry out the duties.

(5) The recommendations made to the local education agency regarding response actions, under § 763.88(d), the name, signature, State of accreditation of each person making the recommendations, and if applicable, his or her accreditation number.

(6) A detailed description of preventive measures and response actions to be taken, including methods to be used, for any friable ACBM, the locations where such measures and action will be taken, reasons for selecting the response action or preventive measure, and a schedule for beginning and completing each preventive measure and response action.

(7) With respect to the person or persons who inspected for ACBM and who will design or carry out response actions, except for operations and maintenance, with respect to the ACBM, one of the following statements:

(i) If the State has adopted a contractor accreditation program under section 206(b) of Title II of the Act, a statement that the person(s) is accredited under such plan.

(ii) A statement that the local education agency used (or will use) persons who have been accredited by another State which has adopted a contractor accreditation plan under section 206(b) of Title II of the Act or is accredited by an EPA-approved course under section 206(c) of Title II of the Act.

(8) A detailed description in the form of a blueprint, diagram, or in writing of

any ACBM or suspected ACBM assumed to be ACM which remains in the school once response actions are undertaken pursuant to § 763.90. This description shall be updated as response actions are completed.

(9) A plan for reinspection under § 763.85, a plan for operations and maintenance activities under § 763.91, and a plan for periodic surveillance under § 763.92, a description of the recommendation made by the management planner regarding additional cleaning under § 763.91(c)(2) as part of an operations and maintenance program, and the response of the local education agency to that recommendation.

(10) A description of steps taken to inform workers and building occupants, or their legal guardians, about inspections, reinspections, response actions, and post-response action activities, including periodic reinspection and surveillance activities that are planned or in progress.

(11) An evaluation of the resources needed to complete response actions successfully and carry out reinspection, operations and maintenance activities, periodic surveillance and training.

(12) With respect to each consultant who contributed to the management plan, the name of the consultant and one of the following statements:

(i) If the State has adopted a contractor accreditation plan under section 206(b) of Title II of the Act, a statement that the consultant is accredited under such plan.

(ii) A statement that the contractor is accredited by another State which has adopted a contractor accreditation plan under section 206(b) of Title II of the Act, or is accredited by an EPA-approved course developed under section 206(c) of Title II of the Act.

(f) A local education agency may require each management plan to contain a statement signed by an accredited management plan developer that such person has prepared or assisted in the preparation of such plan or has reviewed such plan, and that such plan is in compliance with this subpart E. Such statement may not be signed by a person who, in addition to preparing or assisting in preparing the management

Environmental Protection Agency

§ 763.94

plan, also implements (or will implement) the management plan.

(g)(1) Upon submission of a management plan to the Governor for review, a local education agency shall keep a copy of the plan in its administrative office. The management plans shall be available, without cost or restriction, for inspection by representatives of EPA and the State, the public, including teachers, other school personnel and their representatives, and parents. The local education agency may charge a reasonable cost to make copies of management plans.

(2) Each local education agency shall maintain in its administrative office a complete, updated copy of a management plan for each school under its administrative control or direction. The management plans shall be available, during normal business hours, without cost or restriction, for inspection by representatives of EPA and the State, the public, including teachers, other school personnel and their representatives, and parents. The local education agency may charge a reasonable cost to make copies of management plans.

(3) Each school shall maintain in its administrative office a complete, updated copy of the management plan for that school. Management plans shall be available for inspection, without cost or restriction, to workers before work begins in any area of a school building. The school shall make management plans available for inspection to representatives of EPA and the State, the public, including parents, teachers, and other school personnel and their representatives within 5 working days after receiving a request for inspection. The school may charge a reasonable cost to make copies of the management plan.

(4) Upon submission of its management plan to the Governor and at least once each school year, the local education agency shall notify in writing parent, teacher, and employee organizations of the availability of management plans and shall include in the management plan a description of the steps taken to notify such organizations, and a dated copy of the notification. In the absence of any such organizations for parents, teachers, or employees, the local education agency

shall provide written notice to that relevant group of the availability of management plans and shall include in the management plan a description of the steps taken to notify such groups, and a dated copy of the notification.

(h) Records required under § 763.94 shall be made by local education agencies and maintained as part of the management plan.

(i) Each management plan must contain a true and correct statement, signed by the individual designated by the local education agency under § 763.84, which certifies that the general, local education agency responsibilities, as stipulated by § 763.84, have been met or will be met.

§ 763.94 Recordkeeping.

(a) Records required under this section shall be maintained in a centralized location in the administrative office of both the school and the local education agency as part of the management plan. For each homogeneous area where all ACBM has been removed, the local education agency shall ensure that such records are retained for 3 years after the next reinspection required under § 763.85(b)(1), or for an equivalent period.

(b) For each preventive measure and response action taken for friable and nonfriable ACBM and friable and nonfriable suspected ACBM assumed to be ACM, the local education agency shall provide:

(1) A detailed written description of the measure or action, including methods used, the location where the measure or action was taken, reasons for selecting the measure or action, start and completion dates of the work, names and addresses of all contractors involved, and if applicable, their State of accreditation, and accreditation numbers, and if ACBM is removed, the name and location of storage or disposal site of the ACM.

(2) The name and signature of any person collecting any air sample required to be collected at the completion of certain response actions specified by § 763.90(i), the locations where samples were collected, date of collection, the name and address of the laboratory analyzing the samples, the date of analysis, the results of the

§ 763.95

analysis, the method of analysis, the name and signature of the person performing the analysis, and a statement that the laboratory meets the applicable requirements of § 763.90(i)(2)(ii).

(c) For each person required to be trained under § 763.92(a) (1) and (2), the local education agency shall provide the person's name and job title, the date that training was completed by that person, the location of the training, and the number of hours completed in such training.

(d) For each time that periodic surveillance under § 763.92(b) is performed, the local education agency shall record the name of each person performing the surveillance, the date of the surveillance, and any changes in the conditions of the materials.

(e) For each time that cleaning under § 763.91(c) is performed, the local education agency shall record the name of each person performing the cleaning, the date of such cleaning, the locations cleaned, and the methods used to perform such cleaning.

(f) For each time that operations and maintenance activities under § 763.91(d) are performed, the local education agency shall record the name of each person performing the activity, the start and completion dates of the activity, the locations where such activity occurred, a description of the activity including preventive measures used, and if ACM is removed, the name and location of storage or disposal site of the ACM.

(g) For each time that major asbestos activity under § 763.91(e) is performed, the local education agency shall provide the name and signature, State of accreditation, and if applicable, the accreditation number of each person performing the activity, the start and completion dates of the activity, the locations where such activity occurred, a description of the activity including preventive measures used, and if ACM is removed, the name and location of storage or disposal site of the ACM.

(h) For each fiber release episode under § 763.91(f), the local education agency shall provide the date and location of the episode, the method of repair, preventive measures or response action taken, the name of each person performing the work, and if ACM is

40 CFR Ch. I (7-1-11 Edition)

removed, the name and location of storage or disposal site of the ACM.

(Approved by the Office of Management and Budget under control number 2070-0091)

§ 763.95 Warning labels.

(a) The local education agency shall attach a warning label immediately adjacent to any friable and nonfriable ACM and suspected ACM assumed to be ACM located in routine maintenance areas (such as boiler rooms) at each school building. This shall include:

(1) Friable ACM that was responded to by a means other than removal.

(2) ACM for which no response action was carried out.

(b) All labels shall be prominently displayed in readily visible locations and shall remain posted until the ACM that is labeled is removed.

(c) The warning label shall read, in print which is readily visible because of large size or bright color, as follows: CAUTION: ASBESTOS. HAZARDOUS. DO NOT DISTURB WITHOUT PROPER TRAINING AND EQUIPMENT.

§ 763.97 Compliance and enforcement.

(a) *Compliance with Title II of the Act.* (1) Section 207(a) of Title II of the Act (15 U.S.C. 2647) makes it unlawful for any local education agency to:

(i) Fail to conduct inspections pursuant to section 203(b) of Title II of the Act, including failure to follow procedures and failure to use accredited personnel and laboratories.

(ii) Knowingly submit false information to the Governor regarding any inspection pursuant to regulations under section 203(i) of Title II of the Act.

(iii) Fail to develop a management plan pursuant to regulations under section 203(i) of Title II of the Act.

(2) Section 207(a) of Title II of the Act (15 U.S.C. 2647) also provides that any local education agency which violates any provision of section 207 shall be liable for a civil penalty of not more than \$5,000 for each day during which the violation continues. For the purposes of this subpart, a "violation" means a failure to comply with respect to a single school building.

(b) *Compliance with Title I of the Act.* (1) Section 15(1)(D) of Title I of the Act (15 U.S.C. 2614) makes it unlawful for

Environmental Protection Agency

§ 763.98

any person to fail or refuse to comply with any requirement of Title II or any rule promulgated or order issued under Title II. Therefore, any person who violates any requirement of this subpart is in violation of section 15 of Title I of the Act.

(2) Section 15(3) of Title I of the Act (15 U.S.C. 2614) makes it unlawful for any person to fail or refuse to establish or maintain records, submit reports, notices or other information, or permit access to or copying of records, as required by this Act or a rule thereunder.

(3) Section 15(4) (15 U.S.C. 2614) of Title I of the Act makes it unlawful for any person to fail or refuse to permit entry or inspection as required by section 11 of Title I of the Act.

(4) Section 16(a) of Title I of the Act (15 U.S.C. 2615) provides that any person who violates any provision of section 15 of Title I of the Act shall be liable to the United States for a civil penalty in an amount not to exceed \$25,000 for each such violation. Each day such a violation continues shall, for purposes of this paragraph, constitute a separate violation of section 15. A local education agency is not liable for any civil penalty under Title I of the Act for failing or refusing to comply with any rule promulgated or order issued under Title II of the Act.

(c) *Criminal penalties.* If any violation committed by any person (including a local education agency) is knowing or willful, criminal penalties may be assessed under section 16(b) of Title I of the Act.

(d) *Injunctive relief.* The Agency may obtain injunctive relief under section 208(b) of Title II of the Act to respond to a hazard which poses an imminent and substantial endangerment to human health or the environment or section 17 (15 U.S.C. 2616) of Title I of the Act to restrain any violation of section 15 of Title I of the Act or to compel the taking of any action required by or under Title I of the Act.

(e) *Citizen complaints.* Any citizen who wishes to file a complaint pursuant to section 207(d) of Title II of the Act should direct the complaint to the Governor of the State or the EPA Asbestos Ombudsman, 1200 Pennsylvania Ave., NW., Washington, DC 20460. The citizen complaint should be in writing and

identified as a citizen complaint pursuant to section 207(d) of Title II of TSCA. The EPA Asbestos Ombudsman or the Governor shall investigate and respond to the complaint within a reasonable period of time if the allegations provide a reasonable basis to believe that a violation of the Act has occurred.

(f) *Inspections.* EPA may conduct inspections and review management plans under section 11 of Title I of the Act (15 U.S.C. 2610) to ensure compliance.

§ 763.98 Waiver; delegation to State.

(a) *General.* (1) Upon request from a state Governor and after notice and comment and an opportunity for a public hearing in accordance with paragraphs (b) and (c) of this section, EPA may waive some or all of the requirements of this subpart E if the state has established and is implementing or intends to implement a program of asbestos inspection and management that contains requirements that are at least as stringent as the requirements of this subpart. In addition, if the state chooses to receive electronic documents, the state program must include, at a minimum, the requirements of 40 CFR part 3—(Electronic reporting).

(2) A waiver from any requirement of this subpart E shall apply only to the specific provision for which a waiver has been granted under this section. All requirements of this subpart E shall apply until a waiver is granted under this section.

(b) *Request.* Each request by a Governor to waive any requirement of this subpart E shall be sent with three complete copies of the request to the Regional Administrator for the EPA Region in which the State is located and shall include:

(1) A copy of the State provisions or proposed provisions relating to its program of asbestos inspection and management in schools for which the request is made.

(2)(i) The name of the State agency that is or will be responsible for administering and enforcing the requirements for which a waiver is requested, the names and job titles of responsible officials in that agency, and phone

numbers where the officials can be contacted.

(ii) In the event that more than one agency is or will be responsible for administering and enforcing the requirements for which a waiver is requested, a description of the functions to be performed by each agency, how the program will be coordinated by the lead agency to ensure consistency and effective administration in the asbestos inspection and management program within the State, the names and job titles of responsible officials in the agencies, and phone numbers where the officials can be contacted. The lead agency will serve as the central contact point for the EPA.

(3) Detailed reasons, supporting papers, and the rationale for concluding that the state's asbestos inspection and management program provisions for which the request is made are at least as stringent as the requirements of Subpart E of this part, and that, if the state chooses to receive electronic documents, the state program includes, at a minimum, the requirements of 40 CFR part 3—(Electronic reporting).

(4) A discussion of any special situations, problems, and needs pertaining to the waiver request accompanied by an explanation of how the State intends to handle them.

(5) A statement of the resources that the State intends to devote to the administration and enforcement of the provisions relating to the waiver request.

(6) Copies of any specific or enabling State laws (enacted and pending enactment) and regulations (promulgated and pending promulgation) relating to the request, including provisions for assessing criminal and/or civil penalties.

(7) Assurance from the Governor, the Attorney General, or the legal counsel of the lead agency that the lead agency or other cooperating agencies have the legal authority necessary to carry out the requirements relating to the request.

(c) *General notice—hearing.* (1) Within 30 days after receipt of a request for a waiver, EPA will determine the completeness of the request. If EPA does not request further information within

the 30-day period, the request will be deemed complete.

(2) Within 30 days after EPA determines that a request is complete, EPA will issue for publication in the FEDERAL REGISTER a notice that announces receipt of the request, describes the information submitted under paragraph (b) of this section, and solicits written comment from interested members of the public. Comments must be submitted within 60 days.

(3) If, during the comment period, EPA receives a written objection to a Governor's request and a request for a public hearing detailing specific objections to the granting of a waiver, EPA will schedule a public hearing to be held in the affected State after the close of the comment period and will announce the public hearing date in the FEDERAL REGISTER before the date of the hearing. Each comment shall include the name and address of the person submitting the comment.

(d) *Criteria.* EPA may waive some or all of the requirements of subpart E of this part if:

(1) The State's lead agency and other cooperating agencies have the legal authority necessary to carry out the provisions of asbestos inspection and management in schools relating to the waiver request.

(2) The State's program of asbestos inspection and management in schools relating to the waiver request and implementation of the program are or will be at least as stringent as the requirements of this subpart E.

(3) The state has an enforcement mechanism to allow it to implement the program described in the waiver request and any electronic reporting requirements are at least as stringent as 40 CFR part 3—(Electronic reporting).

(4) The lead agency and any cooperating agencies have or will have qualified personnel to carry out the provisions relating to the waiver request.

(5) The State will devote adequate resources to the administration and enforcement of the asbestos inspection and management provisions relating to the waiver request.

(6) When specified by EPA, the State gives satisfactory assurances that necessary steps, including specific actions it proposes to take and a time schedule

Environmental Protection Agency

§ 763.99

for their accomplishment, will be taken within a reasonable time to conform with applicable criteria under paragraphs (d) (2) through (4) of this section.

(e) *Decision.* EPA will issue for publication in the FEDERAL REGISTER a notice announcing its decision to grant or deny, in whole or in part, a Governor's request for a waiver from some or all of the requirements of this subpart E within 30 days after the close of the comment period or within 30 days following a public hearing, whichever is applicable. The notice will include the Agency's reasons and rationale for granting or denying the Governor's request. The 30-day period may be extended if mutually agreed upon by EPA and the State.

(f) *Modifications.* When any substantial change is made in the administration or enforcement of a State program for which a waiver was granted under this section, a responsible official in the lead agency shall submit such changes to EPA.

(g) *Reports.* The lead agency in each State that has been granted a waiver by EPA from any requirement of subpart E of this part shall submit a report to the Regional Administrator for the Region in which the State is located at least once every 12 months to include the following information:

(1) A summary of the State's implementation and enforcement activities during the last reporting period relating to provisions waived under this section, including enforcement actions taken.

(2) Any changes in the administration or enforcement of the State program implemented during the last reporting period.

(3) Other reports as may be required by EPA to carry out effective oversight of any requirement of this subpart E that was waived under this section.

(h) *Oversight.* EPA may periodically evaluate the adequacy of a State's implementation and enforcement of and resources devoted to carrying out requirements relating to the waiver. This evaluation may include, but is not limited to, site visits to local education agencies without prior notice to the State.

(i) *Informal conference.* (1) EPA may request that an informal conference be held between appropriate State and EPA officials when EPA has reason to believe that a State has failed to:

(i) Substantially comply with the terms of any provision that was waived under this section.

(ii) Meet the criteria under paragraph (d) of this section, including the failure to carry out enforcement activities or act on violations of the State program.

(2) EPA will:

(i) Specify to the State those aspects of the State's program believed to be inadequate.

(ii) Specify to the State the facts that underlie the belief of inadequacy.

(3) If EPA finds, on the basis of information submitted by the State at the conference, that deficiencies did not exist or were corrected by the State, no further action is required.

(4) Where EPA finds that deficiencies in the State program exist, a plan to correct the deficiencies shall be negotiated between the State and EPA. The plan shall detail the deficiencies found in the State program, specify the steps the State has taken or will take to remedy the deficiencies, and establish a schedule for each remedial action to be initiated.

(j) *Rescission.* (1) If the State fails to meet with EPA or fails to correct deficiencies raised at the informal conference, EPA will deliver to the Governor of the State and a responsible official in the lead agency a written notice of its intent to rescind, in whole or part, the waiver.

(2) EPA will issue for publication in the FEDERAL REGISTER a notice that announces the rescission of the waiver, describes those aspects of the State's program determined to be inadequate, and specifies the facts that underlie the findings of inadequacy.

[52 FR 41846, Oct. 30, 1987, as amended at 70 FR 59889, Oct. 13, 2005]

§ 763.99 Exclusions.

(a) A local education agency shall not be required to perform an inspection under § 763.85(a) in any sampling area as defined in 40 CFR 763.103 or homogeneous area of a school building where:

(1) An accredited inspector has determined that, based on sampling records, friable ACBM was identified in that homogeneous or sampling area during an inspection conducted before December 14, 1987. The inspector shall sign and date a statement to that effect with his or her State of accreditation and if applicable, accreditation number and, within 30 days after such determination, submit a copy of the statement to the person designated under § 763.84 for inclusion in the management plan. However, an accredited inspector shall assess the friable ACBM under § 763.88.

(2) An accredited inspector has determined that, based on sampling records, nonfriable ACBM was identified in that homogeneous or sampling area during an inspection conducted before December 14, 1987. The inspector shall sign and date a statement to that effect with his or her State of accreditation and if applicable, accreditation number and, within 30 days after such determination, submit a copy of the statement to the person designated under § 763.84 for inclusion in the management plan. However, an accredited inspector shall identify whether material that was nonfriable has become friable since that previous inspection and shall assess the newly-friable ACBM under § 763.88.

(3) Based on sampling records and inspection records, an accredited inspector has determined that no ACBM is present in the homogeneous or sampling area and the records show that the area was sampled, before December 14, 1987 in substantial compliance with § 763.85(a), which for purposes of this section means in a random manner and with a sufficient number of samples to reasonably ensure that the area is not ACBM.

(i) The accredited inspector shall sign and date a statement, with his or her State of accreditation and if applicable, accreditation number that the homogeneous or sampling area determined not to be ACBM was sampled in substantial compliance with § 763.85(a).

(ii) Within 30 days after the inspector's determination, the local education agency shall submit a copy of the inspector's statement to the EPA Regional Office and shall include the

statement in the management plan for that school.

(4) The lead agency responsible for asbestos inspection in a State that has been granted a waiver from § 763.85(a) has determined that, based on sampling records and inspection records, no ACBM is present in the homogeneous or sampling area and the records show that the area was sampled before December 14, 1987, in substantial compliance with § 763.85(a). Such determination shall be included in the management plan for that school.

(5) An accredited inspector has determined that, based on records of an inspection conducted before December 14, 1987, suspected ACBM identified in that homogeneous or sampling area is assumed to be ACM. The inspector shall sign and date a statement to that effect, with his or her State of accreditation and if applicable, accreditation number and, within 30 days of such determination, submit a copy of the statement to the person designated under § 763.84 for inclusion in the management plan. However, an accredited inspector shall identify whether material that was nonfriable suspected ACBM assumed to be ACM has become friable since the previous inspection and shall assess the newly friable material and previously identified friable suspected ACBM assumed to be ACM under § 763.88.

(6) Based on inspection records and contractor and clearance records, an accredited inspector has determined that no ACBM is present in the homogeneous or sampling area where asbestos removal operations have been conducted before December 14, 1987, and shall sign and date a statement to that effect and include his or her State of accreditation and, if applicable, accreditation number. The local education agency shall submit a copy of the statement to the EPA Regional Office and shall include the statement in the management plan for that school.

(7) An architect or project engineer responsible for the construction of a new school building built after October 12, 1988, or an accredited inspector signs a statement that no ACBM was specified as a building material in any

Environmental Protection Agency

Pt. 763, Subpt. E, App. A

construction document for the building, or, to the best of his or her knowledge, no ACBM was used as a building material in the building. The local education agency shall submit a copy of the signed statement of the architect, project engineer, or accredited inspector to the EPA Regional Office and shall include the statement in the management plan for that school.

(b) The exclusion, under paragraphs (a) (1) through (4) of this section, from conducting the inspection under §763.85(a) shall apply only to homogeneous or sampling areas of a school building that were inspected and sampled before October 17, 1987. The local education agency shall conduct an inspection under §763.85(a) of all areas inspected before October 17, 1987, that were not sampled or were not assumed to be ACM.

(c) If ACBM is subsequently found in a homogeneous or sampling area of a local education agency that had been identified as receiving an exclusion by an accredited inspector under paragraphs (a) (3), (4), (5) of this section, or an architect, project engineer or accredited inspector under paragraph (a)(7) of this section, the local education agency shall have 180 days following the date of identification of ACBM to comply with this subpart E.

APPENDIX A TO SUBPART E OF PART 763—INTERIM TRANSMISSION ELECTRON MICROSCOPY ANALYTICAL METHODS—MANDATORY AND NON-MANDATORY—AND MANDATORY SECTION TO DETERMINE COMPLETION OF RESPONSE ACTIONS

I. Introduction

The following appendix contains three units. The first unit is the mandatory transmission electron microscopy (TEM) method which all laboratories must follow; it is the minimum requirement for analysis of air samples for asbestos by TEM. The mandatory method contains the essential elements of the TEM method. The second unit contains the complete non-mandatory method. The non-mandatory method supplements the mandatory method by including additional steps to improve the analysis. EPA recommends that the non-mandatory method be employed for analyzing air filters; however, the laboratory may choose to employ the mandatory method. The non-mandatory method contains the same minimum require-

ments as are outlined in the mandatory method. Hence, laboratories may choose either of the two methods for analyzing air samples by TEM.

The final unit of this Appendix A to subpart E defines the steps which must be taken to determine completion of response actions. This unit is mandatory.

II. Mandatory Transmission Electron Microscopy Method

A. Definitions of Terms

1. *Analytical sensitivity*—Airborne asbestos concentration represented by each fiber counted under the electron microscope. It is determined by the air volume collected and the proportion of the filter examined. This method requires that the analytical sensitivity be no greater than 0.005 structures/cm³.

2. *Asbestiform*—A specific type of mineral fibrosity in which the fibers and fibrils possess high tensile strength and flexibility.

3. *Aspect ratio*—A ratio of the length to the width of a particle. Minimum aspect ratio as defined by this method is equal to or greater than 5:1.

4. *Bundle*—A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

5. *Clean area*—A controlled environment which is maintained and monitored to assure a low probability of asbestos contamination to materials in that space. Clean areas used in this method have HEPA filtered air under positive pressure and are capable of sustained operation with an open laboratory blank which on subsequent analysis has an average of less than 18 structures/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a maximum of 53 structures/mm² for any single preparation for that same area.

6. *Cluster*—A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

7. *ED*—Electron diffraction.

8. *EDXA*—Energy dispersive X-ray analysis.

9. *Fiber*—A structure greater than or equal to 0.5 μm in length with an aspect ratio (length to width) of 5:1 or greater and having substantially parallel sides.

10. *Grid*—An open structure for mounting on the sample to aid in its examination in the TEM. The term is used here to denote a 200-mesh copper lattice approximately 3 mm in diameter.

11. *Intersection*—Nonparallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater.

12. *Laboratory sample coordinator*—That person responsible for the conduct of sample

Pt. 763, Subpt. E, App. A

40 CFR Ch. I (7–1–11 Edition)

handling and the certification of the testing procedures.

13. *Filter background level*—The concentration of structures per square millimeter of filter that is considered indistinguishable from the concentration measured on a blank (filters through which no air has been drawn). For this method the filter background level is defined as 70 structures/mm².

14. *Matrix*—Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

15. *NSD*—No structure detected.

16. *Operator*—A person responsible for the TEM instrumental analysis of the sample.

17. *PCM*—Phase contrast microscopy.

18. *SAED*—Selected area electron diffraction.

19. *SEM*—Scanning electron microscope.

20. *STEM*—Scanning transmission electron microscope.

21. *Structure*—a microscopic bundle, cluster, fiber, or matrix which may contain asbestos.

22. *S/cm³*—Structures per cubic centimeter.

23. *S/mm²*—Structures per square millimeter.

24. *TEM*—Transmission electron microscope.

B. Sampling

1. The sampling agency must have written quality control procedures and documents which verify compliance.

2. Sampling operations must be performed by qualified individuals completely independent of the abatement contractor to avoid possible conflict of interest (References 1, 2, 3, and 5 of Unit II.J.).

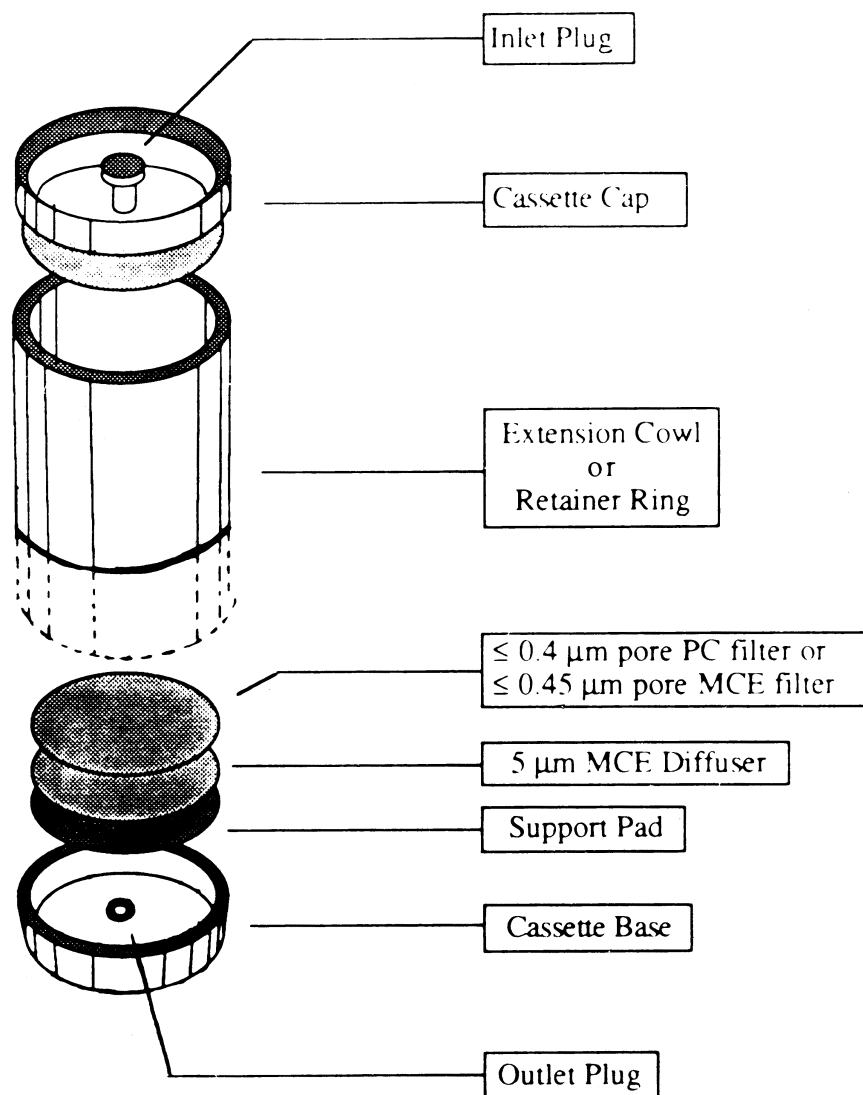
3. Sampling for airborne asbestos following an abatement action must use commercially available cassettes.

4. Prescreen the loaded cassette collection filters to assure that they do not contain concentrations of asbestos which may interfere with the analysis of the sample. A filter blank average of less than 18 s/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a single preparation with a maximum of 53 s/mm² for that same area is acceptable for this method.

5. Use sample collection filters which are either polycarbonate having a pore size less than or equal to 0.4 µm or mixed cellulose ester having a pore size less than or equal to 0.45 µm.

6. Place these filters in series with a 5.0 µm backup filter (to serve as a diffuser) and a support pad. See the following Figure 1:

FIGURE I--SAMPLING CASSETTE CONFIGURATION



7. Reloading of used cassettes is not permitted.

8. Orient the cassette downward at approximately 45 degrees from the horizontal.

9. Maintain a log of all pertinent sampling information.

Pt. 763, Subpt. E, App. A

40 CFR Ch. I (7–1–11 Edition)

10. Calibrate sampling pumps and their flow indicators over the range of their intended use with a recognized standard. Assemble the sampling system with a representative filter (not the filter which will be used in sampling) before and after the sampling operation.

11. Record all calibration information.

12. Ensure that the mechanical vibrations from the pump will be minimized to prevent transferral of vibration to the cassette.

13. Ensure that a continuous smooth flow of negative pressure is delivered by the pump by damping out any pump action fluctuations if necessary.

14. The final plastic barrier around the abatement area remains in place for the sampling period.

15. After the area has passed a thorough visual inspection, use aggressive sampling conditions to dislodge any remaining dust. (See suggested protocol in Unit III.B.7.d.)

16. Select an appropriate flow rate equal to or greater than 1 liter per minute (L/min) or less than 10 L/min for 25 mm cassettes. Larger filters may be operated at proportionally higher flow rates.

17. A minimum of 13 samples are to be collected for each testing site consisting of the following:

a. A minimum of five samples per abatement area.

b. A minimum of five samples per ambient area positioned at locations representative of the air entering the abatement site.

c. Two field blanks are to be taken by removing the cap for not more than 30 seconds and replacing it at the time of sampling before sampling is initiated at the following places:

i. Near the entrance to each abatement area.

ii. At one of the ambient sites. (DO NOT leave the field blanks open during the sampling period.)

d. A sealed blank is to be carried with each sample set. This representative cassette is not to be opened in the field.

18. Perform a leak check of the sampling system at each indoor and outdoor sampling site by activating the pump with the closed sampling cassette in line. Any flow indicates a leak which must be eliminated before initiating the sampling operation.

19. The following Table I specifies volume ranges to be used:

TABLE 1--NUMBER OF 200 MESH EM GRID OPENINGS
(0.0057 MM²) THAT NEED TO BE ANALYZED TO
MAINTAIN SENSITIVITY OF 0.005 STRUCTURES/CC
BASED ON VOLUME AND EFFECTIVE FILTER AREA

Effective Filter Area 385 sq mm		Effective Filter Area 855 sq mm	
Volume (liters)	# of grid openings	Volume (liters)	# of grid openings
560	24	1,250	24
600	23	1,300	23
700	19	1,400	21
800	17	1,600	19
900	15	1,800	17
1,000	14	2,000	15
1,100	12	2,200	14
1,200	11	2,400	13
1,300	10	2,600	12
1,400	10	2,800	11
1,500	9	3,000	10
1,600	8	3,200	9
1,700	8	3,400	9
1,800	8	3,600	8
1,900	7	3,800	8
2,000	7	4,000	8
2,100	6	4,200	7
2,200	6	4,400	7
2,300	6	4,600	7
2,400	6	4,800	6
2,500	5	5,000	6
2,600	5	5,200	6
2,700	5	5,400	6
2,800	5	5,600	5
2,900	5	5,800	5
3,000	5	6,000	5
3,100	4	6,200	5
3,200	4	6,400	5
3,300	4	6,600	5
3,400	4	6,800	4
3,500	4	7,000	4
3,600	4	7,200	4
3,700	4	7,400	4
3,800	4	7,600	4

Note minimum volumes required:
25 mm : 560 liters
37 mm : 1250 liters

Filter diameter of 25 mm = effective area of 385 sq mm
Filter diameter of 37 mm = effective area of 855 sq mm

20. Ensure that the sampler is turned up-right before interrupting the pump flow.

21. Check that all samples are clearly labeled and that all pertinent information has been enclosed before transfer of the samples to the laboratory.

22. Ensure that the samples are stored in a secure and representative location.

23. Do not change containers if portions of these filters are taken for other purposes.

24. A summary of Sample Data Quality Objectives is shown in the following Table II:

TABLE II--SUMMARY OF SAMPLING AGENCY DATA QUALITY OBJECTIVES

This table summarizes the data quality objectives from the performance of this method in terms of precision, accuracy, completeness, representativeness, and comparability. These objectives are assured by the periodic control checks and reference checks listed here and described in the text of the method.

Unit Operation	QC Check	Frequency	Conformance Expectation
Sampling materials	Sealed blank	1 per I/O site	95%
Sample procedures	Field blanks	2 per I/O site	95%
	Pump calibration	Before and after each field series	90%
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample shipment	Review of sending report	Each sample	95% complete

C. Sample Shipment

Ship bulk samples to the analytical laboratory in a separate container from air samples.

D. Sample Receiving

1. Designate one individual as sample coordinator at the laboratory. While that individual will normally be available to receive samples, the coordinator may train and supervise others in receiving procedures for those times when he/she is not available.

2. Bulk samples and air samples delivered to the analytical laboratory in the same container shall be rejected.

E. Sample Preparation

1. All sample preparation and analysis shall be performed by a laboratory independent of the abatement contractor.

2. Wet-wipe the exterior of the cassettes to minimize contamination possibilities before taking them into the clean room facility.

3. Perform sample preparation in a well-equipped clean facility.

NOTE: The clean area is required to have the following minimum characteristics. The area or hood must be capable of maintaining a positive pressure with make-up air being HEPA-filtered. The cumulative analytical blank concentration must average less than 18 s/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a single preparation with a maximum of 53 s/mm² for that same area.

4. Preparation areas for air samples must not only be separated from preparation areas for bulk samples, but they must be prepared in separate rooms.

5. Direct preparation techniques are required. The object is to produce an intact film containing the particulates of the filter surface which is sufficiently clear for TEM analysis.

a. TEM Grid Opening Area measurement must be done as follows:

i. The filter portion being used for sample preparation must have the surface collapsed using an acetone vapor technique.

ii. Measure 20 grid openings on each of 20 random 200-mesh copper grids by placing a grid on a glass and examining it under the PCM. Use a calibrated graticule to measure the average field diameters. From the data, calculate the field area for an average grid opening.

iii. Measurements can also be made on the TEM at a properly calibrated low magnification or on an optical microscope at a magnification of approximately 400X by using an eyepiece fitted with a scale that has been calibrated against a stage micrometer. Optical microscopy utilizing manual or automated procedures may be used providing instrument calibration can be verified.

b. TEM specimen preparation from polycarbonate (PC) filters. Procedures as described in Unit III.G. or other equivalent methods may be used.

c. TEM specimen preparation from mixed cellulose ester (MCE) filters.

i. Filter portion being used for sample preparation must have the surface collapsed using an acetone vapor technique or the Burdette procedure (Ref. 7 of Unit II.J.)

ii. Plasma etching of the collapsed filter is required. The microscope slide to which the collapsed filter pieces are attached is placed in a plasma asher. Because plasma ashers vary greatly in their performance, both from unit to unit and between different positions in the asher chamber, it is difficult to specify the conditions that should be used. Insufficient etching will result in a failure to expose embedded filters, and too much etching may result in loss of particulate from the surface. As an interim measure, it is recommended that the time for ashing of a

known weight of a collapsed filter be established and that the etching rate be calculated in terms of micrometers per second. The actual etching time used for the particulate ashers and operating conditions will then be set such that a 1-2 μm (10 percent) layer of collapsed surface will be removed.

iii. Procedures as described in Unit III, or other equivalent methods may be used to prepare samples.

F. TEM Method

1. An 80-120 kV TEM capable of performing electron diffraction with a fluorescent screen inscribed with calibrated gradations is required. If the TEM is equipped with EDXA it must either have a STEM attachment or be capable of producing a spot less than 250 nm in diameter at crossover. The microscope shall be calibrated routinely for magnification and camera constant.

2. *Determination of Camera Constant and ED Pattern Analysis.* The camera length of the TEM in ED operating mode must be calibrated before ED patterns on unknown samples are observed. This can be achieved by using a carbon-coated grid on which a thin film of gold has been sputtered or evaporated. A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis ED patterns superimposed with a ring pattern from the polycrystalline gold film. In practice, it is desirable to optimize the thickness of the gold film so that only one or two sharp rings are obtained on the superimposed ED pattern. Thicker gold film would normally give multiple gold rings, but it will tend to mask weaker diffraction spots from the unknown fibrous particulate. Since the unknown d-spacings of most interest in asbestos analysis are those which lie closest to the transmitted beam, multiple gold rings are unnecessary on zone-axis ED patterns. An average camera constant using multiple gold rings can be determined. The camera constant is one-half the diameter of the rings times the interplanar spacing of the ring being measured.

3. *Magnification Calibration.* The magnification calibration must be done at the fluorescent screen. The TEM must be calibrated at the grid opening magnification (if used) and also at the magnification used for fiber counting. This is performed with a cross grating replica (e.g., one containing 2,160 lines/mm). Define a field of view on the fluorescent screen either by markings or physical boundaries. The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should

be metric). A logbook must be maintained, and the dates of calibration and the values obtained must be recorded. The frequency of calibration depends on the past history of the particular microscope. After any maintenance of the microscope that involved adjustment of the power supplied to the lenses or the high-voltage system or the mechanical disassembly of the electron optical column apart from filament exchange, the magnification must be recalibrated. Before the TEM calibration is performed, the analyst must ensure that the cross grating replica is placed at the same distance from the objective lens as the specimens are. For instruments that incorporate a eucentric tilting specimen stage, all specimens and the cross grating replica must be placed at the eucentric position.

4. While not required on every microscope in the laboratory, the laboratory must have either one microscope equipped with energy dispersive X-ray analysis or access to an equivalent system on a TEM in another laboratory.

5. Microscope settings: 80-120 kV, grid assessment 250-1,000X, then 15,000-20,000X screen magnification for analysis.

6. Approximately one-half (0.5) of the predetermined sample area to be analyzed shall be performed on one sample grid preparation and the remaining half on a second sample grid preparation.

7. Individual grid openings with greater than 5 percent openings (holes) or covered with greater than 25 percent particulate matter or obviously having nonuniform loading must not be analyzed.

8. Reject the grid if:

a. Less than 50 percent of the grid openings covered by the replica are intact.

b. The replica is doubled or folded.

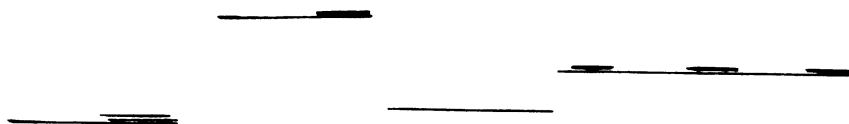
c. The replica is too dark because of incomplete dissolution of the filter.

9. *Recording Rules.*

a. Any continuous grouping of particles in which an asbestos fiber with an aspect ratio greater than or equal to 5:1 and a length greater than or equal to 0.5 μm is detected shall be recorded on the count sheet. These will be designated asbestos structures and will be classified as fibers, bundles, clusters, or matrices. Record as individual fibers any contiguous grouping having 0, 1, or 2 definable intersections. Groupings having more than 2 intersections are to be described as cluster or matrix. An intersection is a non-parallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater. See the following Figure 2:

FIGURE 2--COUNTING GUIDELINES USED IN
DETERMINING ASBESTOS STRUCTURES

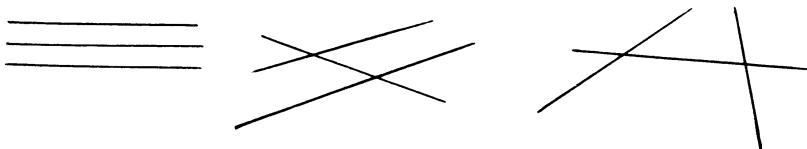
Count as 1 fiber; 1 Structure; no intersections.



Count as 2 fibers if space between fibers is greater than width of 1 fiber diameter or number of intersections is equal to or less than 1.



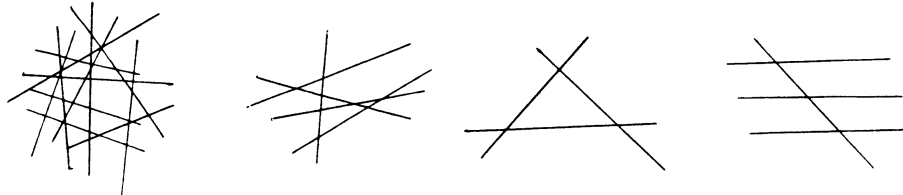
Count as 3 structures if space between fibers is greater than width of 1 fiber diameter or if the number of intersections is equal to or less than 2.



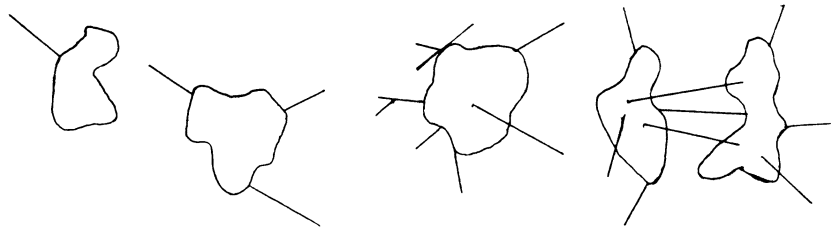
Count bundles as 1 structure; 3 or more parallel fibrils less than 1 fiber diameter separation.



Count clusters as 1 structure; fibers having greater than or equal to 3 intersections.



Count matrix as 1 structure.



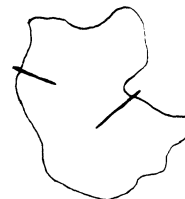
DO NOT COUNT AS STRUCTURES:



Fiber protrusion
<5:1 Aspect Ratio



No fiber protrusion



Fiber protrusion
<0.5 micrometer

— <0.5 micrometer in length
— <5:1 Aspect Ratio

i. *Fiber*. A structure having a minimum length greater than or equal to 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

ii. *Bundle*. A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

iii. *Cluster*. A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated

from the group. Groupings must have more than two intersections.

iv. *Matrix*. Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

b. Separate categories will be maintained for fibers less than 5 μm and for fibers equal to or greater than 5 μm in length.

c. Record NSD when no structures are detected in the field.

d. Visual identification of electron diffraction (ED) patterns is required for each asbestos structure counted which would cause the

analysis to exceed the 70 s/mm² concentration. (Generally this means the first four fibers identified as asbestos must exhibit an identifiable diffraction pattern for chrysotile or amphibole.)

e. The micrograph number of the recorded diffraction patterns must be reported to the client and maintained in the laboratory's quality assurance records. In the event that examination of the pattern by a qualified individual indicates that the pattern has been misidentified visually, the client shall be contacted.

f. Energy Dispersive X-ray Analysis (EDXA) is required of all amphiboles which would cause the analysis results to exceed the 70 s/mm² concentration. (Generally speaking, the first 4 amphiboles would require EDXA.)

g. If the number of fibers in the non-asbestos class would cause the analysis to exceed the 70 s/mm² concentration, the fact that they are not asbestos must be confirmed by EDXA or measurement of a zone axis diffraction pattern.

h. Fibers classified as chrysotile must be identified by diffraction or X-ray analysis and recorded on a count sheet. X-ray analysis alone can be used only after 70 s/mm² have been exceeded for a particular sample.

i. Fibers classified as amphiboles must be identified by X-ray analysis and electron diffraction and recorded on the count sheet. (X-ray analysis alone can be used only after 70 s/mm² have been exceeded for a particular sample.)

j. If a diffraction pattern was recorded on film, record the micrograph number on the count sheet.

k. If an electron diffraction was attempted but no pattern was observed, record N on the count sheet.

l. If an EDXA spectrum was attempted but not observed, record N on the count sheet.

m. If an X-ray analysis spectrum is stored, record the file and disk number on the count sheet.

10. Classification Rules.

a. *Fiber*. A structure having a minimum length greater than or equal to 0.5 μ m and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

b. *Bundle*. A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

c. *Cluster*. A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

d. *Matrix*. Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

11. After finishing with a grid, remove it from the microscope, and replace it in the appropriate grid holder. Sample grids must be stored for a minimum of 1 year from the date of the analysis; the sample cassette must be retained for a minimum of 30 days by the laboratory or returned at the client's request.

G. Sample Analytical Sequence

1. Under the present sampling requirements a minimum of 13 samples is to be collected for the clearance testing of an abatement site. These include five abatement area samples, five ambient samples, two field blanks, and one sealed blank.

2. Carry out visual inspection of work site prior to air monitoring.

3. Collect a minimum of 5 air samples inside the work site and 5 samples outside the work site. The indoor and outdoor samples shall be taken during the same time period.

4. Remaining steps in the analytical sequence are contained in Unit IV of this Appendix.

H. Reporting

1. The following information must be reported to the client for each sample analyzed:

a. Concentration in structures per square millimeter and structures per cubic centimeter.

b. Analytical sensitivity used for the analysis.

c. Number of asbestos structures.

d. Area analyzed.

e. Volume of air sampled (which must be initially supplied to lab by client).

f. Copy of the count sheet must be included with the report.

g. Signature of laboratory official to indicate that the laboratory met specifications of the method.

h. Report form must contain official laboratory identification (e.g., letterhead).

i. Type of asbestos.

I. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of sensitive sampling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filter and the actual examination of this grid in the microscope. Each of these unit operations must produce a product of defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards are to be performed along with the sample analysis as indicators that the materials used are adequate and the

Environmental Protection Agency

Pt. 763, Subpt. E, App. A

operations are within acceptable limits. In this way, the quality of the data is defined and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might

develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the following Table III:

TABLE III--SUMMARY OF LABORATORY DATA QUALITY OBJECTIVES

Unit Operation	QC Check	Frequency	Conformance Expectation
Sample receiving	Review of receiving report	Each sample	95% complete
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample preparation	Supplies and reagents	On receipt	Meet specs. or reject
	Grid opening size	20 openings/20 grids/lot of 1000 or 1 opening/sample	100%
	Special clean area monitoring	After cleaning or service	Meet specs or reclean
	Laboratory blank	1 per prep series or 10%	Meet specs. or reanalyze series
	Plasma etch blank	1 per 20 samples	75%
	Multiple preps (3 per sample)	Each sample	One with cover of 15 complete grid sqs.
Sample analysis	System check	Each day	Each day
	Alignment check	Each day	Each day
	Magnification calibration with low and high standards	Each month or after service	95%
	ED calibration by gold standard	Weekly	95%
	EDS calibration by copper line	Daily	95%
Performance check	Laboratory blank (measure of cleanliness)	Prep 1 per series or 10% read 1 per 25 samples	Meet specs or reanalyze series
	Replicate counting (measure of precision)	1 per 100 samples	1.5 x Poisson Std. Dev.
	Duplicate analysis (measure of reproducibility)	1 per 100 samples	2 x Poisson Std. Dev.
	Known samples of typical materials (working standards)	Training and for comparison with unknowns	100%
	Analysis of NBS SRM 1876 and/or RM 8410 (measure of accuracy and comparability)	1 per analyst per year	1.5 x Poisson Std. Dev.
	Data entry review (data validation and measure of completeness)	Each sample	95%
	Record and verify ID electron diffraction pattern of structure	1 per 5 samples	80% accuracy
Calculations and data reduction	Hand calculation of automated data reduction procedure or independent recalculation of hand-calculated data	1 per 100 samples	85%

1. When the samples arrive at the laboratory, check the samples and documentation for completeness and requirements before initiating the analysis.

2. Check all laboratory reagents and supplies for acceptable asbestos background levels.

3. Conduct all sample preparation in a clean room environment monitored by laboratory blanks. Testing with blanks must also be done after cleaning or servicing the room.

4. Prepare multiple grids of each sample.

5. Provide laboratory blanks with each sample batch. Maintain a cumulative average of these results. If there are more than 53 fibers/mm² per 10 200-mesh grid openings, the system must be checked for possible sources of contamination.

6. Perform a system check on the transmission electron microscope daily.

7. Make periodic performance checks of magnification, electron diffraction and energy dispersive X-ray systems as set forth in Table III under Unit II.I.

8. Ensure qualified operator performance by evaluation of replicate analysis and standard sample comparisons as set forth in Table III under Unit II.I.

9. Validate all data entries.

10. Recalculate a percentage of all computations and automatic data reduction steps as specified in Table III under Unit II.I.

11. Record an electron diffraction pattern of one asbestos structure from every five samples that contain asbestos. Verify the identification of the pattern by measurement or comparison of the pattern with patterns collected from standards under the same conditions. The records must also demonstrate that the identification of the pattern has been verified by a qualified individual and that the operator who made the identification is maintaining at least an 80 percent correct visual identification based on his measured patterns.

12. Appropriate logs or records must be maintained by the analytical laboratory verifying that it is in compliance with the mandatory quality assurance procedures.

J. References

For additional background information on this method, the following references should be consulted.

1. "Guidance for Controlling Asbestos-Containing Materials in Buildings," EPA 560/5-85-024, June 1985.

2. "Measuring Airborne Asbestos Following an Abatement Action," USEPA, Office of Pollution Prevention and Toxics, EPA 600/4-85-049, 1985.

3. Small, John and E. Steel. Asbestos Standards: Materials and Analytical Methods. N.B.S. Special Publication 619, 1982.

4. Campbell, W.J., R.L. Blake, L.L. Brown, E.E. Cather, and J.J. Sjöberg. Selected Silicate Minerals and Their Asbestiform Varieties. Information Circular 8751, U.S. Bureau of Mines, 1977.

5. Quality Assurance Handbook for Air Pollution Measurement System. Ambient Air Methods, EPA 600/4-77-027a, USEPA, Office of Research and Development, 1977.

6. Method 2A: Direct Measurement of Gas Volume through Pipes and Small Ducts. 40 CFR Part 60 Appendix A.

7. Burdette, G.J., Health & Safety Exec. Research & Lab. Services Div., London,

"Proposed Analytical Method for Determination of Asbestos in Air."

8. Chatfield, E.J., Chatfield Tech. Cons., Ltd., Clark, T., PEI Assoc., "Standard Operating Procedure for Determination of Airborne Asbestos Fibers by Transmission Electron Microscopy Using Polycarbonate Membrane Filters," WERL SOP 87-1, March 5, 1987.

9. NIOSH Method 7402 for Asbestos Fibers, 12-11-86 Draft.

10. Yamate, G., Agarwall, S.C., Gibbons, R.D., IIT Research Institute, "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy," Draft report, USEPA Contract 68-02-3266, July 1984.

11. "Guidance to the Preparation of Quality Assurance Project Plans," USEPA, Office of Pollution Prevention and Toxics, 1984.

III. Nonmandatory Transmission Electron Microscopy Method

A. Definitions of Terms

1. *Analytical sensitivity*—Airborne asbestos concentration represented by each fiber counted under the electron microscope. It is determined by the air volume collected and the proportion of the filter examined. This method requires that the analytical sensitivity be no greater than 0.005 s/cm³.

2. *Asbestiform*—A specific type of mineral fibrosity in which the fibers and fibrils possess high tensile strength and flexibility.

3. *Aspect ratio*—A ratio of the length to the width of a particle. Minimum aspect ratio as defined by this method is equal to or greater than 5:1.

4. *Bundle*—A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

5. *Clean area*—A controlled environment which is maintained and monitored to assure a low probability of asbestos contamination to materials in that space. Clean areas used in this method have HEPA filtered air under positive pressure and are capable of sustained operation with an open laboratory blank which on subsequent analysis has an average of less than 18 structures/mm² in an area of 0.057 mm² (nominally 10 200 mesh grid openings) and a maximum of 53 structures/mm² for no more than one single preparation for that same area.

6. *Cluster*—A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

7. *ED*—Electron diffraction.

8. *EDXA*—Energy dispersive X-ray analysis.

9. *Fiber*—A structure greater than or equal to 0.5 μ m in length with an aspect ratio (length to width) of 5:1 or greater and having substantially parallel sides.

10. *Grid*—An open structure for mounting on the sample to aid in its examination in the TEM. The term is used here to denote a 200-mesh copper lattice approximately 3 mm in diameter.

11. *Intersection*—Nonparallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater.

12. *Laboratory sample coordinator*—That person responsible for the conduct of sample handling and the certification of the testing procedures.

13. *Filter background level*—The concentration of structures per square millimeter of filter that is considered indistinguishable from the concentration measured on blanks (filters through which no air has been drawn). For this method the filter background level is defined as 70 structures/mm².

14. *Matrix*—Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

15. *NSD*—No structure detected.

16. *Operator*—A person responsible for the TEM instrumental analysis of the sample.

17. *PCM*—Phase contrast microscopy.

18. *SAED*—Selected area electron diffraction.

19. *SEM*—Scanning electron microscope.

20. *STEM*—Scanning transmission electron microscope.

21. *Structure*—a microscopic bundle, cluster, fiber, or matrix which may contain asbestos.

22. *S/cm³*—Structures per cubic centimeter.

23. *S/mm²*—Structures per square millimeter.

24. *TEM*—Transmission electron microscope.

B. Sampling

1. Sampling operations must be performed by qualified individuals completely independent of the abatement contractor to avoid possible conflict of interest (See References 1, 2, and 5 of Unit III.L.) Special precautions should be taken to avoid contamination of the sample. For example, materials that have not been prescreened for their asbestos background content should not be used; also, sample handling procedures which

do not take cross contamination possibilities into account should not be used.

2. Material and supply checks for asbestos contamination should be made on all critical supplies, reagents, and procedures before their use in a monitoring study.

3. Quality control and quality assurance steps are needed to identify problem areas and isolate the cause of the contamination (see Reference 5 of Unit III.L.). Control checks shall be permanently recorded to document the quality of the information produced. The sampling firm must have written quality control procedures and documents which verify compliance. Independent audits by a qualified consultant or firm should be performed once a year. All documentation of compliance should be retained indefinitely to provide a guarantee of quality. A summary of Sample Data Quality Objectives is shown in Table II of Unit II.B.

4. Sampling materials.

a. Sample for airborne asbestos following an abatement action using commercially available cassettes.

b. Use either a cowl or a filter-retaining middle piece. Conductive material may reduce the potential for particulates to adhere to the walls of the cowl.

c. Cassettes must be verified as "clean" prior to use in the field. If packaged filters are used for loading or preloaded cassettes are purchased from the manufacturer or a distributor, the manufacturer's name and lot number should be entered on all field data sheets provided to the laboratory, and are required to be listed on all reports from the laboratory.

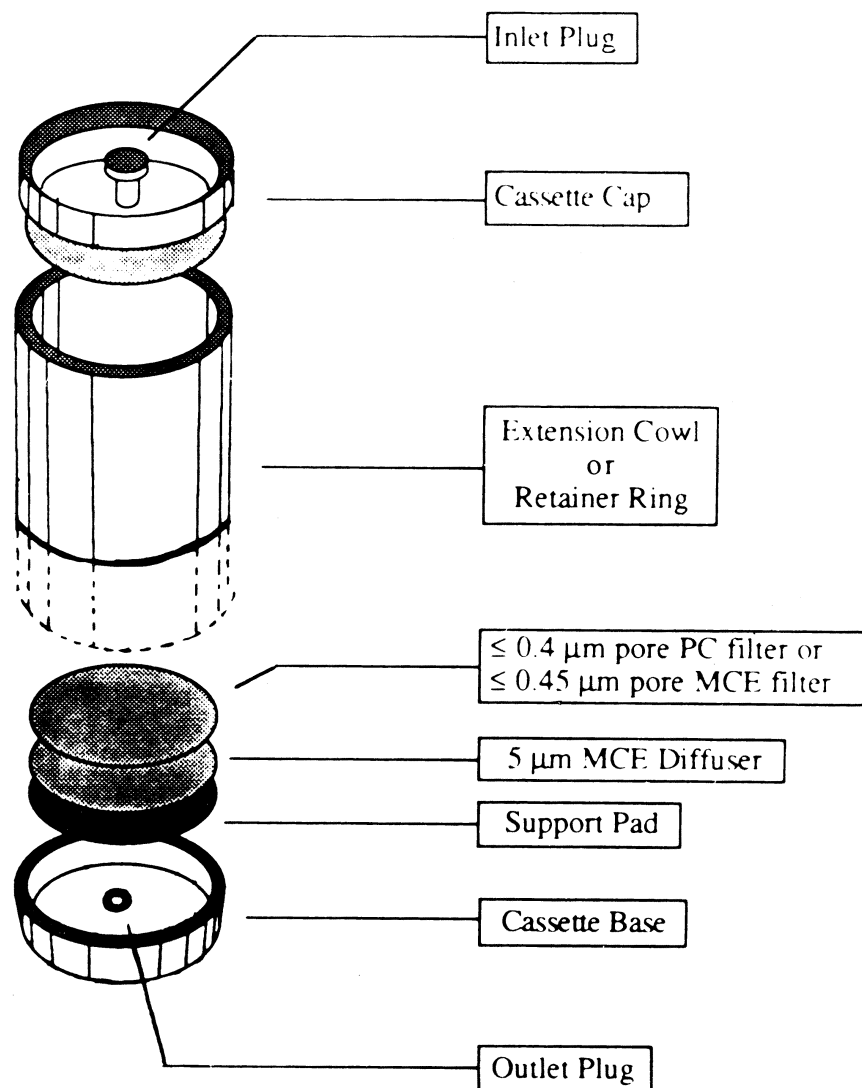
d. Assemble the cassettes in a clean facility (See definition of clean area under Unit III.A.).

e. Reloading of used cassettes is not permitted.

f. Use sample collection filters which are either polycarbonate having a pore size of less than or equal to 0.4 μ m or mixed cellulose ester having a pore size of less than or equal to 0.45 μ m.

g. Place these filters in series with a backup filter with a pore size of 5.0 μ m (to serve as a diffuser) and a support pad. See the following Figure 1:

FIGURE I--SAMPLING CASSETTE CONFIGURATION



h. When polycarbonate filters are used, position the highly reflective face such that the incoming particulate is received on this surface.

i. Seal the cassettes to prevent leakage around the filter edges or between cassette part joints. A mechanical press may be useful to achieve a reproducible leak-free seal.

Environmental Protection Agency

Pt. 763, Subpt. E, App. A

Shrink fit gel-bands may be used for this purpose and are available from filter manufacturers and their authorized distributors.

j. Use wrinkle-free loaded cassettes in the sampling operation.

5. Pump setup.

a. Calibrate the sampling pump over the range of flow rates and loads anticipated for the monitoring period with this flow measuring device in series. Perform this calibration using guidance from EPA Method 2A each time the unit is sent to the field (See Reference 6 of Unit III.L.).

b. Configure the sampling system to preclude pump vibrations from being transmitted to the cassette by using a sampling stand separate from the pump station and making connections with flexible tubing.

c. Maintain continuous smooth flow conditions by damping out any pump action fluctuations if necessary.

d. Check the sampling system for leaks with the end cap still in place and the pump operating before initiating sample collection. Trace and stop the source of any flow indicated by the flowmeter under these conditions.

e. Select an appropriate flow rate equal to or greater than 1 L/min or less than 10 L/min for 25 mm cassettes. Larger filters may be operated at proportionally higher flow rates.

f. Orient the cassette downward at approximately 45 degrees from the horizontal.

g. Maintain a log of all pertinent sampling information, such as pump identification number, calibration data, sample location, date, sample identification number, flow rates at the beginning, middle, and end, start and stop times, and other useful information or comments. Use of a sampling log form is recommended. See the following Figure 2:

FIGURE 2--SAMPLING LOG FORM

Sample Number	Location of Sample	Pump I.D.	Start Time	Middle Time	End Time	Flow Rate

Inspector: _____ Date: _____

h. Initiate a chain of custody procedure at the start of each sampling, if this is requested by the client.

i. Maintain a close check of all aspects of the sampling operation on a regular basis.

j. Continue sampling until at least the minimum volume is collected, as specified in the following Table I:

TABLE 1--NUMBER OF 200 MESH EM GRID OPENINGS
(0.0057 MM²) THAT NEED TO BE ANALYZED TO
MAINTAIN SENSITIVITY OF 0.005 STRUCTURES/CC
BASED ON VOLUME AND EFFECTIVE FILTER AREA

Effective Filter Area 385 sq mm		Effective Filter Area 855 sq mm	
Volume (liters)	# of grid openings	Volume (liters)	# of grid openings
560	24	1,250	24
600	23	1,300	23
700	19	1,400	21
800	17	1,600	19
900	15	1,800	17
1,000	14	2,000	15
1,100	12	2,200	14
1,200	11	2,400	13
1,300	10	2,600	12
1,400	10	2,800	11
1,500	9	3,000	10
1,600	8	3,200	9
1,700	8	3,400	9
1,800	8	3,600	8
1,900	7	3,800	8
2,000	7	4,000	8
2,100	6	4,200	7
2,200	6	4,400	7
2,300	6	4,600	7
2,400	6	4,800	6
2,500	5	5,000	6
2,600	5	5,200	6
2,700	5	5,400	6
2,800	5	5,600	5
2,900	5	5,800	5
3,000	5	6,000	5
3,100	4	6,200	5
3,200	4	6,400	5
3,300	4	6,600	5
3,400	4	6,800	4
3,500	4	7,000	4
3,600	4	7,200	4
3,700	4	7,400	4
3,800	4	7,600	4

Note minimum volumes required:
25 mm : 560 liters
37 mm : 1250 liters

Filter diameter of 25 mm = effective area of 385 sq mm
Filter diameter of 37 mm = effective area of 855 sq mm

k. At the conclusion of sampling, turn the cassette upward before stopping the flow to minimize possible particle loss. If the sampling is resumed, restart the flow before re-orienting the cassette downward. Note the condition of the filter at the conclusion of sampling.

l. Double check to see that all information has been recorded on the data collection forms and that the cassette is securely

closed and appropriately identified using a waterproof label. Protect cassettes in individual clean resealed polyethylene bags. Bags are to be used for storing cassette caps when they are removed for sampling purposes. Caps and plugs should only be removed or replaced using clean hands or clean disposable plastic gloves.

m. Do not change containers if portions of these filters are taken for other purposes.

6. Minimum sample number per site. A minimum of 13 samples are to be collected for each testing consisting of the following:

- a. A minimum of five samples per abatement area.
- b. A minimum of five samples per ambient area positioned at locations representative of the air entering the abatement site.
- c. Two field blanks are to be taken by removing the cap for not more than 30 sec and replacing it at the time of sampling before sampling is initiated at the following places:
 - i. Near the entrance to each ambient area.
 - ii. At one of the ambient sites.

(NOTE: Do not leave the blank open during the sampling period.)

d. A sealed blank is to be carried with each sample set. This representative cassette is not to be opened in the field.

7. Abatement area sampling.

a. Conduct final clearance sampling only after the primary containment barriers have been removed; the abatement area has been thoroughly dried; and, it has passed visual inspection tests by qualified personnel. (See Reference 1 of Unit III.L.)

b. Containment barriers over windows, doors, and air passageways must remain in place until the TEM clearance sampling and analysis is completed and results meet clearance test criteria. The final plastic barrier remains in place for the sampling period.

c. Select sampling sites in the abatement area on a random basis to provide unbiased and representative samples.

d. After the area has passed a thorough visual inspection, use aggressive sampling conditions to dislodge any remaining dust.

i. Equipment used in aggressive sampling such as a leaf blower and/or fan should be properly cleaned and decontaminated before use.

ii. Air filtration units shall remain on during the air monitoring period.

iii. Prior to air monitoring, floors, ceiling and walls shall be swept with the exhaust of a minimum one (1) horsepower leaf blower.

iv. Stationary fans are placed in locations which will not interfere with air monitoring equipment. Fan air is directed toward the ceiling. One fan shall be used for each 10,000 ft³ of worksite.

v. Monitoring of an abatement work area with high-volume pumps and the use of circulating fans will require electrical power. Electrical outlets in the abatement area may be used if available. If no such outlets are available, the equipment must be supplied with electricity by the use of extension cords and strip plug units. All electrical power supply equipment of this type must be approved Underwriter Laboratory equipment that has not been modified. All wiring must be grounded. Ground fault interrupters should be used. Extreme care must be taken to clean up any residual water and ensure

that electrical equipment does not become wet while operational.

vi. Low volume pumps may be carefully wrapped in 6-mil polyethylene to insulate the pump from the air. High volume pumps cannot be sealed in this manner since the heat of the motor may melt the plastic. The pump exhausts should be kept free.

vii. If recleaning is necessary, removal of this equipment from the work area must be handled with care. It is not possible to completely decontaminate the pump motor and parts since these areas cannot be wetted. To minimize any problems in this area, all equipment such as fans and pumps should be carefully wet wiped prior to removal from the abatement area. Wrapping and sealing low volume pumps in 6-mil polyethylene will provide easier decontamination of this equipment. Use of clean water and disposable wipes should be available for this purpose.

e. Pump flow rate equal to or greater than 1 L/min or less than 10 L/min may be used for 25 mm cassettes. The larger cassette diameters may have comparably increased flow.

f. Sample a volume of air sufficient to ensure the minimum quantitation limits. (See Table I of Unit III.B.5.j.)

8. Ambient sampling.

a. Position ambient samplers at locations representative of the air entering the abatement site. If makeup air entering the abatement site is drawn from another area of the building which is outside of the abatement area, place the pumps in the building, pumps should be placed out of doors located near the building and away from any obstructions that may influence wind patterns. If construction is in progress immediately outside the enclosure, it may be necessary to select another ambient site. Samples should be representative of any air entering the work site.

b. Locate the ambient samplers at least 3 ft apart and protect them from adverse weather conditions.

c. Sample same volume of air as samples taken inside the abatement site.

C. Sample Shipment

1. Ship bulk samples in a separate container from air samples. Bulk samples and air samples delivered to the analytical laboratory in the same container shall be rejected.

2. Select a rigid shipping container and pack the cassettes upright in a noncontaminating nonfibrous medium such as a bubble pack. The use of resealable polyethylene bags may help to prevent jostling of individual cassettes.

3. Avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials because of possible contamination.

4. Include a shipping bill and a detailed listing of samples shipped, their descriptions

and all identifying numbers or marks, sampling data, shipper's name, and contact information. For each sample set, designate which are the ambient samples, which are the abatement area samples, which are the field blanks, and which is the sealed blank if sequential analysis is to be performed.

5. Hand-carry samples to the laboratory in an upright position if possible; otherwise choose that mode of transportation least likely to jar the samples in transit.

6. Address the package to the laboratory sample coordinator by name when known and alert him or her of the package description, shipment mode, and anticipated arrival as part of the chain of custody and sample tracking procedures. This will also help the laboratory schedule timely analysis for the samples when they are received.

D. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of sensitive sampling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filter and the actual examination of this grid in the microscope. Each of these unit operations must produce a product of defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards is performed along with the sample analysis as indicators that the materials used are adequate and the operations are within acceptable limits. In this way, the quality of the data is defined, and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the text below.

1. Prescreen the loaded cassette collection filters to assure that they do not contain concentrations of asbestos which may interfere with the analysis of the sample. A filter blank average of less than 18 s/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a maximum of 53 s/mm² for that same area for any single preparation is acceptable for this method.

2. Calibrate sampling pumps and their flow indicators over the range of their intended use with a recognized standard. Assemble the sampling system with a representative filter—not the filter which will be used in sampling—before and after the sampling operation.

3. Record all calibration information with the data to be used on a standard sampling form.

4. Ensure that the samples are stored in a secure and representative location.

5. Ensure that mechanical calibrations from the pump will be minimized to prevent transferral of vibration to the cassette.

6. Ensure that a continuous smooth flow of negative pressure is delivered by the pump by installing a damping chamber if necessary.

7. Open a loaded cassette momentarily at one of the indoor sampling sites when sampling is initiated. This sample will serve as an indoor field blank.

8. Open a loaded cassette momentarily at one of the outdoor sampling sites when sampling is initiated. This sample will serve as an outdoor field blank.

9. Carry a sealed blank into the field with each sample series. Do not open this cassette in the field.

10. Perform a leak check of the sampling system at each indoor and outdoor sampling site by activating the pump with the closed sampling cassette in line. Any flow indicates a leak which must be eliminated before initiating the sampling operation.

11. Ensure that the sampler is turned upright before interrupting the pump flow.

12. Check that all samples are clearly labeled and that all pertinent information has been enclosed before transfer of the samples to the laboratory.

E. Sample Receiving

1. Designate one individual as sample coordinator at the laboratory. While that individual will normally be available to receive samples, the coordinator may train and supervise others in receiving procedures for those times when he/she is not available.

2. Adhere to the following procedures to ensure both the continued chain-of-custody and the accountability of all samples passing through the laboratory:

a. Note the condition of the shipping package and data written on it upon receipt.

b. Retain all bills of lading or shipping slips to document the shipper and delivery time.

c. Examine the chain-of-custody seal, if any, and the package for its integrity.

d. If there has been a break in the seal or substantive damage to the package, the sample coordinator shall immediately notify the shipper and a responsible laboratory manager before any action is taken to unpack the shipment.

e. Packages with significant damage shall be accepted only by the responsible laboratory manager after discussions with the client.

3. Unwrap the shipment in a clean, uncluttered facility. The sample coordinator or his or her designee will record the contents, including a description of each item and all identifying numbers or marks. A

Pt. 763, Subpt. E, App. A

40 CFR Ch. I (7-1-11 Edition)

Sample Receiving Form to document this information is attached for use when necessary. (See the following Figure 3.)

FIGURE 3--SAMPLE RECEIVING FORM

Date of package delivery _____ Package shipped from _____
 Carrier _____ Shipping bill retained _____
 *Condition of package on receipt _____
 *Condition of custody seal _____
 Number of samples received _____ Shipping manifest attached _____
 Purchase Order No. _____ Project I.D. _____
 Comments _____

No.	Description	Sampling Medium		Sampled Volume Liters	Receiving ID #	Assigned #
		PC	MCE			
1	_____	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____	_____
8	_____	_____	_____	_____	_____	_____
9	_____	_____	_____	_____	_____	_____
10	_____	_____	_____	_____	_____	_____
11	_____	_____	_____	_____	_____	_____
12	_____	_____	_____	_____	_____	_____
13	_____	_____	_____	_____	_____	_____

(Use as many additional sheets as needed.)

Comments _____
 Date of acceptance into sample bank _____
 Signature of chain-of-custody recipient _____
 Disposition of samples _____

*Note: If the package has sustained substantial damage or the custody seal is broken, stop and contact the project manager and the shipper.

NOTE: The person breaking the chain-of-custody seal and itemizing the contents assumes responsibility for the shipment and signs documents accordingly.

4. Assign a laboratory number and schedule an analysis sequence.

5. Manage all chain-of-custody samples within the laboratory such that their integrity can be ensured and documented.

F. Sample Preparation

1. Personnel not affiliated with the Abatement Contractor shall be used to prepare samples and conduct TEM analysis. Wet-wipe the exterior of the cassettes to minimize contamination possibilities before taking them to the clean sample preparation facility.

2. Perform sample preparation in a well-equipped clean facility.

NOTE: The clean area is required to have the following minimum characteristics. The area or hood must be capable of maintaining a positive pressure with make-up air being HEPA filtered. The cumulative analytical blank concentration must average less than 18 s/mm² in an area of 0.057 s/mm² (nominally 10 200-mesh grid openings) with no more than one single preparation to exceed 53 s/mm² for that same area.

3. Preparation areas for air samples must be separated from preparation areas for bulk samples. Personnel must not prepare air samples if they have previously been preparing bulk samples without performing appropriate personal hygiene procedures, i.e., clothing change, showering, etc.

4. *Preparation.* Direct preparation techniques are required. The objective is to produce an intact carbon film containing the particulates from the filter surface which is sufficiently clear for TEM analysis. Currently recommended direct preparation procedures for polycarbonate (PC) and mixed cellulose ester (MCE) filters are described in Unit III.F.7. and 8. Sample preparation is a subject requiring additional research. Variation on those steps which do not substantively change the procedure, which improve filter clearing or which reduce contamination problems in a laboratory are permitted.

a. Use only TEM grids that have had grid opening areas measured according to directions in Unit III.J.

b. Remove the inlet and outlet plugs prior to opening the cassette to minimize any pressure differential that may be present.

c. Examples of techniques used to prepare polycarbonate filters are described in Unit III.F.7.

d. Examples of techniques used to prepare mixed cellulose ester filters are described in Unit III.F.8.

e. Prepare multiple grids for each sample.

f. Store the three grids to be measured in appropriately labeled grid holders or polyethylene capsules.

5. Equipment.

a. Clean area.

b. Tweezers. Fine-point tweezers for handling of filters and TEM grids.

c. Scalpel Holder and Curved No. 10 Surgical Blades.

d. Microscope slides.

e. Double-coated adhesive tape.

f. Gummed page reinforcements.

g. Micro-pipet with disposal tips 10 to 100 μ L variable volume.

h. Vacuum coating unit with facilities for evaporation of carbon. Use of a liquid nitrogen cold trap above the diffusion pump will minimize the possibility of contamination of the filter surface by oil from the pumping system. The vacuum-coating unit can also be used for deposition of a thin film of gold.

i. *Carbon rod electrodes.* Spectrochemically pure carbon rods are required for use in the vacuum evaporator for carbon coating of filters.

j. *Carbon rod sharpener.* This is used to sharpen carbon rods to a neck. The use of necked carbon rods (or equivalent) allows the carbon to be applied to the filters with a minimum of heating.

k. *Low-temperature plasma asher.* This is used to etch the surface of collapsed mixed cellulose ester (MCE) filters. The asher should be supplied with oxygen, and should be modified as necessary to provide a throttle or bleed valve to control the speed of the vacuum to minimize disturbance of the filter. Some early models of ashers admit air too rapidly, which may disturb particulates on the surface of the filter during the etching step.

l. *Glass petri dishes, 10 cm in diameter, 1 cm high.* For prevention of excessive evaporation of solvent when these are in use, a good seal must be provided between the base and the lid. The seal can be improved by grinding the base and lid together with an abrasive grinding material.

m. Stainless steel mesh.

n. Lens tissue.

o. Copper 200-mesh TEM grids, 3 mm in diameter, or equivalent.

p. Gold 200-mesh TEM grids, 3 mm in diameter, or equivalent.

q. Condensation washer.

r. Carbon-coated, 200-mesh TEM grids, or equivalent.

s. Analytical balance, 0.1 mg sensitivity.

t. Filter paper, 9 cm in diameter.

u. Oven or slide warmer. Must be capable of maintaining a temperature of 65–70 °C.

v. Polyurethane foam, 6 mm thickness.

w. Gold wire for evaporation.

6. Reagents.

a. *General.* A supply of ultra-clean, fiber-free water must be available for washing of all components used in the analysis. Water

that has been distilled in glass or filtered or deionized water is satisfactory for this purpose. Reagents must be fiber-free.

b. Polycarbonate preparation method—chloroform.

c. Mixed Cellulose Ester (MCE) preparation method—acetone or the Burdette procedure (Ref. 7 of Unit III.L.).

7. TEM specimen preparation from polycarbonate filters.

a. *Specimen preparation laboratory.* It is most important to ensure that contamination of TEM specimens by extraneous asbestos fibers is minimized during preparation.

b. Cleaning of sample cassettes. Upon receipt at the analytical laboratory and before they are taken into the clean facility or laminar flow hood, the sample cassettes must be cleaned of any contamination adhering to the outside surfaces.

c. Preparation of the carbon evaporator. If the polycarbonate filter has already been carbon-coated prior to receipt, the carbon coating step will be omitted, unless the analyst believes the carbon film is too thin. If there is a need to apply more carbon, the filter will be treated in the same way as an uncoated filter. Carbon coating must be performed with a high-vacuum coating unit. Units that are based on evaporation of carbon filaments in a vacuum generated only by an oil rotary pump have not been evaluated for this application, and must not be used. The carbon rods should be sharpened by a carbon rod sharpener to necks of about 4 mm long and 1 mm in diameter. The rods are installed in the evaporator in such a manner that the points are approximately 10 to 12 cm from the surface of a microscope slide held in the rotating and tilting device.

d. Selection of filter area for carbon coating. Before preparation of the filters, a 75 mm×50 mm microscope slide is washed and dried. This slide is used to support strips of filter during the carbon evaporation. Two parallel strips of double-sided adhesive tape are applied along the length of the slide. Polycarbonate filters are easily stretched during handling, and cutting of areas for further preparation must be performed with great care. The filter and the MCE backing filter are removed together from the cassette and placed on a cleaned glass microscope slide. The filter can be cut with a curved scalpel blade by rocking the blade from the point placed in contact with the filter. The process can be repeated to cut a strip approximately 3 mm wide across the diameter of the filter. The strip of polycarbonate filter is separated from the corresponding strip of backing filter and carefully placed so that it bridges the gap between the adhesive tape strips on the microscope slide. The filter strip can be held with fine-point tweezers and supported underneath by the scalpel blade during placement on the microscope slide. The analyst can place several such

strips on the same microscope slide, taking care to rinse and wet-wipe the scalpel blade and tweezers before handling a new sample. The filter strips should be identified by etching the glass slide or marking the slide using a marker insoluble in water and solvents. After the filter strip has been cut from each filter, the residual parts of the filter must be returned to the cassette and held in position by reassembly of the cassette. The cassette will then be archived for a period of 30 days or returned to the client upon request.

e. Carbon coating of filter strips. The glass slide holding the filter strips is placed on the rotation-tilting device, and the evaporator chamber is evacuated. The evaporation must be performed in very short bursts, separated by some seconds to allow the electrodes to cool. If evaporation is too rapid, the strips of polycarbonate filter will begin to curl, which will lead to cross-linking of the surface material and make it relatively insoluble in chloroform. An experienced analyst can judge the thickness of carbon film to be applied, and some test should be made first on unused filters. If the film is too thin, large particles will be lost from the TEM specimen, and there will be few complete and undamaged grid openings on the specimen. If the coating is too thick, the filter will tend to curl when exposed to chloroform vapor and the carbon film may not adhere to the support mesh. Too thick a carbon film will also lead to a TEM image that is lacking in contrast, and the ability to obtain ED patterns will be compromised. The carbon film should be as thin as possible and remain intact on most of the grid openings of the TEM specimen intact.

f. Preparation of the Jaffe washer. The precise design of the Jaffe washer is not considered important, so any one of the published designs may be used. A washer consisting of a simple stainless steel bridge is recommended. Several pieces of lens tissue approximately 1.0 cm×0.5 cm are placed on the stainless steel bridge, and the washer is filled with chloroform to a level where the meniscus contacts the underside of the mesh, which results in saturation of the lens tissue. See References 8 and 10 of Unit III.L.

g. Placing of specimens into the Jaffe washer. The TEM grids are first placed on a piece of lens tissue so that individual grids can be picked up with tweezers. Using a curved scalpel blade, the analyst excises three 3 mm square pieces of the carbon-coated polycarbonate filter from the filter strip. The three squares are selected from the center of the strip and from two points between the outer periphery of the active surface and the center. The piece of filter is placed on a TEM specimen grid with the shiny side of the TEM grid facing upwards, and the whole assembly is placed boldly onto the saturated lens tissue in the Jaffe washer. If carbon-coated grids are used, the filter should be

placed carbon-coated side down. The three excised squares of filters are placed on the same piece of lens tissue. Any number of separate pieces of lens tissue may be placed in the same Jaffe washer. The lid is then placed on the Jaffe washer, and the system is allowed to stand for several hours, preferably overnight.

h. *Condensation washing.* It has been found that many polycarbonate filters will not dissolve completely in the Jaffe washer, even after being exposed to chloroform for as long as 3 days. This problem becomes more serious if the surface of the filter was overheated during the carbon evaporation. The presence of undissolved filter medium on the TEM preparation leads to partial or complete obscuration of areas of the sample, and fibers that may be present in these areas of the specimen will be overlooked; this will lead to a low result. Undissolved filter medium also compromises the ability to obtain ED patterns. Before they are counted, TEM grids must be examined critically to determine whether they are adequately cleared of residual filter medium. It has been found that condensation washing of the grids after the initial Jaffe washer treatment, with chloroform as the solvent, clears all residual filter medium in a period of approximately 1 hour. In practice, the piece of lens tissue supporting the specimen grids is transferred to the cold finger of the condensation washer, and the washer is operated for about 1 hour. If the specimens are cleared satisfactorily by the Jaffe washer alone, the condensation washer step may be unnecessary.

8. TEM specimen preparation from MCE filters.

a. This method of preparing TEM specimens from MCE filters is similar to that specified in NIOSH Method 7402. See References 7, 8, and 9 of Unit III.L.

b. Upon receipt at the analytical laboratory, the sample cassettes must be cleaned of any contamination adhering to the outside surfaces before entering the clean sample preparation area.

c. Remove a section from any quadrant of the sample and blank filters.

d. Place the section on a clean microscope slide. Affix the filter section to the slide with a gummed paged reinforcement or other suitable means. Label the slide with a water and solvent-proof marking pen.

e. Place the slide in a petri dish which contains several paper filters soaked with 2 to 3 mL acetone. Cover the dish. Wait 2 to 4 minutes for the sample filter to fuse and clear.

f. Plasma etching of the collapsed filter is required.

i. The microscope slide to which the collapsed filter pieces are attached is placed in a plasma asher. Because plasma ashers vary greatly in their performance, both from unit to unit and between different positions in the asher chamber, it is difficult to specify

the conditions that should be used. This is one area of the method that requires further evaluation. Insufficient etching will result in a failure to expose embedded filters, and too much etching may result in loss of particulate from the surface. As an interim measure, it is recommended that the time for ashing of a known weight of a collapsed filter be established and that the etching rate be calculated in terms of micrometers per second. The actual etching time used for a particular asher and operating conditions will then be set such that a 1–2 μm (10 percent) layer of collapsed surface will be removed.

ii. Place the slide containing the collapsed filters into a low-temperature plasma asher, and etch the filter.

g. Transfer the slide to a rotating stage inside the bell jar of a vacuum evaporator. Evaporate a 1 mm $\times$ 5 mm section of graphite rod onto the cleared filter. Remove the slide to a clean, dry, covered petri dish.

h. Prepare a second petri dish as a Jaffe washer with the wicking substrate prepared from filter or lens paper placed on top of a 6 mm thick disk of clean spongy polyurethane foam. Cut a V-notch on the edge of the foam and filter paper. Use the V-notch as a reservoir for adding solvent. The wicking substrate should be thin enough to fit into the petri dish without touching the lid.

i. Place carbon-coated TEM grids face up on the filter or lens paper. Label the grids by marking with a pencil on the filter paper or by putting registration marks on the petri dish lid and marking with a waterproof marker on the dish lid. In a fume hood, fill the dish with acetone until the wicking substrate is saturated. The level of acetone should be just high enough to saturate the filter paper without creating puddles.

j. Remove about a quarter section of the carbon-coated filter samples from the glass slides using a surgical knife and tweezers. Carefully place the section of the filter, carbon side down, on the appropriately labeled grid in the acetone-saturated petri dish. When all filter sections have been transferred, slowly add more solvent to the wedge-shaped trough to bring the acetone level up to the highest possible level without disturbing the sample preparations. Cover the petri dish. Elevate one side of the petri dish by placing a slide under it. This allows drops of condensed solvent vapors to form near the edge rather than in the center where they would drip onto the grid preparation.

G. TEM Method

1. Instrumentation.

a. Use an 80–120 kV TEM capable of performing electron diffraction with a fluorescent screen inscribed with calibrated gradations. If the TEM is equipped with EDXA it must either have a STEM attachment or be capable of producing a spot less than 250 nm

Pt. 763, Subpt. E, App. A

40 CFR Ch. I (7–1–11 Edition)

in diameter at crossover. The microscope shall be calibrated routinely (see Unit III.J.) for magnification and camera constant.

b. While not required on every microscope in the laboratory, the laboratory must have either one microscope equipped with energy dispersive X-ray analysis or access to an equivalent system on a TEM in another laboratory. This must be an Energy Dispersive X-ray Detector mounted on TEM column and associated hardware/software to collect, save, and read out spectral information. Calibration of Multi-Channel Analyzer shall be checked regularly for Al at 1.48 KeV and Cu at 8.04 KeV, as well as the manufacturer's procedures.

i. Standard replica grating may be used to determine magnification (e.g., 2160 lines/mm).

ii. Gold standard may be used to determine camera constant.

c. Use a specimen holder with single tilt and/or double tilt capabilities.

2. Procedure.

a. Start a new Count Sheet for each sample to be analyzed. Record on count sheet: analyst's initials and date; lab sample number; client sample number microscope identification; magnification for analysis; number of predetermined grid openings to be analyzed; and grid identification. See the following Figure 4:

FIGURE 4--COUNT SHEET

Lab Sample No. _____ Filter Type _____ Operator _____
 Client Sample No. _____ Filter Area _____ Date _____
 Instrument I.D. _____ Grid I.D. _____ Comments _____
 Magnification _____ Grid Opening (GO) Area _____
 Acc. Voltage _____ No. GO to be Analyzed _____

GO	Structure No.	Structure Type *	Length		ED Observation				EDAX
			< 5 μ m	$\geq$ 5 μ m	Chrys.	Amph.	Nonasb.	Neg. ID	

GO	Structure No.	Structure Type *	Length		ED Observation				EDAX
			< 5 μ m	$\geq$ 5 μ m	Chrys.	Amph.	Nonasb.	Neg. ID	

*B = Bundle
 C = Cluster
 F = Fiber
 M = Matrix

NFD = No fibers detected
 N = No diffraction obtained

b. Check that the microscope is properly aligned and calibrated according to the manufacturer's specifications and instructions.

c. Microscope settings: 80-120 kV, grid assessment 250-1000X, then 15,000-20,000X screen magnification for analysis.

d. Approximately one-half (0.5) of the pre-determined sample area to be analyzed shall be performed on one sample grid preparation and the remaining half on a second sample grid preparation.

e. Determine the suitability of the grid.

i. Individual grid openings with greater than 5 percent openings (holes) or covered with greater than 25 percent particulate matter or obviously having nonuniform loading shall not be analyzed.

ii. Examine the grid at low magnification (<1000X) to determine its suitability for detailed study at higher magnifications.

iii. Reject the grid if:

(1) Less than 50 percent of the grid openings covered by the replica are intact.

(2) It is doubled or folded.

(3) It is too dark because of incomplete dissolution of the filter.

iv. If the grid is rejected, load the next sample grid.

v. If the grid is acceptable, continue on to Step 6 if mapping is to be used; otherwise proceed to Step 7.

f. Grid Map (Optional).

i. Set the TEM to the low magnification mode.

ii. Use flat edge or finder grids for mapping.

iii. Index the grid openings (fields) to be counted by marking the acceptable fields for one-half (0.5) of the area needed for analysis on each of the two grids to be analyzed. These may be marked just before examining each grid opening (field), if desired.

iv. Draw in any details which will allow the grid to be properly oriented if it is re-

loaded into the microscope and a particular field is to be reliably identified.

g. Scan the grid.

i. Select a field to start the examination.

ii. Choose the appropriate magnification (15,000 to 20,000X screen magnification).

iii. Scan the grid as follows.

(1) At the selected magnification, make a series of parallel traverses across the field. On reaching the end of one traverse, move the image one window and reverse the traverse.

NOTE: A slight overlap should be used so as not to miss any part of the grid opening (field).

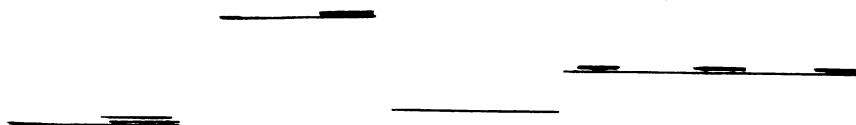
(2) Make parallel traverses until the entire grid opening (field) has been scanned.

h. Identify each structure for appearance and size.

i. Appearance and size: Any continuous grouping of particles in which an asbestos fiber within aspect ratio greater than or equal to 5:1 and a length greater than or equal to 0.5 μm is detected shall be recorded on the count sheet. These will be designated asbestos structures and will be classified as fibers, bundles, clusters, or matrices. Record as individual fibers any contiguous grouping having 0, 1, or 2 definable intersections. Groupings having more than 2 intersections are to be described as cluster or matrix. See the following Figure 5:

FIGURE 5--COUNTING GUIDELINES USED IN
DETERMINING ASBESTOS STRUCTURES

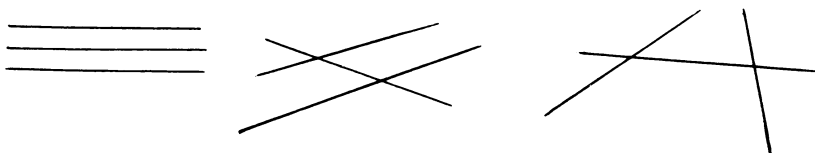
Count as 1 fiber; 1 Structure; no intersections.



Count as 2 fibers if space between fibers is greater than width of 1 fiber diameter or number of intersections is equal to or less than 1.



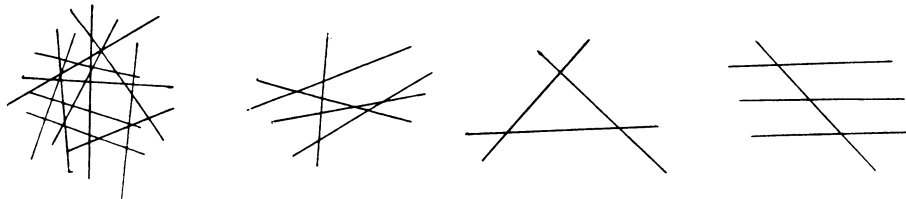
Count as 3 structures if space between fibers is greater than width of 1 fiber diameter or if the number of intersections is equal to or less than 2.



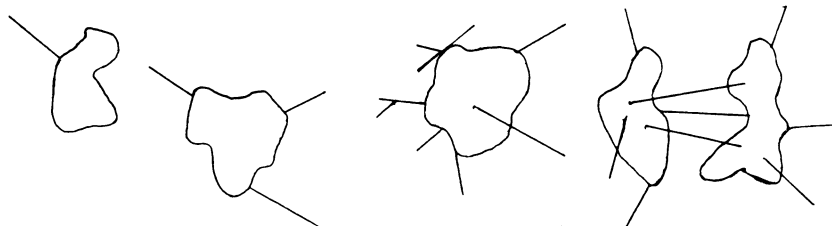
Count bundles as 1 structure; 3 or more parallel fibrils less than 1 fiber diameter separation.



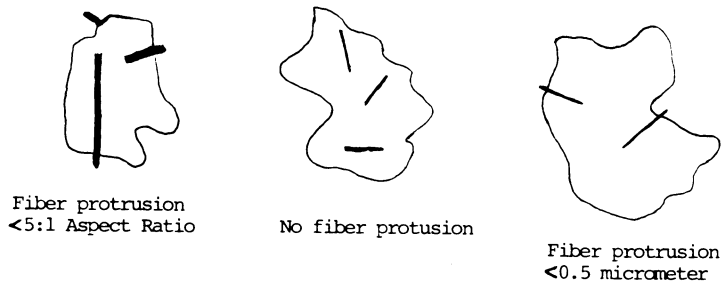
Count clusters as 1 structure; fibers having greater than or equal to 3 intersections.



Count matrix as 1 structure.



DO NOT COUNT AS STRUCTURES:



— <0.5 micrometer in length
 — <5:1 Aspect Ratio

An intersection is a non-parallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater. Combinations such as a matrix and cluster, matrix and bundle, or bundle and cluster are categorized by the dominant fiber quality—cluster, bundle, and matrix, respectively. Separate categories will be maintained for fibers less than 5 μm and for fibers greater than or equal to 5 μm in length. Not required, but useful, may be to record the fiber length in 1 μm intervals. (Identify each structure morphologically and analyze it as it enters the “window”.)

(1) *Fiber*. A structure having a minimum length greater than 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed, no intersections.

(2) *Bundle*. A structure composed of 3 or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

(3) *Cluster*. A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group; groupings must have more than 2 intersections.

(4) *Matrix*. Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

(5) *NSD*. Record NSD when no structures are detected in the field.

(6) *Intersection*. Non-parallel touching or crossing of fibers, with the projection having an aspect ratio 5:1 or greater.

ii. Structure Measurement.

(1) Recognize the structure that is to be sized.

(2) Memorize its location in the "window" relative to the sides, inscribed square and to other particulates in the field so this exact location can be found again when scanning is resumed.

(3) Measure the structure using the scale on the screen.

(4) Record the length category and structure type classification on the count sheet after the field number and fiber number.

(5) Return the fiber to its original location in the window and scan the rest of the field for other fibers; if the direction of travel is not remembered, return to the right side of the field and begin the traverse again.

i. Visual identification of Electron Diffraction (ED) patterns is required for each asbestos structure counted which would cause the analysis to exceed the 70 s/mm² concentration. (Generally this means the first four fibers identified as asbestos must exhibit an identifiable diffraction pattern for chrysotile or amphibole.)

i. Center the structure, focus, and obtain an ED pattern. (See Microscope Instruction Manual for more detailed instructions.)

ii. From a visual examination of the ED pattern, obtained with a short camera length, classify the observed structure as belonging to one of the following classifications: chrysotile, amphibole, or nonasbestos.

(1) Chrysotile: The chrysotile asbestos pattern has characteristic streaks on the layer lines other than the central line and some streaking also on the central line. There will be spots of normal sharpness on the central layer line and on alternate lines (2nd, 4th, etc.). The repeat distance between layer lines is 0.53 nm and the center doublet is at 0.73 nm. The pattern should display (002), (110), (130) diffraction maxima; distances and geometry should match a chrysotile pattern and be measured semiquantitatively.

(2) Amphibole Group [includes grunerite (amosite), crocidolite, anthophyllite, tremolite, and actinolite]: Amphibole asbestos fiber patterns show layer lines formed by very closely spaced dots, and the repeat distance between layer lines is also about 0.53 nm. Streaking in layer lines is occasionally present due to crystal structure defects.

(3) Nonasbestos: Incomplete or unobtainable ED patterns, a nonasbestos EDXA, or a nonasbestos morphology.

iii. The micrograph number of the recorded diffraction patterns must be reported to the client and maintained in the laboratory's quality assurance records. The records must also demonstrate that the identification of the pattern has been verified by a qualified individual and that the operator who made the identification is maintaining at least an 80 percent correct visual identification based on his measured patterns. In the event that examination of the pattern by the qualified individual indicates that the pattern had been misidentified visually, the client shall be contacted. If the pattern is a suspected chrysotile, take a photograph of the diffraction pattern at 0 degrees tilt. If the structure is suspected to be amphibole, the sample may have to be tilted to obtain a simple geometric array of spots.

j. Energy Dispersive X-Ray Analysis (EDXA).

i. Required of all amphiboles which would cause the analysis results to exceed the 70 s/mm² concentration. (Generally speaking, the first 4 amphiboles would require EDXA.)

ii. Can be used alone to confirm chrysotile after the 70 s/mm² concentration has been exceeded.

iii. Can be used alone to confirm all non-asbestos.

iv. Compare spectrum profiles with profiles obtained from asbestos standards. The closest match identifies and categorizes the structure.

v. If the EDXA is used for confirmation, record the properly labeled spectrum on a computer disk, or if a hard copy, file with analysis data.

vi. If the number of fibers in the non-asbestos class would cause the analysis to exceed the 70 s/mm² concentration, their identities must be confirmed by EDXA or measurement of a zone axis diffraction pattern to establish that the particles are non-asbestos.

k. Stopping Rules.

i. If more than 50 asbestiform structures are counted in a particular grid opening, the analysis may be terminated.

ii. After having counted 50 asbestiform structures in a minimum of 4 grid openings, the analysis may be terminated. The grid opening in which the 50th fiber was counted must be completed.

iii. For blank samples, the analysis is always continued until 10 grid openings have been analyzed.

iv. In all other samples the analysis shall be continued until an analytical sensitivity of 0.005 s/cm³ is reached.

l. Recording Rules. The count sheet should contain the following information:

i. Field (grid opening): List field number.

ii. Record "NSD" if no structures are detected.

iii. Structure information.

(1) If fibers, bundles, clusters, and/or matrices are found, list them in consecutive numerical order, starting over with each field.

(2) Length. Record length category of asbestos fibers examined. Indicate if less than 5 μm or greater than or equal to 5 μm .

(3) Structure Type. Positive identification of asbestos fibers is required by the method. At least one diffraction pattern of each fiber type from every five samples must be recorded and compared with a standard diffraction pattern. For each asbestos fiber reported, both a morphological descriptor and an identification descriptor shall be specified on the count sheet.

(4) Fibers classified as chrysotile must be identified by diffraction and/or X-ray analysis and recorded on the count sheet. X-ray analysis alone can be used as sole identification only after 70s/mm² have been exceeded for a particular sample.

(5) Fibers classified as amphiboles must be identified by X-ray analysis and electron diffraction and recorded on the count sheet. (X-ray analysis alone can be used as sole identification only after 70s/mm² have been exceeded for a particular sample.)

(6) If a diffraction pattern was recorded on film, the micrograph number must be indicated on the count sheet.

(7) If an electron diffraction was attempted and an appropriate spectra is not observed, N should be recorded on the count sheet.

(8) If an X-ray analysis is attempted but not observed, N should be recorded on the count sheet.

(9) If an X-ray analysis spectrum is stored, the file and disk number must be recorded on the count sheet.

m. Classification Rules.

i. *Fiber*. A structure having a minimum length greater than or equal to 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

ii. *Bundle*. A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

iii. *Cluster*. A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated

from the group. Groupings must have more than two intersections.

iv. *Matrix*. Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

v. *NSD*. Record NSD when no structures are detected in the field.

n. After all necessary analyses of a particle structure have been completed, return the goniometer stage to 0 degrees, and return the structure to its original location by recall of the original location.

o. Continue scanning until all the structures are identified, classified and sized in the field.

p. Select additional fields (grid openings) at low magnification; scan at a chosen magnification (15,000 to 20,000X screen magnification); and analyze until the stopping rule becomes applicable.

q. Carefully record all data as they are being collected, and check for accuracy.

r. After finishing with a grid, remove it from the microscope, and replace it in the appropriate grid hold. Sample grids must be stored for a minimum of 1 year from the date of the analysis; the sample cassette must be retained for a minimum of 30 days by the laboratory or returned at the client's request.

H. Sample Analytical Sequence

1. Carry out visual inspection of work site prior to air monitoring.

2. Collect a minimum of five air samples inside the work site and five samples outside the work site. The indoor and outdoor samples shall be taken during the same time period.

3. Analyze the abatement area samples according to this protocol. The analysis must meet the 0.005 s/cm³ analytical sensitivity.

4. Remaining steps in the analytical sequence are contained in Unit IV. of this Appendix.

I. Reporting

The following information must be reported to the client. See the following Table II:

TABLE II--EXAMPLE LABORATORY LETTERHEAD

Laboratory I.D.	Client I.D.	FILTER MEDIA DATA				Analyzed Area, mm ²	Sample Volume, cc
		Type	Diameter, mm	Effective Area, mm ²	Pore Size, μ m		

INDIVIDUAL ANALYTICAL RESULTS

Laboratory I.D.	Client I.D.	# Asbestos Structures	Analytical Sensitivity, s/cc	CONCENTRATION	
				Structures/mm ²	Structures/cc

The analysis was carried out to the approved TEM method. This laboratory is in compliance with the quality specified by the method.

Authorized Signature

1. Concentration in structures per square millimeter and structures per cubic centimeter.

2. Analytical sensitivity used for the analysis.

3. Number of asbestos structures.

4. Area analyzed.

5. Volume of air samples (which was initially provided by client).

6. Average grid size opening.

7. Number of grids analyzed.

8. Copy of the count sheet must be included with the report.

9. Signature of laboratory official to indicate that the laboratory met specifications of the AHERA method.

10. Report form must contain official laboratory identification (e.g., letterhead).

11. Type of asbestos.

J. Calibration Methodology

NOTE: Appropriate implementation of the method requires a person knowledgeable in electron diffraction and mineral identification by ED and EDXA. Those inexperienced laboratories wishing to develop capabilities may acquire necessary knowledge through analysis of appropriate standards and by following detailed methods as described in References 8 and 10 of Unit III.L.

1. *Equipment Calibration.* In this method, calibration is required for the air-sampling equipment and the transmission electron microscope (TEM).

a. *TEM Magnification.* The magnification at the fluorescent screen of the TEM must be calibrated at the grid opening magnification (if used) and also at the magnification used for fiber counting. This is performed with a cross grating replica. A logbook must be maintained, and the dates of calibration depend on the past history of the particular microscope; no frequency is specified. After any maintenance of the microscope that involved adjustment of the power supplied to the lenses or the high-voltage system or the mechanical disassembly of the electron optical column apart from filament exchange, the magnification must be recalibrated. Before the TEM calibration is performed, the analyst must ensure that the cross grating replica is placed at the same distance from the objective lens as the specimens are. For instruments that incorporate an eucentric tilting specimen stage, all specimens and the cross grating replica must be placed at the eucentric position.

b. Determination of the TEM magnification on the fluorescent screen.

i. Define a field of view on the fluorescent screen either by markings or physical boundaries. The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric).

ii. Insert a diffraction grating replica (for example a grating containing 2,160 lines/mm) into the specimen holder and place into the microscope. Orient the replica so that the grating lines fall perpendicular to the scale on the TEM fluorescent screen. Ensure that the goniometer stage tilt is 0 degrees.

iii. Adjust microscope magnification to 10,000X or 20,000X. Measure the distance (mm) between two widely separated lines on the grating replica. Note the number of spaces between the lines. Take care to measure between the same relative positions on the lines (e.g., between left edges of lines).

NOTE: The more spaces included in the measurement, the more accurate the final

calculation. On most microscopes, however, the magnification is substantially constant only within the central 8-10 cm diameter region of the fluorescent screen.

iv. Calculate the true magnification (M) on the fluorescent screen:

$$M = XG/Y$$

where:

X = total distance (mm) between the designated grating lines;

G = calibration constant of the grating replica (lines/mm);

Y = number of grating replica spaces counted along X.

c. *Calibration of the EDXA System.* Initially, the EDXA system must be calibrated by using two reference elements to calibrate the energy scale of the instrument. When this has been completed in accordance with the manufacturer's instructions, calibration in terms of the different types of asbestos can proceed. The EDXA detectors vary in both solid angle of detection and in window thickness. Therefore, at a particular accelerating voltage in use on the TEM, the count rate obtained from specific dimensions of fiber will vary both in absolute X-ray count rate and in the relative X-ray peak heights for different elements. Only a few minerals are relevant for asbestos abatement work, and in this procedure the calibration is specified in terms of a "fingerprint" technique. The EDXA spectra must be recorded from individual fibers of the relevant minerals, and identifications are made on the basis of semiquantitative comparisons with these reference spectra.

d. *Calibration of Grid Openings.*

i. Measure 20 grid openings on each of 20 random 200-mesh copper grids by placing a grid on a glass slide and examining it under the PCM. Use a calibrated graticule to measure the average field diameter and use this number to calculate the field area for an average grid opening. Grids are to be randomly selected from batches up to 1,000.

NOTE: A grid opening is considered as one field.

ii. The mean grid opening area must be measured for the type of specimen grids in use. This can be accomplished on the TEM at a properly calibrated low magnification or on an optical microscope at a magnification of approximately 400X by using an eyepiece fitted with a scale that has been calibrated against a stage micrometer. Optical microscopy utilizing manual or automated procedures may be used providing instrument calibration can be verified.

e. *Determination of Camera Constant and ED Pattern Analysis.*

i. The camera length of the TEM in ED operating mode must be calibrated before ED patterns on unknown samples are observed. This can be achieved by using a carbon-coated grid on which a thin film of gold has been

Environmental Protection Agency

Pt. 763, Subpt. E, App. A

sputtered or evaporated. A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis ED patterns superimposed with a ring pattern from the polycrystalline gold film.

ii. In practice, it is desirable to optimize the thickness of the gold film so that only one or two sharp rings are obtained on the superimposed ED pattern. Thicker gold film would normally give multiple gold rings, but it will tend to mask weaker diffraction spots from the unknown fibrous particulates. Since the unknown d-spacings of most interest in asbestos analysis are those which lie closest to the transmitted beam, multiple gold rings are unnecessary on zone-axis ED patterns. An average camera constant using multiple gold rings can be determined. The camera constant is one-half the diameter, D , of the rings times the interplanar spacing, d , of the ring being measured.

K. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of sensitive sam-

pling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filter and the actual examination of this grid in the microscope. Each of these unit operations must produce a product of defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards is performed along with the sample analysis as indicators that the materials used are adequate and the operations are within acceptable limits. In this way, the quality of the data is defined and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the following Table III:

TABLE III--SUMMARY OF LABORATORY
DATA QUALITY OBJECTIVES

Unit Operation	QC Check	Frequency	Conformance Expectation
Sample receiving	Review of receiving report	Each sample	95% complete
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample preparation	Supplies and reagents	On receipt	Meet specs. or reject
	Grid opening size	20 openings/20 grids/lot of 1000 or 1 opening/sample	100%
	Special clean area monitoring	After cleaning or service	Meet specs or reclean
	Laboratory blank	1 per prep series or 10%	Meet specs. or reanalyze series
	Plasma etch blank	1 per 20 samples	75%
	Multiple preps (3 per sample)	Each sample	One with cover of 15 complete grid sqs.
Sample analysis	System check	Each day	Each day
	Alignment check	Each day	Each day
	Magnification calibration with low and high standards	Each month or after service	95%
	ED calibration by gold standard	Weekly	95%
	EDS calibration by copper line	Daily	95%
Performance check	Laboratory blank (measure of cleanliness)	Prep 1 per series or 10% read 1 per 25 samples	Meet specs or reanalyze series
	Replicate counting (measure of precision)	1 per 100 samples	1.5 x Poisson Std. Dev.
	Duplicate analysis (measure of reproducibility)	1 per 100 samples	2 x Poisson Std. Dev.
	Known samples of typical materials (working standards)	Training and for comparison with unknowns	100%
	Analysis of NBS SRM 1876 and/or RM 8410 (measure of accuracy and comparability)	1 per analyst per year	1.5 x Poisson Std. Dev.
	Data entry review (data validation and measure of completeness)	Each sample	95%
	Record and verify ID electron diffraction pattern of structure	1 per 5 samples	80% accuracy
Calculations and data reduction	Hand calculation of automated data reduction procedure or independent recalculation of hand-calculated data	1 per 100 samples	85%

1. When the samples arrive at the laboratory, check the samples and documentation for completeness and requirements before initiating the analysis.

2. Check all laboratory reagents and supplies for acceptable asbestos background levels.

3. Conduct all sample preparation in a clean room environment monitored by laboratory blanks and special testing after cleaning or servicing the room.

4. Prepare multiple grids of each sample.

5. Provide laboratory blanks with each sample batch. Maintain a cumulative average of these results. If this average is greater than 53 f/mm² per 10 200-mesh grid openings, check the system for possible sources of contamination.

6. Check for recovery of asbestos from cellulose ester filters submitted to plasma asher.

7. Check for asbestos carryover in the plasma asher by including a blank alongside the positive control sample.

8. Perform a systems check on the transmission electron microscope daily.

9. Make periodic performance checks of magnification, electron diffraction and energy dispersive X-ray systems as set forth in Table III of Unit III.K.

10. Ensure qualified operator performance by evaluation of replicate counting, duplicate analysis, and standard sample comparisons as set forth in Table III of Unit III.K.

11. Validate all data entries.

12. Recalculate a percentage of all computations and automatic data reduction steps as specified in Table III.

13. Record an electron diffraction pattern of one asbestos structure from every five samples that contain asbestos. Verify the identification of the pattern by measurement or comparison of the pattern with patterns collected from standards under the same conditions.

The outline of quality control procedures presented above is viewed as the minimum required to assure that quality data is produced for clearance testing of an asbestos abated area. Additional information may be gained by other control tests. Specifics on those control procedures and options available for environmental testing can be obtained by consulting References 6, 7, and 11 of Unit III.L.

L. References

For additional background information on this method the following references should be consulted.

1. "Guidelines for Controlling Asbestos-Containing Materials in Buildings," EPA 560/5-85-024, June 1985.

2. "Measuring Airborne Asbestos Following an Abatement Action," USEP/Office of Pollution Prevention and Toxics, EPA 600/4-85-049, 1985.

3. Small, John and E. Steel. Asbestos Standards: Materials and Analytical Methods. N.B.S. Special Publication 619, 1982.

4. Campbell, W.J., R.L. Blake, L.L. Brown, E.E. Cather, and J.J. Sjoberg. Selected Silicate Minerals and Their Asbestiform Varieties. Information Circular 8751, U.S. Bureau of Mines, 1977.

5. Quality Assurance Handbook for Air Pollution Measurement System. Ambient Air Methods, EPA 600/4-77-027a, USEPA, Office of Research and Development, 1977.

6. Method 2A: Direct Measurement of Gas Volume Through Pipes and Small Ducts. 40 CFR Part 60 Appendix A.

7. Burdette, G.J. Health & Safety Exec., Research & Lab. Services Div., London, "Proposed Analytical Method for Determination of Asbestos in Air."

8. Chatfield, E.J., Chatfield Tech. Cons., Ltd., Clark, T., PEI Assoc. "Standard Operating Procedure for Determination of Airborne Asbestos Fibers by Transmission Elec-

tron Microscopy Using Polycarbonate Membrane Filters." WERL SOP 87-1, March 5, 1987.

9. NIOSH. Method 7402 for Asbestos Fibers, December 11, 1986 Draft.

10. Yamate, G., S.C. Agarwall, R.D. Gibbons, IIT Research Institute, "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy." Draft report, USEPA Contract 68-02-3266, July 1984.

11. Guidance to the Preparation of Quality Assurance Project Plans. USEPA, Office of Pollution Prevention and Toxics, 1984.

IV. Mandatory Interpretation of Transmission Electron Microscopy Results To Determine Completion of Response Actions

A. Introduction

A response action is determined to be completed by TEM when the abatement area has been cleaned and the airborne asbestos concentration inside the abatement area is no higher than concentrations at locations outside the abatement area. "Outside" means outside the abatement area, but not necessarily outside the building. EPA reasons that an asbestos removal contractor cannot be expected to clean an abatement area to an airborne asbestos concentration that is lower than the concentration of air entering the abatement area from outdoors or from other parts of the building. After the abatement area has passed a thorough visual inspection, and before the outer containment barrier is removed, a minimum of five air samples inside the abatement area and a minimum of five air samples outside the abatement area must be collected. Hence, the response action is determined to be completed when the average airborne asbestos concentration measured inside the abatement area is not statistically different from the average airborne asbestos concentration measured outside the abatement area.

The inside and outside concentrations are compared by the Z-test, a statistical test that takes into account the variability in the measurement process. A minimum of five samples inside the abatement area and five samples outside the abatement area are required to control the false negative error rate, i.e., the probability of declaring the removal complete when, in fact, the air concentration inside the abatement area is significantly higher than outside the abatement area. Additional quality control is provided by requiring three blanks (filters through which no air has been drawn) to be analyzed to check for unusually high filter contamination that would distort the test results.

When volumes greater than or equal to 1,199 L for a 25 mm filter and 2,799 L for a 37 mm filter have been collected and the average number of asbestos structures on samples inside the abatement area is no greater than 70 s/mm² of filter, the response action

may be considered complete without comparing the inside samples to the outside samples. EPA is permitting this initial screening test to save analysis costs in situations where the airborne asbestos concentration is sufficiently low so that it cannot be distinguished from the filter contamination/background level (fibers deposited on the filter that are unrelated to the air being sampled). The screening test cannot be used when volumes of less than 1,199 L for 25 mm filter or 2,799 L for a 37 mm filter are collected because the ability to distinguish levels significantly different from filter background is reduced at low volumes.

The initial screening test is expressed in structures per square millimeter of filter because filter background levels come from sources other than the air being sampled and cannot be meaningfully expressed as a concentration per cubic centimeter of air. The value of 70 s/mm² is based on the experience of the panel of microscopists who consider one structure in 10 grid openings (each grid opening with an area of 0.0057 mm²) to be comparable with contamination/background levels of blank filters. The decision is based, in part, on Poisson statistics which indicate that four structures must be counted on a filter before the fiber count is statistically distinguishable from the count for one structure. As more information on the performance of the method is collected, this criterion may be modified. Since different combinations of the number and size of grid openings are permitted under the TEM protocol, the criterion is expressed in structures per square millimeter of filter to be consistent across all combinations. Four structures per 10 grid openings corresponds to approximately 70 s/mm².

B. Sample Collection and Analysis

1. A minimum of 13 samples is required: five samples collected inside the abatement area, five samples collected outside the abatement area, two field blanks, and one sealed blank.

2. Sampling and TEM analysis must be done according to either the mandatory or nonmandatory protocols in Appendix A. At least 0.057 mm² of filter must be examined on blank filters.

C. Interpretation of Results

1. The response action shall be considered complete if either:

a. Each sample collected inside the abatement area consists of at least 1,199 L of air for a 25 mm filter, or 2,799 L of air for a 37 mm filter, and the arithmetic mean of their asbestos structure concentrations per square millimeter of filter is less than or equal to 70 s/mm²; or

b. The three blank samples have an arithmetic mean of the asbestos structure con-

centration on the blank filters that is less than or equal to 70 s/mm² and the average airborne asbestos concentration measured inside the abatement area is not statistically higher than the average airborne asbestos concentration measured outside the abatement area as determined by the Z-test. The Z-test is carried out by calculating

$$Z = \frac{\bar{Y}_I - \bar{Y}_O}{0.8(1/n_I + 1/n_O)^{1/2}}$$

where $\bar{Y}_I$ is the average of the natural logarithms of the inside samples and $\bar{Y}_O$ is the average of the natural logarithms of the outside samples, n_I is the number of inside samples and n_O is the number of outside samples. The response action is considered complete if Z is less than or equal to 1.65.

NOTE: When no fibers are counted, the calculated detection limit for that analysis is inserted for the concentration.

2. If the abatement site does not satisfy either (1) or (2) of this Section C, the site must be recleaned and a new set of samples collected.

D. Sequence for Analyzing Samples

It is possible to determine completion of the response action without analyzing all samples. Also, at any point in the process, a decision may be made to terminate the analysis of existing samples, reclean the abatement site, and collect a new set of samples. The following sequence is outlined to minimize the number of analyses needed to reach a decision.

1. Analyze the inside samples.

2. If at least 1,199 L of air for a 25 mm filter or 2,799 L of air for a 37 mm filter is collected for each inside sample and the arithmetic mean concentration of structures per square millimeter of filter is less than or equal to 70 s/mm², the response action is complete and no further analysis is needed.

3. If less than 1,199 L of air for a 25 mm filter or 2,799 L of air for a 37 mm filter is collected for any of the inside samples, or the arithmetic mean concentration of structures per square millimeter of filter is greater than 70 s/mm², analyze the three blanks.

4. If the arithmetic mean concentration of structures per square millimeter on the blank filters is greater than 70 s/mm², terminate the analysis, identify and correct the source of blank contamination, and collect a new set of samples.

5. If the arithmetic mean concentration of structures per square millimeter on the blank filters is less than or equal to 70 s/mm², analyze the outside samples and perform the Z-test.

Environmental Protection Agency

Pt. 763, Subpt. E, App. C

6. If the Z-statistic is less than or equal to 1.65, the response action is complete. If the Z-statistic is greater than 1.65, reclean the abatement site and collect a new set of samples.

[52 FR 41857, Oct. 30, 1987]

APPENDIX B TO SUBPART E OF PART 763 [RESERVED]

APPENDIX C TO SUBPART E OF PART 763—ASBESTOS MODEL ACCREDITA- TION PLAN

1. Asbestos Model Accreditation Plan for States

The Asbestos Model Accreditation Plan (MAP) for States has eight components:

- (A) Definitions
 - (B) Initial Training
 - (C) Examinations
 - (D) Continuing Education
 - (E) Qualifications
 - (F) Recordkeeping Requirements for Training Providers
 - (G) Deaccreditation
 - (H) Reciprocity
 - (I) Electronic reporting
- A. Definitions

For purposes of Appendix C:

1. "Friable asbestos-containing material (ACM)" means any material containing more than one percent asbestos which has been applied on ceilings, walls, structural members, piping, duct work, or any other part of a building, which when dry, may be crumbled, pulverized, or reduced to powder by hand pressure. The term includes non-friable asbestos-containing material after such previously non-friable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.

2. "Friable asbestos-containing building material (ACBM)" means any friable ACM that is in or on interior structural members or other parts of a school or public and commercial building.

3. "Inspection" means an activity undertaken in a school building, or a public and commercial building, to determine the presence or location, or to assess the condition of, friable or non-friable asbestos-containing building material (ACBM) or suspected ACBM, whether by visual or physical examination, or by collecting samples of such material. This term includes reinspections of friable and non-friable known or assumed ACBM which has been previously identified. The term does not include the following:

- a. Periodic surveillance of the type described in 40 CFR 763.92(b) solely for the purpose of recording or reporting a change in the condition of known or assumed ACBM;
- b. Inspections performed by employees or agents of Federal, State, or local government solely for the purpose of determining

compliance with applicable statutes or regulations; or

c. visual inspections of the type described in 40 CFR 763.90(i) solely for the purpose of determining completion of response actions.

4. "Major fiber release episode" means any uncontrolled or unintentional disturbance of ACBM, resulting in a visible emission, which involves the falling or dislodging of more than 3 square or linear feet of friable ACBM.

5. "Minor fiber release episode" means any uncontrolled or unintentional disturbance of ACBM, resulting in a visible emission, which involves the falling or dislodging of 3 square or linear feet or less of friable ACBM.

6. "Public and commercial building" means the interior space of any building which is not a school building, except that the term does not include any residential apartment building of fewer than 10 units or detached single-family homes. The term includes, but is not limited to: industrial and office buildings, residential apartment buildings and condominiums of 10 or more dwelling units, government-owned buildings, colleges, museums, airports, hospitals, churches, preschools, stores, warehouses and factories. Interior space includes exterior hallways connecting buildings, porticos, and mechanical systems used to condition interior space.

7. "Response action" means a method, including removal, encapsulation, enclosure, repair, and operation and maintenance, that protects human health and the environment from friable ACBM.

8. "Small-scale, short-duration activities (SSSD)" are tasks such as, but not limited to:

- a. Removal of asbestos-containing insulation on pipes.
- b. Removal of small quantities of asbestos-containing insulation on beams or above ceilings.
- c. Replacement of an asbestos-containing gasket on a valve.
- d. Installation or removal of a small section of drywall.
- e. Installation of electrical conduits through or proximate to asbestos-containing materials.

SSSD can be further defined by the following considerations:

- f. Removal of small quantities of ACM only if required in the performance of another maintenance activity not intended as asbestos abatement.
- g. Removal of asbestos-containing thermal system insulation not to exceed amounts greater than those which can be contained in a single glove bag.
- h. Minor repairs to damaged thermal system insulation which do not require removal.
- i. Repairs to a piece of asbestos-containing wallboard.

j. Repairs, involving encapsulation, enclosure, or removal, to small amounts of friable ACM only if required in the performance of emergency or routine maintenance activity and not intended solely as asbestos abatement. Such work may not exceed amounts greater than those which can be contained in a single prefabricated mini-enclosure. Such an enclosure shall conform spatially and geometrically to the localized work area, in order to perform its intended containment function.

B. Initial Training

Training requirements for purposes of accreditation are specified both in terms of required subjects of instruction and in terms of length of training. Each initial training course has a prescribed curriculum and number of days of training. One day of training equals 8 hours, including breaks and lunch. Course instruction must be provided by EPA or State-approved instructors. EPA or State instructor approval shall be based upon a review of the instructor's academic credentials and/or field experience in asbestos abatement.

Beyond the initial training requirements, individual States may wish to consider requiring additional days of training for purposes of supplementing hands-on activities or for reviewing relevant state regulations. States also may wish to consider the relative merits of a worker apprenticeship program. Further, they might consider more stringent minimum qualification standards for the approval of training instructors. EPA recommends that the enrollment in any given course be limited to 25 students so that adequate opportunities exist for individual hands-on experience.

States have the option to provide initial training directly or approve other entities to offer training. The following requirements are for the initial training of persons required to have accreditation under TSCA Title II.

Training requirements for each of the five accredited disciplines are outlined below. Persons in each discipline perform a different job function and distinct role. Inspectors identify and assess the condition of ACBM, or suspect ACBM. Management planners use data gathered by inspectors to assess the degree of hazard posed by ACBM in schools to determine the scope and timing of appropriate response actions needed for schools. Project designers determine how asbestos abatement work should be conducted. Lastly, workers and contractor/supervisors carry out and oversee abatement work. In addition, a recommended training curriculum is also presented for a sixth discipline, which is not federally-accredited, that of "Project Monitor." Each accredited discipline and training curriculum is separate and distinct from the others. A person

seeking accreditation in any of the five accredited MAP disciplines cannot attend two or more courses concurrently, but may attend such courses sequentially.

In several instances, initial training courses for a specific discipline (e.g., workers, inspectors) require hands-on training. For asbestos abatement contractor/supervisors and workers, hands-on training should include working with asbestos-substitute materials, fitting and using respirators, use of glovebags, donning protective clothing, and constructing a decontamination unit as well as other abatement work activities.

1. WORKERS

A person must be accredited as a worker to carry out any of the following activities with respect to friable ACBM in a school or public and commercial building: (1) A response action other than a SSSD activity, (2) a maintenance activity that disturbs friable ACBM other than a SSSD activity, or (3) a response action for a major fiber release episode. All persons seeking accreditation as asbestos abatement workers shall complete at least a 4-day training course as outlined below. The 4-day worker training course shall include lectures, demonstrations, at least 14 hours of hands-on training, individual respirator fit testing, course review, and an examination. Hands-on training must permit workers to have actual experience performing tasks associated with asbestos abatement. A person who is otherwise accredited as a contractor/supervisor may perform in the role of a worker without possessing separate accreditation as a worker.

Because of cultural diversity associated with the asbestos workforce, EPA recommends that States adopt specific standards for the approval of foreign language courses for abatement workers. EPA further recommends the use of audio-visual materials to complement lectures, where appropriate.

The training course shall adequately address the following topics:

(a) *Physical characteristics of asbestos.* Identification of asbestos, aerodynamic characteristics, typical uses, and physical appearance, and a summary of abatement control options.

(b) *Potential health effects related to asbestos exposure.* The nature of asbestos-related diseases; routes of exposure; dose-response relationships and the lack of a safe exposure level; the synergistic effect between cigarette smoking and asbestos exposure; the latency periods for asbestos-related diseases; a discussion of the relationship of asbestos exposure to asbestosis, lung cancer, mesothelioma, and cancers of other organs.

(c) *Employee personal protective equipment.* Classes and characteristics of respirator

types; limitations of respirators; proper selection, inspection; donning, use, maintenance, and storage procedures for respirators; methods for field testing of the facepiece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit (e.g., facial hair); the components of a proper respiratory protection program; selection and use of personal protective clothing; use, storage, and handling of non-disposable clothing; and regulations covering personal protective equipment.

(d) *State-of-the-art work practices.* Proper work practices for asbestos abatement activities, including descriptions of proper construction; maintenance of barriers and decontamination enclosure systems; positioning of warning signs; lock-out of electrical and ventilation systems; proper working techniques for minimizing fiber release; use of wet methods; use of negative pressure exhaust ventilation equipment; use of high-efficiency particulate air (HEPA) vacuums; proper clean-up and disposal procedures; work practices for removal, encapsulation, enclosure, and repair of ACM; emergency procedures for sudden releases; potential exposure situations; transport and disposal procedures; and recommended and prohibited work practices.

(e) *Personal hygiene.* Entry and exit procedures for the work area; use of showers; avoidance of eating, drinking, smoking, and chewing (gum or tobacco) in the work area; and potential exposures, such as family exposure.

(f) *Additional safety hazards.* Hazards encountered during abatement activities and how to deal with them, including electrical hazards, heat stress, air contaminants other than asbestos, fire and explosion hazards, scaffold and ladder hazards, slips, trips, and falls, and confined spaces.

(g) *Medical monitoring.* OSHA and EPA Worker Protection Rule requirements for physical examinations, including a pulmonary function test, chest X-rays, and a medical history for each employee.

(h) *Air monitoring.* Procedures to determine airborne concentrations of asbestos fibers, focusing on how personal air sampling is performed and the reasons for it.

(i) *Relevant Federal, State, and local regulatory requirements, procedures, and standards.* With particular attention directed at relevant EPA, OSHA, and State regulations concerning asbestos abatement workers.

(j) *Establishment of respiratory protection programs.*

(k) *Course review.* A review of key aspects of the training course.

2. CONTRACTOR/SUPERVISORS

A person must be accredited as a contractor/supervisor to supervise any of the following activities with respect to friable ACBM in a school or public and commercial building: (1) A response action other than a SSSD activity, (2) a maintenance activity that disturbs friable ACBM other than a SSSD activity, or (3) a response action for a major fiber release episode. All persons seeking accreditation as asbestos abatement contractor/supervisors shall complete at least a 5-day training course as outlined below. The training course must include lectures, demonstrations, at least 14 hours of hands-on training, individual respirator fit testing, course review, and a written examination. Hands-on training must permit supervisors to have actual experience performing tasks associated with asbestos abatement.

EPA recommends the use of audiovisual materials to complement lectures, where appropriate.

Asbestos abatement supervisors include those persons who provide supervision and direction to workers performing response actions. Supervisors may include those individuals with the position title of foreman, working foreman, or leadman pursuant to collective bargaining agreements. At least one supervisor is required to be at the work-site at all times while response actions are being conducted. Asbestos workers must have access to accredited supervisors throughout the duration of the project.

The contractor/supervisor training course shall adequately address the following topics:

(a) *The physical characteristics of asbestos and asbestos-containing materials.* Identification of asbestos, aerodynamic characteristics, typical uses, physical appearance, a review of hazard assessment considerations, and a summary of abatement control options.

(b) *Potential health effects related to asbestos exposure.* The nature of asbestos-related diseases; routes of exposure; dose-response relationships and the lack of a safe exposure level; synergism between cigarette smoking and asbestos exposure; and latency period for diseases.

(c) *Employee personal protective equipment.* Classes and characteristics of respirator types; limitations of respirators; proper selection, inspection, donning, use, maintenance, and storage procedures for respirators; methods for field testing of the facepiece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit (e.g., facial hair); the components of a proper respiratory protection program; selection and use of personal protective clothing; and use, storage,

and handling of non-disposable clothing; and regulations covering personal protective equipment.

(d) *State-of-the-art work practices.* Proper work practices for asbestos abatement activities, including descriptions of proper construction and maintenance of barriers and decontamination enclosure systems; positioning of warning signs; lock-out of electrical and ventilation systems; proper working techniques for minimizing fiber release; use of wet methods; use of negative pressure exhaust ventilation equipment; use of HEPA vacuums; and proper clean-up and disposal procedures. Work practices for removal, encapsulation, enclosure, and repair of ACM; emergency procedures for unplanned releases; potential exposure situations; transport and disposal procedures; and recommended and prohibited work practices. New abatement-related techniques and methodologies may be discussed.

(e) *Personal hygiene.* Entry and exit procedures for the work area; use of showers; and avoidance of eating, drinking, smoking, and chewing (gum or tobacco) in the work area. Potential exposures, such as family exposure, shall also be included.

(f) *Additional safety hazards.* Hazards encountered during abatement activities and how to deal with them, including electrical hazards, heat stress, air contaminants other than asbestos, fire and explosion hazards, scaffold and ladder hazards, slips, trips, and falls, and confined spaces.

(g) *Medical monitoring.* OSHA and EPA Worker Protection Rule requirements for physical examinations, including a pulmonary function test, chest X-rays and a medical history for each employee.

(h) *Air monitoring.* Procedures to determine airborne concentrations of asbestos fibers, including descriptions of aggressive air sampling, sampling equipment and methods, reasons for air monitoring, types of samples and interpretation of results.

EPA recommends that transmission electron microscopy (TEM) be used for analysis of final air clearance samples, and that sample analyses be performed by laboratories accredited by the National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program (NVLAP).

(i) *Relevant Federal, State, and local regulatory requirements, procedures, and standards, including:*

(i) Requirements of TSCA Title II.

(ii) National Emission Standards for Hazardous Air Pollutants (40 CFR part 61), Subparts A (General Provisions) and M (National Emission Standard for Asbestos).

(iii) OSHA standards for permissible exposure to airborne concentrations of asbestos fibers and respiratory protection (29 CFR 1910.134).

(iv) OSHA Asbestos Construction Standard (29 CFR 1926.58). (v) EPA Worker Protection Rule, (40 CFR part 763, Subpart G).

(j) *Respiratory Protection Programs and Medical Monitoring Programs.*

(k) *Insurance and liability issues.* Contractor issues; worker's compensation coverage and exclusions; third-party liabilities and defenses; insurance coverage and exclusions.

(l) *Recordkeeping for asbestos abatement projects.* Records required by Federal, State, and local regulations; records recommended for legal and insurance purposes.

(m) *Supervisory techniques for asbestos abatement activities.* Supervisory practices to enforce and reinforce the required work practices and discourage unsafe work practices.

(n) *Contract specifications.* Discussions of key elements that are included in contract specifications.

(o) *Course review.* A review of key aspects of the training course.

3. INSPECTOR

All persons who inspect for ACBM in schools or public and commercial buildings must be accredited. All persons seeking accreditation as an inspector shall complete at least a 3-day training course as outlined below. The course shall include lectures, demonstrations, 4 hours of hands-on training, individual respirator fit-testing, course review, and a written examination.

EPA recommends the use of audiovisual materials to complement lectures, where appropriate. Hands-on training should include conducting a simulated building walk-through inspection and respirator fit testing. The inspector training course shall adequately address the following topics:

(a) *Background information on asbestos.* Identification of asbestos, and examples and discussion of the uses and locations of asbestos in buildings; physical appearance of asbestos.

(b) *Potential health effects related to asbestos exposure.* The nature of asbestos-related diseases; routes of exposure; dose-response relationships and the lack of a safe exposure level; the synergistic effect between cigarette smoking and asbestos exposure; the latency periods for asbestos-related diseases; a discussion of the relationship of asbestos exposure to asbestosis, lung cancer, mesothelioma, and cancers of other organs.

(c) *Functions/qualifications and role of inspectors.* Discussions of prior experience and qualifications for inspectors and management planners; discussions of the functions of an accredited inspector as compared to those of an accredited management planner; discussion of inspection process including inventory of ACM and physical assessment.

(d) *Legal liabilities and defenses.* Responsibilities of the inspector and management

planner; a discussion of comprehensive general liability policies, claims-made, and occurrence policies, environmental and pollution liability policy clauses; state liability insurance requirements; bonding and the relationship of insurance availability to bond availability.

(e) *Understanding building systems.* The interrelationship between building systems, including: an overview of common building physical plan layout; heat, ventilation, and air conditioning (HVAC) system types, physical organization, and where asbestos is found on HVAC components; building mechanical systems, their types and organization, and where to look for asbestos on such systems; inspecting electrical systems, including appropriate safety precautions; reading blueprints and as-built drawings.

(f) *Public/employee/building occupant relations.* Notifying employee organizations about the inspection; signs to warn building occupants; tact in dealing with occupants and the press; scheduling of inspections to minimize disruptions; and education of building occupants about actions being taken.

(g) *Pre-inspection planning and review of previous inspection records.* Scheduling the inspection and obtaining access; building record review; identification of probable homogeneous areas from blueprints or as-built drawings; consultation with maintenance or building personnel; review of previous inspection, sampling, and abatement records of a building; the role of the inspector in exclusions for previously performed inspections.

(h) *Inspecting for friable and non-friable ACM and assessing the condition of friable ACM.* Procedures to follow in conducting visual inspections for friable and non-friable ACM; types of building materials that may contain asbestos; touching materials to determine friability; open return air plenums and their importance in HVAC systems; assessing damage, significant damage, potential damage, and potential significant damage; amount of suspected ACM, both in total quantity and as a percentage of the total area; type of damage; accessibility; material's potential for disturbance; known or suspected causes of damage or significant damage; and deterioration as assessment factors.

(i) *Bulk sampling/documentation of asbestos.* Detailed discussion of the "Simplified Sampling Scheme for Friable Surfacing Materials (EPA 560/5-85-030a October 1985)"; techniques to ensure sampling in a randomly distributed manner for other than friable surfacing materials; sampling of non-friable materials; techniques for bulk sampling; inspector's sampling and repair equipment; patching or repair of damage from sampling; discussion of polarized light microscopy; choosing an accredited laboratory to analyze bulk samples; quality control and quality as-

urance procedures. EPA's recommendation that all bulk samples collected from school or public and commercial buildings be analyzed by a laboratory accredited under the NVLAP administered by NIST.

(j) *Inspector respiratory protection and personal protective equipment.* Classes and characteristics of respirator types; limitations of respirators; proper selection, inspection; donning, use, maintenance, and storage procedures for respirators; methods for field testing of the facepiece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit (e.g., facial hair); the components of a proper respiratory protection program; selection and use of personal protective clothing; use, storage, and handling of non-disposable clothing.

(k) *Recordkeeping and writing the inspection report.* Labeling of samples and keying sample identification to sampling location; recommendations on sample labeling; detailing of ACM inventory; photographs of selected sampling areas and examples of ACM condition; information required for inclusion in the management plan required for school buildings under TSCA Title II, section 203 (i)(1). EPA recommends that States develop and require the use of standardized forms for recording the results of inspections in schools or public or commercial buildings, and that the use of these forms be incorporated into the curriculum of training conducted for accreditation.

(l) *Regulatory review.* The following topics should be covered: National Emission Standards for Hazardous Air Pollutants (NESHAP; 40 CFR part 61, Subparts A and M); EPA Worker Protection Rule (40 CFR part 763, Subpart G); OSHA Asbestos Construction Standard (29 CFR 1926.58); OSHA respirator requirements (29 CFR 1910.134); the Asbestos-Containing Materials in School Rule (40 CFR part 763, Subpart E; applicable State and local regulations, and differences between Federal and State requirements where they apply, and the effects, if any, on public and nonpublic schools or commercial or public buildings.

(m) *Field trip.* This includes a field exercise, including a walk-through inspection; on-site discussion about information gathering and the determination of sampling locations; on-site practice in physical assessment; classroom discussion of field exercise.

(n) *Course review.* A review of key aspects of the training course.

4. MANAGEMENT PLANNER

All persons who prepare management plans for schools must be accredited. All persons seeking accreditation as management planners shall complete a 3-day inspector training course as outlined above and a 2-day

management planner training course. Possession of current and valid inspector accreditation shall be a prerequisite for admission to the management planner training course. The management planner course shall include lectures, demonstrations, course review, and a written examination.

EPA recommends the use of audiovisual materials to complement lectures, where appropriate.

TSCA Title II does not require accreditation for persons performing the management planner role in public and commercial buildings. Nevertheless, such persons may find this training and accreditation helpful in preparing them to design or administer asbestos operations and maintenance programs for public and commercial buildings.

The management planner training course shall adequately address the following topics:

(a) *Course overview.* The role and responsibilities of the management planner; operations and maintenance programs; setting work priorities; protection of building occupants.

(b) *Evaluation/interpretation of survey results.* Review of TSCA Title II requirements for inspection and management plans for school buildings as given in section 203(i)(1) of TSCA Title II; interpretation of field data and laboratory results; comparison of field inspector's data sheet with laboratory results and site survey.

(c) *Hazard assessment.* Amplification of the difference between physical assessment and hazard assessment; the role of the management planner in hazard assessment; explanation of significant damage, damage, potential damage, and potential significant damage; use of a description (or decision tree) code for assessment of ACM; assessment of friable ACM; relationship of accessibility, vibration sources, use of adjoining space, and air plenums and other factors to hazard assessment.

(d) *Legal implications.* Liability; insurance issues specific to planners; liabilities associated with interim control measures, in-house maintenance, repair, and removal; use of results from previously performed inspections.

(e) *Evaluation and selection of control options.* Overview of encapsulation, enclosure, interim operations and maintenance, and removal; advantages and disadvantages of each method; response actions described via a decision tree or other appropriate method; work practices for each response action; staging and prioritizing of work in both vacant and occupied buildings; the need for containment barriers and decontamination in response actions.

(f) *Role of other professionals.* Use of industrial hygienists, engineers, and architects in developing technical specifications for response actions; any requirements that may exist for architect sign-off of plans; team ap-

proach to design of high-quality job specifications.

(g) *Developing an operations and maintenance (O&M) plan.* Purpose of the plan; discussion of applicable EPA guidance documents; what actions should be taken by custodial staff; proper cleaning procedures; steam cleaning and HEPA vacuuming; reducing disturbance of ACM; scheduling O&M for off-hours; rescheduling or canceling renovation in areas with ACM; boiler room maintenance; disposal of ACM; in-house procedures for ACM—bridging and penetrating encapsulants; pipe fittings; metal sleeves; polyvinyl chloride (PVC), canvas, and wet wraps; muslin with straps, fiber mesh cloth; mineral wool, and insulating cement; discussion of employee protection programs and staff training; case study in developing an O&M plan (development, implementation process, and problems that have been experienced).

(h) *Regulatory review.* Focusing on the OSHA Asbestos Construction Standard found at 29 CFR 1926.58; the National Emission Standard for Hazardous Air Pollutants (NESHAP) found at 40 CFR part 61, Subparts A (General Provisions) and M (National Emission Standard for Asbestos); EPA Worker Protection Rule found at 40 CFR part 763, Subpart G; TSCA Title II; applicable State regulations.

(i) *Recordkeeping for the management planner.* Use of field inspector's data sheet along with laboratory results; on-going recordkeeping as a means to track asbestos disturbance; procedures for recordkeeping. EPA recommends that States require the use of standardized forms for purposes of management plans and incorporate the use of such forms into the initial training course for management planners.

(j) *Assembling and submitting the management plan.* Plan requirements for schools in TSCA Title II section 203(i)(1); the management plan as a planning tool.

(k) *Financing abatement actions.* Economic analysis and cost estimates; development of cost estimates; present costs of abatement versus future operation and maintenance costs; Asbestos School Hazard Abatement Act grants and loans.

(l) *Course review.* A review of key aspects of the training course.

5. PROJECT DESIGNER

A person must be accredited as a project designer to design any of the following activities with respect to friable ACM in a school or public and commercial building: (1) A response action other than a SSSD maintenance activity, (2) a maintenance activity that disturbs friable ACM other than a SSSD maintenance activity, or (3) a response action for a major fiber release episode. All persons seeking accreditation as a project designer shall complete at least a minimum

3-day training course as outlined below. The project designer course shall include lectures, demonstrations, a field trip, course review and a written examination.

EPA recommends the use of audiovisual materials to complement lectures, where appropriate.

The abatement project designer training course shall adequately address the following topics:

(a) *Background information on asbestos.* Identification of asbestos; examples and discussion of the uses and locations of asbestos in buildings; physical appearance of asbestos.

(b) *Potential health effects related to asbestos exposure.* Nature of asbestos-related diseases; routes of exposure; dose-response relationships and the lack of a safe exposure level; the synergistic effect between cigarette smoking and asbestos exposure; the latency period of asbestos-related diseases; a discussion of the relationship between asbestos exposure and asbestosis, lung cancer, mesothelioma, and cancers of other organs.

(c) *Overview of abatement construction projects.* Abatement as a portion of a renovation project; OSHA requirements for notification of other contractors on a multi-employer site (29 CFR 1926.58).

(d) *Safety system design specifications.* Design, construction, and maintenance of containment barriers and decontamination enclosure systems; positioning of warning signs; electrical and ventilation system lock-out; proper working techniques for minimizing fiber release; entry and exit procedures for the work area; use of wet methods; proper techniques for initial cleaning; use of negative-pressure exhaust ventilation equipment; use of HEPA vacuums; proper clean-up and disposal of asbestos; work practices as they apply to encapsulation, enclosure, and repair; use of glove bags and a demonstration of glove bag use.

(e) *Field trip.* A visit to an abatement site or other suitable building site, including on-site discussions of abatement design and building walk-through inspection. Include discussion of rationale for the concept of functional spaces during the walk-through.

(f) *Employee personal protective equipment.* Classes and characteristics of respirator types; limitations of respirators; proper selection, inspection; donning, use, maintenance, and storage procedures for respirators; methods for field testing of the facepiece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit (e.g., facial hair); the components of a proper respiratory protection program; selection and use of personal protective clothing; use, storage, and handling of non-disposable clothing.

(g) *Additional safety hazards.* Hazards encountered during abatement activities and

how to deal with them, including electrical hazards, heat stress, air contaminants other than asbestos, fire, and explosion hazards.

(h) *Fiber aerodynamics and control.* Aerodynamic characteristics of asbestos fibers; importance of proper containment barriers; settling time for asbestos fibers; wet methods in abatement; aggressive air monitoring following abatement; aggressive air movement and negative-pressure exhaust ventilation as a clean-up method.

(i) *Designing abatement solutions.* Discussions of removal, enclosure, and encapsulation methods; asbestos waste disposal.

(j) *Final clearance process.* Discussion of the need for a written sampling rationale for aggressive final air clearance; requirements of a complete visual inspection; and the relationship of the visual inspection to final air clearance.

EPA recommends the use of TEM for analysis of final air clearance samples. These samples should be analyzed by laboratories accredited under the NIST NVLAP.

(k) *Budgeting/cost estimating.* Development of cost estimates; present costs of abatement versus future operation and maintenance costs; setting priorities for abatement jobs to reduce costs.

(l) *Writing abatement specifications.* Preparation of and need for a written project design; means and methods specifications versus performance specifications; design of abatement in occupied buildings; modification of guide specifications for a particular building; worker and building occupant health/medical considerations; replacement of ACM with non-asbestos substitutes.

(m) *Preparing abatement drawings.* Significance and need for drawings, use of as-built drawings as base drawings; use of inspection photographs and on-site reports; methods of preparing abatement drawings; diagramming containment barriers; relationship of drawings to design specifications; particular problems related to abatement drawings.

(n) *Contract preparation and administration.*

(o) *Legal/liabilities/defenses.* Insurance considerations; bonding; hold-harmless clauses; use of abatement contractor's liability insurance; claims made versus occurrence policies.

(p) *Replacement.* Replacement of asbestos with asbestos-free substitutes.

(q) *Role of other consultants.* Development of technical specification sections by industrial hygienists or engineers; the multi-disciplinary team approach to abatement design.

(r) *Occupied buildings.* Special design procedures required in occupied buildings; education of occupants; extra monitoring recommendations; staging of work to minimize occupant exposure; scheduling of renovation to minimize exposure.

(s) *Relevant Federal, State, and local regulatory requirements, procedures and standards, including, but not limited to:*

- (i) Requirements of TSCA Title II.
- (ii) National Emission Standards for Hazardous Air Pollutants, (40 CFR part 61) subparts A (General Provisions) and M (National Emission Standard for Asbestos).
- (iii) OSHA Respirator Standard found at 29 CFR 1910.134.
- (iv) EPA Worker Protection Rule found at 40 CFR part 763, subpart G.
- (v) OSHA Asbestos Construction Standard found at 29 CFR 1926.58.
- (vi) OSHA Hazard Communication Standard found at 29 CFR 1926.59.
- (t) *Course review.* A review of key aspects of the training course.

6. PROJECT MONITOR

EPA recommends that States adopt training and accreditation requirements for persons seeking to perform work as project monitors. Project monitors observe abatement activities performed by contractors and generally serve as a building owner's representative to ensure that abatement work is completed according to specification and in compliance with all relevant statutes and regulations. They may also perform the vital role of air monitoring for purposes of determining final clearance. EPA recommends that a State seeking to accredit individuals as project monitors consider adopting a minimum 5-day training course covering the topics outlined below. The course outlined below consists of lectures and demonstrations, at least 6 hours of hands-on training, course review, and a written examination. The hands-on training component might be satisfied by having the student simulate participation in or performance of any of the relevant job functions or activities (or by incorporation of the workshop component described in item "n" below of this unit).

EPA recommends that the project monitor training course adequately address the following topics:

- (a) *Roles and responsibilities of the project monitor.* Definition and responsibilities of the project monitor, including regulatory/specification compliance monitoring, air monitoring, conducting visual inspections, and final clearance monitoring.
- (b) *Characteristics of asbestos and asbestos-containing materials.* Typical uses of asbestos; physical appearance of asbestos; review of asbestos abatement and control techniques; presentation of the health effects of asbestos exposure, including routes of exposure, dose-response relationships, and latency periods for asbestos-related diseases.
- (c) *Federal asbestos regulations.* Overview of pertinent EPA regulations, including: NESHAP, 40 CFR part 61, subparts A and M; AHERA, 40 CFR part 763, subpart E; and the

EPA Worker Protection Rule, 40 CFR part 763, subpart G. Overview of pertinent OSHA regulations, including: Construction Industry Standard for Asbestos, 29 CFR 1926.58; Respirator Standard, 29 CFR 1910.134; and the Hazard Communication Standard, 29 CFR 1926.59. Applicable State and local asbestos regulations; regulatory interrelationships.

(d) *Understanding building construction and building systems.* Building construction basics, building physical plan layout; understanding building systems (HVAC, electrical, etc.); layout and organization, where asbestos is likely to be found on building systems; renovations and the effect of asbestos abatement on building systems.

(e) *Asbestos abatement contracts, specifications, and drawings.* Basic provisions of the contract; relationships between principle parties, establishing chain of command; types of specifications, including means and methods, performance, and proprietary and nonproprietary; reading and interpreting records and abatement drawings; discussion of change orders; common enforcement responsibilities and authority of project monitor.

(f) *Response actions and abatement practices.* Pre-work inspections; pre-work considerations, precleaning of the work area, removal of furniture, fixtures, and equipment; shutdown/modification of building systems; construction and maintenance of containment barriers, proper demarcation of work areas; work area entry/exit, hygiene practices; determining the effectiveness of air filtration equipment; techniques for minimizing fiber release, wet methods, continuous cleaning; abatement methods other than removal; abatement area clean-up procedures; waste transport and disposal procedures; contingency planning for emergency response.

(g) *Asbestos abatement equipment.* Typical equipment found on an abatement project; air filtration devices, vacuum systems, negative pressure differential monitoring; HEPA filtration units, theory of filtration, design/construction of HEPA filtration units, qualitative and quantitative performance of HEPA filtration units, sizing the ventilation requirements, location of HEPA filtration units, qualitative and quantitative tests of containment barrier integrity; best available technology.

(h) *Personal protective equipment.* Proper selection of respiratory protection; classes and characteristics of respirator types, limitations of respirators; proper use of other safety equipment, protective clothing selection, use, and proper handling, hard/bump hats, safety shoes; breathing air systems, high pressure v. low pressure, testing for Grade D air, determining proper backup air volumes.

(i) *Air monitoring strategies.* Sampling equipment, sampling pumps (low v. high volume), flow regulating devices (critical and

limiting orifices), use of fibrous aerosol monitors on abatement projects; sampling media, types of filters, types of cassettes, filter orientation, storage and shipment of filters; calibration techniques, primary calibration standards, secondary calibration standards, temperature/pressure effects, frequency of calibration, recordkeeping and field work documentation, calculations; air sample analysis, techniques available and limitations of AHERA on their use, transmission electron microscopy (background to sample preparation and analysis, air sample conditions which prohibit analysis, EPA's recommended technique for analysis of final air clearance samples), phase contrast microscopy (background to sample preparation, and AHERA's limits on the use of phase contrast microscopy), what each technique measures; analytical methodologies, AHERA TEM protocol, NIOSH 7400, OSHA reference method (non clearance), EPA recommendation for clearance (TEM); sampling strategies for clearance monitoring, types of air samples (personal breathing zone v. fixed-station area) sampling location and objectives (pre-abatement, during abatement, and clearance monitoring), number of samples to be collected, minimum and maximum air volumes, clearance monitoring (post-visual-inspection) (number of samples required, selection of sampling locations, period of sampling, aggressive sampling, interpretations of sampling results, calculations), quality assurance; special sampling problems, crawl spaces, acceptable samples for laboratory analysis, sampling in occupied buildings (barrier monitoring).

(j) *Safety and health issues other than asbestos.* Confined-space entry, electrical hazards, fire and explosion concerns, ladders and scaffolding, heat stress, air contaminants other than asbestos, fall hazards, hazardous materials on abatement projects.

(k) *Conducting visual inspections.* Inspections during abatement, visual inspections using the ASTM E1368 document; conducting inspections for completeness of removal; discussion of "how clean is clean?"

(l) *Legal responsibilities and liabilities of project monitors.* Specification enforcement capabilities; regulatory enforcement; licensing; powers delegated to project monitors through contract documents.

(m) *Recordkeeping and report writing.* Developing project logs/daily logs (what should be included, who sees them); final report preparation; recordkeeping under Federal regulations.

(n) *Workshops (6 hours spread over 3 days).* Contracts, specifications, and drawings: This workshop could consist of each participant being issued a set of contracts, specifications, and drawings and then being asked to answer questions and make recommendations to a project architect, engineer or to

the building owner based on given conditions and these documents.

Air monitoring strategies/asbestos abatement equipment: This workshop could consist of simulated abatement sites for which sampling strategies would have to be developed (i.e., occupied buildings, industrial situations). Through demonstrations and exhibition, the project monitor may also be able to gain a better understanding of the function of various pieces of equipment used on abatement projects (air filtration units, water filtration units, negative pressure monitoring devices, sampling pump calibration devices, etc.).

Conducting visual inspections: This workshop could consist, ideally, of an interactive video in which a participant is "taken through" a work area and asked to make notes of what is seen. A series of questions will be asked which are designed to stimulate a person's recall of the area. This workshop could consist of a series of two or three videos with different site conditions and different degrees of cleanliness.

C. Examinations

1. Each State shall administer a closed book examination or designate other entities such as State-approved providers of training courses to administer the closed-book examination to persons seeking accreditation who have completed an initial training course. Demonstration testing may also be included as part of the examination. A person seeking initial accreditation in a specific discipline must pass the examination for that discipline in order to receive accreditation. For example, a person seeking accreditation as an abatement project designer must pass the State's examination for abatement project designer.

States may develop their own examinations, have providers of training courses develop examinations, or use standardized examinations developed for purposes of accreditation under TSCA Title II. In addition, States may supplement standardized examinations with questions about State regulations. States may obtain commercially developed standardized examinations, develop standardized examinations independently, or do so in cooperation with other States, or with commercial or non-profit providers on a regional or national basis. EPA recommends the use of standardized, scientifically-validated testing instruments, which may be beneficial in terms of both promoting competency and in fostering accreditation reciprocity between States.

Each examination shall adequately cover the topics included in the training course for that discipline. Each person who completes a

training course, passes the required examination, and fulfills whatever other requirements the State imposes must receive an accreditation certificate in a specific discipline. Whether a State directly issues accreditation certificates, or authorizes training providers to issue accreditation certificates, each certificate issued to an accredited person must contain the following minimum information:

- a. A unique certificate number
- b. Name of accredited person
- c. Discipline of the training course completed.
- d. Dates of the training course.
- e. Date of the examination.
- f. An expiration date of 1 year after the date upon which the person successfully completed the course and examination.
- g. The name, address, and telephone number of the training provider that issued the certificate.
- h. A statement that the person receiving the certificate has completed the requisite training for asbestos accreditation under TSCA Title II.

States or training providers who reaccredit persons based upon completion of required refresher training must also provide accreditation certificates with all of the above information, except the examination date may be omitted if a State does not require a refresher examination for reaccreditation.

Where a State licenses accredited persons but has authorized training providers to issue accreditation certificates, the State may issue licenses in the form of photo-identification cards. Where this applies, EPA recommends that the State licenses should include all of the same information required for the accreditation certificates. A State may also choose to issue photo-identification cards in addition to the required accreditation certificates.

Accredited persons must have their initial and current accreditation certificates at the location where they are conducting work.

2. The following are the requirements for examination in each discipline:

- a. Worker:
 - i. 50 multiple-choice questions
 - ii. Passing score: 70 percent correct
- b. Contractor/Supervisor:
 - i. 100 multiple-choice questions
 - ii. Passing score: 70 percent correct
- c. Inspector:
 - i. 50 Multiple-choice questions
 - ii. Passing score: 70 percent correct
- d. Management Planner:
 - i. 50 Multiple-choice questions
 - ii. Passing score: 70 percent correct
- e. Project Designer:
 - i. 100 multiple-choice questions
 - ii. Passing score: 70 percent correct

D. Continuing Education

For all disciplines, a State's accreditation program shall include annual refresher training as a requirement for reaccreditation as indicated below:

1. Workers: One full day of refresher training.
2. Contractor/Supervisors: One full day of refresher training.
3. Inspectors: One half-day of refresher training.
4. Management Planners: One half-day of inspector refresher training and one half-day of refresher training for management planners.
5. Project Designers: One full day of refresher training.

The refresher courses shall be specific to each discipline. Refresher courses shall be conducted as separate and distinct courses and not combined with any other training during the period of the refresher course. For each discipline, the refresher course shall review and discuss changes in Federal, State, and local regulations, developments in state-of-the-art procedures, and a review of key aspects of the initial training course as determined by the State. After completing the annual refresher course, persons shall have their accreditation extended for an additional year from the date of the refresher course. A State may consider requiring persons to pass reaccreditation examinations at specific intervals (for example, every 3 years).

EPA recommends that States formally establish a 12-month grace period to enable formerly accredited persons with expired certificates to complete refresher training and have their accreditation status reinstated without having to re-take the initial training course.

E. Qualifications

In addition to requiring training and an examination, a State may require candidates for accreditation to meet other qualification and/or experience standards that the State considers appropriate for some or all disciplines. States may choose to consider requiring qualifications similar to the examples outlined below for inspectors, management planners and project designers. States may modify these examples as appropriate. In addition, States may want to include some requirements based on experience in performing a task directly as a part of a job or in an apprenticeship role. They may also wish to consider additional criteria for the approval of training course instructors beyond those prescribed by EPA.

1. Inspectors: Qualifications - possess a high school diploma. States may want to require an Associate's Degree in specific fields (e.g., environmental or physical sciences).

2. Management Planners: Qualifications - Registered architect, engineer, or certified industrial hygienist or related scientific field.

3. Project Designers: Qualifications - registered architect, engineer, or certified industrial hygienist.

4. Asbestos Training Course Instructor: Qualifications - academic credentials and/or field experience in asbestos abatement.

EPA recommends that States prescribe minimum qualification standards for training instructors employed by training providers.

F. Recordkeeping Requirements for Training Providers

All approved providers of accredited asbestos training courses must comply with the following minimum recordkeeping requirements.

1. Training course materials. A training provider must retain copies of all instructional materials used in the delivery of the classroom training such as student manuals, instructor notebooks and handouts.

2. Instructor qualifications. A training provider must retain copies of all instructors' resumes, and the documents approving each instructor issued by either EPA or a State. Instructors must be approved by either EPA or a State before teaching courses for accreditation purposes. A training provider must notify EPA or the State, as appropriate, in advance whenever it changes course instructors. Records must accurately identify the instructors that taught each particular course for each date that a course is offered.

3. Examinations. A training provider must document that each person who receives an accreditation certificate for an initial training course has achieved a passing score on the examination. These records must clearly indicate the date upon which the exam was administered, the training course and discipline for which the exam was given, the name of the person who proctored the exam, a copy of the exam, and the name and test score of each person taking the exam. The topic and dates of the training course must correspond to those listed on that person's accreditation certificate. States may choose to apply these same requirements to examinations for refresher training courses.

4. Accreditation certificates. The training providers or States, whichever issues the accreditation certificate, shall maintain records that document the names of all persons who have been awarded certificates, their certificate numbers, the disciplines for which accreditation was conferred, training and expiration dates, and the training location. The training provider or State shall maintain the records in a manner that allows verification by telephone of the required information.

5. Verification of certificate information. EPA recommends that training providers of refresher training courses confirm that their students possess valid accreditation before granting course admission. EPA further recommends that training providers offering the initial management planner training course verify that students have met the prerequisite of possessing valid inspector accreditation at the time of course admission.

6. Records retention and access. (a) The training provider shall maintain all required records for a minimum of 3 years. The training provider, however, may find it advantageous to retain these records for a longer period of time.

(b) The training provider must allow reasonable access to all of the records required by the MAP, and to any other records which may be required by States for the approval of asbestos training providers or the accreditation of asbestos training courses, to both EPA and to State Agencies, on request. EPA encourages training providers to make this information equally accessible to the general public.

(c) If a training provider ceases to conduct training, the training provider shall notify the approving government body (EPA or the State) and give it the opportunity to take possession of that providers asbestos training records.

G. Deaccreditation

1. States must establish criteria and procedures for deaccrediting persons accredited as workers, contractor/supervisors, inspectors, management planners, and project designers. States must follow their own administrative procedures in pursuing deaccreditation actions. At a minimum, the criteria shall include:

(a) Performing work requiring accreditation at a job site without being in physical possession of initial and current accreditation certificates;

(b) Permitting the duplication or use of one's own accreditation certificate by another;

(c) Performing work for which accreditation has not been received; or

(d) Obtaining accreditation from a training provider that does not have approval to offer training for the particular discipline from either EPA or from a State that has a contractor accreditation plan at least as stringent as the EPA MAP.

EPA may directly pursue deaccreditation actions without reliance on State deaccreditation or enforcement authority or actions. In addition to the above-listed situations, the Administrator may suspend or revoke the accreditation of persons who have been subject to a final order imposing a civil penalty or convicted under section 16 of TSCA, 15 U.S.C. 2615 or 2647, for violations of 40 CFR part 763, or section 113 of the Clean

Air Act, 42 U.S.C. 7413, for violations of 40 CFR part 61, subpart M.

2. Any person who performs asbestos work requiring accreditation under section 206(a) of TSCA, 15 U.S.C. 2646(a), without such accreditation is in violation of TSCA. The following persons are not accredited for purposes of section 206(a) of TSCA:

- (a) Any person who obtains accreditation through fraudulent representation of training or examination documents;
- (b) Any person who obtains training documentation through fraudulent means;
- (c) Any person who gains admission to and completes refresher training through fraudulent representation of initial or previous refresher training documentation; or
- (d) Any person who obtains accreditation through fraudulent representation of accreditation requirements such as education, training, professional registration, or experience.

H. Reciprocity

EPA recommends that each State establish reciprocal arrangements with other States that have established accreditation programs that meet or exceed the requirements of the MAP. Such arrangements might address cooperation in licensing determinations, the review and approval of training programs and/or instructors, candidate testing and exam administration, curriculum development, policy formulation, compliance monitoring, and the exchange of information and data. The benefits to be derived from these arrangements include a potential cost-savings from the reduction of duplicative activity and the attainment of a more professional accredited workforce as States are able to refine and improve the effectiveness of their programs based upon the experience and methods of other States.

I. Electronic Reporting

States that choose to receive electronic documents must include, at a minimum, the requirements of 40 CFR Part 3—(Electronic reporting) in their programs.

II. EPA Approval Process for State Accreditation Programs

A. States may seek approval for a single discipline or all disciplines as specified in the MAP. For example, a State that currently only requires worker accreditation may receive EPA approval for that discipline alone. EPA encourages States that currently do not have accreditation requirements for all disciplines required under section 206(b)(2) of TSCA, 15 U.S.C. 2646(b)(2), to seek EPA approval for those disciplines the State does accredit. As States establish accreditation requirements for the remaining disciplines, the requested information outlined below should be submitted to EPA as soon as

possible. Any State that had an accreditation program approved by EPA under an earlier version of the MAP may follow the same procedures to obtain EPA approval of their accreditation program under this MAP.

B. Partial approval of a State Program for the accreditation of one or more disciplines does not mean that the State is in full compliance with TSCA where the deadline for that State to have adopted a State Plan no less stringent than the MAP has already passed. State Programs which are at least as stringent as the MAP for one or more of the accredited disciplines may, however, accredit persons in those disciplines only.

C. States seeking EPA approval or re-approval of accreditation programs shall submit the following information to the Regional Asbestos Coordinator at their EPA Regional office:

1. A copy of the legislation establishing or upgrading the State's accreditation program (if applicable).
 2. A copy of the State's accreditation regulations or revised regulations.
 3. A letter to the Regional Asbestos Coordinator that clearly indicates how the State meets the program requirements of this MAP. Addresses for each of the Regional Asbestos Coordinators are shown below:
- EPA, Region I, (ATC-111) Asbestos Coordinator, JFK Federal Bldg., Boston, MA 02203-2211, (617) 565-3836.
 - EPA, Region II, (MS-500), Asbestos Coordinator, 2890 Woodbridge Ave., Edison, NJ 08837-3679, (908) 321-6671.
 - EPA, Region III, (3AT-33), Asbestos Coordinator, 841 Chestnut Bldg., Philadelphia, PA 19107, (215) 597-3160.
 - EPA, Region IV, Asbestos Coordinator, 345 Courtland St., N.E., Atlanta, GA 30365, (404) 347-5014.
 - EPA, Region V, (SP-14J), Asbestos Coordinator, 77 W. Jackson Blvd., Chicago, IL 60604-3590, (312) 886-6003.
 - EPA, Region VI, (6T-PT), Asbestos Coordinator, 1445 Ross Ave. Dallas, TX 75202-2744, (214) 655-7244.
 - EPA, Region VII, (ARTX/ASBS), Asbestos Coordinator, 726 Minnesota Ave., Kansas City, KS 66101, (913) 551-7020.
 - EPA, Region VIII, (8AT-TS), Asbestos Coordinator, 1 Denver Place, Suite 500 999 - 18th St., Denver, CO 80202-2405, (303) 293-1442.
 - EPA, Region IX, Asbestos NESHAPs Contact, Air Division (A-5), 75 Hawthorne Street, San Francisco, CA 94105, (415) 972-3989.
 - EPA, Region X, (AT-083), Asbestos Coordinator, 1200 Sixth Ave., Seattle, WA 98101, (206) 553-4762.

EPA maintains a listing of all those States that have applied for and received EPA approval for having accreditation requirements that are at least as stringent as the MAP for one or more disciplines. Any training courses

Environmental Protection Agency

Pt. 763, Subpt. E, App. C

approved by an EPA-approved State Program are considered to be EPA-approved for purposes of accreditation.

III. Approval of Training Courses

Individuals or groups wishing to sponsor training courses for disciplines required to be accredited under section 206(b)(1)(A) of TSCA, 15 U.S.C. 2646(b)(1)(A), may apply for approval from States that have accreditation program requirements that are at least as stringent as this MAP. For a course to receive approval, it must meet the requirements for the course as outlined in this MAP, and any other requirements imposed by the State from which approval is being sought. Courses that have been approved by a State with an accreditation program at least as stringent as this MAP are approved under section 206(a) of TSCA, 15 U.S.C. 2646(a), for that particular State, and also for any other State that does not have an accreditation program as stringent as this MAP.

A. Initial Training Course Approval

A training provider must submit the following minimum information to a State as part of its application for the approval of each training course:

1. The course provider's name, address, and telephone number.
2. A list of any other States that currently approve the training course.
3. The course curriculum.
4. A letter from the provider of the training course that clearly indicates how the course meets the MAP requirements for:
 - a. Length of training in days.
 - b. Amount and type of hands-on training.
 - c. Examination (length, format, and passing score).
 - d. Topics covered in the course.
5. A copy of all course materials (student manuals, instructor notebooks, handouts, etc.).
6. A detailed statement about the development of the examination used in the course.
7. Names and qualifications of all course instructors. Instructors must have academic and/or field experience in asbestos abatement.
8. A description of and an example of the numbered certificates issued to students who attend the course and pass the examination.

B. Refresher Training Course Approval

The following minimum information is required for approval of refresher training courses by States:

1. The length of training in half-days or days.
2. The topics covered in the course.
3. A copy of all course materials (student manuals, instructor notebooks, handouts, etc.).

4. The names and qualifications of all course instructors. Instructors must have academic and/or field experience in asbestos abatement.

5. A description of and an example of the numbered certificates issued to students who complete the refresher course and pass the examination, if required.

C. Withdrawal of Training Course Approval

States must establish criteria and procedures for suspending or withdrawing approval from accredited training programs. States should follow their own administrative procedures in pursuing actions for suspension or withdrawal of approval of training programs. At a minimum, the criteria shall include:

- (1) Misrepresentation of the extent of a training course's approval by a State or EPA;
- (2) Failure to submit required information or notifications in a timely manner;
- (3) Failure to maintain requisite records;
- (4) Falsification of accreditation records, instructor qualifications, or other accreditation information; or
- (5) Failure to adhere to the training standards and requirements of the EPA MAP or State Accreditation Program, as appropriate.

In addition to the criteria listed above, EPA may also suspend or withdraw a training course's approval where an approved training course instructor, or other person with supervisory authority over the delivery of training has been found in violation of other asbestos regulations administered by EPA. An administrative or judicial finding of violation, or execution of a consent agreement and order under 40 CFR 22.18, constitutes evidence of a failure to comply with relevant statutes or regulations. States may wish to adopt this criterion modified to include their own asbestos statutes or regulations. EPA may also suspend or withdraw approval of training programs where a training provider has submitted false information as a part of the self-certification required under Unit V.B. of the revised MAP.

Training course providers shall permit representatives of EPA or the State which approved their training courses to attend, evaluate, and monitor any training course without charge. EPA or State compliance inspection staff are not required to give advance notice of their inspections. EPA may suspend or withdraw State or EPA approval of a training course based upon the criteria specified in this Unit III.C.

IV. EPA Procedures for Suspension or Revocation of Accreditation or Training Course Approval.

A. If the Administrator decides to suspend or revoke the accreditation of any person or

suspend or withdraw the approval of a training course, the Administrator will notify the affected entity of the following:

1. The grounds upon which the suspension, revocation, or withdrawal is based.
2. The time period during which the suspension, revocation, or withdrawal is effective, whether permanent or otherwise.
3. The conditions, if any, under which the affected entity may receive accreditation or approval in the future.
4. Any additional conditions which the Administrator may impose.
5. The opportunity to request a hearing prior to final Agency action to suspend or revoke accreditation or suspend or withdraw approval.

B. If a hearing is requested by the accredited person or training course provider pursuant to the preceding paragraph, the Administrator will:

1. Notify the affected entity of those assertions of law and fact upon which the action to suspend, revoke, or withdraw is based.
2. Provide the affected entity an opportunity to offer written statements of facts, explanations, comments, and arguments relevant to the proposed action.
3. Provide the affected entity such other procedural opportunities as the Administrator may deem appropriate to ensure a fair and impartial hearing.
4. Appoint an EPA attorney as Presiding Officer to conduct the hearing. No person shall serve as Presiding Officer if he or she has had any prior connection with the specific case.

C. The Presiding Officer appointed pursuant to the preceding paragraph shall:

1. Conduct a fair, orderly, and impartial hearing, without unnecessary delay.
2. Consider all relevant evidence, explanation, comment, and argument submitted pursuant to the preceding paragraph.
3. Promptly notify the affected entity of his or her decision and order. Such an order is a final Agency action.

D. If the Administrator determines that the public health, interest, or welfare warrants immediate action to suspend the accreditation of any person or the approval of any training course provider, the Administrator will:

1. Notify the affected entity of the grounds upon which the emergency suspension is based;
2. Notify the affected entity of the time period during which the emergency suspension is effective.
3. Notify the affected entity of the Administrator's intent to suspend or revoke accreditation or suspend or withdraw training course approval, as appropriate, in accordance with Unit IV.A. above. If such suspension, revocation, or withdrawal notice has not previously been issued, it will be issued

at the same time the emergency suspension notice is issued.

E. Any notice, decision, or order issued by the Administrator under this section, and any documents filed by an accredited person or approved training course provider in a hearing under this section, shall be available to the public except as otherwise provided by section 14 of TSCA or by 40 CFR part 2. Any such hearing at which oral testimony is presented shall be open to the public, except that the Presiding Officer may exclude the public to the extent necessary to allow presentation of information which may be entitled to confidential treatment under section 14 of TSCA or 40 CFR part 2.

V. Implementation Schedule

The various requirements of this MAP become effective in accordance with the following schedules:

A. Requirements applicable to State Programs

1. Each State shall adopt an accreditation plan that is at least as stringent as this MAP within 180 days after the commencement of the first regular session of the legislature of the State that is convened on or after April 4, 1994.

2. If a State has adopted an accreditation plan at least as stringent as this MAP as of April 4, 1994, the State may continue to:

a. Conduct TSCA training pursuant to this MAP.

b. Approve training course providers to conduct training and to issue accreditation that satisfies the requirements for TSCA accreditation under this MAP.

c. Issue accreditation that satisfies the requirements for TSCA accreditation under this MAP.

3. A State that had complied with an earlier version of the MAP, but has not adopted an accreditation plan at least as stringent as this MAP by April 4, 1994, may:

a. Conduct TSCA training which remains in compliance with the requirements of Unit V.B. of this MAP. After such training has been self-certified in accordance with Unit V.B. of this MAP, the State may issue accreditation that satisfies the requirement for TSCA accreditation under this MAP.

b. Sustain its approval for any training course providers to conduct training and issue TSCA accreditation that the State had approved before April 4, 1994, and that remain in compliance with Unit V.B. of this MAP.

c. Issue accreditation pursuant to an earlier version of the MAP that provisionally satisfies the requirement for TSCA accreditation until October 4, 1994.

Such a State may not approve new TSCA training course providers to conduct training or to issue TSCA accreditation that satisfies

Environmental Protection Agency

Pt. 763, Subpt. E, App. C

the requirements of this MAP until the State adopts an accreditation plan that is at least as stringent as this MAP.

4. A State that had complied with an earlier version of the MAP, but fails to adopt a plan as stringent as this MAP by the deadline established in Unit V.A.1., is subject to the following after that deadline date:

a. The State loses any status it may have held as an EPA-approved State for accreditation purposes under section 206 of TSCA, 15 U.S.C. 2646.

b. All training course providers approved by the State lose State approval to conduct training and issue accreditation that satisfies the requirements for TSCA accreditation under this MAP.

c. The State may not:

i. Conduct training for accreditation purposes under section 206 of TSCA, 15 U.S.C. 2646.

ii. Approve training course providers to conduct training or issue accreditation that satisfies the requirements for TSCA accreditation; or

iii. Issue accreditation that satisfies the requirement for TSCA accreditation.

EPA will extend EPA-approval to any training course provider that loses State approval because the State does not comply with the deadline, so long as the provider is in compliance with Unit V.B. of this MAP, and the provider is approved by a State that had complied with an earlier version of the MAP as of the day before the State loses its EPA approval.

5. A State that does not have an accreditation program that satisfies the requirements for TSCA accreditation under either an earlier version of the MAP or this MAP, may not:

a. Conduct training for accreditation purposes under section 206 of TSCA, 15 U.S.C. 2646;

b. Approve training course providers to conduct training or issue accreditation that satisfies the requirements for TSCA accreditation; or

c. Issue accreditation that satisfies the requirement for TSCA accreditation.

B. Requirements applicable to Training Courses and Providers

As of October 4, 1994, an approved training provider must certify to EPA and to any State that has approved the provider for TSCA accreditation, that each of the provider's training courses complies with the requirements of this MAP. The written submission must document in specific detail the changes made to each training course in order to comply with the requirements of this MAP and clearly state that the provider is also in compliance with all other requirements of this MAP, including the new recordkeeping and certificate provisions. Each submission must include the following state-

ment signed by an authorized representative of the training provider: "Under civil and criminal penalties of law for the making or submission of false or fraudulent statements or representations (18 U.S.C. 1001 and 15 U.S.C. 2615), I certify that the training described in this submission complies with all applicable requirements of Title II of TSCA, 40 CFR part 763, Appendix C to Subpart E, as revised, and any other applicable Federal, state, or local requirements." A consolidated self-certification submission from each training provider that addresses all of its approved training courses is permissible and encouraged.

The self-certification must be sent via registered mail, to EPA Headquarters at the following address: Attn. Self-Certification Program, Field Programs Branch, Chemical Management Division (7404), Office of Pollution Prevention and Toxics, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460. A duplicate copy of the complete submission must also be sent to any States from which approval had been obtained.

The timely receipt of a complete self-certification by EPA and all approving States shall have the effect of extending approval under this MAP to the training courses offered by the submitting provider. If a self-certification is not received by the approving government bodies on or before the due date, the affected training course is not approved under this MAP. Such training providers must then reapply for approval of these training courses pursuant to the procedures outlined in Unit III.

C. Requirements applicable to Accredited Persons.

Persons accredited by a State with an accreditation program no less stringent than an earlier version of the MAP or by an EPA-approved training provider as of April 3, 1994, are accredited in accordance with the requirements of this MAP, and are not required to retake initial training. They must continue to comply with the requirements for annual refresher training in Unit I.D. of the revised MAP.

D. Requirements applicable to Non-Accredited Persons.

In order to perform work requiring accreditation under TSCA Title II, persons who are not accredited by a State with an accreditation program no less stringent than an earlier version of the MAP or by an EPA-approved training provider as of April 3, 1994, must comply with the upgraded training requirements of this MAP by no later than October 4, 1994. Non-accredited persons may obtain initial accreditation on a provisional basis by successfully completing any of the training programs approved under an earlier

Pt. 763, Subpt. E, App. D

40 CFR Ch. I (7–1–11 Edition)

version of the MAP, and thereby perform work during the first 6 months after this MAP takes effect. However, by October 4, 1994, these persons must have successfully completed an upgraded training program that fully complies with the requirements of this MAP in order to continue to perform work requiring accreditation under section 206 of TSCA, 15 U.S.C. 2646.

[59 FR 5251, Feb. 3, 1994, as amended at 60 FR 31922, June 19, 1995; 70 FR 59889, Oct. 13, 2005; 75 FR 69353, Nov. 12, 2010]

APPENDIX D TO SUBPART E OF PART 763—TRANSPORT AND DISPOSAL OF ASBESTOS WASTE

For the purposes of this appendix, transport is defined as all activities from receipt of the containerized asbestos waste at the generation site until it has been unloaded at the disposal site. Current EPA regulations state that there must be no visible emissions to the outside air during waste transport. However, recognizing the potential hazards and subsequent liabilities associated with exposure, the following additional precautions are recommended.

Recordkeeping. Before accepting wastes, a transporter should determine if the waste is properly wetted and containerized. The transporter should then require a chain-of-custody form signed by the generator. A chain-of-custody form may include the name and address of the generator, the name and address of the pickup site, the estimated quantity of asbestos waste, types of containers used, and the destination of the waste. The chain-of-custody form should then be signed over to a disposal site operator to transfer responsibility for the asbestos waste. A copy of the form signed by the disposal site operator should be maintained by the transporter as evidence of receipt at the disposal site.

Waste handling. A transporter should ensure that the asbestos waste is properly contained in leak-tight containers with appropriate labels, and that the outside surfaces of the containers are not contaminated with asbestos debris adhering to the containers. If there is reason to believe that the condition of the asbestos waste may allow significant fiber release, the transporter should not accept the waste. Improper containerization of wastes is a violation of the NESHAPs regulation and should be reported to the appropriate EPA Regional Asbestos NESHAPs contact below:

Region I

Asbestos NESHAPs Contact, Air Management Division, USEPA, Region I, JFK Federal Building, Boston, MA 02203, (617) 223-3266.

Region II

Asbestos NESHAPs Contact, Air & Waste Management Division, USEPA, Region II, 26 Federal Plaza, New York, NY 10007, (212) 264-6770.

Region III

Asbestos NESHAPs Contact, Air Management Division, USEPA, Region III, 841 Chestnut Street, Philadelphia, PA 19107, (215) 597-9325.

Region IV

Asbestos NESHAPs Contact, Air, Pesticide & Toxic Management, USEPA, Region IV, 345 Courtland Street, NE., Atlanta, GA 30365, (404) 347-4298.

Region V

Asbestos NESHAPs Contact, Air Management Division, USEPA, Region V, 77 West Jackson Boulevard, Chicago, IL 60604, (312) 353-6793.

Region VI

Asbestos NESHAPs Contact, Air & Waste Management Division, USEPA, Region VI, 1445 Ross Avenue, Dallas, TX 75202, (214) 655-7229.

Region VII

Asbestos NESHAPs Contact, Air & Waste Management Division, USEPA, Region VII, 726 Minnesota Avenue, Kansas City, KS 66101, (913) 236-2896.

Region VIII

Asbestos NESHAPs Contact, Air & Waste Management Division, USEPA, Region VIII, 999 18th Street, Suite 500, Denver, CO 80202, (303) 293-1814.

Region IX

Asbestos NESHAPs Contact, Air Division, USEPA, Region IX, 75 Hawthorne Street, San Francisco, CA 94105, (415) 972-3989.

Region X

Asbestos NESHAPs Contact, Air & Toxics Management Division, USEPA, Region X, 1200 Sixth Avenue, Seattle, WA 98101, (206) 442-2724.

Once the transporter is satisfied with the condition of the asbestos waste and agrees to handle it, the containers should be loaded into the transport vehicle in a careful manner to prevent breaking of the containers. Similarly, at the disposal site, the asbestos waste containers should be transferred carefully to avoid fiber release.

Waste transport. Although there are no regulatory specifications regarding the transport vehicle, it is recommended that vehicles used for transport of containerized asbestos

waste have an enclosed carrying compartment or utilize a canvas covering sufficient to contain the transported waste, prevent damage to containers, and prevent fiber release. Transport of large quantities of asbestos waste is commonly conducted in a 20-cubic-yard "roll off" box, which should also be covered. Vehicles that use compactors to reduce waste volume should not be used because these will cause the waste containers to rupture. Vacuum trucks used to transport waste slurry must be inspected to ensure that water is not leaking from the truck.

Disposal involves the isolation of asbestos waste material in order to prevent fiber release to air or water. Landfilling is recommended as an environmentally sound isolation method because asbestos fibers are virtually immobile in soil. Other disposal techniques such as incineration or chemical treatment are not feasible due to the unique properties of asbestos. EPA has established asbestos disposal requirements for active and inactive disposal sites under NESHAPs (40 CFR Part 61, subpart M) and specifies general requirements for solid waste disposal under RCRA (40 CFR Part 257). Advance EPA notification of the intended disposal site is required by NESHAPs.

Selecting a disposal facility. An acceptable disposal facility for asbestos wastes must adhere to EPA's requirements of no visible emissions to the air during disposal, or minimizing emissions by covering the waste within 24 hours. The minimum required cover is 6 inches of nonasbestos material, normally soil, or a dust-suppressing chemical. In addition to these Federal requirements, many state or local government agencies require more stringent handling procedures. These agencies usually supply a list of "approved" or licensed asbestos disposal sites upon request. Solid waste control agencies are listed in local telephone directories under state, county, or city headings. A list of state solid waste agencies may be obtained by calling the RCRA hotline: 1-800-424-9346 (382-3000 in Washington, DC). Some landfill owners or operators place special requirements on asbestos waste, such as placing all bagged waste into 55-gallon metal drums. Therefore, asbestos removal contractors should contact the intended landfill before arriving with the waste.

Receiving asbestos waste. A landfill approved for receipt of asbestos waste should require notification by the waste hauler that the load contains asbestos. The landfill operator should inspect the loads to verify that asbestos waste is properly contained in leak-tight containers and labeled appropriately. The appropriate EPA Regional Asbestos NESHAPs Contact should be notified if the landfill operator believes that the asbestos waste is in a condition that may cause significant fiber release during disposal. In situations when the wastes are not properly con-

tainerized, the landfill operator should thoroughly soak the asbestos with a water spray prior to unloading, rinse out the truck, and immediately cover the wastes with non-asbestos material prior to compacting the waste in the landfill.

Waste deposition and covering. Recognizing the health dangers associated with asbestos exposure, the following procedures are recommended to augment current federal requirements:

- Designate a separate area for asbestos waste disposal. Provide a record for future landowners that asbestos waste has been buried there and that it would be hazardous to attempt to excavate that area. (Future regulations may require property deeds to identify the location of any asbestos wastes and warn against excavation.)
- Prepare a separate trench to receive asbestos wastes. The size of the trench will depend upon the quantity and frequency of asbestos waste delivered to the disposal site. The trenching technique allows application of soil cover without disturbing the asbestos waste containers. The trench should be ramped to allow the transport vehicle to back into it, and the trench should be as narrow as possible to reduce the amount of cover required. If possible, the trench should be aligned perpendicular to prevailing winds.
- Place the asbestos waste containers into the trench carefully to avoid breaking them. Be particularly careful with plastic bags because when they break under pressure asbestos particles can be emitted.
- Completely cover the containerized waste within 24 hours with a minimum of 6 inches of nonasbestos material. Improperly containerized waste is a violation of the NESHAPs and EPA should be notified.

However, if improperly containerized waste is received at the disposal site, it should be covered immediately after unloading. Only after the wastes, including properly containerized wastes, are completely covered, can the wastes be compacted or other heavy equipment run over it. During compacting, avoid exposing wastes to the air or tracking asbestos material away from the trench.

- For final closure of an area containing asbestos waste, cover with at least an additional 30 inches of compacted nonasbestos material to provide a 36-inch final cover. To control erosion of the final cover, it should be properly graded and vegetated. In areas of the United States where excessive soil erosion may occur or the frost line exceeds 3 feet, additional final cover is recommended. In desert areas where vegetation would be difficult to maintain, 3-6 inches of well graded crushed rock is recommended for placement on top of the final cover.

Controlling public access. Under the current NESHAPs regulation, EPA does not require that a landfill used for asbestos disposal use

warning signs or fencing if it meets the requirement to cover asbestos wastes. However, under RCRA, EPA requires that access be controlled to prevent exposure of the public to potential health and safety hazards at the disposal site. Therefore, for liability protection of operators of landfills that handle asbestos, fencing and warning signs are recommended to control public access when natural barriers do not exist. Access to a landfill should be limited to one or two entrances with gates that can be locked when left unattended. Fencing should be installed around the perimeter of the disposal site in a manner adequate to deter access by the general public. Chain-link fencing, 6-ft high and topped with a barbed wire guard, should be used. More specific fencing requirements may be specified by local regulations. Warning signs should be displayed at all entrances and at intervals of 330 feet or less along the property line of the landfill or perimeter of the sections where asbestos waste is deposited. The sign should read as follows:

ASBESTOS WASTE DISPOSAL SITE
BREATHING ASBESTOS DUST MAY
CAUSE LUNG DISEASE AND CANCER

Recordkeeping. For protection from liability, and considering possible future requirements for notification on disposal site deeds, a landfill owner should maintain documentation of the specific location and quantity of the buried asbestos wastes. In addition, the estimated depth of the waste below the surface should be recorded whenever a landfill section is closed. As mentioned previously, such information should be recorded in the land deed or other record along with a notice warning against excavation of the area.

[52 FR 41897, Oct. 30, 1987, as amended at 62 FR 1834, Jan. 14, 1997; 75 FR 69353, Nov. 12, 2010]

APPENDIX E TO SUBPART E OF PART 763—INTERIM METHOD OF THE DETERMINATION OF ASBESTOS IN BULK INSULATION SAMPLES

SECTION 1. POLARIZED LIGHT MICROSCOPY

1.1 Principle and Applicability

Bulk samples of building materials taken for asbestos identification are first examined for homogeneity and preliminary fiber identification at low magnification. Positive identification of suspect fibers is made by analysis of subsamples with the polarized light microscope.

The principles of optical mineralogy are well established.^{1,2} A light microscope equipped with two polarizing filters is used to observe specific optical characteristics of a sample. The use of plane polarized light allows the determination of refractive indices along specific crystallographic axes. Mor-

phology and color are also observed. A retardation plate is placed in the polarized light path for determination of the sign of elongation using orthoscopic illumination. Orientation of the two filters such that their vibration planes are perpendicular (crossed polars) allows observation of the birefringence and extinction characteristics of anisotropic particles.

Quantitative analysis involves the use of point counting. Point counting is a standard technique in petrography for determining the relative areas occupied by separate minerals in thin sections of rock. Background information on the use of point counting² and the interpretation of point count data³ is available.

This method is applicable to all bulk samples of friable insulation materials submitted for identification and quantitation of asbestos components.

1.2 Range

The point counting method may be used for analysis of samples containing from 0 to 100 percent asbestos. The upper detection limit is 100 percent. The lower detection limit is less than 1 percent.

1.3 Interferences

Fibrous organic and inorganic constituents of bulk samples may interfere with the identification and quantitation of the asbestos mineral content. Spray-on binder materials may coat fibers and affect color or obscure optical characteristics to the extent of masking fiber identity. Fine particles of other materials may also adhere to fibers to an extent sufficient to cause confusion in identification. Procedures that may be used for the removal of interferences are presented in Section 1.7.2.2.

1.4 Precision and Accuracy

Adequate data for measuring the accuracy and precision of the method for samples with various matrices are not currently available. Data obtained for samples containing a single asbestos type in a simple matrix are available in the EPA report *Bulk Sample Analysis for Asbestos Content: Evaluation of the Tentative Method*.⁴

1.5 Apparatus

1.5.1 Sample Analysis

A low-power binocular microscope, preferably stereoscopic, is used to examine the bulk insulation sample as received.

- *Microscope:* binocular, 10–45X (approximate).
- *Light Source:* incandescent or fluorescent.
- *Forceps, Dissecting Needles, and Probes*
- *Glassine Paper or Clean Glass Plate*

Environmental Protection Agency

Pt. 763, Subpt. E, App. E

Compound microscope requirements: A polarized light microscope complete with polarizer, analyzer, port for wave retardation plate, 360° graduated rotating stage, substage condenser, lamp, and lamp iris.

- *Polarized Light Microscope*: described above.
- *Objective Lenses*: 10X, 20X, and 40X or near equivalent.
- *Dispersion Staining Objective Lens* (optional)
- *Ocular Lens*: 10X minimum.
- *Eyepiece Reticle*: cross hair or 25 point Chalkley Point Array.
- *Compensator Plate*: 550 millimicron retardation.

1.5.2 Sample Preparation

Sample preparation apparatus requirements will depend upon the type of insulation sample under consideration. Various physical and/or chemical means may be employed for an adequate sample assessment.

- *Ventilated Hood* or negative pressure glove box.
- *Microscope Slides*
- *Coverslips*
- *Mortar and Pestle*: agate or porcelain. (optional)
- *Wylie Mill* (optional)
- *Beakers and Assorted Glassware* (optional)
- *Centrifuge* (optional)
- *Filtration apparatus* (optional)
- *Low temperature asher* (optional)

1.6 Reagents

1.6.1 Sample Preparation

- *Distilled Water* (optional)
- *Dilute CH₃COOH*: ACS reagent grade (optional)
- *Dilute HCl*: ACS reagent grade (optional)
- *Sodium metaphosphate* (NaPO₃)₆ (optional)

1.6.2 Analytical Reagents

Refractive Index Liquids: 1.490–1.570, 1.590–1.720 in increments of 0.002 or 0.004.

- *Refractive Index Liquids for Dispersion Staining*: high-dispersion series, 1.550, 1.605, 1.630 (optional).
- *UICC Asbestos Reference Sample Set*: Available from: UICC MRC Pneumoconiosis Unit, Llandough Hospital, Penarth, Glamorgan CF6 1XW, UK, and commercial distributors.
- *Tremolite-asbestos* (source to be determined)
- *Actinolite-asbestos* (source to be determined)

1.7 Procedures

NOTE: Exposure to airborne asbestos fibers is a health hazard. Bulk samples submitted for analysis are usually friable and may release fibers during handling or matrix reduction steps. All sample and slide preparations should be carried out in a ventilated hood or glove box with continuous airflow (negative pressure). Handling of samples without these precautions may result in exposure of the

analyst and contamination of samples by airborne fibers.

1.7.1 Sampling

Samples for analysis of asbestos content shall be taken in the manner prescribed in Reference 5 and information on design of sampling and analysis programs may be found in Reference 6. If there are any questions about the representative nature of the sample, another sample should be requested before proceeding with the analysis.

1.7.2 Analysis

1.7.2.1 Gross Examination

Bulk samples of building materials taken for the identification and quantitation of asbestos are first examined for homogeneity at low magnification with the aid of a stereomicroscope. The core sample may be examined in its container or carefully removed from the container onto a glassine transfer paper or clean glass plate. If possible, note is made of the top and bottom orientation. When discrete strata are identified, each is treated as a separate material so that fibers are first identified and quantified in that layer only, and then the results for each layer are combined to yield an estimate of asbestos content for the whole sample.

1.7.2.2 Sample Preparation

Bulk materials submitted for asbestos analysis involve a wide variety of matrix materials. Representative subsamples may not be readily obtainable by simple means in heterogeneous materials, and various steps may be required to alleviate the difficulties encountered. In most cases, however, the best preparation is made by using forceps to sample at several places from the bulk material. Forcep samples are immersed in a refractive index liquid on a microscope slide, teased apart, covered with a cover glass, and observed with the polarized light microscope.

Alternatively, attempts may be made to homogenize the sample or eliminate interferences before further characterization. The selection of appropriate procedures is dependent upon the samples encountered and personal preference. The following are presented as possible sample preparation steps.

A mortar and pestle can sometimes be used in the size reduction of soft or loosely bound materials though this may cause matting of some samples. Such samples may be reduced in a Wylie mill. Apparatus should be clean and extreme care exercised to avoid cross-contamination of samples. Periodic checks of the particle sizes should be made during the grinding operation so as to preserve any fiber bundles present in an identifiable form. These procedures are not recommended for samples that contain amphibole minerals or

vermiculite. Grinding of amphiboles may result in the separation of fiber bundles or the production of cleavage fragments with aspect ratios greater than 3:1. Grinding of vermiculite may also produce fragments with aspect ratios greater than 3:1.

Acid treatment may occasionally be required to eliminate interferences. Calcium carbonate, gypsum, and bassanite (plaster) are frequently present in sprayed or trowelled insulations. These materials may be removed by treatment with warm dilute acetic acid. Warm dilute hydrochloric acid may also be used to remove the above materials. If acid treatment is required, wash the sample at least twice with distilled water, being careful not to lose the particulates during decanting steps. Centrifugation or filtration of the suspension will prevent significant fiber loss. The pore size of the filter should be 0.45 micron or less. Caution: prolonged acid contact with the sample may alter the optical characteristics of chrysotile fibers and should be avoided.

Coatings and binding materials adhering to fiber surfaces may also be removed by treatment with sodium metaphosphate.⁷ Add 10 mL of 10g/L sodium metaphosphate solution to a small (0.1 to 0.5 mL) sample of bulk material in a 15-mL glass centrifuge tube. For approximately 15 seconds each, stir the mixture on a vortex mixer, place in an ultrasonic bath and then shake by hand. Repeat the series. Collect the dispersed solids by centrifugation at 1000 rpm for 5 minutes. Wash the sample three times by suspending in 10 mL distilled water and recentrifuging. After washing, resuspend the pellet in 5 mL distilled water, place a drop of the suspension on a microscope slide, and dry the slide at 110 °C.

In samples with a large portion of cellulosic or other organic fibers, it may be useful to ash part of the sample and view the residue. Ashing should be performed in a low temperature ashers. Ashing may also be performed in a muffle furnace at temperatures

of 500 °C or lower. Temperatures of 550 °C or higher will cause dehydroxylation of the asbestos minerals, resulting in changes of the refractive index and other key parameters. If a muffle furnace is to be used, the furnace thermostat should be checked and calibrated to ensure that samples will not be heated at temperatures greater than 550 °C.

Ashing and acid treatment of samples should not be used as standard procedures. In order to monitor possible changes in fiber characteristics, the material should be viewed microscopically before and after any sample preparation procedure. Use of these procedures on samples to be used for quantitation requires a correction for percent weight loss.

1.7.2.3 Fiber Identification

Positive identification of asbestos requires the determination of the following optical properties.

- Morphology
- Color and pleochroism
- Refractive indices
- Birefringence
- Extinction characteristics
- Sign of elongation

Table 1–1 lists the above properties for commercial asbestos fibers. Figure 1–1 presents a flow diagram of the examination procedure. Natural variations in the conditions under which deposits of asbestiform minerals are formed will occasionally produce exceptions to the published values and differences from the UICC standards. The sign of elongation is determined by use of the compensator plate and crossed polars. Refractive indices may be determined by the Becke line test. Alternatively, dispersion staining may be used. Inexperienced operators may find that the dispersion staining technique is more easily learned, and should consult Reference 9 for guidance. Central stop dispersion staining colors are presented in Table 1–2. Available high-dispersion (HD) liquids should be used.

TABLE 1–1—OPTICAL PROPERTIES OF ASBESTOC FIBERS

Mineral	Morphology, color ^a	Refractive indices ^b		Birefringence	Extinction	Sign of elongation
		α	γ			
Chrysotile (asbestiform serpentine).	Wavy fibers. Fiber bundles have splayed ends and "kinks". Aspect ratio typically >10:1. Colorless ³ , nonpleochroic.	1.493–1.560	1.517–1.562 ^f (normally 1.556).	.008	to fiber length.	+ (length slow)
Amosite (asbestiform grunerite).	Straight, rigid fibers. Aspect ratio typically >10:1. Colorless to brown, nonpleochroic or weakly so. Opaque inclusions may be present.	1.635–1.696	1.655–1.729 ^f (normally 1.696–1.710).	.020–.033	to fiber length.	+ (length slow)

TABLE 1-1—OPTICAL PROPERTIES OF ASBESTOC FIBERS—Continued

Mineral	Morphology, color ^a	Refrac- tive indices ^b		Birefring- ence	Extinction	Sign of elongation
		α	γ			
Crocidolite (asbestiform Riebeckite).	Straight, rigid fibers. Thick fibers and bundles common, blue to purple-blue in color. Pleochroic. Birefringence is generally masked by blue color.	1.654–1.701	1.668–1.717 ^{3e} (nor- mally close to 1.700).	.014–.016	to fiber length.	– (length fast)
Anthophyllite- asbestos.	Straight fibers and acicular cleavage fragments. ^d Some composite fibers. Aspect ratio <10:1. Colorless to light brown.	1.596–1.652	1.615–1.676 ^f .	.019–.024	to fiber length.	+ (length slow)
Tremolite-actin- olite-asbes- tos.	Normally present as acicular or pris- matic cleavage fragments. ^d Single crystals predominate, aspect ratio <10:1. Colorless to pale green.	1.599–1.668	1.622–1.688 ^f .	.023–.020	Oblique extinc- tion, 10– 20° for frag- ments. Com- posite fi- bers show extinc- tion.	+ (length slow)

^aFrom reference 5; colors cited are seen by observation with plane polarized light.^bFrom references 5 and 8.^cFibers subjected to heating may be brownish.^dFibers defined as having aspect ratio >3:1.^eto fiber length.^f|To fiber length.

Polarized light microscopy analysis: For each type of material identified by examination of sample at low magnification. Mount spacially dispersed sample in 1.550 RI liquid. (If using dispersion staining, mount in 1.550 HD.) View at 100X with both plane polarized light and crossed polars. More than one fiber type may be present.

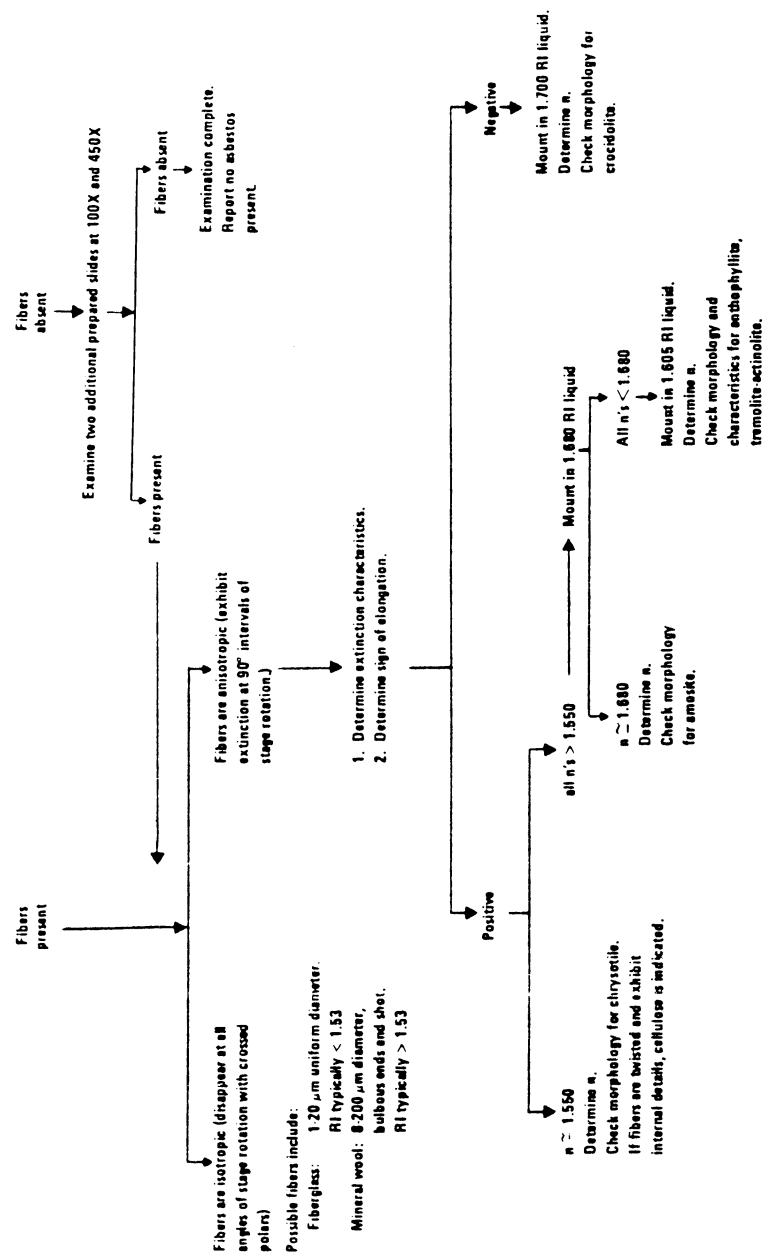


Figure 1-1. Flow chart for analysis of bulk samples by polarized light microscopy.

TABLE 1-2—CENTRAL STOP DISPERSION
STAINING COLORS^a

Mineral	RI Liquid	η	η
Chrysotile	1.550 ^{HD}	Blue	Blue-ma- genta
Amosite	1.680	Blue-ma- genta to pale blue.	Golden-yel- low
	1.550 ^{HD}	Yellow to white.	Yellow to white
Crocidolite ^b ..	1.700	Red magenta	Blue-ma- genta
	1.550 ^{HD}	Yellow to white.	Yellow to white
Anthophyllite	1.605 ^{HD}	Blue	Gold to gold- magenta
Tremolite	1.605 ^{HD c}	Pale blue	Gold
Actinolite	1.605 ^{HD}	Gold-ma- genta to blue.	Gold
	1.630 ^{HD c}	Magenta	Golden-yel- low

^aFrom reference 9.^bBlue absorption color.^cOblique extinction view.

1.7.2.4 Quantitation of Asbestos Content

Asbestos quantitation is performed by a point-counting procedure or an equivalent estimation method. An ocular reticle (cross-hair or point array) is used to visually superimpose a point or points on the microscope field of view. Record the number of points positioned directly above each kind of particle or fiber of interest. Score only points directly over asbestos fibers or nonasbestos matrix material. Do not score empty points for the closest particle. If an asbestos fiber and a matrix particle overlap so that a point is superimposed on their visual intersection, a point is scored for both categories. Point counting provides a determination of the area percent asbestos. Reliable conversion of area percent to percent of dry weight is not currently feasible unless the specific gravities and relative volumes of the materials are known.

For the purpose of this method, "asbestos fibers" are defined as having an aspect ratio greater than 3:1 and being positively identified as one of the minerals in Table 1-1.

A total of 400 points superimposed on either asbestos fibers or nonasbestos matrix material must be counted over at least eight different preparations of representative subsamples. Take eight forcep samples and mount each separately with the appropriate refractive index liquid. The preparation should not be heavily loaded. The sample should be uniformly dispersed to avoid overlapping particles and allow 25-50 percent empty area within the fields of view. Count 50 nonempty points on each preparation, using either

- A cross-hair reticle and mechanical stage; or

- A reticle with 25 points (Chalkley Point Array) and counting at least 2 randomly selected fields.

For samples with mixtures of isotropic and anisotropic materials present, viewing the sample with slightly uncrossed polars or the addition of the compensator plate to the polarized light path will allow simultaneous discrimination of both particle types. Quantitation should be performed at 100X or at the lowest magnification of the polarized light microscope that can effectively distinguish the sample components. Confirmation of the quantitation result by a second analyst on some percentage of analyzed samples should be used as standard quality control procedure.

The percent asbestos is calculated as follows:

$$\% \text{ asbestos} = (a/n) 100\%$$

where

a=number of asbestos counts,

n=number of nonempty points counted (400).

If a=0, report "No asbestos detected." If 0<a≤3, report "<1% asbestos".

The value reported should be rounded to the nearest percent.

1.8 References

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SECTION 2. X-RAY POWDER DIFFRACTION

2.1 Principle and Applicability

The principle of X-ray powder diffraction (XRD) analysis is well established.^{1,2} Any solid, crystalline material will diffract an impinging beam of parallel, monochromatic X-rays whenever Bragg's Law,

$$\lambda = 2d \sin \theta,$$

is satisfied for a particular set of planes in the crystal lattice, where

λ = the X-ray wavelength, Å;

d = the interplanar spacing of the set of reflecting lattice planes, Å; and

θ = the angle of incidence between the X-ray beam and the reflecting lattice planes.

By appropriate orientation of a sample relative to the incident X-ray beam, a diffraction pattern can be generated that, in most cases, will be uniquely characteristic of both the chemical composition and structure of the crystalline phases present.

Unlike optical methods of analysis, however, XRD cannot determine crystal morphology. Therefore, in asbestos analysis, XRD does not distinguish between fibrous and nonfibrous forms of the serpentine and amphibole minerals (Table 2-1). However, when used in conjunction with optical methods such as polarized light microscopy (PLM), XRD techniques can provide a reliable analytical method for the identification and characterization of asbestiform minerals in bulk materials.

For *qualitative analysis* by XRD methods, samples are initially scanned over limited diagnostic peak regions for the serpentine (~7.4 Å) and amphibole (8.2–8.5 Å) minerals (Table 2-2). Standard slow-scanning methods for bulk sample analysis may be used for materials shown by PLM to contain significant amounts of asbestos (>5–10 percent). Detection of minor or trace amounts of asbestos may require special sample preparation and step-scanning analysis. All samples that exhibit diffraction peaks in the diagnostic regions for asbestiform minerals are submitted to a full (5°–60° 2 θ ; 1° 2 θ /min) qualitative XRD scan, and their diffraction patterns are compared with standard reference powder diffraction patterns³ to verify initial peak assignments and to identify possible matrix interferences when subsequent quantitative analysis will be performed.

TABLE 2-1—THE ASBESTOS MINERALS AND THEIR NONASBESTIFORM ANALOGS

Asbestiform	Nonasbestiform
SERPENTINE	
Chrysotile	Antigorite, lizardite
AMPHIBOLE	
Anthophyllite asbestos	Anthophyllite
Cummingtonite-grunerite asbestos ("Amosite")	Cummingtonite-grunerite
Crocidolite	Riebeckite
Tremolite asbestos	Tremolite
Actinolite asbestos	Actinolite

TABLE 2-2—PRINCIPAL LATTICE SPACINGS OF ASBESTIFORM MINERALS^A

Minerals	Principal d-spacings (Å) and relative intensities			JCPDS Powder diffraction file ³ number
Chrysotile	7.37 ₁₀₀	3.65 ₇₀	4.57 ₅₀	21–543 ^b
	7.36 ₁₀₀ ..	3.66 ₈₀	2.45 ₆₅	25–645
	7.10 ₁₀₀ ..	2.33 ₈₀	3.55 ₇₀	22–1162 (theoretical)
"Amosite"	8.33 ₁₀₀	3.06 ₇₀	2.756 ₇₀	17–745 (nonfibrous)
	8.22 ₁₀₀ ..	3.060 ₈₅	3.25 ₇₀	27–1170 (UICC)
Anthophyllite	3.05 ₁₀₀	3.24 ₆₀	8.26 ₅₅	9–455
	3.06 ₁₀₀ ..	8.33 ₇₀	3.23 ₅₀	16–401 (synthetic)
Anthophyllite	2.72 ₁₀₀	2.54 ₁₀₀	3.480 ₈₀	25–157
Crocidolite	8.35 ₁₀₀	3.10 ₅₅	2.720 ₃₅	27–1415 (UICC)
Tremolite	8.38 ₁₀₀	3.12 ₁₀₀	2.705 ₉₀	13–437 ^b
	2.706 ₁₀₀	3.14 ₉₅	8.43 ₄₀	20–1310 ^b (synthetic)
	3.13 ₁₀₀ ..	2.706 ₆₀	8.44 ₄₀	23–666 (synthetic mixture with richterite)

^AThis information is intended as a guide, only. Complete powder diffraction data, including mineral type and source, should be referred to, to ensure comparability of sample and reference materials where possible. Additional precision XRD data on amosite, crocidolite, tremolite, and chrysotile are available from the U.S. Bureaus of Mines.⁴

^bFibrosity questionable.

Accurate *quantitative analysis* of asbestos in bulk samples by XRD is critically dependent on particle size distribution, crystallite size, preferred orientation and matrix absorption effects, and comparability of standard reference and sample materials. The most intense diffraction peak that has been shown to be free from interference by prior

qualitative XRD analysis is selected for quantitation of each asbestiform mineral. A "thin-layer" method of analysis^{5,6} is recommended in which, subsequent to comminution of the bulk material to ~10 μ m by suitable cryogenic milling techniques, an accurately known amount of the sample is deposited on a silver membrane filter. The

mass of asbestiform material is determined by measuring the integrated area of the selected diffraction peak using a step-scanning mode, correcting for matrix absorption effects, and comparing with suitable calibration standards. Alternative "thick-layer" or bulk methods,^{7,8} may be used for *semi-quantitative analysis*.

This XRD method is applicable as a confirmatory method for identification and quantitation of asbestos in bulk material samples that have undergone prior analysis by PLM or other optical methods.

2.2 Range and Sensitivity

The range of the method has not been determined.

The sensitivity of the method has not been determined. It will be variable and dependent upon many factors, including matrix effects (absorption and interferences), diagnostic reflections selected, and their relative intensities.

2.3 Limitations

2.3.1 Interferences

Since the fibrous and nonfibrous forms of the serpentine and amphibole minerals (Table 2-1) are indistinguishable by XRD techniques unless special sample preparation techniques and instrumentation are used,⁹ the presence of nonasbestiform serpentines and amphiboles in a sample will pose severe interference problems in the identification and quantitative analysis of their asbestiform analogs.

The use of XRD for identification and quantitation of asbestiform minerals in bulk samples may also be limited by the presence of other interfering materials in the sample. For naturally occurring materials the commonly associated asbestos-related mineral interferences can usually be anticipated. However, for fabricated materials the nature of the interferences may vary greatly (Table 2-3) and present more serious problems in identification and quantitation.¹⁰ Potential interferences are summarized in Table 2-4 and include the following:

- *Chlorite* has major peaks at 7.19 Å and 3.58 Å That interfere with both the primary (7.36 Å) and secondary (3.66 Å) peaks for chrysotile. Resolution of the primary peak to give good quantitative results may be possible when a step-scanning mode of operation is employed.
- *Halloysite* has a peak at 3.63 Å that interferes with the secondary (3.66 Å) peak for chrysotile.
- *Kaolinite* has a major peak at 7.15 Å that may interfere with the primary peak of chrysotile at 7.36 Å when present at concentrations of >10 percent. However, the secondary chrysotile peak at 3.66 Å may be used for quantitation.

- *Gypsum* has a major peak at 7.5 Å that overlaps the 7.36 Å peak of chrysotile when present as a major sample constituent. This may be removed by careful washing with distilled water, or by heating to 300 °C to convert gypsum to plaster of paris.
- *Cellulose* has a broad peak that partially overlaps the secondary (3.66 Å) chrysotile peak.⁸
- Overlap of major diagnostic peaks of the amphibole asbestos minerals, amosite, anthophyllite, crocidolite, and tremolite, at approximately 8.3 Å and 3.1 Å causes mutual interference when these minerals occur in the presence of one another. In some instances, adequate resolution may be attained by using step-scanning methods and/or by decreasing the collimator slit width at the X-ray port.

TABLE 2-3—COMMON CONSTITUENTS IN INSULATION AND WALL MATERIALS

A. Insulation materials

Chrysotile
 "Amosite"
 Crocidolite
 *Rock wool
 *Slag wool
 *Fiber glass
 Gypsum (CaSO₄ · 2H₂O)
 Vermiculite (micas)
 *Perlite
 Clays (kaolin)
 *Wood pulp
 *Paper fibers (talc, clay, carbonate fillers)
 Calcium silicates (synthetic)
 Opaques (chromite, magnetite inclusions in serpentine)
 Hematite (inclusions in "amosite")
 Magnesite
 *Diatomaceous earth

B. Spray finishes or paints

Bassanite
 Carbonate minerals (calcite, dolomite, vaterite)
 Talc
 Tremolite
 Anthophyllite
 Serpentine (including chrysotile)
 Amosite
 Crocidolite
 *Mineral wool
 *Rock wool
 *Slag wool
 *Fiber glass
 Clays (kaolin)
 Micas
 Chlorite
 Gypsum (CaSO₄ · 2H₂O)
 Quartz
 *Organic binders and thickeners
 Hyrdomagnesite
 Wollastonite
 Opaques (chromite, magnetite inclusions in serpentine)
 Hematite (inclusions in "amosite")

*Amorphous materials contribute only to overall scattered radiation and increased background radiation.

TABLE 2-4—INTERFERENCES IN XRD ANALYSIS ASBESTIFORM MINERALS

Asbestiform mineral	Primary diagnostic peaks (approximate d-spacings, in Å)	Interference
Serpentine Chrysotile	7.4	Nonasbestiform serpentines (antigorite, lizardite)
	3.7	Chlorite Kaolinite Gypsum Chlorite Halloysite Cellulose
Amphibole "Amosite" Anthophyllite Crocidolite Tremolite	3.1	Nonasbestiform amphiboles (cummingtonite-grunerite, anthophyllite, riebeckite, tremolite)
	8.3	Mutual interferences Carbonates Talc Mutual interferences

- *Carbonates* may also interfere with quantitative analysis of the amphibole asbestos minerals, amosite, anthophyllite, crocidolite, and tremolite. Calcium carbonate (CaCO_3) has a peak at 3.035 Å that overlaps major amphibole peaks at approximately 3.1 Å when present in concentrations of >5 percent. Removal of carbonates with a dilute acid wash is possible; however, if present, chrysotile may be partially dissolved by this treatment.¹¹
- A major *talc* peak at 3.12 Å interferes with the primary tremolite peak at this same position and with secondary peaks of crocidolite (3.10 Å), amosite (3.06 Å), and anthophyllite (3.05 Å). In the presence of talc, the major diagnostic peak at approximately 8.3 Å should be used for quantitation of these asbestiform minerals.

The problem of intraspecies and matrix interferences is further aggravated by the variability of the silicate mineral powder diffraction patterns themselves, which often makes definitive identification of the asbestos minerals by comparison with standard reference diffraction patterns difficult. This variability results from alterations in the crystal lattice associated with differences in isomorphous substitution and degree of crystallinity. This is especially true for the amphiboles. These minerals exhibit a wide variety of very similar chemical compositions, with the result being that their diffraction patterns are characterized by having major (110) reflections of the monoclinic amphiboles and (210) reflections of the

orthorhombic anthophyllite separated by less than 0.2 Å.¹²

2.3.2 Matrix Effects

If a copper X-ray source is used, the presence of iron at high concentrations in a sample will result in significant X-ray fluorescence, leading to loss of peak intensity along with increased background intensity and an overall decrease in sensitivity. This situation may be corrected by choosing an X-ray source other than copper; however, this is often accompanied both by loss of intensity and by decreased resolution of closely spaced reflections. Alternatively, use of a diffracted beam monochromator will reduce background fluorescent radiation, enabling weaker diffraction peaks to be detected.

X-ray absorption by the sample matrix will result in overall attenuation of the diffracted beam and may seriously interfere with quantitative analysis. Absorption effects may be minimized by using sufficiently "thin" samples for analysis.^{5,13,14} However, unless absorption effects are known to be the same for both samples and standards, appropriate corrections should be made by referencing diagnostic peak areas to an internal standard^{7,8} or filter substrate (Ag) peak.^{5,6}

2.3.3 Particle Size Dependence

Because the intensity of diffracted X-radiation is particle-size dependent, it is essential for accurate quantitative analysis that both sample and standard reference materials have similar particle size distributions. The optimum particle size range for quantitative analysis of asbestos by XRD has been reported to be 1 to 10 µm.¹⁵ Comparability of sample and standard reference material particle size distributions should be verified by optical microscopy (or another suitable method) prior to analysis.

2.3.4 Preferred Orientation Effects

Preferred orientation of asbestiform minerals during sample preparation often poses a serious problem in quantitative analysis by XRD. A number of techniques have been developed for reducing preferred orientation effects in "thick layer" samples.^{7,8,15} However, for "thin" samples on membrane filters, the preferred orientation effects seem to be both reproducible and favorable to enhancement of the principal diagnostic reflections of asbestos minerals, actually increasing the overall sensitivity of the method.^{12,14} (Further investigation into preferred orientation effects in both thin layer and bulk samples is required.)

2.3.5 Lack of Suitably Characterized Standard Materials

The problem of obtaining and characterizing suitable reference materials for asbestos analysis is clearly recognized. NIOSH has

recently directed a major research effort toward the preparation and characterization of analytical reference materials, including asbestos standards;^{16,17} however, these are not available in large quantities for routine analysis.

In addition, the problem of ensuring the comparability of standard reference and sample materials, particularly regarding crystallite size, particle size distribution, and degree of crystallinity, has yet to be adequately addressed. For example, Langer et al.¹⁸ have observed that in insulating matrices, chrysotile tends to break open into bundles more frequently than amphiboles. This results in a line-broadening effect with a resultant decrease in sensitivity. Unless this effect is the same for both standard and sample materials, the amount of chrysotile in the sample will be underestimated by XRD analysis. To minimize this problem, it is recommended that standardized matrix reduction procedures be used for both sample and standard materials.

2.4 Precision and Accuracy

Precision of the method has not been determined.

Accuracy of the method has not been determined.

2.5 Apparatus

2.5.1 Sample Preparation

Sample preparation apparatus requirements will depend upon the sample type under consideration and the kind of XRD analysis to be performed.

- *Mortar and Pestle*: Agate or porcelain.
- *Razor Blades*
- *Sample Mill*: SPEX, Inc., freezer mill or equivalent.
- *Bulk Sample Holders*
- *Silver Membrane Filters*: 25-mm diameter, 0.45- μ m pore size. Selas Corp. of America, Flotronics Div., 1957 Pioneer Road, Huntington Valley, PA 19006.
- *Microscope Slides*
- *Vacuum Filtration Apparatus*: Gelman No. 1107 or equivalent, and side-arm vacuum flask.
- *Microbalance*
- *Ultrasonic Bath or Probe*: Model W140, Ultrasonics, Inc., operated at a power density of approximately 0.1 W/mL, or equivalent.
- *Volumetric Flasks*: 1-L volume.
- *Assorted Pipettes*
- *Pipette Bulb*
- *Nonserrated Forceps*
- *Polyethylene Wash Bottle*
- *Pyrex Beakers*: 50-mL volume.
- *Desiccator*
- *Filter Storage Cassettes*
- *Magnetic Stirring Plate and Bars*
- *Porcelain Crucibles*
- *Muffle Furnace or Low Temperature Asher*

2.5.2 Sample Analysis

Sample analysis requirements include an X-ray diffraction unit, equipped with:

- *Constant Potential Generator; Voltage and mA Stabilizers*
- *Automated Diffractometer with Step-Scanning Mode*
- *Copper Target X-Ray Tube*: High intensity, fine focus, preferably.
- *X-Ray Pulse Height Selector*
- *X-Ray Detector* (with high voltage power supply): Scintillation or proportional counter.
- *Focusing Graphite Crystal Monochromator*; or *Nickel Filter* (if copper source is used, and iron fluorescence is not a serious problem).
- *Data Output Accessories*:
 - *Strip Chart Recorder*
 - *Decade Scaler/Timer*
 - *Digital Printer*
- *Sample Spinner* (optional).
- *Instrument Calibration Reference Specimen*: α -quartz reference crystal (Arkansas quartz standard, #180-147-00, Philips Electronics Instruments, Inc., 85 McKee Drive, Mahwah, NJ 07430) or equivalent.

2.6 Reagents

2.6.1 Standard Reference Materials

The reference materials listed below are intended to serve as a guide. Every attempt should be made to acquire pure reference materials that are comparable to sample materials being analyzed.

- *Chrysotile*: UICC Canadian, or NIEHS Plastibest. (UICC reference materials available from: UICC, MRC Pneumoconiosis Unit, Llandough Hospital, Penarth, Glamorgan, CF61XW, UK).
- *Crocidolite*: UICC
- *Amosite*: UICC
- *Anthophyllite*: UICC
- *Tremolite Asbestos*: Wards Natural Science Establishment, Rochester, N.Y.; Cyprus Research Standard, Cyprus Research, 2435 Military Ave., Los Angeles, CA 90064 (washed with dilute HCl to remove small amount of calcite impurity); India tremolite, Rajasthan State, India.
- *Actinolite Asbestos*

2.6.2 Adhesive

Tape, petroleum jelly, etc. (for attaching silver membrane filters to sample holders).

2.6.3 Surfactant

1 percent aerosol OT aqueous solution or equivalent.

2.6.4 Isopropanol

ACS Reagent Grade.

2.7 Procedure

2.7.1 Sampling

Samples for analysis of asbestos content shall be collected as specified in EPA Guidance Document #C0090, *Asbestos-Containing Materials in School Buildings*.¹⁰

2.7.2 Analysis

All samples must be analyzed initially for asbestos content by PLM. XRD should be used as an auxiliary method when a second, independent analysis is requested.

NOTE: Asbestos is a toxic substance. All handling of dry materials should be performed in an operating fume hood.

2.7.2.1 Sample Preparation

The method of sample preparation required for XRD analysis will depend on: (1) The condition of the sample received (sample size, homogeneity, particle size distribution, and overall composition as determined by PLM); and (2) the type of XRD analysis to be performed (qualitative, quantitative, thin layer or bulk).

Bulk materials are usually received as inhomogeneous mixtures of complex composition with very wide particle size distributions. Preparation of a homogeneous, representative sample from asbestos-containing materials is particularly difficult because the fibrous nature of the asbestos minerals inhibits mechanical mixing and stirring, and because milling procedures may cause adverse lattice alterations.

A discussion of specific matrix reduction procedures is given below. Complete methods of sample preparation are detailed in Sections 2.7.2.2 and 2.7.2.3.

NOTE: All samples should be examined microscopically before and after each matrix reduction step to monitor changes in sample particle size, composition, and crystallinity, and to ensure sample representativeness and homogeneity for analysis.

2.7.2.1.1 Milling—Mechanical milling of asbestos materials has been shown to decrease fiber crystallinity, with a resultant decrease in diffraction intensity of the specimen; the degree of lattice alteration is related to the duration and type of milling process.^{19,22} Therefore, all milling times should be kept to a minimum.

For *qualitative analysis*, particle size is not usually of critical importance and initial characterization of the material with a minimum of matrix reduction is often desirable to document the composition of the sample as received. Bulk samples of very large particle size (>2–3 mm) should be comminuted to ~100 µm. A mortar and pestle can sometimes be used in size reduction of soft or loosely bound materials though this may cause matting of some samples. Such sam-

ples may be reduced by cutting with a razor blade in a mortar, or by grinding in a suitable mill (e.g., a microhammer mill or equivalent). When using a mortar for grinding or cutting, the sample should be moistened with ethanol, or some other suitable wetting agent, to minimize exposures.

For accurate, reproducible *quantitative analysis*, the particle size of both sample and standard materials should be reduced to ~10 µm (see Section 2.3.3). Dry ball milling at liquid nitrogen temperatures (e.g., Spex Freezer Mill, or equivalent) for a maximum time of 10 min. is recommended to obtain satisfactory particle size distributions while protecting the integrity of the crystal lattice.⁵ Bulk samples of very large particle size may require grinding in two stages for full matrix reduction to <10 µm.^{8,16}

Final particle size distributions should always be verified by optical microscopy or another suitable method.

2.7.2.1.2 Low temperature ashing—For materials shown by PLM to contain large amounts of gypsum, cellulosic, or other organic materials, it may be desirable to ash the samples prior to analysis to reduce background radiation or matrix interference. Since chrysotile undergoes dehydroxylation at temperatures between 550 °C and 650 °C, with subsequent transformation to forsterite,^{23,24} ashing temperatures should be kept below 500 °C. Use of a low temperature asher is recommended. In all cases, calibration of the oven is essential to ensure that a maximum ashing temperature of 500 °C is not exceeded.

2.7.2.1.3 Acid leaching—Because of the interference caused by gypsum and some carbonates in the detection of asbestiform minerals by XRD (see Section 2.3.1), it may be necessary to remove these interferents by a simple acid leaching procedure prior to analysis (see Section 1.7.2.2).

2.7.2.2 Qualitative Analysis

2.7.2.2.1 Initial screening of bulk material—Qualitative analysis should be performed on a representative, homogeneous portion of the sample with a minimum of sample treatment.

1. Grind and mix the sample with a mortar and pestle (or equivalent method, see Section 2.7.2.1.1.) to a final particle size sufficiently small (~100 µm) to allow adequate packing into the sample holder.

2. Pack the sample into a standard bulk sample holder. Care should be taken to ensure that a representative portion of the milled sample is selected for analysis. Particular care should be taken to avoid possible size segregation of the sample. (Note: Use of a back-packing method²⁵ of bulk sample preparation may reduce preferred orientation effects.)

3. Mount the sample on the diffractometer and scan over the diagnostic peak regions for

the serpentine (~67.4 Å) and amphibole (8.2–8.5 Å) minerals (see Table 2-2). The X-ray diffraction equipment should be optimized for intensity. A slow scanning speed of 1° 2 θ /min is recommended for adequate resolution. Use of a sample spinner is recommended.

4. Submit all samples that exhibit diffraction peaks in the diagnostic regions for asbestiform minerals to a full qualitative XRD scan (5°–60° 2 θ ; 1°2 θ /min) to verify initial peak assignments and to identify potential matrix interferences when subsequent quantitative analysis is to be performed.

5. Compare the sample XRD pattern with standard reference powder diffraction patterns (i.e., JCPDS powder diffraction data³ or those of other well-characterized reference materials). Principal lattice spacings of asbestiform minerals are given in Table 2-2; common constituents of bulk insulation and wall materials are listed in Table 2-3.

2.7.2.2.2 Detection of minor or trace constituents—Routine screening of bulk materials by XRD may fail to detect small concentrations (<5 percent) of asbestos. The limits of detection will, in general, be improved if matrix absorption effects are minimized, and if the sample particle size is reduced to the optimal 1 to 10 μ m range, provided that the crystal lattice is not degraded in the milling process. Therefore, in those instances where confirmation of the presence of an asbestiform mineral at very low levels is required, or where a negative result from initial screening of the bulk material by XRD (see Section 2.7.2.2.1) is in conflict with previous PLM results, it may be desirable to prepare the sample as described for quantitative analysis (see Section 2.7.2.3) and step-scan over appropriate 2 θ ranges of selected diagnostic peaks (Table 2-2). Accurate transfer of the sample to the silver membrane filter is not necessary unless subsequent quantitative analysis is to be performed.

2.7.2.3 Quantitative Analysis

The proposed method for quantitation of asbestos in bulk samples is a modification of the NIOSH-recommended thin-layer method for chrysotile in air.⁵ A thick-layer or bulk method involving pelletizing the sample may be used for semiquantitative analysis;^{7,8} however, this method requires the addition of an internal standard, use of a specially fabricated sample press, and relatively large amounts of standard reference materials. Additional research is required to evaluate the comparability of thin- and thick-layer methods for quantitative asbestos analysis.

For quantitative analysis by thin-layer methods, the following procedure is recommended:

1. Mill and size all or a substantial representative portion of the sample as outlined in Section 2.7.2.1.1.

2. Dry at 100 °C for 2 hr; cool in a desiccator.

3. Weigh accurately to the nearest 0.01 mg.

4. Samples shown by PLM to contain large amounts of cellulosic or other organic materials, gypsum, or carbonates, should be submitted to appropriate matrix reduction procedures described in Sections 2.7.2.1.2 and 2.7.2.1.3. After ashing and/or acid treatment, repeat the drying and weighing procedures described above, and determine the percent weight loss; L.

5. Quantitatively transfer an accurately weighed amount (50–100 mg) of the sample to a 1-L volumetric flask with approximately 200 mL isopropanol to which 3 to 4 drops of surfactant have been added.

6. Ultrasonicate for 10 min at a power density of approximately 0.1 W/mL, to disperse the sample material.

7. Dilute to volume with isopropanol.

8. Place flask on a magnetic stirring plate. Stir.

9. Place a silver membrane filter on the filtration apparatus, apply a vacuum, and attach the reservoir. Release the vacuum and add several milliliters of isopropanol to the reservoir. Vigorously hand shake the asbestos suspension and immediately withdraw an aliquot from the center of the suspension so that total sample weight, W_T , on the filter will be approximately 1 mg. Do not adjust the volume in the pipet by expelling part of the suspension; if more than the desired aliquot is withdrawn, discard the aliquot and resume the procedure with a clean pipet. Transfer the aliquot to the reservoir. Filter rapidly under vacuum. Do not wash the reservoir walls. Leave the filter apparatus under vacuum until dry. Remove the reservoir, release the vacuum, and remove the filter with forceps. (Note: Water-soluble matrix interferences such as gypsum may be removed at this time by careful washing of the filtrate with distilled water. Extreme care should be taken not to disturb the sample.)

10. Attach the filter to a flat holder with a suitable adhesive and place on the diffractometer. Use of a sample spinner is recommended.

11. For each asbestos mineral to be quantitated select a reflection (or reflections) that has been shown to be free from interferences by prior PLM or qualitative XRD analysis and that can be used unambiguously as an index of the amount of material present in the sample (see Table 2-2).

12. Analyze the selected diagnostic reflection(s) by step scanning in increments of 0.02° 2 θ for an appropriate fixed time and integrating the counts. (A fixed count scan may be used alternatively; however, the method chosen should be used consistently for all samples and standards.) An appropriate scanning interval should be selected for each peak, and background corrections made. For a fixed time scan, measure the

background on each side of the peak for one-half the peak-scanning time. The net intensity, I_n , is the difference between the peak integrated count and the total background count.

13. Determine the net count, I_{Ag} , of the filter 2.36 Å silver peak following the procedure in step 12. Remove the filter from the holder, reverse it, and reattach it to the holder. Determine the net count for the unattenuated silver peak, I_{Ag}° . Scan times may be less for measurement of silver peaks than for sample peaks; however, they should be constant throughout the analysis.

14. Normalize all raw, net intensities (to correct for instrument instabilities) by referencing them to an external standard (e.g., the 3.34 Å peak of an α -quartz reference crystal). After each unknown is scanned, determine the net count, I_r , of the reference specimen following the procedure in step 12. Determine the normalized intensities by dividing the peak intensities by I_r :

$$\hat{I}_a = \frac{I_a}{I_r^\circ}, \quad \hat{I}_{Ag} = \frac{I_{Ag}}{I_r^\circ}, \quad \text{and} \quad \hat{I}_{Ag}^\circ = \frac{I_{Ag}^\circ}{I_r^\circ}$$

2.8 Calibration

2.8.1 Preparation of Calibration Standards

1. Mill and size standard asbestos materials according to the procedure outlined in Section 2.7.2.1.1. *Equivalent, standardized matrix reduction and sizing techniques should be used for both standard and sample materials.*

2. Dry at 100 °C for 2 hr; cool in a desiccator.

3. Prepare two suspensions of each standard in isopropanol by weighing approximately 10 and 50 mg of the dry material to the nearest 0.01 mg. Quantitatively transfer each to a 1-L volumetric flask with approximately 200 mL isopropanol to which a few drops of surfactant have been added.

4. Ultrasonicate for 10 min at a power density of approximately 0.1 W/mL, to disperse the asbestos material.

5. Dilute to volume with isopropanol.

6. Place the flask on a magnetic stirring plate. Stir.

7. Prepare, in triplicate, a series of at least five standard filters to cover the desired analytical range, using appropriate aliquots of the 10 and 50 mg/L suspensions and the following procedure.

Mount a silver membrane filter on the filtration apparatus. Place a few milliliters of isopropanol in the reservoir. Vigorously hand shake the asbestos suspension and immediately withdraw an aliquot from the center of the suspension. Do not adjust the volume in the pipet by expelling part of the suspension; if more than the desired aliquot is withdrawn, discard the aliquot and resume the procedure with a clean pipet. Transfer

the aliquot to the reservoir. Keep the tip of the pipet near the surface of the isopropanol. Filter rapidly under vacuum. Do not wash the sides of the reservoir. Leave the vacuum on for a time sufficient to dry the filter. Release the vacuum and remove the filter with forceps.

2.8.2 Analysis of Calibration Standards

1. Mount each filter on a flat holder. Perform step scans on selected diagnostic reflections of the standards and reference specimen using the procedure outlined in Section 2.7.2.3, step 12, and the same conditions as those used for the samples.

2. Determine the normalized intensity for each peak measured, $\hat{I}_{std}$, as outlined in Section 2.7.2.3, step 14.

2.9 Calculations

For each asbestos reference material, calculate the exact weight deposited on each standard filter from the concentrations of the standard suspensions and aliquot volumes. Record the weight, w , of each standard. Prepare a calibration curve by regressing $\hat{I}_{std}$ on w . Poor reproducibility (± 15 percent RSD) at any given level indicates problems in the sample preparation technique, and a need for new standards. The data should fit a straight line equation.

Determine the slope, m , of the calibration curve in counts/microgram. The intercept, b , of the line with the $\hat{I}_{std}$ axis should be approximately zero. A large negative intercept indicates an error in determining the background. This may arise from incorrectly measuring the baseline or from interference by another phase at the angle of background measurement. A large positive intercept indicates an error in determining the baseline or that an impurity is included in the measured peak.

Using the normalized intensity, $\hat{I}_{Ag}$, for the attenuated silver peak of a sample, and the corresponding normalized intensity from the unattenuated silver peak, $\hat{I}_{Ag}^\circ$, of the sample filter, calculate the transmittance, T , for each sample as follows:^{26,27}

$$T = \frac{\hat{I}_{Ag}}{\hat{I}_{Ag}^\circ}$$

Determine the correction factor, $f(T)$, for each sample according to the formula:

$$f(T) = \frac{-R(\ln T)}{1 - T^R}$$

where

$$R = \frac{\sin \theta_{Ag}}{\sin \theta_a}$$

θ_{Ag} =angular position of the measured silver peak (from Bragg's Law), and

θ_a =angular position of the diagnostic asbestos peak.

Calculate the weight, W_a , in micrograms, of the asbestos material analyzed for in each sample, using the appropriate calibration data and absorption corrections:

$$W_a = \frac{\hat{I}_a f(t) - b}{m}$$

Calculate the percent composition, P_a , of each asbestos mineral analyzed for in the parent material, from the total sample weight, W_T , on the filter:

$$P_a = \frac{W_a(1-0.01L)}{W_T} \times 100$$

where

P_a =percent asbestos mineral in parent material;

W_a =mass of asbestos mineral on filter, in μg ;

W_T =total sample weight on filter, in μg ;

L =percent weight loss of parent material on ashing and/or acid treatment (see Section 2.7.2.3).

2.10 References

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§ 763.120

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[47 FR 23369, May 27, 1982; 47 FR 38535, Sept. 1, 1982; Redesignated at 60 FR 31922, June 19, 1995]

Subpart F [Reserved]

Subpart G—Asbestos Worker Protection

SOURCE: 65 FR 69216, Nov. 15, 2000, unless otherwise noted.

§ 763.120 What is the purpose of this subpart?

This subpart protects certain State and local government employees who are not protected by the Asbestos Standards of the Occupational Safety and Health Administration (OSHA). This subpart applies the OSHA Asbestos Standards in 29 CFR 1910.1001 and 29 CFR 1926.1101 to these employees.

§ 763.121 Does this subpart apply to me?

If you are a State or local government employer and you are not subject to a State asbestos standard that OSHA has approved under section 18 of the Occupational Safety and Health Act or a State asbestos plan that EPA

40 CFR Ch. I (7-1-11 Edition)

has exempted from the requirements of this subpart under § 763.123, you must follow the requirements of this subpart to protect your employees from occupational exposure to asbestos.

§ 763.122 What does this subpart require me to do?

If you are a State or local government employer whose employees perform:

(a) Construction activities identified in 29 CFR 1926.1101(a), you must:

(1) Comply with the OSHA standards in 29 CFR 1926.1101.

(2) Submit notifications required for alternative control methods to the Director, National Program Chemicals Division (7404), Office of Pollution Prevention and Toxics, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460.

(b) Custodial activities not associated with the construction activities identified in 29 CFR 1926.1101(a), you must comply with the OSHA standards in 29 CFR 1910.1001.

(c) Repair, cleaning, or replacement of asbestos-containing clutch plates and brake pads, shoes, and linings, or removal of asbestos-containing residue from brake drums or clutch housings, you must comply with the OSHA standards in 29 CFR 1910.1001.

§ 763.123 May a State implement its own asbestos worker protection plan?

This section describes the process under which a State may be exempted from the requirements of this subpart.

(a) *States seeking an exemption.* If your State wishes to implement its own asbestos worker protection plan, rather than complying with the requirements of this subpart, your State must apply for and receive an exemption from EPA.

(1) *What must my State do to apply for an exemption?* To apply for an exemption from the requirements of this subpart, your State must send to the Director of EPA's Office of Pollution Prevention and Toxics (OPPT) a copy of its asbestos worker protection regulations and a detailed explanation of how your State's asbestos worker protection plan meets the requirements of TSCA section 18 (15 U.S.C. 2617).

APPENDIX B

NESHAP Regulations

40 CFR, Chapter 61, Subpart M

National Emission Standard for Asbestos

§61.140	Applicability.
§61.141	Definitions.
§61.142	Standard for asbestos mills.
§61.143	Standard for roadways.
§61.144	Standard for manufacturing.
§61.145	Standard for demolition and renovation.
§61.146	Standard for spraying.
§61.147	Standard for fabricating.
§61.148	Standard for insulating materials.
§61.149	Standard for waste disposal for asbestos mills.
§61.150	Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations.
§61.151	Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations.
§61.152	Air-cleaning.
§61.153	Reporting.
§61.154	Standard for active waste disposal sites.
§61.155	Standard for operations that convert asbesto-containing waste material into nonasbestos (asbestos-free) material.
§61.156	Cross-reference to other asbestos regulations.
§61.157	Delegation of authority.

61 Subpart M Appendix A Interpretive Rule Governing Roof Removal Operations

61.140 Applicability.

The provisions of this subpart are applicable to those sources specified in 61.142 through 61.151, 61.154, and 61.155.

[55 FR 48414, Nov. 20, 1990]

61.141 Definitions.

All terms that are used in this subpart and are not defined below are given the same meaning as in the Act and in subpart A of this part.

Active waste disposal site means any disposal site other than an inactive site.

Adequately wet means sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from asbestos-containing material, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wet.

Asbestos means the asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.

Asbestos-containing waste materials means mill tailings or any waste that contains commercial asbestos and is generated by a source subject to the provisions of this subpart. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term also includes regulated asbestos-containing material waste and materials contaminated with asbestos including disposable equipment and clothing.

Asbestos mill means any facility engaged in converting, or in any intermediate step in converting, asbestos ore into commercial asbestos. Outside storage of asbestos material is not considered a part of the asbestos mill.

Asbestos tailings means any solid waste that contains asbestos and is a product of asbestos mining or milling operations.

Asbestos waste from control devices means any waste material that contains asbestos and is collected by a pollution control device.

Category I nonfriable asbestos-containing material (ACM) means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy.

Category II nonfriable ACM means any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos as determined using the methods specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Commercial asbestos means any material containing asbestos that is extracted from ore and has value because of its asbestos content.

Cutting means to penetrate with a sharp-edged instrument and includes sawing, but does not include shearing, slicing, or punching.

Demolition means the wrecking or taking out of any load-supporting structural member of a facility together with any related handling operations or the intentional burning of any facility.

Emergency renovation operation means a renovation operation that was not planned but results from a sudden, unexpected event that, if not immediately attended to, presents a safety or public health hazard, is necessary to protect equipment from

damage, or is necessary to avoid imposing an unreasonable financial burden. This term includes operations necessitated by nonroutine failures of equipment.

Fabricating means any processing (e.g., cutting, sawing, drilling) of a manufactured product that contains commercial asbestos, with the exception of processing at temporary sites (field fabricating) for the construction or restoration of facilities. In the case of friction products, fabricating includes bonding, debonding, grinding, sawing, drilling, or other similar operations performed as part of fabricating.

Facility means any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding residential buildings having four or fewer dwelling units); any ship; and any active or inactive waste disposal site. For purposes of this definition, any building, structure, or installation that contains a loft used as a dwelling is not considered a residential structure, installation, or building. Any structure, installation or building that was previously subject to this subpart is not excluded, regardless of its current use or function.

Facility component means any part of a facility including equipment.

Friable asbestos material means any material containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763 section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent as determined by a method other than point counting by polarized light microscopy (PLM), verify the asbestos content by point counting using PLM.

Fugitive source means any source of emissions not controlled by an air pollution control device.

Glove bag means a sealed compartment with attached inner gloves used for the handling of asbestos-containing materials. Properly installed and used, glove bags provide a small work area enclosure typically used for small-scale asbestos stripping operations. Information on glove-bag installation, equipment and supplies, and work practices is contained in the Occupational Safety and Health Administration's (OSHA's) final rule on occupational exposure to asbestos (appendix G to 29 CFR 1926.58).

Grinding means to reduce to powder or small fragments and includes mechanical chipping or drilling.

Inactive waste disposal site means any disposal site or portion of it where additional asbestos-containing waste material has not been deposited within the past year.

In poor condition means the binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material.

Installation means any building or structure or any group of buildings or structures at a single demolition or renovation site that are under the control of the same owner or operator (or owner or operator under common control).

Leak-tight means that solids or liquids cannot escape or spill out. It also means dust-tight.

Malfunction means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of asbestos are increased. Failures of equipment shall not be considered malfunctions if they are caused in any way by poor maintenance, careless operation, or any other preventable upset conditions, equipment breakdown, or process failure.

Manufacturing means the combining of commercial asbestos-or, in the case of woven friction products, the combining of textiles containing commercial asbestos-with any other material(s), including commercial asbestos, and the processing of this combination into a product. Chlorine production is considered a part of manufacturing.

Natural barrier means a natural object that effectively precludes or deters access.

Natural barriers include physical obstacles such as cliffs, lakes or other large bodies of water, deep and wide ravines, and mountains. Remoteness by itself is not a natural barrier.

Nonfriable asbestos-containing material means any material containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Nonscheduled renovation operation means a renovation operation necessitated by the routine failure of equipment, which is expected to occur within a given period based on past operating experience, but for which an exact date cannot be predicted.

Outside air means the air outside buildings and structures, including, but not limited to, the air under a bridge or in an open air ferry dock.

Owner or operator of a demolition or renovation activity means any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Particulate asbestos material means finely divided particles of asbestos or material containing asbestos.

Planned renovation operations means a renovation operation, or a number of such operations, in which some RACM will be removed or stripped within a given period of time and that can be predicted. Individual nonscheduled operations are included if a number of such operations can be predicted to occur during a given period of time based on operating experience.

Regulated asbestos-containing material (RACM) means

- (a) Friable asbestos material,
- (b) Category I nonfriable ACM that has become friable,
- (c) Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or
- (d) Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations regulated by this subpart.

Remove means to take out RACM or facility components that contain or are covered with RACM from any facility.

Renovation means altering a facility or one or more facility components in any way, including the stripping or removal of RACM from a facility component. Operations in which load-supporting structural members are wrecked or taken out are demolitions.

Resilient floor covering means asbestos-containing floor tile, including asphalt and vinyl floor tile, and sheet vinyl floor covering containing more than 1 percent asbestos as determined using polarized light microscopy according to the method specified in appendix E, subpart E, 40 CFR part 763, Section 1, Polarized Light Microscopy.

Roadways means surfaces on which vehicles travel. This term includes public and private highways, roads, streets, parking areas, and driveways.

Strip means to take off RACM from any part of a facility or facility components.

Structural member means any load-supporting member of a facility, such as beams and load supporting walls; or any nonload-supporting member, such as ceilings and nonload-supporting walls.

Visible emissions means any emissions, which are visually detectable without the aid of instruments, coming from RACM or asbestos-containing waste material, or from any asbestos milling, manufacturing, or fabricating operation. This does not include condensed, uncombined water vapor.

Waste generator means any owner or operator of a source covered by this subpart whose act or process produces asbestos-containing waste material.

Waste shipment record means the shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Working day means Monday through Friday and includes holidays that fall on any of the days Monday through Friday.

[49 FR 13661, Apr. 5, 1984; 49 FR 25453, June 21, 1984, as amended by 55 FR 48414, Nov. 20, 1990; 56 FR 1669, Jan. 16, 1991; 60 FR 31917, June 19, 1995]

61.142 Standard for asbestos mills. (deleted from this document)

61.143 Standard for roadways. (deleted from this document)

61.144 Standard for manufacturing. (deleted from this document)

61.145 Standard for demolition and renovation.

(a) Applicability. To determine which requirements of paragraphs (a), (b), and (c) of this section apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM. The requirements of paragraphs (b) and (c) of this section apply to each owner or operator of a demolition or renovation activity, including the removal of RACM as follows:

- (1) In a facility being demolished, all the requirements of paragraphs (b) and (c) of this section apply, except as provided in paragraph (a)(3) of this section, if the combined amount of RACM is
 - (i) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or
 - (ii) At least 1 cubic meter (35 cubic feet) of facility components where the length or area could not be measured previously.
- (2) In a facility being demolished, only the notification requirements of paragraphs (b)(1), (2), (3)(i) and (iv), and (4)(i) through (vii) and (4)(ix) and (xvi) of this section apply, if the combined amount of RACM is
 - (i) Less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, and

- (ii) Less than one cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously or there is no asbestos.
- (3) If the facility is being demolished under an order of a State or local government agency, issued because the facility is structurally unsound and in danger of imminent collapse, only the requirements of paragraphs (b)(1), (b)(2), (b)(3)(iii), (b)(4) (except (b)(4)(viii)), (b)(5), and (c)(4) through (c)(9) of this section apply.
- (4) In a facility being renovated, including any individual nonscheduled renovation operation, all the requirements of paragraphs (b) and (c) of this section apply if the combined amount of RACM to be stripped, removed, dislodged, cut, drilled, or similarly disturbed is
 - (i) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or
 - (ii) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.
 - (iii) To determine whether paragraph (a)(4) of this section applies to planned renovation operations involving individual nonscheduled operations, predict the combined additive amount of RACM to be removed or stripped during a calendar year of January 1 through December 31.
 - (iv) To determine whether paragraph (a)(4) of this section applies to emergency renovation operations, estimate the combined amount of RACM to be removed or stripped as a result of the sudden, unexpected event that necessitated the renovation.
- (5) Owners or operators of demolition and renovation operations are exempt from the requirements of 61.05 (a), 61.07, and 61.09.
- (b) Notification requirements. Each owner or operator of a demolition or renovation activity to which this section applies shall:
 - (1) Provide the Administrator with written notice of intention to demolish or renovate. Delivery of the notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.
 - (2) Update notice, as necessary, including when the amount of asbestos affected changes by at least 20 percent.
 - (3) Postmark or deliver the notice as follows:

- (i) At least 10 working days before asbestos stripping or removal work or any other activity begins (such as site preparation that would break up, dislodge or similarly disturb asbestos material), if the operation is described in paragraphs (a) (1) and (4) (except (a)(4)(iii) and (a)(4)(iv)) of this section. If the operation is as described in paragraph (a)(2) of this section, notification is required 10 working days before demolition begins.
- (ii) At least 10 working days before the end of the calendar year preceding the year for which notice is being given for renovations described in paragraph (a)(4)(iii) of this section.
- (iii) As early as possible before, but not later than, the following working day if the operation is a demolition ordered according to paragraph (a)(3) of this section or, if the operation is a renovation described in paragraph (a)(4)(iv) of this section.
- (iv) For asbestos stripping or removal work in a demolition or renovation operation, described in paragraphs (a) (1) and (4) (except (a)(4)(iii) and (a)(4)(iv)) of this section, and for a demolition described in paragraph (a)(2) of this section, that will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Administrator as follows:
 - (A) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin after the date contained in the notice,
 - (1) Notify the Administrator of the new start date by telephone as soon as possible before the original start date, and
 - (2) Provide the Administrator with a written notice of the new start date as soon as possible before, and no later than, the original start date. Delivery of the updated notice by the U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.
 - (B) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin on a date earlier than the original start date,

- (1) Provide the Administrator with a written notice of the new start date at least 10 working days before asbestos stripping or removal work begins.
 - (2) For demolitions covered by paragraph (a)(2) of this section, provide the Administrator written notice of a new start date at least 10 working days before commencement of demolition. Delivery of updated notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.
 - (C) In no event shall an operation covered by this paragraph begin on a date other than the date contained in the written notice of the new start date.
- (4) Include the following in the notice:
- (i) An indication of whether the notice is the original or a revised notification.
 - (ii) Name, address, and telephone number of both the facility owner and operator and the asbestos removal contractor owner or operator.
 - (iii) Type of operation: demolition or renovation.
 - (iv) Description of the facility or affected part of the facility including the size (square meters [square feet] and number of floors), age, and present and prior use of the facility.
 - (v) Procedure, including analytical methods, employed to detect the presence of RACM and Category I and Category II nonfriable ACM.
 - (vi) Estimate of the approximate amount of RACM to be removed from the facility in terms of length of pipe in linear meters (linear feet), surface area in square meters (square feet) on other facility components, or volume in cubic meters (cubic feet) if off the facility components. Also, estimate the approximate amount of Category I and Category II nonfriable ACM in the affected part of the facility that will not be removed before demolition.
 - (vii) Location and street address (including building number or name and floor or room number, if appropriate), city, county, and state, of the facility being demolished or renovated.

- (viii) Scheduled starting and completion dates of asbestos removal work (or any other activity, such as site preparation that would break up, dislodge, or similarly disturb asbestos material) in a demolition or renovation; planned renovation operations involving individual nonscheduled operations shall only include the beginning and ending dates of the report period as described in paragraph (a)(4)(iii) of this section.
- (ix) Scheduled starting and completion dates of demolition or renovation.
- (x) Description of planned demolition or renovation work to be performed and method(s) to be employed, including demolition or renovation techniques to be used and description of affected facility components.
- (xi) Description of work practices and engineering controls to be used to comply with the requirements of this subpart, including asbestos removal and waste-handling emission control procedures.
- (xii) Name and location of the waste disposal site where the asbestos-containing waste material will be deposited.
- (xiii) A certification that at least one person trained as required by paragraph (c)(8) of this section will supervise the stripping and removal described by this notification. This requirement shall become effective 1 year after promulgation of this regulation.
- (xiv) For facilities described in paragraph (a)(3) of this section, the name, title, and authority of the State or local government representative who has ordered the demolition, the date that the order was issued, and the date on which the demolition was ordered to begin. A copy of the order shall be attached to the notification.
- (xv) For emergency renovations described in paragraph (a)(4)(iv) of this section, the date and hour that the emergency occurred, a description of the sudden, unexpected event, and an explanation of how the event caused an unsafe condition, or would cause equipment damage or an unreasonable financial burden.
- (xvi) Description of procedures to be followed in the event that unexpected RACM is found or Category II nonfriable ACM becomes crumbled, pulverized, or reduced to powder.
- (xvii) Name, address, and telephone number of the waste transporter.

- (5) The information required in paragraph (b)(4) of this section must be reported using a form similar to that shown in Figure 3.
- (c) Procedures for asbestos emission control. Each owner or operator of a demolition or renovation activity to whom this paragraph applies, according to paragraph (a) of this section, shall comply with the following procedures:
- (1) Remove all RACM from a facility being demolished or renovated before any activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal. RACM need not be removed before demolition if:
 - (i) It is Category I nonfriable ACM that is not in poor condition and is not friable.
 - (ii) It is on a facility component that is encased in concrete or other similarly hard material and is adequately wet whenever exposed during demolition; or
 - (iii) It was not accessible for testing and was, therefore, not discovered until after demolition began and, as a result of the demolition, the material cannot be safely removed. If not removed for safety reasons, the exposed RACM and any asbestos-contaminated debris must be treated as asbestos-containing waste material and adequately wet at all times until disposed of.
 - (iv) They are Category II nonfriable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.
 - (2) When a facility component that contains, is covered with, or is coated with RACM is being taken out of the facility as a unit or in sections:
 - (i) Adequately wet all RACM exposed during cutting or disjoining operations; and
 - (ii) Carefully lower each unit or section to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the RACM.
 - (3) When RACM is stripped from a facility component while it remains in place in the facility, adequately wet the RACM during the stripping operation.
 - (i) In renovation operations, wetting is not required if:

- (A) The owner or operator has obtained prior written approval from the Administrator based on a written application that wetting to comply with this paragraph would unavoidably damage equipment or present a safety hazard; and
- (B) The owner or operator uses one of the following emission control methods:
 - (1) A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the asbestos materials. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in 61.152.
 - (2) A glove-bag system designed and operated to contain the particulate asbestos material produced by the stripping of the asbestos materials.
 - (3) Leak-tight wrapping to contain all RACM prior to dismantlement.
- (ii) In renovation operations where wetting would result in equipment damage or a safety hazard, and the methods allowed in paragraph (c)(3)(i) of this section cannot be used, another method may be used after obtaining written approval from the Administrator based upon a determination that it is equivalent to wetting in controlling emissions or to the methods allowed in paragraph (c)(3)(i) of this section.
- (iii) A copy of the Administrator's written approval shall be kept at the worksite and made available for inspection.
- (4) After a facility component covered with, coated with, or containing RACM has been taken out of the facility as a unit or in sections pursuant to paragraph (c)(2) of this section, it shall be stripped or contained in leak-tight wrapping, except as described in paragraph (c)(5) of this section. If stripped, either:
 - (i) Adequately wet the RACM during stripping; or
 - (ii) Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping. The system must exhibit no visible emissions to the

outside air or be designed and operated in accordance with the requirements in 61.152.

- (5) For large facility components such as reactor vessels, large tanks, and steam generators, but not beams (which must be handled in accordance with paragraphs (c)(2), (3), and (4) of this section), the RACM is not required to be stripped if the following requirements are met:
 - (i) The component is removed, transported, stored, disposed of, or reused without disturbing or damaging the RACM.
 - (ii) The component is encased in a leak-tight wrapping.
 - (iii) The leak-tight wrapping is labeled according to 61.149 (d)(1)(i), (ii), and (iii) during all loading and unloading operations and during storage.
- (6) For all RACM, including material that has been removed or stripped:
 - (i) Adequately wet the material and ensure that it remains wet until collected and contained or treated in preparation for disposal in accordance with 61.150; and
 - (ii) Carefully lower the material to the ground and floor, not dropping, throwing, sliding, or otherwise damaging or disturbing the material.
 - (iii) Transport the material to the ground via leak-tight chutes or containers if it has been removed or stripped more than 50 feet above ground level and was not removed as units or in sections.
 - (iv) RACM contained in leak-tight wrapping that has been removed in accordance with paragraphs (c)(4) and (c)(3)(i)(B)(3) of this section need not be wetted.
- (7) When the temperature at the point of wetting is below 0 °C (32 °F):
 - (i) The owner or operator need not comply with paragraph (c)(2)(i) and the wetting provisions of paragraph (c)(3) of this section.
 - (ii) The owner or operator shall remove facility components containing, coated with, or covered with RACM as units or in sections to the maximum extent possible.
 - (iii) During periods when wetting operations are suspended due to freezing temperatures, the owner or operator must record the temperature in the area containing the facility components at the

beginning, middle, and end of each workday and keep daily temperature records available for inspection by the Administrator during normal business hours at the demolition or renovation site. The owner or operator shall retain the temperature records for at least 2 years.

- (8) Effective 1 year after promulgation of this regulation, no RACM shall be stripped, removed, or otherwise handled or disturbed at a facility regulated by this section unless at least one on-site representative, such as a foreman or management-level person or other authorized representative, trained in the provisions of this regulation and the means of complying with them, is present. Every 2 years, the trained on-site individual shall receive refresher training in the provisions of this regulation. The required training shall include as a minimum: applicability; notifications; material identification; control procedures for removals including, at least, wetting, local exhaust ventilation, negative pressure enclosures, glove-bag procedures, and High Efficiency Particulate Air (HEPA) filters; waste disposal work practices; reporting and recordkeeping; and asbestos hazards and worker protection. Evidence that the required training has been completed shall be posted and made available for inspection by the Administrator at the demolition or renovation site.
- (9) For facilities described in paragraph (a)(3) of this section, adequately wet the portion of the facility that contains RACM during the wrecking operation.
- (10) If a facility is demolished by intentional burning, all RACM including Category I and Category II nonfriable ACM must be removed in accordance with the NESHAP before burning.

(Approved by the Office of Management and Budget under control number 2060-0101)
[55 FR 48419, Nov. 20, 1990; 56 FR 1669, Jan. 16, 1991; 58 FR 18014, Apr. 7, 1993]

- 61.146 Standard for spraying.** (deleted from this document)
- 61.147 Standard for fabricating.** (deleted from this document)
- 61.148 Standard for insulating materials.** (deleted from this document)
- 61.149 Standard for waste disposal for asbestos mills.** (deleted from this document)

61.150 Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations.

Each owner or operator of any source covered under the provisions of 61.144, 61.145, 61.146, and 61.147 shall comply with the following provisions:

- (a) Discharge no visible emissions to the outside air during the collection, processing (including incineration), packaging, or transporting of any asbestos-containing waste material generated by the source, or use one of the emission control and waste treatment methods specified in paragraphs (a) (1) through (4) of this section.
 - (1) Adequately wet asbestos-containing waste material as follows:
 - (i) Mix control device asbestos waste to form a slurry; adequately wet other asbestos-containing waste material; and
 - (ii) Discharge no visible emissions to the outside air from collection, mixing, wetting, and handling operations, or use the methods specified by 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air; and
 - (iii) After wetting, seal all asbestos-containing waste material in leak-tight containers while wet; or, for materials that will not fit into containers without additional breaking, put materials into leak-tight wrapping; and
 - (iv) Label the containers or wrapped materials specified in paragraph (a)(1)(iii) of this section using warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.1001 (j)(2) or 1926.58 (k)(2)(iii). The labels shall be printed in letters of sufficient size and contrast so as to be readily visible and legible.
 - (v) For asbestos-containing waste material to be transported off the facility site, label containers or wrapped materials with the name of the waste generator and the location at which the waste was generated.
 - (2) Process asbestos-containing waste material into nonfriable forms as follows:
 - (i) Form all asbestos-containing waste material into nonfriable pellets or other shapes;

- (ii) Discharge no visible emissions to the outside air from collection and processing operations, including incineration, or use the method specified by 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.
- (3) For facilities demolished where the RACM is not removed prior to demolition according to 61.145 (c)(1) (i), (ii), (iii), and (iv) or for facilities demolished according to 61.145 (c)(9), adequately wet asbestos-containing waste material at all times after demolition and keep wet during handling and loading for transport to a disposal site. Asbestos-containing waste materials covered by this paragraph do not have to be sealed in leak-tight containers or wrapping but may be transported and disposed of in bulk.
- (4) Use an alternative emission control and waste treatment method that has received prior approval by the Administrator according to the procedure described in 61.149 (c)(2).
- (5) As applied to demolition and renovation, the requirements of paragraph (a) of this section do not apply to Category I nonfriable ACM waste and Category II nonfriable ACM waste that did not become crumbled, pulverized, or reduced to powder.
- (b) All asbestos-containing waste material shall be deposited as soon as is practical by the waste generator at:
 - (1) A waste disposal site operated in accordance with the provisions of 61.154, or
 - (2) An EPA-approved site that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material according to the provisions of 61.155.
 - (3) The requirements of paragraph (b) of this section do not apply to Category I nonfriable ACM that is not RACM.
- (c) Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of waste so that the signs are visible. The markings must conform to the requirements of 61.149 (d)(1) (i), (ii), and (iii).
- (d) For all asbestos-containing waste material transported off the facility site:
 - (1) Maintain waste shipment records, using a form similar to that shown in Figure 4, and include the following information:

- (i) The name, address, and telephone number of the waste generator.
 - (ii) The name and address of the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program.
 - (iii) The approximate quantity in cubic meters (cubic yards).
 - (iv) The name and telephone number of the disposal site operator.
 - (v) The name and physical site location of the disposal site.
 - (vi) The date transported.
 - (vii) The name, address, and telephone number of the transporter(s).
 - (viii) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.
- (2) Provide a copy of the waste shipment record, described in paragraph (d)(1) of this section, to the disposal site owners or operators at the same time as the asbestos-containing waste material is delivered to the disposal site.
- (3) For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated disposal site, is not received by the waste generator within 35 days of the date the waste was accepted by the initial transporter, contact the transporter and/or the owner or operator of the designated disposal site to determine the status of the waste shipment.
- (4) Report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator if a copy of the waste shipment record, signed by the owner or operator of the designated waste disposal site, is not received by the waste generator within 45 days of the date the waste was accepted by the initial transporter. Include in the report the following information:
- (i) A copy of the waste shipment record for which a confirmation of delivery was not received, and

- (ii) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.
- (5) Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.
- (e) Furnish upon request, and make available for inspection by the Administrator, all records required under this section.

[55 FR 48429, Nov. 20, 1990; 56 FR 1669, Jan. 16, 1991]

- 61.151 Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations. (deleted from this document)
- 61.152 Air-cleaning. (deleted from this document)
- 61.153 Reporting. (deleted from this document)
- 61.154 Standard for active waste disposal sites.

Each owner or operator of an active waste disposal site that receives asbestos-containing waste material from a source covered under 61.149, 61.150, or 61.155 shall meet the requirements of this section:

- (a) Either there must be no visible emissions to the outside air from any active waste disposal site where asbestos-containing waste material has been deposited, or the requirements of paragraph (c) or (d) of this section must be met.
- (b) Unless a natural barrier adequately deters access by the general public, either warning signs and fencing must be installed and maintained as follows, or the requirements of paragraph (c)(1) of this section must be met.
 - (1) Warning signs must be displayed at all entrances and at intervals of 100 m (330 ft) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material is deposited. The warning signs must:
 - (i) Be posted in such a manner and location that a person can easily read the legend; and

- (ii) Conform to the requirements of 51 cm 36 cm (20" 14") upright format signs specified in 29 CFR 1910.145 (d)(4) and this paragraph; and
- (iii) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

<u>Legend</u>	<u>Notation</u>
Asbestos Waste Disposal Site	2.5 cm (1 inch) Sans Serif, Gothic or Block.
Do Not Create Dust	1.9 cm (3/4 inch) Sans Serif, Gothic or Block.
Breathing Asbestos is Hazardous to Your Health	14 Point Gothic.

Spacing between any two lines must be at least equal to the height of the upper of the two lines.

- (2) The perimeter of the disposal site must be fenced in a manner adequate to deter access by the general public.
 - (3) Upon request and supply of appropriate information, the Administrator will determine whether a fence or a natural barrier adequately deters access by the general public.
- (c) Rather than meet the no visible emission requirement of paragraph (a) of this section, at the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material that has been deposited at the site during the operating day or previous 24-hour period shall:
- (1) Be covered with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, or
 - (2) Be covered with a resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. Such an agent shall be used in the manner and frequency recommended for the particular dust by the dust suppression agent manufacturer to achieve and maintain dust control. Other equally effective dust suppression agents may be used upon prior approval by the Administrator. For purposes of this paragraph, any used, spent, or other waste oil is not considered a dust suppression agent.
- (d) Rather than meet the no visible emission requirement of paragraph (a) of this section, use an alternative emissions control method that has received prior

written approval by the Administrator according to the procedures described in 61.149 (c)(2).

- (e) For all asbestos-containing waste material received, the owner or operator of the active waste disposal site shall:
 - (1) Maintain waste shipment records, using a form similar to that shown in Figure 4, and include the following information:
 - (i) The name, address, and telephone number of the waste generator.
 - (ii) The name, address, and telephone number of the transporter(s).
 - (iii) The quantity of the asbestos-containing waste material in cubic meters (cubic yards).
 - (iv) The presence of improperly enclosed or uncovered waste, or any asbestos-containing waste material not sealed in leak-tight containers. Report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator (identified in the waste shipment record), and, if different, the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the disposal site, by the following working day, the presence of a significant amount of improperly enclosed or uncovered waste. Submit a copy of the waste shipment record along with the report.
 - (v) The date of the receipt.
 - (2) As soon as possible and no longer than 30 days after receipt of the waste, send a copy of the signed waste shipment record to the waste generator.
 - (3) Upon discovering a discrepancy between the quantity of waste designated on the waste shipment records and the quantity actually received, attempt to reconcile the discrepancy with the waste generator. If the discrepancy is not resolved within 15 days after receiving the waste, immediately report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator (identified in the waste shipment record), and, if different, the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the disposal site. Describe the discrepancy and attempts to reconcile it, and submit a copy of the waste shipment record along with the report.
 - (4) Retain a copy of all records and reports required by this paragraph for at least 2 years.

- (f) Maintain, until closure, records of the location, depth and area, and quantity in cubic meters (cubic yards) of asbestos-containing waste material within the disposal site on a map or diagram of the disposal area.
- (g) Upon closure, comply with all the provisions of 61.151.
- (h) Submit to the Administrator, upon closure of the facility, a copy of records of asbestos waste disposal locations and quantities.
- (i) Furnish upon request, and make available during normal business hours for inspection by the Administrator, all records required under this section.
- (j) Notify the Administrator in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site and is covered. If the excavation will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Administrator at least 10 working days before excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:
 - (1) Scheduled starting and completion dates.
 - (2) Reason for disturbing the waste.
 - (3) Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the Administrator may require changes in the emission control procedures to be used.
 - (4) Location of any temporary storage site and the final disposal site.

(Secs. 112 and 301(a) of the Clean Air Act as amended (42 U.S.C. 7412, 7601(a)) [49 FR 13661, Apr. 5, 1990. Redesignated and amended at 55 FR 48431, Nov. 20, 1990; 56 FR 1669, Jan. 16, 1991]

61.155 Standard for operations that convert asbestos-containing waste material into nonasbestos (asbestos-free) material. (deleted from this document)

61.156 Cross-reference to other asbestos regulations.

In addition to this subpart, the regulations referenced in Table 1 also apply to asbestos and may be applicable to those sources specified in 61.142 through 61.151, 61.154,

and 61.155 of this subpart. These cross-references are presented for the reader's information and to promote compliance with the cited regulations.

Table 1-Cross-reference to Other Asbestos Regulations

Agency	CFR citation	Comment
EPA	40 CFR 763, Subpart E	Requires schools to inspect for asbestos and implement response actions and submit asbestos management plans to States. Specifies use of accredited inspectors, air sampling methods, and waste disposal procedures.
	40 CFR 427	Effluent standards for asbestos manufacturing source categories.
	40 CFR 763, Subpart G	Protects public employees performing asbestos abatement work in States not covered by OSHA asbestos standard.
OSHA	29 CFR 1910.1001	Worker protection measures-engineering controls, worker training, labeling, respiratory protection, bagging of waste, 0.2 f/cc permissible exposure level.
	29 CFR 1926.58	Worker protection measures for all construction work involving asbestos, including demolition and renovation-work practices, worker training, bagging of waste, 0.2 f/cc permissible exposure level.
MSHA	30 CFR 56, Subpart D	Specifies exposures limits, engineering controls, and respiratory protection measures for workers in surface mines.
	30 CFR 57, Subpart D	Specifies exposure limits, engineering controls, and respiratory protection measures

for workers in underground mines.

DOT

49 CFR 171 and 172

Regulates the of asbestos-containing material. Requires waste containment and shipping papers.

[55 FR 48432, Nov. 20, 1990; 60 FR 31917, June 19, 1995]

61.157 **Delegation of authority.** (deleted from this document)

App A **Interpretive Rule Governing Roof Removal Operations** (deleted from this document)

APPENDIX C

MDEQ Regulations

ENVIRONMENTAL QUALITY

CHAPTER 74

NOISE, ASBESTOS CONTROL, METHAMPHETAMINE CLEANUP

Subchapter 3

Asbestos Control

Rule	17.74.301	Applicability and Purpose
	17.74.302	Definitions (REPEALED)
	17.74.303	Exclusions
		Rules 17.74.304 through 17.74.306 reserved
	17.74.307	Evaluation of Asbestos Hazards in Structures Other Than LEA School Buildings (REPEALED)
	17.74.308	Clearing Asbestos Abatement Projects in Structures Other Than LEA School Buildings (REPEALED)
	17.74.309	Evaluation of Asbestos Hazards in LEA School Buildings (REPEALED)
	17.74.310	Clearing Asbestos Abatement Projects in LEA School Buildings (REPEALED)
		Rules 17.74.311 through 17.74.313 reserved
	17.74.314	Requirements of Accreditation and Permitting for Persons Engaged in an Asbestos-Type Occupation (REPEALED)
	17.74.315	Accreditation of Asbestos Inspector; Asbestos Management Planner; Asbestos Abatement Project Designer; Asbestos Abatement Contractor; Asbestos Abatement Supervisor; and Asbestos Worker (REPEALED)
	17.74.316	Renewal of Accreditation (REPEALED)
	17.74.317	Training Course and Examination Requirements (REPEALED)
	17.74.318	Application for Accreditation of a Training Course; Certification (REPEALED)
	17.74.319	Course Approval (REPEALED)
		Rules 17.74.320 through 17.74.324 reserved
	17.74.325	Asbestos Inspector's Course (REPEALED)

- 17.74.326 Asbestos Management Planners Course (REPEALED)
- 17.74.327 Asbestos Abatement Project Designer's Course (REPEALED)
- 17.74.328 Asbestos Abatement Contractor's and Supervisor's Course (REPEALED)
- 17.74.329 Asbestos Abatement Worker's Course (REPEALED)
- 17.74.330 Examinations (REPEALED)
- 17.74.331 Refresher Courses (REPEALED)
- Rules 17.74.332 through 17.74.334 reserved
- 17.74.335 Asbestos Abatement Project Permits (REPEALED)
- 17.74.336 Annual Permits (REPEALED)
- 17.74.337 Emergency Asbestos Project Permits (REPEALED)
- 17.74.338 Asbestos Abatement Project Control Measures (REPEALED)
- Rules 17.74.339 and 17.74.340 reserved
- 17.74.341 Recordkeeping (REPEALED)
- 17.74.342 Inspections (REPEALED)
- 17.74.343 Reciprocity
- Rules 17.74.344 through 17.74.349 reserved
- 17.74.350 Incorporation by Reference -- Publication Dates
- 17.74.351 Incorporation by Reference
- 17.74.352 Definitions
- 17.74.353 Applicability--Asbestos Project Requirements
- 17.74.354 Inspection of Demolition and Renovation Activities
- 17.74.355 Asbestos Project Permits
- 17.74.356 Asbestos Project Control Measures
- 17.74.357 Clearing Asbestos Projects
- 17.74.358 Emergency Renovation Operation Permits

- 17.74.359 Annual Asbestos Project Permits
- 17.74.360 Recordkeeping
- 17.74.361 Department Inspections
- 17.74.362 Accreditation Requirements for Asbestos-Related Occupations
- 17.74.363 Renewal of Accreditation
- 17.74.364 Training Provider Requirements
- 17.74.365 Training Course Requirements
- 17.74.366 Training Course Examinations
- 17.74.367 Refresher Courses
- 17.74.368 Training Course and Refresher Course Certificate and Recordkeeping Requirements

Subchapter 3

Asbestos Control

17.74.301 APPLICABILITY AND PURPOSE (1) Except as otherwise specifically provided, this subchapter applies to all persons or entities engaged in an asbestos-related occupation, persons in charge of asbestos abatement projects, and persons who offer course work for accreditation of persons engaged in asbestos abatement projects.

(2) The purpose of these rules is to regulate and establish criteria for asbestos abatement practices and to require state-wide standards for accreditation of persons in asbestos-type occupations, for approval of course work, and for a fee and permit system. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; TRANS, from DHES, 1996 MAR p. 433.)

17.74.302 DEFINITIONS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.303 EXCLUSIONS (1) A private homeowner conducting, on his own, an asbestos abatement project in his/her private residence where the sole use of such residence is as the homeowner's domicile, is not subject to the provisions of this subchapter during the period that asbestos-containing material is present on the homeowner's private property and the homeowner controls or maintains the asbestos-containing material.

(2) A private homeowner as described in (1) of this rule is subject to state and federal requirements for proper packaging, transport, and delivery to an approved asbestos disposal facility of asbestos containing material.

(3) A private homeowner as described in (1) of this rule must use an accredited asbestos abatement worker or an accredited asbestos abatement contractor or accredited asbestos abatement supervisor to perform the transportation and disposal operations described in (2) of this rule.

(4) A private homeowner as described in (1) of this rule must obtain an asbestos abatement project permit from the department for transportation and disposal operations as described in (2) of this rule. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; TRANS, from DHES, 1996 MAR p. 433.)

Rules 17.74.304 through 17.74.306 reserved

17.74.307 EVALUATION OF ASBESTOS HAZARDS IN STRUCTURES OTHER THAN LEA SCHOOL BUILDINGS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.308 CLEARING ASBESTOS ABATEMENT PROJECTS IN STRUCTURES OTHER THAN LEA SCHOOL BUILDINGS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.309 EVALUATION OF ASBESTOS HAZARDS IN LEA SCHOOL BUILDINGS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.310 CLEARING ASBESTOS ABATEMENT PROJECTS IN LEA SCHOOL BUILDINGS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

Rules 17.74.311 through 17.74.313 reserved

17.74.314 REQUIREMENTS OF ACCREDITATION AND PERMITTING FOR PERSONS ENGAGED IN AN ASBESTOS-TYPE OCCUPATION (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.315 ACCREDITATION OF ASBESTOS INSPECTOR; ASBESTOS MANAGEMENT PLANNER; ASBESTOS ABATEMENT PROJECT DESIGNER; ASBESTOS ABATEMENT CONTRACTOR; ASBESTOS ABATEMENT SUPERVISOR; AND ASBESTOS WORKER (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.316 RENEWAL OF ACCREDITATION (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.317 TRAINING COURSE AND EXAMINATION REQUIREMENTS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.318 APPLICATION FOR ACCREDITATION OF A TRAINING COURSE; CERTIFICATION (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.319 COURSE APPROVAL (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

Rules 17.74.320 through 17.74.324 reserved

17.74.325 ASBESTOS INSPECTOR'S COURSE (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.326 ASBESTOS MANAGEMENT PLANNERS COURSE (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.327 ASBESTOS ABATEMENT PROJECT DESIGNER'S COURSE (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.328 ASBESTOS ABATEMENT CONTRACTOR'S AND SUPERVISOR'S COURSE (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.329 ASBESTOS ABATEMENT WORKER'S COURSE (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.330 EXAMINATIONS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.331 REFRESHER COURSES (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

Rules 17.74.332 through 17.74.334 reserved

17.74.335 ASBESTOS ABATEMENT PROJECT PERMITS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.336 ANNUAL PERMITS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-504, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.337 EMERGENCY ASBESTOS PROJECT PERMITS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; AMD, 1995 MAR p. 1578, Eff. 8/11/95; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.338 ASBESTOS ABATEMENT PROJECT CONTROL MEASURES (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

Rules 17.74.339 and 17.74.340 reserved

17.74.341 RECORDKEEPING (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-513, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.342 INSPECTIONS (REPEALED) (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; AMD, 1993 MAR p. 549, Eff. 4/16/93; TRANS, from DHES, 1996 MAR p. 433; REP, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.343 RECIPROCITY (1) The department may accredit a person in an asbestos-related occupation who is accredited in another state. Upon receipt of an application for accreditation based upon accreditation requirements of the state where the applicant is accredited, the department shall evaluate the requirements for accreditation of the other state, and accredit the person if the requirements in the other state are at least as stringent as the accreditation requirements under this subchapter. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 1989 MAR p. 2234, Eff. 1/1/90; TRANS, from DHES, 1996 MAR p. 433; AMD, 2006 MAR p. 1574, Eff. 6/23/06.)

Rules 17.74.344 through 17.74.349 reserved

17.74.350 INCORPORATION BY REFERENCE -- PUBLICATION DATES

(1) Unless expressly provided otherwise, whenever there is a reference in this subchapter to:

(a) a federal regulation, the reference is to the July 1, 2006, edition of the Code of Federal Regulations (CFR);

(b) a section of the United States Code (USC), the reference is to the 2000 edition of the USC and Supplement III (2003); or

(c) a section of the Montana Code Annotated (MCA), the reference is to the 2005 edition of the MCA. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06; AMD, 2006 MAR p. 2962, Eff. 12/8/06.)

17.74.351 INCORPORATION BY REFERENCE (1) For the purposes of this subchapter, the department adopts and incorporates by reference:

(a) 40 CFR 61, subparts A and M, pertaining to national emission standards for hazardous air pollutants (NESHAPs) for asbestos, with the following exception:

(i) 40 CFR 61.145(a)(2) is not incorporated by reference.

(b) National Institute of Occupational Safety and Health (NIOSH) Manual of Analytical Methods, fourth edition, August 1994, which contains a description of the 7400 Analytical Method for detecting asbestos and other fibers by phase contrast microscopy (PCM) and a description of the 7402 Analytical Method for detecting asbestos by transmission electron microscopy (TEM);

(c) Montana Asbestos Work Practices and Procedures Manual (2005).

(2) Copies of these materials may be obtained from the Department of Environmental Quality, 1520 E. Sixth Avenue, P.O. Box 200901, Helena, MT 59620-0901. Copies of the CFR are available from the Superintendent of Documents, Government Printing Office, Washington, DC 20402, (202) 512-1800. The CFR can also be accessed electronically at www.gpoaccess.gov/cfr/index.html. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.352 DEFINITIONS For purposes of this subchapter, the following definitions apply:

(1) "Approved asbestos disposal facility" means a licensed Class II landfill as described in ARM 17.50.504.

(2) "Asbestos-containing material (ACM)" means any material containing more than 1% asbestos.

(3) "Asbestos inspector" means any person who inspects a facility for the presence of asbestos-containing material.

(4) "Asbestos management planner" means any person who develops plans for the management of asbestos-containing material.

(5) "Asbestos project" has the meaning given in 75-2-502(3), MCA. "Pipe," as the term is used in this definition and 75-2-502(3), MCA, includes any coating or wrap made of regulated asbestos-containing material that partially or wholly covers the inner or outer surface of the pipe.

(6) "Asbestos project contractor" means any person who contracts to perform an asbestos project for another person.

(7) "Asbestos project contractor/supervisor" means a person who provides supervision and/or direction to asbestos workers engaged in an asbestos project.

(8) "Asbestos project designer" means a person who develops the plans, specifications, and/or designs for an asbestos project.

(9) "Asbestos project worker" means any person other than those listed in (4) and (6) through (8) who is engaged in an asbestos project.

(10) "Asbestos-related occupation" has the meaning given in 75-2-502(4), MCA.

(11) "Category I non-friable ACM" has the meaning given in 40 CFR 61.141.

(12) "Category II non-friable ACM" has the meaning given in 40 CFR 61.141.

(13) "Clean room" means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

(14) "Containment area" means a negative-pressure asbestos project work area and decontamination unit that is configured to isolate asbestos project activities from areas that are to remain uncontaminated.

(15) "Critical barrier" means one or more layers of plastic sealed over all openings into a work area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a work area from migrating to an adjacent area.

(16) "Decontamination area" means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

(17) "Demolition" has the meaning given in 40 CFR 61.141.

(18) "Department", as defined in 75-2-502(5), MCA, means the Department of Environmental Quality, provided for in 2-15-3501, MCA.

(19) "Emergency renovation operation" has the meaning given in 40 CFR 61.141.

(20) "Encapsulation" means the treatment of regulated asbestos-containing material (RACM) with a material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent the release of fibers, as the encapsulant creates a membrane over the surface (bridging encapsulant) or penetrates the material and binds its components together (penetrating encapsulant). This definition does not include the repainting of a previously painted, undamaged, non-friable RACM surface primarily to improve the appearance of the surface.

(21) "Enclosure" has the meaning given in 40 CFR 763.83.

(22) "Equipment room (change room)" means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

(23) "Facility" has the meaning given in 40 CFR 61.141.

(24) "Friable asbestos-containing material" or "friable ACM" means any ACM that when dry may be crumbled, pulverized, or reduced to powder by hand pressure.

(25) "Glove bag" has the meaning given in 40 CFR 61.141.

(26) "Inspection" means an activity undertaken in a facility to determine the presence or location, or to assess the condition, of friable or non-friable RACM or suspected RACM, whether by visual or physical examination, or by collecting samples of the material. This term includes reinspections of friable and/or non-friable known or assumed RACM which has been previously identified. The term does not include the following:

(a) inspections performed by employees or agents of federal, state, or local government solely to determine compliance with applicable statutes or regulations; or

(b) visual inspections performed solely to determine completion of response actions.

(27) "Local education agency" or "LEA" has the meaning given in 40 CFR 763.83.

(28) "Non-friable asbestos-containing material (non-friable ACM)" has the meaning given in 40 CFR 61.141.

(29) "Nonoccupational setting" means an environment in which the occupants are not handling, working with, or exposed to asbestos resulting from an asbestos project.

(30) "Person" has the meaning given in 75-2-502(6), MCA.

(31) "Regulated area" means an area established by an asbestos contractor or building owner to demarcate areas in which an asbestos project is being conducted, and any adjoining area where debris and waste from such asbestos work accumulate.

(32) "Regulated asbestos-containing material (RACM)" has the meaning given in 40 CFR 61.141.

(33) "Renovation" means altering (including modifying and/or remodeling) a facility or any of its components in any way, including the stripping or removal of RACM from a facility component. Operations in which load-supporting structural members are wrecked or taken out are demolitions.

(34) "Repair" means returning damaged RACM to an undamaged condition or to an intact state so as to prevent fiber release.

(35) "Structural member" has the meaning given in 40 CFR 61.141.

(36) "Visible emissions" has the meaning given in 40 CFR 61.141. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06; AMD, 2006 MAR p. 2962, Eff. 12/8/06.)

17.74.353 APPLICABILITY--ASBESTOS PROJECT REQUIREMENTS

(1) All asbestos projects must be performed in accordance with the requirements of the Montana Asbestos Work Practices and Procedures Manual and 40 CFR 61, subpart M, with the following exceptions:

(a) the minimum quantities of regulated asbestos-containing material (RACM) specified in 40 CFR 61.145(a)(1)(i) and (ii) and (4)(i) and (ii) do not apply; and

(b) for purposes of 40 CFR 61.145(a)(1) and (4), the minimum quantities of RACM provided in 75-2-502(3), MCA, shall apply.

(2) For purposes of this subchapter, inspections required by 40 CFR 61.145(a) must be conducted by a Montana-accredited asbestos inspector. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.354 INSPECTION OF DEMOLITION AND RENOVATION ACTIVITIES

(1) Prior to any demolition or renovation of a facility, the owner or operator shall have the facility inspected for the presence of asbestos by a Montana-accredited asbestos inspector.

(2) An inspection required under this rule must be conducted in conformance with the Montana Asbestos Work Practices and Procedures Manual. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.355 ASBESTOS PROJECT PERMITS (1) Pursuant to 75-2-511, MCA, a person may not conduct an asbestos project without a permit issued by the department, or violate the conditions of the permit.

(2) The owner, or the asbestos project contractor, of the facility where an asbestos project is to be conducted shall submit to the department, on a form provided by the department, an application for a project permit that contains the following:

(a) a completed original Montana Asbestos Project Permit Application and NESHAP Demolition/Renovation Notification form;

(b) a description of the facility, the asbestos project to be performed, and the dates during which the asbestos project will be performed;

(c) a signed statement by the owner or the asbestos project contractor/supervisor that all work performed under authorization of the requested permit will be performed in accordance with this subchapter;

(d) a list of the asbestos project workers and contractor/supervisors who will be performing functions on the project, including their Montana accreditation identification numbers and accreditation expiration dates;

(e) the permit fee required under ARM 17.74.401;

(f) a project design prepared by an asbestos project designer. At a minimum, the asbestos project design must contain the following information:

- (i) a description of the physical work area, including a drawing (not necessarily to scale), indicating the location of exhaust ventilation machines, decontamination enclosures and waste load-out area;
- (ii) a description of the amount of RACM to be removed, encapsulated, enclosed, repaired, transported, or disposed;
- (iii) a description of how the project will shut down and lock out electric power and heating, ventilation, and air conditioning systems;
- (iv) a description of precleaning and removal of objects from the work area;
- (v) a schedule for sealing off all openings with critical barriers including, but not limited to, corridors, doorways, skylights, ducts, grills, diffusers, and other penetrations of the work area;
- (vi) a description of containment barriers including airlocks, fire and emergency exits, and labeling procedures to be used on barriers;
- (vii) a description of the worker decontamination enclosure system to be used;
- (viii) a description of exhaust ventilation systems to be used;
- (ix) a description of alternate methods of containment to be used, such as glove bags, removal of the entire asbestos covered pipe or structure, and construction of mini-enclosures, which, if used, must comply with the Montana Asbestos Work Practices and Procedures Manual.
- (x) a description of personal protective equipment and clothing to be worn by asbestos project workers;
- (xi) a description of work practices to be followed by asbestos project workers;
- (xii) a description of methods to be used to remove, encapsulate, repair, or enclose RACM;
- (xiii) a description of wetting agents, encapsulants, and sealants to be used;
- (xiv) a description of the air monitoring plan and the identity of the individual conducting the air monitoring; and
- (xv) a description of the procedures to be used for transportation and disposal of RACM.

(3) If an application is deficient or incomplete, the department shall notify the applicant of the information necessary to complete the application. If the department has not received the information within its established time frame, the application will be considered withdrawn.

(4) If the dates during which an asbestos project is to be conducted change, the asbestos project contractor/supervisor or the owner of the facility shall notify the department of the change at least 24 hours prior to:

- (a) implementation of the new scheduled date; or
- (b) the original scheduled date, whichever comes first.

(5) Within 72 hours after any initial verbal notice to the department of a change in the dates during which an asbestos project is to be performed, the permittee shall submit to the department a signed, original written notice of the newly-scheduled dates, using an application form provided by the department. If the new dates are substantially different from those specified in the permit, the department may require the permittee to apply for an amendment to the permit. (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.356 ASBESTOS PROJECT CONTROL MEASURES (1) An asbestos project contractor/supervisor shall be physically present at all times at the work site when regulated work is being conducted on an asbestos project. The asbestos project contractor/supervisor shall be accessible to all asbestos project workers.

(2) Asbestos projects, including any on-site air monitoring, must comply with the requirements of the Montana Asbestos Work Practices and Procedures Manual.

(3) Upon written request, the department may approve alternate control measures that are equivalent to those required under this rule. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06; AMD, 2006 MAR p. 2962, Eff. 12/8/06.)

17.74.357 CLEARING ASBESTOS PROJECTS (1) At the conclusion of any asbestos project conducted in a facility, the owner of the facility or the owner's designee shall sample and analyze the air to ensure that the indoor concentration of airborne fibers in a nonoccupational setting for each of five samples is less than or equal to 0.01 fibers per cubic centimeter of air or 70 structures per square millimeter of filter. Clearance sampling is not required if an asbestos project in a facility has occurred immediately prior to demolition of the entire facility, and the facility is not reoccupied prior to demolition. The five air samples must be taken in accordance with the Montana Asbestos Work Practices and Procedures Manual.

(2) The department may approve alternate work practices. (History: 75-2-503, MCA; IMP, 75-2-503, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06; AMD, 2006 MAR p. 2962, Eff. 12/8/06.)

17.74.358 EMERGENCY RENOVATION OPERATION PERMITS

(1) For an emergency renovation operation, as defined in 40 CFR 61.141, the asbestos project contractor or owner of the facility shall immediately notify the department by telephone or in person and submit to the department, on a form provided by the department, a completed application for an asbestos project permit pursuant to ARM 17.74.355 within five working days after the initial notice.

(2) An application for an emergency renovation operation permit must include a description of the emergency renovation operation and must demonstrate that an emergency, as defined in 40 CFR 61.141, existed that prevented the asbestos project contractor or owner of the facility from applying for a permit prior to initiation of the project. (History: 75-2-503, MCA; IMP, 75-2-503, 75-2-511, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.359 ANNUAL ASBESTOS PROJECT PERMITS (1) An annual asbestos project permit authorizes a facility to conduct asbestos projects within the confines of the facility's controlled area during the period for which the permit is in force.

(2) The owner or operator of a facility may apply to the department for an annual asbestos project permit if the facility:

- (a) continuously employs asbestos project workers; or
- (b) continuously contracts with outside contractors to perform asbestos projects for the facility; and

(c) maintains an asbestos health and safety program that incorporates standard operating procedures for employees involved in asbestos projects in accordance with the Montana Asbestos Work Practices and Procedures Manual.

(3) An owner or operator conducting asbestos projects under an annual permit shall comply with all requirements pertaining to asbestos project notification.

(4) The owner or operator of a facility applying for an annual asbestos project permit shall submit to the department:

- (a) the fee required under ARM 17.74.401;
- (b) a copy of the facility's written health and safety program on asbestos; and
- (c) a completed application on a form provided by the department, including:
 - (i) a description of the structure and the asbestos work to be performed;
 - (ii) the name(s) and address(es) of any outside contractor or contractors who will be performing asbestos projects at the facility under the permit;
 - (iii) a signed statement that all work performed under the permit will be performed in accordance with this subchapter;
 - (iv) a signed statement that all work will be performed by persons accredited by the department; and
 - (v) a signed statement that removed RACM will be disposed of at an approved asbestos disposal facility and the name and location of the disposal facility.

(5) A facility owner or operator may apply annually for renewal of an annual permit.

(a) An application for renewal need address in detail only the portions of the permit application that require revision, updating, supplementation, or deletion, and may reference any required information that has been previously submitted.

(History: 75-2-503, MCA; IMP, 75-2-503, 75-2-504, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.360 RECORDKEEPING (1) Records of asbestos projects that are being, or have been, conducted must be retained for at least 30 years and made available to the department upon request.

(2) Records must be retained and made available to the department by:

(a) the asbestos project contractor/supervisor for the project; or

(b) the owner of the facility in which the project is being or has been conducted if the owner is accredited by the department and is conducting the project without a contractor/supervisor.

(3) Records of asbestos projects must include, but are not limited to, the following:

(a) the name, address, and accreditation identification number of the person who supervised each asbestos project, and of each person who worked on the project;

(b) the location and description of each project and the amount of RACM that was enclosed, removed, repaired, encapsulated, or placed in new construction;

(c) the starting and completion dates of each instance of enclosure, removal, repair, encapsulation, or placement in new construction;

(d) the name and address of each facility where waste RACM was deposited for disposal. Holders of annual permits are not required to maintain records designating where wastes from specific asbestos projects are deposited, but holders of annual permits shall maintain records of each shipment of RACM;

(e) a receipt from each disposal facility indicating the amount of RACM deposited at the site and the date of the deposit; and

(f) the transportation manifest records indicating the amount of RACM transported to each approved asbestos disposal facility and the name and location of each facility. (History: 75-2-503, MCA; IMP, 75-2-513, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.361 DEPARTMENT INSPECTIONS (1) The owner of the facility where an asbestos project is being or was conducted, or a person conducting or in charge of an asbestos project shall:

(a) afford the department, at all reasonable times, the opportunity to inspect the project site;

(b) upon request, make records maintained pursuant to this subchapter available to the department for inspection and copying;

(c) allow department inspectors to consult privately with asbestos project workers concerning occupational exposure to asbestos and other matters related to the applicable provisions of this subchapter, to the extent necessary for an effective and thorough inspection; and

(d) maintain proof of accreditation and photo identification of all persons involved in the asbestos project. These documents must be available at the project site for the duration of the project and must be made available to the department upon request. (History: 75-2-503, MCA; IMP, 75-2-518, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.362 ACCREDITATION REQUIREMENTS FOR ASBESTOS-RELATED OCCUPATIONS (1) Pursuant to 75-2-511, MCA, a person may not:

(a) engage in an asbestos-related occupation unless accredited in that occupation by the department; or

(b) contract with or employ in an asbestos-related occupation a person not accredited in that occupation by the department.

(2) A person seeking initial accreditation in an asbestos-related occupation shall:

(a) successfully complete either a training course approved by the department pursuant to this subchapter, or a course approved by the U.S. Environmental Protection Agency and shall pass an examination approved by the department; and

(b) submit to the department a completed application form provided by the department, with the fee required in ARM 17.74.402 and a copy of a certificate of satisfactory completion from the course approved for that occupation.

(3) The department may deny, suspend, or revoke accreditation of a person pursuant to 75-2-515, MCA. (History: 75-2-503, MCA; IMP, 75-2-511, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.363 RENEWAL OF ACCREDITATION (1) A person may not engage in an asbestos-related occupation after the expiration of accreditation until accreditation is renewed.

(2) Accreditation for each asbestos-related occupation may be renewed annually on or before the expiration date of accreditation by submitting to the department a completed application form provided by the department, a certificate of satisfactory completion of a department approved refresher course, and the appropriate fee.

(3) An applicant for renewal of accreditation in an asbestos-related occupation, except asbestos project inspector and management planner, shall attend a one-day refresher course approved by the department or EPA for that specific occupation.

(4) For renewal of accreditation as an asbestos project inspector, a person shall attend a half-day refresher course approved by the department or EPA.

(5) Asbestos project management planners shall attend the half-day asbestos inspector refresher course plus an additional half-day refresher course on asbestos project management planning approved by the department or EPA.

(6) If a person does not apply for renewal of accreditation within one year following the expiration of accreditation, the person must obtain accreditation under ARM 17.74.362 to engage in an asbestos-related occupation.

(7) An applicant for renewal of accreditation as instructor shall attend a refresher course:

(a) taught by another instructor; or

(b) taught by the instructor with three or more students. (History: 75-2-503, MCA; IMP, 75-2-511, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.364 TRAINING PROVIDER REQUIREMENTS (1) Pursuant to 75-2-511, MCA, a person may not offer a training course in Montana for accreditation of persons in any asbestos-related occupation unless the department has approved the course.

(2) The department shall approve a training course if it meets the requirements listed in ARM 17.74.365.

(3) For department approval of a training course, instructors' qualifications must include:

(a) significant academic and/or field experience in asbestos control; and

(b) current accreditation in the course(s) they teach.

(i) A training provider who is accredited as a contractor/supervisor may teach the asbestos project worker course without current accreditation as an asbestos project worker.

(4) Except for the asbestos project worker course and the refresher courses, at least two approved instructors shall conduct all training courses.

(5) All training course materials and examinations must be submitted to the department for approval. A person may apply for approval of a training course by submitting all of the following to the department at least 45 calendar days prior to the proposed date of course presentation:

(a) a completed written application on a form provided by the department;

(b) a curriculum that includes the course topics specified in this subchapter;

(c) a copy of the course examination and all course materials (written and visual);

(d) a copy of the certification of satisfactory completion to be used for certification at the end of the course;

(e) a list of the instructors who will teach the course and documentation of the instructors' qualifications, which must include significant academic and/or field experience in asbestos control;

(f) a description of hands-on training to be provided in the course;

(g) a course schedule indicating the time allotted and the instructor for each subject;

(h) the appropriate fee for approval of the course, specified in ARM 17.74.403; and

(i) documentation of EPA course approval if the course has been approved by EPA pursuant to 15 USC 2643.

(6) At least ten working days before a course commences, the person providing the training course shall notify the department of the date, time, and location of the course.

(7) The department must be notified in advance of any proposed changes in the content of training courses, examinations, or instructors. The department shall approve or deny any proposed changes in training course or examination contents or change in instructor(s) prior to approving the course or examination.

(8) The department may audit an approved training course and examination and may audit a training course following any change in the course.

(9) Following an audit conducted under this rule, the course provider shall pay the audit fee specified in ARM 17.74.404.

(10) Department personnel may audit any training course offered for accreditation in an asbestos-related occupation without paying tuition or the cost of materials. (History: 75-2-503, MCA; IMP, 75-2-511, MCA; NEW, 2006 MAR p. 1876, Eff. 6/23/06.)

17.74.365 TRAINING COURSE REQUIREMENTS (1) A training course for accreditation as an asbestos project worker must meet the requirements of 40 CFR 763, subpart E, Appendix C, section B.1, Workers.

(2) A training course for accreditation as an asbestos project contractor/supervisor must meet the requirements of 40 CFR 763, subpart E, Appendix C, section B.2, Contractor/Supervisor.

(3) A training course for accreditation as an asbestos project inspector must meet the requirements of 40 CFR 763, subpart E, Appendix C, section B.3, Inspector.

(4) A training course for accreditation as an asbestos project management planner must meet the requirements of 40 CFR 763, subpart E, Appendix C, section B.4, Management Planner.

(5) A training course for accreditation as an asbestos project designer must meet the requirements of 40 CFR 763, subpart E, Appendix C, section B.5, Project Designer.

(6) For purposes of this rule, the phrase "public and commercial building" has the meaning given in the definition of "facility" at ARM 17.74.352(23). (History: 75-2-503, MCA; IMP, 75-2-511, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.366 TRAINING COURSE EXAMINATIONS (1) The following requirements apply to asbestos-related occupation accreditation training course examinations:

(a) for asbestos project worker, asbestos inspector, and asbestos project management planner training courses, the examination must include 50 multiple choice questions with a passing score of at least 70%; and

(b) for asbestos project contractor/supervisor and asbestos project designer courses, the examination must include 100 multiple choice questions with a passing score of at least 70%.

(2) All examinations must be closed book. (History: 75-2-503, MCA; IMP, 75-2-511, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.367 REFRESHER COURSES (1) A person may not offer a refresher course for renewal of accreditation under ARM 17.74.363 unless the department has approved the course.

(2) Refresher courses must relate to a particular asbestos-related occupation and must include review of changes in federal and state regulations, developments in state-of-the-art procedures, and key aspects of the initial training course.

(3) For department approval of a refresher course, a person shall submit to the department, on a form provided by the department, a completed application and the fee specified in ARM 17.74.403. The application must include:

- (a) a description of the subject matter to be taught in the refresher course;
- (b) the materials to be used;
- (c) a description and example of the numbered certificates to be issued to students who successfully complete the course;
- (d) the names of the instructors who will teach the course; and
- (e) a description of the instructors' qualifications, which must include academic and/or field experience in asbestos control. (History: 75-2-503, MCA; IMP, 75-2-511, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

17.74.368 TRAINING COURSE AND REFRESHER COURSE
CERTIFICATE AND RECORDKEEPING REQUIREMENTS (1) A person providing a training course for accreditation in an asbestos-related occupation shall provide a certificate to all persons who successfully complete the course and the examination. The certificate must be numbered and include:

- (a) the asbestos-related occupation course completed;
- (b) the course participant's name and address;
- (c) the date of the examination;
- (d) the signature of at least one course instructor;
- (e) the inclusive dates of the course;
- (f) the name, address, and telephone number of the training provider who issued the certificate;
- (g) the name and address of the agency that approved the course;
- (h) a statement that the person receiving the certificate has completed the training required for accreditation under this subchapter;
- (i) a statement that the trainee, by name, has successfully passed the examination for the course; and
- (j) an accreditation expiration date of one year after the date upon which the person successfully completed the course and examination.

(2) A person providing a training course for accreditation or a refresher course for renewal of accreditation in an asbestos-related occupation shall retain:

- (a) copies of all training course materials used, including student manuals, instructor notebooks, and handouts;
- (b) copies of all documents relating to that training course or refresher course issued to that person by the department;
- (c) records that identify the instructors;

- (d) records of the examinations, including:
 - (i) the date of the examination;
 - (ii) the name of the training course;
 - (iii) the name of the person who proctored the examination;
 - (iv) the name of each person taking the examination;
 - (v) each trainee's examination score; and
 - (vi) a copy of the examination; and
 - (e) records of all persons who have been awarded certificates, including:
 - (i) their names and certificate numbers;
 - (ii) their certified asbestos-related occupations;
 - (iii) the dates of their training;
 - (iv) the expiration dates of accreditation; and
 - (v) the training location.
- (3) A training course provider shall maintain all records required under this rule for at least three years.
- (4) A training course provider shall provide EPA and the department with reasonable access to all training records upon request. (History: 75-2-503, MCA; IMP, 75-2-511, MCA; NEW, 2006 MAR p. 1574, Eff. 6/23/06.)

APPENDIX D

Inspection Checklist Sheet

ASBESTOS INSPECTION CHECKLIST

Project Name: _____ **Project Number:** _____

Technician: _____ **Date:** _____

Planning Phase	
Contact site contact informing them of your arrival time.	
Contact Name:	
Contact Number:	
Review existing inspections and drawings of facility.	
Key Location:	
Inspection Phase	
Conduct on-site informational meeting and discuss sampling protocol/ Fill Out JSA	
Perform initial walk through of building.	
Identify different phases of construction.	
Locate mechanical areas	
Walk exterior of building.	
Complete Field Drawing	
Fill out building information sheet.	
Fill out homogeneous area summary sheet.	
Review homogeneous area list generated and develop sampling strategy.	
Collect samples and fill out chain-of-custody.	
Note sample location on drawings.	
Patch sample holes and clean surrounding area of sample debris.	
Photograph homogeneous areas using identifier in photo.	
Check out with Facility Staff/ Return Key	
Post Field Work Phase	
Ship Samples – Verify Samples, TAT, and Lab.	
Photo Copy COC.	
Place Field Materials in File Location.	
Download Photos.	
Discuss Project with Project Manager.	

APPENDIX E

Homogeneous Area Summery Sheet



ASBESTOS HOMOGENEOUS SUMMARY

Project Name:	Project Number:
Building:	Date:
Address:	Tetra Tech Inspector(s):
Area:	Checked By:
Project Sample Identifier:	Page 1 of

Friability

F	Friable
NF	Non-Friable

Condition (Cond.)

G	Good
D	Damaged
SD	Significantly Damaged
A	ASSUMED

Damaged Potential

LP	Low Potential for Damage
PD	Potential for Damage
PSD	Potential for Significant Damage

Type

MM	Miscellaneous Material
SM	Surfacing Material
TSI	Thermal System Insulation

[illegible]

APPENDIX F

Building Information Sheet

BUILDING INFORMATION SHEET

Project Name: _____
 Building Name/Number: _____
 Building Address: _____
 City/State: _____
 Site of Contact: _____

Project No.: _____
 Date: _____
 Inspected by: _____
 Site Phone No.: _____

General Building Information	
Original construction date (year)	Number of floors
Renovation or building additions (year)	Number of basement levels
Building size (square feet)	Number of attic or penthouse levels
General Building Exterior Information	General Building Interior Information
Siding material	Wall material
Roof type and material	Floor material
Window Glazing Y N	Ceiling material
Foundation Coating: Y N	Base cove material
	Building insulation
HVAC System Location:	
Heating System ☐ Boiler Units ☐ Other ☐ Forced Air Furnaces Comments:	Fuel Type ☐ Natural Gas ☐ Oil ☐ Electric ☐ Other ☐ Steam Comments:
Mechanical Piping Route ☐ Above Ceilings ☐ Crawl Spaces ☐ Pipe Tunnels ☐ Floor Slab ☐ Wall Chases/ Pipe Chases ☐ Other Comments:	

Comments: _____

APPENDIX G

Suspect ACBM Room by Room Sheet

SUSPECT ACBM ROOM SUMMARY

Project Name: _____
 Building: _____
 Building Address: _____
 Building Floor/Area: _____

Date: _____
 Project No.: _____
 Sheet: _____ of _____
 Inspected by: _____

	HA Number	Asbestos Present (Yes or No)	Quantity (SF, LF or EA)	Friable (Yes or No)	AHERA Category (1 thru 7)	Comments
Room No.:	Use:	Room Size:			Ceiling Height:	
Floors						
Walls						
Ceiling						
Base						
TSI						
Miscellaneous						
Room No.:	Use:	Room Size:			Ceiling Height:	
Floors						
Walls						
Ceiling						
Base						
TSI						
Miscellaneous						
Room No.:	Use:	Room Size:			Ceiling Height:	
Floors						
Walls						
Ceiling						
Base						
TSI						
Miscellaneous						

HAZARD RANKING

7
6
5
4
3
2
1

ACBM CONDITION

Significant Damage
 Damaged
 Damaged
 Damaged
 Good
 Good
 Good

ACBM DISTURBANCE POTENTIAL

Any
 Potential for Significant Damage
 Potential for Damage
 Low
 Potential for Significant Damage
 Potential for Damage
 Low

APPENDIX H

Random Number Diagrams

RANDOM NUMBER DIAGRAMS

Name of Facility _____ Project Number _____

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APPENDIX I

Suspect Material List

SUSPECT MATERIALS LIST

TSI

T1	BOILER JACKETING
T2	PIPE JOINT INSULATION
T3	STRAIGHT PIPE INSULATION
T4	HVAC CONNECTOR MATERIAL
T5	TANK INSULATION
T6	BOILER INSULATION
T7	BOILER INSULATION BOILER BREECHING
T8	DUCT INSULATION
T9	PATCHING MATERIAL
T10	FLUE INSULATION/METALBESTOS
T11	DUCT WRAP
T12	VERMICULITE INSULATION
T13	ASBESTOS PAPER/ BOARD

MISCELLANEOUS MATERIALS

M1	ROOF MATERIAL	M16	CERAMIC TILE/ GROUT
M2	ROOF FLASHING	M17	SOFT CONCRETE
M3	WALLBOARD/TAPING/JOINT COMPOUND	M18	CONCRETE
M4	TRANSITE	M19	FIRE HOSE
M5	CEILING PANELS	M20	FELT PAPER/ MOISTURE BARRIER
M6	CEILING TILES	M21	STAGE FIRE CURTAIN
M7	ROOF PENETRATION COMPOUND	M22	CMU BLOCK/ MORTAR
M8	CAULKING	M23	CHALKBOARD
M9	FIRE DOORS	M24	GLASS WINDOW BLOCK GROUT
M10	SINK UNDERCOATING	M25	DUCT SEAM MASTIC
M11	ELECTRICAL WIRE INS	M26	CORKBOARD MASTIC
M12	WALL BASE	M27	KILN BRICK INSULATION
M13	BRICK/ MORTAR	M28	WALL PANELS
M14	PIPE PENETRATION COMPOUND	M29	WINDOW GLAZING
M15	LAB COUNTER TOPS		

SURFACING MATERIAL

S1	PLASTER
S2	STUCCO
S3	WALLBOARD TEXTURE
S4	POPCORN CEILING
S5	FIREPROOFING
S6	WALL COATING

FLOOR COVERING

F1	SHEET VINYL
F2	12" X 12" TILE
F3	9" X 9" TILE
F4	FLOORING FELT
F5	STAIR TREAD COVERING
F6	MASTICS AND ADHESIVES

HAZARD RANKING

HAZARD RANKING

7
6
5
4
3
2
1

ACBM CONDITION

SIGNIFICANT DAMAGE
DAMAGED
DAMAGED
DAMAGED
GOOD
GOOD
GOOD

ACBM DISTURBANCE POTENTIAL

ANY
POTENTIAL FOR SIGNIFICANT DAMAGE
POTENTIAL FOR DAMAGE
LOW
POTENTIAL FOR SIGNIFICANT DAMAGE
POTENTIAL FOR DAMAGE
LOW

APPENDIX J

Chain-of-Custody Sheet



COC # 1

Date: _____

CHAIN OF CUSTODY BULK ASBESTOS SAMPLE LOG

Client _____

Contact Name _____

Project or Site Name _____

Contact Email _____

Project Number _____

☐ PLM EPA 600/R-93/116 ☐ TEM Bulk

Sampler Name (Print) _____

☐
Positive Stop

Sampler Signature _____

Turnaround Time
10 Day 5 Day 3 Day 2 Day 1 Day 12 Hour 6 Hour

Preliminary Results By: _____

☐ ☐ ☐ ☐ ☐ ☐ ☐

SAMPLE NUMBER		LAB NUMBER	SAMPLE DESCRIPTION AND LOCATION				NOTES
Date	Time	Relinquished by	# Samples	Date	Time	Received by	
Date	Time	Relinquished by	# Samples	Date	Time	Received by	

Sheet _____ of _____



TETRA TECH

Standard Operating Procedures

for

Lead-Based Paint Inspection

Prepared By:

Tetra Tech

7100 Commercial Avenue, Suite 4
Billings, Montana 59101

January 2019

complex world

CLEAR SOLUTIONS™

TABLE OF CONTENTS

1.0	INTRODUCTION	2
2.0	EQUIPMENT	3
3.0	PLANNING AND PREPARATION	4
4.0	INSPECTION	5
4.1	Calibration.....	5
4.2	Procedures	5
5.0	BULK PAINT-CHIP SAMPLES	8
5.1	Identification of Samples	8
5.2	Collecting Paint Chip Samples	8
5.3	Sample Handling and Analysis.....	9
5.4	Quality Assurance.....	10
6.0	DOCUMENTATION.....	11
6.1	Field Notes.....	11
6.2	Photographs	12
6.3	Figures.....	12
6.4	Final Report	12
7.0	REFERENCES.....	13

LIST OF APPENDICES

- Appendix A: HUD Guidelines Chapter 7: Lead-Based Paint Inspection and EPA Title X
Appendix B: Inspection Checklist Sheet
Appendix C: Building Information Sheet
Appendix D: Chain-of-Custody Sheet

1.0 INTRODUCTION

In order to insure that each U.S. Environmental Protection Agency (EPA) and/or State certified lead-based paint (LBP) inspector working for Tetra Tech is conducting the inspection of LBP using current standards under the EPA, current guidelines under U.S. Department of Housing and Urban Development (HUD) and/or State regulations, this Standard Operating Procedure (SOP) for LBP inspection has been developed. This SOP is intended as a guide for new inspectors as well a reminder for experienced inspectors. Anyone performing LBP inspections must have successfully completed an EPA and/or State LBP Inspector Course if required.

Please take time to read through this SOP to be sure that you are conducting inspections for lead-based paint according to HUD Guidelines and/or State regulations. Chapter 7 of the HUD Guidelines, Lead-Based Paint Inspection, and Title X of the 1992 EPA Housing and Community Development Act are included in Appendix A. State regulations are not included in this SOP, as each State regulation may vary from State to State. Each inspector should have received a copy of the above referenced regulations in their inspector course, which were provided during the Initial LBP Inspector training course they attended.

2.0 EQUIPMENT

- X-Ray Florescence Spectrum Analyzer (XRF)
- Ladder to access areas.
- Flashlight to aid in visibility.
- Air tight sampling containers (film canisters, centrifuge tubes, zip lock baggies).
- Spray mister bottle with water to spray the area to be sampled.
- Plastic drop cloth to spread beneath the area to be sampled.
- Heat gun, scraper or other tool appropriate for extracting samples.
- Cloth (pre-moistened) for cleaning up debris and tools.
- Vacuum cleaner equipped with high efficiency particulate air (HEPA) filters.
- Indelible ink pen for field forms and labeling sample containers.
- Camera for photographic documentation.
- Disposable protective clothing, gloves and bootees.
- Personal respirator, either a negative pressure full or half mask with HEPA (P100) cartridges.
- Safety Equipment required for the particular site (safety glasses, hearing protection, hard hat, steel-toed boots, etc.).
- Radiation Dosimeter Badge
- Laptop for downloading XRF readings

3.0 PLANNING AND PREPARATION

Prior to commencing building inspection activities, the following tasks should be performed.

- Contact management of the facility to inform them as to what will take place during the inspection.
- Determine the hours of operation for the facility.
- Develop a project schedule agreeable to the management of the facility including arrival time at the site and time of initial meeting with site personnel.
- Review existing as-built drawings, if available to become familiar with the facility as to the mechanical system layout, and materials used in construction. Develop drawings from as-built drawings, if provided by the management of the facility, for use in the inspection.
- Review any previous LBP inspections that may have been conducted in the past.
- Collect all materials necessary for the inspection.
- Insure that all the XRF components are in its case. Equipment in the case should include: XRF with battery, spare battery, battery charger, charger cords, XRF-Computer interface cable, lead calibration pages, leak test documentation, and XRF source documentation.
- Insure that both batteries are fully charged. Note that batteries will slowly lose a charge from sitting in the case and should be recharged before going into the field.
- Obtain the XRF Performance Characteristic Sheet for the instrument to be used for the inspection. Review the XRF Performance Characteristic Sheet to determine the inconclusive range for the XRF.
- Follow all Tetra Tech radiation safety procedures when handling or using the XRF, as it is a potential source of radiation. Radiation dosimeter badges are assigned to personnel who routinely use the XRF instruments.

4.0 INSPECTION

Inspection should be performed using the currently recognized standard protocol developed under HUD. General guidelines for conducting the inspection are as follows:

4.1 Calibration

Take at least three calibration check readings prior to the commencement of the lead-based paint inspection. These calibration check readings should be repeated every four hours, every time the XRF is turned on, or at the conclusion of the sampling job, whichever is more frequent.

4.1.1 The XRF calibration check readings are taken on the red 1.02 mg/cm² Standard Reference Material (SRM) paint film, developed by the National Institute of Standards and Technology (NIST).

4.1.1.1 The red NIST SRM film is to be placed on top of a 12-inch piece of styrofoam or some other lead-free material as recommended by the manufacturer before taking readings.

4.1.2 Each time calibration check readings are made, three nominal-time readings should be taken on the red NIST (1.02 mg/cm²) SRM film and the results recorded. The average of the three calibration check readings should be computed and also recorded.

4.1.3 Large differences of calibration check reading averages from 1.02 mg/cm² may alert the lead-based paint inspector to problems in the instrument's performance. The calibration check reading averages should not differ from 1.02 mg/cm² by more than the calibration check tolerance specified in the XRF Performance Characteristics Sheet for the specific instrument used.

4.1.4 If the observed calibration check average minus 1.02 is greater than the calibration check tolerance, the instructions provided by the manufacturer should be followed in order to bring the instrument back into control before any more XRF testing is done. All readings taken by the suspended instrument since the last successful calibration check test should be repeated. If a backup XRF instrument is used as a replacement, the backup instrument must successfully pass the initial calibration check test before retesting the affected test locations.

4.2 Procedures

4.2.1 Obtain a drawing of the building and exterior areas if available; otherwise develop a field sketch of the project site for use as a reference.

4.2.2 Perform a walk-through of the building with building personnel to familiarize yourself with the layout of the building.

4.2.3 Determine the testing combinations in each room equivalent or on each exterior building component. An inventory of the painted surfaces in interior rooms, on exterior walls, and on surfaces in other exterior areas should be conducted. An inventory of the building should be completed prior to any XRF testing. It may be also done on a room-by-room basis during testing.

4.2.3.1 A room equivalent is an identifiable part of a building, such as a room, a building exterior side, or an exterior area.

- 4.2.3.2 Each room equivalent is made up of components. Components can be located inside or outside the structure. All components that are coated with paint, varnish, shellac, stain, or other coating should also be tested. Some components may be grouped if painting histories are identical as described below.
- 4.2.4 Take at least one XRF Reading on each testing combination.
- 4.2.5 Using the XRF Performance Characteristic Sheet, determine whether or not a substrate correction is necessary for that testing combination.
 - 4.2.5.1 The substrate is the material underneath the paint. Substrates are generally classified into one of six substrate types: brick, concrete, drywall, metal, plaster, and wood. These substrate types are intended to include a broad range of materials. For example, the concrete substrate type includes poured concrete, precast concrete, and concrete block. If the true substrate is not one of the six types, the substrate type that most closely matches the true substrate should be selected. For substrates on top of substrates, such as plaster over concrete, the substrate directly beneath the painted surface should be used.
 - 4.2.5.2 XRF results are corrected for substrate bias by subtracting a correction value determined separately in each test location for each type of substrate. The correction value is an average of XRF readings taken from test locations that have been scraped clean of their paint covering. A criterion for selecting these test locations is that their initial XRF results are less than 2.5 mg/cm². If test locations with XRF results equal to or greater than 2.5 mg/cm² were selected, the outcome might "overcorrect" XRF results. Therefore, only test locations with initial XRF results less than 2.5 mg/cm² should be chosen. If all initial readings on a substrate type are above 2.5 mg/cm², the locations with the lowest initial reading should be chosen. This will help ensure that XRF readings taken from non-representative portions of substrates and other underlying materials, such as hidden nails and pipes, are not used to compute the substrate correction. It is important to note that some XRF results may not need to be corrected for substrate bias depending on the specific instruments used and the specifications in the XRF Performance Characteristics Sheet.
 - 4.2.5.3 Using the same XRF instrument, take a reading on the first bare substrate area. Record the substrate and XRF readings. Repeat this procedure for each bare substrate area and record the readings on the same form. A variant to this step is to first cover the bare area with an NIST SRM film prior to taking the readings. The need for this variation will be specified in the XRF Performance Characteristics Sheet for affected XRF instruments and instructions will be provided explaining how to compute the correction value when this variation is used.
 - 4.2.5.4 Compute the correction value for each necessary substrate type in the house by computing the average of all readings.
- 4.2.6 Classify the XRF results as negative, positive, or inconclusive.
- 4.2.7 For inconclusive readings, collect a bulk sample of the inconclusive paint for laboratory analysis. If sampling is not desired, inconclusive readings must be assumed positive.
- 4.2.8 Record the locations, component, substrate, and color of materials found to be positive for lead or assumed to be positive for lead.

- 4.2.8.1 Location of the material should include room and side of the room.
- 4.2.8.2 Component should be the component being tested. Examples of components are listed in section 4.2.2.2.
- 4.2.8.3 Substrate should be one of the six substrate types explained in section 4.2.6.1.
- 4.2.8.4 For practical purposes, paint is almost always differentiated by color. Since more than one color may be observed when paint is peeling or the substrate is damaged, both "white" and "blue over green" would be acceptable color entries.

5.0 BULK PAINT-CHIP SAMPLES

For XRF results that fall into the inconclusive range and for areas that cannot be tested using XRF instruments, a bulk paint-chip sample should be removed and sent to a laboratory for lead determination. Results should be reported in mg/cm², the primary unit of measure. Results should only be reported as percent by weight if the dimensions of the surface area cannot be accurately measured or if all paint within the sampled area cannot be appropriately removed. In these cases, results should not be reported in mg/cm², but in µg/g or weight percent.

5.1 Identification of Samples

Assign a unique sample ID number to each bulk paint sample collected. This ID number will be on the sampling container when it goes to the certified laboratory for analysis. Record the ID number and the sample location on the sample area diagrams, the room by room summary sheet, and the chain-of-custody form. This must be done carefully so that there is no uncertainty about the location and identity of each sample collected. Make sure that no two samples have the same ID number.

5.2 Collecting Paint Chip Samples

Personal protective equipment should be utilized. Since inhalation of lead during hundreds of LBP inspections and sampling projects may pose a serious health hazard, the use of personal protective equipment by inspectors is crucial during the sampling process. As a level of protection, inspectors should wear a respirator, either a negative pressure full or half mask with HEPA cartridges. Disposable clothing should be worn during sampling if the sampling operation is likely to dislodge pieces of suspect material or if the environment is extremely dusty. Inspectors should have plastic bags, tape, and labels with them to handle the disposal of cartridges, protective clothing, wet cloths, and debris. These waste materials should be stored pending survey results.

5.2.1 If it is necessary to remove a paint-chip sample for laboratory analysis, only one paint-chip sample is needed for each testing combination. The paint-chip sample location should be representative of the paint on the entire testing combination. If the testing combination is replicated, one representative paint-chip sample should be taken from one randomly selected replicate.

- If possible, collect samples after hours or when the building is not in use.
- Spread the plastic drop cloth and set up other equipment.
- Put on protective equipment.
- Mark the location of the sample on the sampling diagram and record the sample identification number on the plan diagram as well.
- Collect a 4-square inch portion of material to ensure that the laboratory has a sufficient sample to conduct the analysis and that it is representative of the testing combination being sampled.
- Place sample in a container and tightly seal it.

- Label containers with its ID, sample location, and type of material sampled on a sample data form. Always place the label on the container itself. If using ridged containers always place the ID on the container, not on the lid, as lids can be inadvertently switched by a laboratory when handling numerous sample containers.
- Wipe the exterior of the container with a wet wipe to remove any material which may have adhered to it during sampling.
- Clean your tools with wet wipes and wet mop or vacuum area with a HEPA vacuum to clean all debris.
- Repeat the above steps at each sample location. Place sample containers in plastic bags.
- Discard protective clothing, wet wipes and rags, filter cartridges, and drop cloth in a labeled plastic bag.
- Paint-chip collection should include, as a priority, collection of all the paint layers from the substrate, while minimizing any collection of actual substrate.
- If substantial substrate material is included, results should definitely be reported in mg/cm² to avoid a downward bias in results.

5.3 Sample Handling and Analysis

To preserve the quality and integrity of samples from the time of collection until the time of analysis, sample preparation, preservation, storage, and shipment procedures have been established. Procedures and methods for accomplishing these tasks are described below.

- After placing a sample in a container according to the procedures outlined earlier, enter the ID number on the Chain-of-Custody Sheet. A sample Chain-of-Custody Sheet is located in Appendix D.
- Upon receipt of samples from the inspector, the laboratory should check and sign the Chain-of-Custody Sheet(s), copy same and return original(s) to the inspector. It is important that this or a similar arrangement for sample accountability be agreed upon by the laboratory prior to sending samples for analysis.
- Each individual or laboratory engaged in lead identification shall participate in the Proficiency Analytical Testing Program or equivalent.

5.4 Quality Assurance

Quality assurance / quality control samples will be collected during the investigation. Duplicate samples will be collected at a rate of 1 duplicate per 100 field samples. Duplicate samples will be packaged, and sealed in the same manner described for the filed bulk samples (above). A separate sample number will be assigned to each duplicate, and it will be submitted blind to the laboratory.

After inspection is completed perform a field quality assurance program as indicated by the following tasks.

- Review all inspection forms for completeness.
- Walk through building a final time to verify that you have identified all the suspect homogeneous areas.
- Review Chain-of-Custody document for completeness and verify the number of samples and sample numbers for the suspect materials collected during the inspection.

6.0 DOCUMENTATION

6.1 Field Notes

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be completed and accurate enough to permit reconstruction of field activities. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual(s) making the entries. Language will be factual, objective, and free of personal opinions. At a minimum, the following information will be recorded, if applicable, during the collection of each sample.

- Inspector's name(s)
- Date and time of inspection
- Type of component
- Location of component
- Field observations and details related to condition and/ or status of component

In addition to inspection information, the following specifics may also be recorded in the field logbook for each day of inspection:

- Team members and their responsibilities
- Time of arrival on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with any potentially responsible parties, or
- Representatives of any federal, state, or other regulatory agency
- Deviations from inspection plans or site safety plan procedures
- Changes in personnel and responsibilities, as well as reasons for the change
- Levels of safety protection
- Record of photographs

6.2 Photographs

Photographs will be taken at representative inspection locations. They will verify information entered in the field logbook. When a photograph is taken, the following information will be written on the logbook or will be recorded in the field photography log:

- Date, location
- Description of the subject photographed
- Name of person taking the photograph

6.3 Figures

If present, LBP-containing components will be identified on field drawings completed at the time of inspection. Following the conclusion of inspection services, field drawings will be utilized to derive Computer Aided Design (CAD) figures that depict the location of identified components.

6.4 Final Report

A final report will be provided documenting the findings of the inspection services. The report will be utilized to generate designs/ specifications on an as needed basis.

7.0 REFERENCES

Code of Federal Regulations (CFR), Title 40, Part 745, Lead; Requirements for Lead-Based Paint Activities in Target Housing and Child Occupied Facilities; Final Rule, August 29, 1996, revised January 5, 2001.

Code of Federal Regulations (CFR), Title 24 Part 35 and Title 40, Part 745, Lead; Requirements for Disclosure of Know Lead-Based Paint and/or Lead-Based Paint Hazards in Housing; Final Rule, March 6, 1996.

Housing and Community Development Act, Residential Lead-Based Paint Hazard Reduction Act, Title X, 1992.

Housing and Urban Development (HUD), *Guidelines for the Control of Lead-Based Paint Hazards in Housing*, June 1995, revised 1997 and 2000.

APPENDIX A

HUD Guidelines – Chapter 7 Title X



U.S. Department of Housing and Urban Development

**Guidelines for the
Evaluation and Control
of Lead-Based Paint
Hazards in Housing**

**Chapter 7:
Lead-Based Paint Inspection**

1997 Revision

Chapter 7: Lead-Based Paint Inspection

Table of Contents

Step-by-Step Summary	iii
I. Introduction	1
A. Purpose	1
B. Qualifications of Inspectors and Laboratories	1
C. Other Sources of Information Required to Use This Protocol	2
D. Paint Testing for Inspections, Risk Assessments and Hazard Screens ...	2
E. Most Common Inspection Method	3
F. XRF Performance Characteristic Sheets and Manufacturer's Instructions	3
G. Inspection by Paint Chip Analysis	3
H. Additional Means of Analyzing Paint	4
II. Summary of XRF Radiation Safety Issues	4
III. Definitions	5
IV. Inspections in Single-Family Housing	8
A. Listing Testing Combinations	9
B. Number and Location of XRF Readings	10
C. XRF Instrument Reading Time	11
D. XRF Calibration Check Readings	12
E. Substrate Correction	13
F. Discarding Readings	15
G. Classification of XRF Results	15
H. Evaluation of the Quality of the Inspection	16
I. Documentation in Single-Family Housing	17
V. Inspections in Multifamily Housing	19
A. Statistical Confidence in Dwelling Unit Sampling	19
B. Selection of Housing Units	23
C. Listing Testing Combinations	24
D. Number of Readings on Each Testing Combination	25
E. XRF Calibration Check Readings	25
F. Substrate Correction in Multifamily Housing	25
G. Classification of XRF Results in Multifamily Housing	25

H.	Evaluation of the Inspection	28
I.	Documentation in Multifamily Housing	28
VI.	Laboratory Testing for Lead in Paint	29
A.	Number of Samples	29
B.	Size of Samples	29
C.	Inclusion of Substrate Material	29
D.	Repair of Sampled Locations	29
E.	Classification of Paint-Chip Sample Results	29
F.	Units of Measure	30
G.	Sample Containers	30
H.	Laboratory Analysis Methods	30
I.	Laboratory Selection	31
J.	Laboratory Report	32
VII.	Radiation Hazards	32
A.	XRF Licenses and Certification	32
B.	Safe Operating Distance	33
VIII.	References	34
Addendum 1	Examples of Inspections	35
A.	Single-Family	35
B.	Multifamily	36
Endnotes		40
Addendum 2	Data Collection Forms	
Addendum 3	XRF Performance Characteristic Sheets	

Step-by-Step Summary

Lead-Based Paint Inspection: How to Do It

Note: This 1997 Revision replaces Chapter 7 of the 1995 *HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*

1. See Chapters 3, 5 and 16 for guidance on when a lead-based paint inspection is appropriate. A lead-based paint inspection will determine:
 - Whether lead-based paint is present in a house, dwelling unit, residential building, or housing development, including common areas and exterior surfaces; and
 - If present, which building components contain lead-based paint.

The U.S. Department of Housing and Urban Development (HUD) and the U.S. Environmental Protection Agency (EPA) define an inspection as a surface-by-surface investigation to determine the presence of lead-based paint (see 40 CFR part 745 and Title X of the 1992 Housing and Community Development Act). The sampling protocols in this chapter fulfill that definition.

2. The client should hire a certified (licensed) lead-based paint inspector or risk assessor (see 40 CFR part 745). Lists of inspectors and laboratories can be obtained by calling 1-888-LEADLIST or through the Internet at www.leadlisting.org. Lists are also available through State agencies (call 1-800-LEAD-FYI for the appropriate local contact). More than half of all States now require a license or certification to perform a lead-based paint inspection. If the State does not yet have a certification law, an inspector or risk assessor certified under another State's law should be used. By the fall of 1999, all lead-based paint inspections must be performed by a certified lead-based paint inspector or risk assessor in accordance with 40 CFR part 745, section 227.
3. The inspector should use the HUD/EPA standard for lead-based paint of 1.0 mg/cm² or 0.5% by weight, as defined by Title X of the 1992 Housing and Community Development Act. If the applicable standard in the jurisdiction is different, the procedures in this chapter will need to be modified. For the purposes of the HUD/EPA lead-based paint disclosure rule, 1.0 milligrams per square centimeter (mg/cm²) or 0.5% by weight are the standards that must be used.
4. Obtain the *XRF Performance Characteristic Sheet* for the X-Ray Fluorescence (XRF) lead paint analyzer to be used in the inspection. It will specify the ranges where XRF results are positive, negative or inconclusive, the calibration check tolerances, and other important information. Contact the National Lead Information Center Clearinghouse (1-800-424-LEAD) to obtain the appropriate *XRF Performance Characteristic Sheet*, or download it from the Internet at www.hud.gov/lea/leahome.html. *XRF Performance Characteristic Sheets* have been developed by HUD and EPA for most commercially available XRFs (see Addendum 3 of this chapter).
5. Report lead paint amounts in mg/cm² because this unit of measurement does not depend on the number of layers of non-lead-based paint and can usually be obtained without damaging the painted surface. All measurements of

lead in paint should be in mg/cm², unless the surface area cannot be measured or if all paint cannot be removed from the measured surface area. In such cases, concentrations may be reported in weight percent (%) or parts per million by weight (ppm).

6. Follow the radiation safety procedures explained in this chapter, and as required by the U.S. Nuclear Regulatory Commission and applicable State and local regulations when using XRF instruments.
7. Take at least three calibration check readings before beginning the inspection. Additional calibration check readings should be made every 4 hours or after inspection work has been completed for the day, or according to the manufacturer's instructions, whichever is most frequent. Calibration checks should always be done before the instrument is turned off and again after it has been warmed up (calibration checks do not need to be done each time an instrument enters an automatic "sleep" state while still powered on).
8. When conducting an inspection in a multifamily housing development or building, obtain a complete list of all housing units, common areas, and exterior site areas. Determine which can be grouped together for inspection purposes based on similarity of construction materials and common painting histories. In each group of similar units, similar common areas, and similar exterior sites, determine the minimum number of each to be inspected from the tables in this chapter. Random selection procedures are explained in this chapter.
9. For each unit, common area, and exterior site to be inspected, identify all testing combinations in each room equivalent. A testing combination is characterized by the room equivalent, the component type, and the substrate. A room equivalent is an identifiable part of a residence (e.g., room, house exterior, foyer, etc.). Painted surfaces include any surface coated with paint, shellac, varnish, stain, paint covered by wallpaper, or any other coating. Wallpaper should be assumed to cover paint unless building records or physical evidence indicates no paint is present.
10. Take at least one individual XRF reading on each testing combination in each room equivalent. For walls, take at least four readings (one reading on each wall) in each room equivalent. A different visible color does not by itself result in a separate testing combination. It is not necessary to take multiple XRF readings on the same spot, as was recommended in the 1990 Interim Guidelines for Public and Indian Housing.
11. Determine whether to correct the XRF readings for substrate interference by consulting the *XRF Performance Characteristic Sheet*. If test results for a given substrate fall within the substrate correction range, take readings on that bare substrate scraped completely clean of paint, as explained in this chapter.
12. Classify XRF results for each testing combination. Readings above the upper limit of the inconclusive range are considered positive, while readings below the lower limit of the inconclusive range are considered negative. Readings within the inconclusive range (including its boundary values) are classified as inconclusive. Some instruments have a threshold value separating ranges of readings considered positive from readings considered negative for a given substrate. Readings at or above the threshold are considered positive, while readings below the threshold are considered negative.
13. In single-family housing inspections, all inconclusive readings must be confirmed in the laboratory, unless the client wishes to assume that all inconclusive results are positive. Such an assumption may reduce the cost of an inspection, but it will probably increase subsequent abatement, interim control, and maintenance costs, because laboratory analysis often shows that testing combinations with inconclusive readings do not in fact contain lead-based paint. Inconclusive readings cannot be assumed to be negative.

14. In multifamily dwelling inspections, XRF readings are aggregated across units and room equivalents by component type. Use the flowchart provided in this chapter (Figure 7.1) to make classifications of all testing combinations or component types in the development as a whole, based on the percentages of positive, negative, and inconclusive readings.
15. If the inspector collected paint-chip samples for analysis, they should be analyzed by a laboratory recognized under the EPA's National Lead Laboratory Accreditation Program (NLLAP). Paint-chip samples are collected when the overall results for a component type are inconclusive. They may be collected by a properly trained and certified inspector, client, or third party, if permitted by State law. Paint-chip samples should contain all layers of paint (not just peeled layers) and must always include the bottom layer. If results will be reported in mg/cm², including a small amount of substrate with the sample will not significantly bias results. Substrate material should not, however, be included in samples reported in weight percent. Paint from 4 square inches (25 square centimeters) should provide a sufficient quantity for laboratory analysis. Smaller surface areas may be used, if the laboratory indicates that a smaller sample is acceptable. In all cases, the surface area sampled must be recorded.
16. The client or client's representative should evaluate the quality of the inspection using the procedures in this chapter.
17. The inspector should write an inspection report indicating if and where lead-based paint is located in the unit or the housing development (or building). The report should include a statement that the presence of lead-based paint must be disclosed to potential new buyers (purchasers) and renters (lessees) prior to obligation under a sales contract or lease, based on Federal law (see 24 CFR part 35, subpart H or 40 CFR part 745, subpart F). The suggested language below may be used. The inspection report should contain detailed information on the following:
 - Who performed the inspection;
 - Date(s);
 - Inspector's certification number;
 - All XRF readings;
 - Classification of all surfaces into positive or negative (but not inconclusive) categories, based on XRF and laboratory analyses;
 - Specific information on the XRF and laboratory methodologies;
 - Housing unit and sampling location identifiers;
 - Results of any laboratory analyses; and
 - Additional information described in Section IV of this chapter.

This chapter also contains language that may be used in an inspection report in the case where no lead-based paint has been identified (see the suggested language below).

Recommended Report Language On Disclosure For Use In Lead-Based Paint Inspections

"A copy of this summary must be provided to new lessees (tenants) and purchasers of this property under Federal law (24 CFR part 35 and 40 CFR part 745) before they become obligated under a lease or sales contract. The complete report must also be provided to new purchasers and it must be made available to new tenants. Landlords (lessors) and sellers are also required to distribute an educational pamphlet approved by the U.S. Environmental Protection Agency and include standard warning language in their leases or sales contracts to ensure that parents have the information they need to protect their children from lead-based paint hazards."

(See Section IV of Chapter 7 of the HUD *Guidelines* for further details)

Recommended Report Language for Inspections Where No Lead-Based Paint Was Identified

"The results of this inspection indicate that no lead in amounts greater than or equal to 1.0 mg/cm² in paint was found on any building components, using the inspection protocol in Chapter 7 of the *HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (1997 Revision)*. Therefore, this dwelling qualifies for the exemption in 24 CFR part 35 and 40 CFR part 745 for target housing being leased that is free of lead-based paint, as defined in the rule. However, some painted surfaces may contain levels of lead below 1.0 mg/cm², which could create lead dust or lead-contaminated soil hazards if the paint is turned into dust by abrasion, scraping, or sanding. This report should be kept by the inspector and should also be kept by the owner and all future owners for the life of the dwelling."

(See Section IV of Chapter 7 of the HUD *Guidelines* for further details)

Chapter 7: Lead-Based Paint Inspection

Note: This 1997 Revision replaces Chapter 7 of the 1995 *HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*

I. Introduction

A. Purpose

This chapter explains methods for performing lead-based paint inspections in housing to determine:

- Whether lead-based paint is present in a house, dwelling unit, residential building, or housing development, including common areas and exterior surfaces; and
- If present, which building components contain lead-based paint.

The information presented here is intended for both inspectors and persons who purchase inspection services (clients). Both an inspection protocol and methods for determining the quality of an inspection are provided. Means for locating certified lead inspectors are also described.

1. Disclosure of Inspections

Federal law now requires that the results of lead-based paint inspections and risk assessments be disclosed to prospective renters (lessees, tenants) entering into a new lease and renters renewing an old lease, and to prospective purchasers prior to obligation under a sales contract, if lead-based paint is found. If the inspection described in this chapter finds that lead-based paint is not present in units which are to be leased, the dwelling unit and, for multifamily housing, all other dwelling units characterized by the inspection are exempt from disclosure requirements. However, for dwelling units which are being sold (not leased), the owner still has certain legal responsibilities to fulfill under Federal

law *even if no lead-based paint is identified*. See the HUD and EPA regulations in 24 CFR part 35 or 40 CFR part 745, respectively, for additional details.

You may contact the National Lead Information Center Clearinghouse (1-800-424-LEAD) to obtain HUD and EPA brochures, question-and-answer booklets, the regulations mentioned above (and the descriptive preamble to those regulations), and other information on lead-based paint disclosure. See Section IV for recommended inspection report language regarding these disclosure requirements.

2. Limitation of this Inspection Protocol

The protocol described here is not intended for investigating housing units where children with elevated blood lead levels are currently residing. Such a protocol can be found in Chapter 16 or may be available from a State or local health department.

3. Documentation of Results

The complete set of forms provided at the end of this chapter may be used in single-family and multifamily housing. Equivalent forms or computerized reports may also be used to document the results of inspections.

B. Qualifications of Inspectors and Laboratories

1. Where to Find Inspectors and Laboratories

Lists of State-licensed (certified) inspectors and accredited laboratories recognized under the U.S. Environmental Protection Agency (EPA) National Lead Laboratory Accreditation Program (NLLAP) are often available from State or local agencies. Call the National Lead Information Center Clearinghouse (1-800-424-LEAD) to locate the appropriate local contact.

A nationwide listing of certified inspectors, risk assessors, and accredited laboratories is also available on the Internet at www.leadlisting.org. The lists are

also available through an automated telephone system by calling 1-888-LEADLIST (1-888-532-3547).

2. Qualifications of Inspectors

The inspector must be certified (licensed) in lead-based paint inspection by the State where the testing is to be done if it has an inspection certification program; if the State does not have such a program, the inspector should be certified by another State. Currently, more than half of all States have such licensing laws. By the fall of 1999, all lead-based paint inspections must be performed only by a certified lead-based paint inspector or risk assessor in accordance with the work practices of 40 CFR part 745, section 227 (see the regulation for specific effective dates for States and Indian Tribes).

C. Other Sources of Information Required to Use This Protocol

The other sources of information and materials needed for using this protocol include an *XRF Performance Characteristic Sheet*, U.S. Nuclear Regulatory Commission and State radiation protection regulations, and standards issued by the American Society for Testing and Materials (ASTM). The National Institute of Standards and Technology (NIST) produces Standard Reference Materials (SRMs) and provides supporting documentation for these materials.

1. XRF Performance Characteristic Sheet

An *XRF Performance Characteristic Sheet* defines acceptable operating specifications and procedures for each model of X-Ray Fluorescence (XRF) lead-based paint analyzer. An inspector should follow the *XRF Performance Characteristic Sheet* for all inspection activities. For most commercially available XRFs, *XRF Performance Characteristic Sheets* are available from the National Lead Information Center Clearinghouse or through the Internet at www.hud.gov/lea/leahome.html. They are also included in a new, easy-to-use format in Addendum 3 to this chapter.

2. XRF Radiation Protection Regulations

Regulations that govern radioactive sources used in XRFs are available from State radiation protection agencies, and the Nuclear Regulatory Commission (301-415-7000).

3. ASTM and NIST Standards

Other helpful information and standards are available from ASTM (610-832-9585), including:

- ASTM E 1583 on evaluating laboratories used to determine lead levels
- ASTM E 1605 on terminology
- ASTM E 1613 on determining lead by atomic emission or atomic absorption spectroscopy
- ASTM E 1645 on laboratory preparation of paint-chip samples
- ASTM E 1729 on collecting paint-chip samples
- ASTM E 1775 on-site extraction and field-portable stripping voltammetry analysis for lead
- ASTM PS 53 on identifying and managing lead in facilities
- ASTM PS 87 on ultrasonic extraction for later analysis for lead
- ASTM PS 88 on determining lead by portable electroanalysis

NIST (301-975-6776) has developed series of paint films that have known amounts of lead-based paint and can be used for calibration check purposes. NIST Standard Reference Material 2579 is available as of mid-1997; NIST is planning to release additional series of paint films in late 1997 or early 1998 (see Section IV.D, below).

D. Paint Testing for Inspections and Risk Assessments

Risk assessments determine the presence of lead-based paint *hazards*, while inspections determine the presence of lead-based paint. The paint-chip sampling and measurement techniques used for paint inspections are similar to the techniques used for risk assessment. However, the number of paint measurements or samples taken for a paint inspection is considerably greater than the number of paint samples required for a risk assessment, because risk assessments measure lead only in deteriorated paint (risk assessments also measure lead in dust and soil). Inspections measure lead in both deteriorated and

intact paint, which involves many more surfaces. Risk assessments always note the condition of paint films; inspections may not. For dwellings in good condition, a full risk assessment may be unnecessary, and a lead hazard screen risk assessment may be conducted. In a lead hazard screen or risk assessment, the certified risk assessor tests only painted surfaces in "deteriorated" condition for their lead content, either by XRF or laboratory analysis. See Chapter 5 for methods to determine the condition of paint films when conducting a risk assessment.

E. Most Common Inspection Method

Portable XRF lead-based paint analyzers are the most common primary analytical method for inspections in housing because of their demonstrated abilities to determine if lead-based paint is present on many surfaces and to measure the paint without destructive sampling or paint removal, as well as their high speed and low cost per sample. Portable XRF instruments expose a building component to X rays or gamma radiation, which causes lead to emit X rays with a characteristic frequency or energy. The intensity of this radiation is measured by the instrument; the inspector must then compare this displayed value (reading) with the inconclusive range or threshold specified in the *XRF Performance Characteristic Sheet* for the specific XRF instrument being used, and the specific substrate beneath the painted surface (see Section IV.G, below). If the reading is less than the lower boundary of the inconclusive range, or less than the threshold, then the reading is considered negative. If the reading is greater than the upper boundary of the inconclusive range, or greater than or equal to the threshold, then the reading is considered positive. Readings within the inconclusive range, including its boundary values, are considered inconclusive. Because the inconclusive ranges and/or thresholds shown in the Performance Characteristic Sheet are based on 1.0 mg/cm², positive and negative readings are consistent with the HUD definition of lead-based paint for identification and disclosure purposes.

F. XRF Performance Characteristic Sheets and Manufacturer's Instructions

Only XRF instruments that have a HUD/EPA-issued or equivalent *XRF Performance Characteristic Sheet* should be used. XRFs must be used in accordance with the manufacturer's instructions and the *XRF Performance Characteristic Sheet*. The *XRF*

Performance Characteristic Sheet contains information about XRF readings taken on specific substrates, calibration check tolerances, interpretation of XRF readings (see section I.E, above), and other aspects of the model's performance. If discrepancies exist between the *XRF Performance Characteristic Sheet*, the *HUD Guidelines* and the manufacturer's instructions, the most stringent guidelines should be followed. For example, if the *XRF Performance Characteristic Sheet* has a lower (more stringent) calibration check tolerance than the manufacturer's instructions, the *XRF Performance Characteristic Sheet* should be followed. These *Guidelines* and the *XRF Performance Characteristic Sheets* are applicable to all XRF instruments that detect K X rays, L X rays, or both.¹

G. Inspection by Paint Chip Analysis

Performing inspections by the sole use of laboratory paint chip analysis is not recommended because it is time-consuming, costly, and requires extensive repair of painted surfaces. Laboratory analysis of paint-chip samples is recommended for inaccessible areas or building components with irregular (non-flat) surfaces that cannot be tested using XRF instrumentation. Laboratory analysis is also recommended to confirm inconclusive XRF results, as specified on the applicable *XRF Performance Characteristic Sheet*. Some newer laboratory analytical methods can provide results within minutes (see section I.H, below). Only laboratories recognized under the EPA NLLAP should be used. Laboratory analysis is more accurate and precise than XRF but only if great care is used to collect and analyze the paint-chip sample. Laboratory results should be reported as mg/cm². Appendix 1 of these *Guidelines* explains why units of mg/cm² are not dependent on the number of overcoats of lead-free paint and why such units of measure are therefore more reliable than weight percent. The dimensions of the area from which a paint-chip sample is removed must be measured as accurately as possible (to the nearest millimeter or 1/16th of an inch).

Although laboratory results can also be reported as a percentage of lead by weight of the paint sample, percents should only be used when it is not feasible to use mg/cm². These two units of measure are not interchangeable. Laboratory results should be reported as mg/cm² if the surface area can be accurately measured and if all paint within that area is collected.

In mg/cm² measurements, collecting small amounts of substrate material with the sample does not bias the results significantly, although having any amount of substrate in the sample can result in less precise results. In weight percent measurements, however, no substrate may be included because the substrate will "dilute" the amount of lead reported. Regardless of the units of measurement selected, the bottom layer of paint must always be included in the sample. If a visual examination shows that the bottom layer of paint appears to have "bled" into the substrate, a very thin upper portion of the substrate should be included in the sample to ensure that all lead within the sample area has been included in the sample. In cases where significant amounts of substrate are included in the sample, the results should always be reported in mg/cm².

See Section VI for additional information on laboratory analysis.

H. Additional Means of Analyzing Paint

Methods of analyzing lead in paint are available in addition to XRF and laboratory paint chip analysis, including transportable instruments and chemical test kits. Because these methods involve paint removal or disturbance, repair is needed after sampling, unless the substrate will be removed, encapsulated, enclosed, or repainted before occupancy (see Section VI), or if analysis shows that the paint is not lead-based paint, and leaving the damage is acceptable to the client and/or the owner.

1. Mobile Laboratories

Portable instruments that employ anodic stripping voltammetry and potentiometric stripping voltammetry are now available. Their use is described in ASTM Provisional Standard Practice PS 88. Also, ASTM Standard Guide E 1775 may be used as a basis for evaluating the performance of on-site extraction and electrochemical and spectrophotometric analyses. If the organization using a portable instrument is recognized under the EPA NLLAP and used that type of instrument to obtain the laboratory's recognition, they can be used in the same way as any other NLLAP-recognized laboratory. In short, both fixed-site and mobile laboratories may be used, provided they are recognized under NLLAP.

2. Chemical Test Kits

Chemical test kits are intended to show a color change when a part of the kit makes contact with the lead in lead-based paint. One type of chemical test kit is based on the formation of lead sulfide, which is black, when lead in paint reacts with sodium sulfide. Another is based on the formation of a red or pink color when lead in paint reacts with sodium rhodizonate.

EPA did not find that chemical spot test kits are sufficiently reliable for use in lead-based paint inspection, and recommended that they not be used (EPA 1995). HUD and EPA may recommend them in the future for inspections if chemical test kit technology is demonstrated to be equivalent to XRF or laboratory paint chip analysis in its ability to properly classify painted surfaces into positive, negative, and inconclusive categories, with appropriate estimates of the magnitude of sampling and analytical error. *XRF Performance Characteristic Sheets* currently provide such estimates for XRFs, and analytical error is well-described for laboratory analysis. HUD is currently funding the National Institute for Standards and Technology (NIST) and other researchers to evaluate commercially available chemical test kits and provide the basis for improved chemical test kits. Information on test kits or other new technologies for testing for lead in paint can be obtained from the National Lead Information Center Clearinghouse (1-800-424-LEAD).

II. Summary of XRF Radiation Safety Issues

Radiation hazards associated with the use of XRFs are covered in detail in Section VII. The shutter of an XRF must never be pointed at anyone, even if the shutter is closed. Inspectors should wear radiation dosimeters to measure their exposure, although excessive exposures are highly unlikely if the instruments are used in accordance with the manufacturer's instructions. If feasible, persons should not be near the other side of a wall, floor, ceiling, or other surface being tested.

III. Definitions

Definitions of several key terms used in this chapter are provided here. Some additional definitions may be found in ASTM Standard E 1605, Standard Terminology Relating to Abatement of Hazards from Lead-based Paint on Buildings and Related Structures, and in other standard chemical, statistical, architectural and engineering dictionaries and texts. For terms discussed both here and in the ASTM document, the definitions and descriptions in this chapter should be used.

Lead-based paint - Lead-based paint means paint or other surface coatings that contain lead equal to or greater than 1.0 mg/cm² or 0.5 percent by weight (equivalent units are: 5,000 µg/g, 5,000 mg/kg, or 5,000 ppm by weight). Surface coatings include paint, shellac, varnish, or any other coating, including wallpaper which covers painted surfaces.

Lead loading - The mass of lead in a given surface area on a substrate. Lead loading is typically measured in units of milligrams per square centimeter (mg/cm²). It is also called area concentration.

Room equivalent - A room equivalent is an identifiable part of a residence, such as a room, a house exterior, a foyer, staircase, hallway, or an exterior area (exterior areas contain items such as play areas, painted swing sets, painted sandboxes, etc.). Closets or other similar areas adjoining rooms should not be considered as separate room equivalents unless they are obviously dissimilar from the adjoining room equivalent. Most closets are not separate room equivalents. Exteriors should be included in all inspections. An individual side of an exterior is not considered to be a separate room equivalent, unless there is visual or other evidence that its paint history is different from that of the other sides. All sides of a building (typically two for row houses or four for freestanding houses) are generally treated as a single room equivalent if the paint history appears to be similar. For multifamily developments or apartment buildings, common areas and exterior sites are treated as separate types of units, not as room equivalents (see section V.C.1 for further guidance).

Substrate - The substrate is the material underneath the paint. Substrates should be classified into one of six types: brick, concrete, drywall, metal, plaster, or wood. These substrates cover almost all building

materials that are painted and are linked to those used in the *XRF Performance Characteristic Sheets*. For example, the concrete substrate type includes poured concrete, precast concrete, and concrete block.

If a painted substrate is encountered that is different from the substrate categories shown on the *XRF Performance Characteristic Sheet*, select the substrate type that is most similar in density and composition to the substrate being tested. For example, for painted glass substrates, an inspector should select the concrete substrate, because it has about the same density (2.5 g/cm³) and because the major element in both is silicon.

For components that have layers of different substrates, such as plaster over concrete, the substrate immediately adjacent to (underneath) the painted surface should be used. For example, plaster over concrete block is recorded as plaster.

Testing Combination - A testing combination is a unique combination of room equivalent, building component type, and substrate. Visible color may not be an accurate predictor of painting history and is not included in the definition of a testing combination. Table 7.1 lists common building component types that could make up distinct testing combinations within room equivalents. The list is not intended to be complete. Unlisted components that are coated with paint, varnish, shellac, wallpaper, stain, or other coating should also be considered as a separate testing combination.

Certain building components that are adjacent to each other and not likely to have different painting histories can be grouped together into a single testing combination, as follows:

- Window casings, stops, jambs and aprons are a single testing combination
- Interior window mullions and window sashes are a single testing combination--do not group interior mullions and sashes with exterior mullions and sashes
- Exterior window mullions and window sashes are a single testing combination
- Door jambs, stops, transoms, casings and other door frame parts are a single testing combination
- Door stiles, rails, panels, mullions and other door parts are a single testing combination

- Baseboards and associated trim (such as quarter-round or other caps) are a single testing combination (do not group chair rails, crown molding or walls with baseboards)
- Painted electrical sockets, switches or plates can be grouped with walls

Each of these building parts should be tested separately if there is some specific reason to believe that they have a different painting history. In most cases, separate testing will not be necessary.

Table 7.1: Examples of Interior and Exterior Building Component Types

Commonly Encountered Interior Painted Components That Should Be Tested Include:	
Air Conditioners	Fireplaces
Balustrades	Floors
Baseboards	Handrails
Bathroom Vanities	Newel Posts
Beams	Other Heating Units
Cabinets	Radiators
Ceilings	Shelf Supports
Chair Rails	Shelves
Columns	Stair Stringers
Counter Tops	Stair Treads and Risers
Crown Molding	Stools and Aprons
Doors and Trims	Walls
Painted Electrical Fixtures	Window Sashes and Trim

Exterior Painted Components That Should Be Tested Include:	
Air Conditioners	Handrails
Balustrades	Lattice Work
Bulkheads	Mailboxes
Ceilings	Painted Roofing
Chimneys	Railing Caps
Columns	Rake Boards
Corner boards	Sashes
Doors and Trim	Siding
Fascias	Soffits
Floors	Stair Risers and Treads
Gutters and Downspouts	Stair Stringers
Joists	Window and Trim

Other Exterior Painted Components Include:	
Fences	Storage Sheds & Garages
Laundry Line Posts	Swing sets and Other Play Equipment

Table 7.2 provides six examples of different testing combinations. The first example is a wooden bedroom door. This is a testing combination because it is described by a room equivalent (bedroom), component (door), and substrate (wood). If one of these variables is different for another component, that component is a different testing combination. For example, if a second door in the room equivalent is metal, two testing combinations, not one, would be present.

For doors separating rooms, each side of the door is assigned to the room equivalent it faces and is tested separately. The same is true of door casings. For prefabricated metal doors where it is apparent that both sides of the door have the same painting history, only one side needs to be tested.

Table 7.2: Examples of Distinct Testing Combinations

Room Equivalent	Building Component	Substrate
Master Bedroom (Room 5)	Door	Wood
Master Bedroom (Room 5)	Door	Metal
Kitchen (Room 3)	Wall	Plaster
Garage (Room 10)	Floor	Concrete
Exterior	Siding	Wood
Exterior	Swing set	Metal

Building Component Types - A building component type consists of doors, windows, walls, and so on that are repeated in more than one room equivalent in a unit and have a common substrate. If a unique building component is present in only one room, it is considered to be a testing combination. Each testing combination may be composed of more than one building component (such as two similar windows within a room equivalent). Component types can be located inside or outside the dwelling. For example, typical component types in a bedroom would be the ceiling, walls, a door and its casing, the window sash, window casings, and any other distinct surface, such as baseboards, crown molding, and chair rails. If trends or patterns of lead-based paint classifications are found among building component types in different room equivalents, an inspection report may summarize results by building component type, as long as all measurements are included in the report. For example, the inspection may find that all doors and door casings in a dwelling unit are positive.

Test Location - The test location is a specific area on a testing combination where either an XRF reading or a paint-chip sample will be taken.

IV. Inspections in Single-Family Housing

Single-family housing inspections should be conducted by a State- or EPA-certified (licensed) lead-based paint inspector using the following seven steps, some of which may be done at the same time:

- List all testing combinations, including those that are painted, stained, shellacked, varnished, coated, or wallpaper which covers painted surfaces.
- Select testing combinations.
- Perform XRF testing (including the calibration check readings).
- Collect and analyze paint-chip samples for testing combinations that cannot be tested with XRF or that had inconclusive XRF results.
- Classify XRF and paint-chip results.
- Evaluate the work and results to ensure the quality of the paint inspection.
- Document all findings in a plain language summary and a complete report; include language in both the summary and the report indicating that the information must be disclosed to tenants and prospective purchasers in accordance with Federal law (24 CFR part 35 or 40 CFR part 745).

A. Listing Testing Combinations

Develop a list of all testing combinations in all interior rooms, on all exterior building surfaces, and on surfaces in other exterior areas, such as fences, playground equipment, and garages. The "Single-Family Housing LBP Testing Data Sheet" (see Form 7.1 at the end of this chapter) or a comparable data collection instrument may be used for this purpose. An inventory of a house may be completed either before any testing or on a room-by-room basis during testing.

1. Number of Room Equivalents to Inspect

Test all room equivalents inside and outside the dwelling unit. The final report must include a final determination of the presence or absence of lead-based paint on each testing combination in each room equivalent.

For varnished, stained, or similar clear-coated floors, measurements in only one room equivalent are permissible if it appears that the floors in the other room equivalents have the same coating.

2. Number of Testing Combinations to Inspect

Inspect each testing combination in each room equivalent, unless similar building component types with identical substrates (such as windows) are all found to contain lead-based paint in the first five interior room equivalents. In that case, testing of that component type in the remaining room equivalents may be discontinued, *if and only if* the purchaser of the inspection services agrees beforehand to such a discontinuation. The inspector should then conclude that similar building component types in the rest of the dwelling unit also contain lead-based paint. See item 6 entitled, "Conditions for Abbreviation of Testing," later in this section for additional details.

Because it is highly unlikely that testing combinations *known* (and not just presumed) to have been replaced or added to the building after 1977 will contain lead-based paint, they need not be tested. If the age of the testing combination is in doubt, it should be tested.

Some testing combinations have multiple parts. For example, a window testing combination could theoretically be broken down into the interior sill (stool), exterior sill, trough, sash, apron, parting bead, stop bead, casing, and so on. Because it is highly unlikely that all these parts will have different painting histories, they should not usually be considered separate testing combinations. (Inspectors should regard parts of building components as separate testing combinations if they have evidence that different parts have separate, distinct painting histories). See the definition of testing combination (Section III, above) for guidance on which building component parts may and which may not be grouped together.

3. Painted Furniture

Painted furniture that is physically attached to the unit (for example, a desk or dresser that is built-in) should be included in the inspection as a testing combination. Other painted furniture may also be tested, depending on the client's wishes. Children's furniture (such as cribs or playpens), especially if built before 1978, may contain lead-based paint and can be tested, subject to the client's wishes.

4. Building Component Types

Results of an inspection may be summarized by classifying component types across room equivalents if patterns or trends are supported by the data.

5. Substrates

All substrates across all room equivalents should be grouped into one of the six substrate categories (brick, concrete, drywall, metal, plaster, or wood) shown on the *XRF Performance Characteristic Sheet* for the instrument being used. Substrate correction procedures can then be applied for all building component types with the same substrate. For example, the substrate correction procedure for wooden doors and wooden baseboards can use the same substrate correction value (see Section IV.E, below).

6. Conditions for Abbreviation of Testing

If lead-based paint is determined to be present (a "positive" finding) for a building component type with

the same substrate in all of the first five room equivalents inspected, further testing of that component type may be discontinued in the remaining room equivalents within that dwelling unit, *if and only if* the purchaser of inspection services agrees beforehand to such a discontinuation. The inspector should then conclude that the similar building component types in the rest of the dwelling unit also contain lead-based paint. For example, if an inspector finds that baseboards in the first five room equivalents are all positive, the inspector -- with the client's permission -- may conclude that all remaining room equivalents in the unit contain positive baseboards.

B. Number and Location of XRF Readings

1. Number of XRF Readings for Each Testing Combination

XRF testing is required for at least one location per testing combination, except for interior and exterior walls, where four readings should be taken, one on each wall. Previous editions of this chapter stated that three readings for each testing combination were needed to control for spatial variation and other sources of error. Recent analysis² of EPA data show a median difference in spatial variation of only 0.1 mg/cm² and a change in classification (positive, negative, or inconclusive) occurs less than 5 percent of the time as a result of different test locations on the same testing combination. Multiple readings on the same testing combination or testing location are, therefore, unnecessary, except for interior and exterior walls.

Because of the large surface areas and quantities of paint involved, and the possibility of increased spatial variation, take at least four readings (one reading on each wall) in each room equivalent. (For room equivalents with fewer than four walls, test each wall.) For each set of walls with the same painting history in a room equivalent, test the four largest walls. Classify each wall based on its individual XRF reading. If a room equivalent has more than four walls, calculate the average of the readings, round the result to the same number of decimal places as the XRF instrument displays, and classify the remaining walls with the same painting history as the tested walls, based on this rounded average. When the remaining walls in a room equivalent clearly do not have the same painting history as that of the tested walls, test and classify the remaining walls individually. For exterior walls, select

at least four sides and average the readings (rounding the result as described above) to obtain a result for any remaining sides. If there are more than four walls and the results of the tested walls do not follow a classification pattern (for example, one is positive and the other three are negative), test each wall individually.

2. Location of XRF Readings

The selection of the test location for a specific testing combination should be representative of the paint over the areas which are most likely to be coated with old paint or other lead-based coatings. Thus, locations where the paint appears to be thickest should be selected. Locations where paint has worn away or been scraped off should not be selected. Areas over pipes, electrical surfaces, nails, and other possible interferences should also be avoided if possible. All layers of paint should be included and the XRF probe faceplate should be able to lie flat against the surface of the test location.

If no acceptable location for XRF testing exists for a given testing combination, a paint-chip sample should be collected. The sample should include all paint layers and should be taken as unobtrusively as possible. Because paint chip sampling is destructive, a single sample may be collected from a wall and used to characterize the other walls in a room equivalent (see section VI for additional details on paint chip sampling).

3. Documentation of XRF Reading Locations

Descriptions of testing combinations should be sufficiently detailed to permit another individual to find them. While it is not necessary to document the *exact* spot or the *exact* building component on which the reading was taken, it is necessary to record the *exact* testing combination measured. Current room uses or colors can change and should not be the only way of identifying them. A numbering system, floor plan, sketch or other system may be used to document which testing combinations were tested. While HUD does not require a standard identification system, one that could be used is as follows:

a. Side identification

Identify perimeter wall sides with letters A, B, C, and D (or numbers or Roman numerals). Side A for single-family housing is the street side for the address. Side A in multifamily housing is the apartment entry door side.

Side B, C, and D are identified clockwise from Side A as one faces the dwelling; thus Wall B is to the left, Wall C is across from Side A, and Side D is to the right of Side A.

Each room equivalent's side identification follows the scheme for the whole housing unit. Because a room can have two or more entries, sides should not be allocated based on the entry point. For example, giving a closet a side allocation based on how the room is entered would make it difficult for another person to make an easy identification, especially if the room had two closets and two entryways.

b. Room Equivalent Identification

Room equivalents should be identified by both a number and a use pattern (for example, Room 5-Kitchen). Room 1 can always be the first room, at the A-D junction at the entryway, or it can be the exterior. Rooms are consecutively numbered clockwise. If multiple closets exist, they are given the side allocation: for example, Room 3, Side C Closet. The exterior is always assigned a separate room equivalent identifier.

c. Sides in a Room

Sides in an interior room equivalent follow the overall housing unit side allocation. Therefore, when standing in any four-sided room facing Side C, the room's Side A will always be to the rear, Side B will be to the left, and Side D will be to the right.

d. Building Component Identification

Individual building components are first identified by their room number and side allocation (for example, the radiator in Room 1, Side B is easily identified). If multiple similar component types are in a room (for example, three windows), they are differentiated from

each other by side allocation. If multiple components are on the same wall side, they are differentiated by being numbered left to right when facing the components. For example, three windows on Wall D are identified as windows D1, D2, and D3, left to right. If window D3 has the only old original sash, it is considered a separate testing combination from the other two windows.

A sketch of the dwelling unit's floor plan is often helpful, but is not required by this protocol. Whatever documentation is used, a description of the room equivalent and testing combination identification system must be included in the final inspection report.

C. XRF Instrument Reading Time

The recommended time to open an XRF instrument's shutter to obtain a single XRF result for a testing location depends on the specific XRF instrument model and the mode in which the instrument is operating. The *XRF Performance Characteristic Sheet* provides information on this issue.

To ensure that a constant amount of radiation is delivered to the painted surface, the open-shutter time must be increased as the source ages and the radiation source weakens. Almost all commercially available XRF instruments automatically adjust for the age of the source. (Some instruments adjust for source decay in some but not all modes; operators should check with the manufacturers of their instruments to determine whether these differences need to be accommodated). The following formula should be employed for instruments requiring manual adjustment of the open-shutter time:

$$\text{Open-Shutter Time} = 2^{(\text{Age}/\text{Half-life})} \times \text{Nominal Time}$$

where:

Age is the age (in days) of the radioactive source, starting from the date the manufacturer says the source had its full radiation strength;

Half-life is the time (in days) it takes for the radioactive material's activity to decrease to one-half its initial level; and

Nominal Time is the recommended nominal number of seconds for open-shutter time,

when the source is at its full radiation strength, and is obtained from the *XRF Performance Characteristic Sheet*.

For example, if the age of the source is equal to its half-life, the open-shutter time should be twice the nominal time. Thus, if the recommended nominal time is 15 seconds, the open-shutter time should be doubled to 30 seconds.

XRFs typically use Cobalt-57 (with a half life of 270 days) or Cadmium-109 (with a half life of 464 days).

XRF Performance Characteristic Sheets typically report different inconclusive ranges or thresholds (see section IV.G, below) for different nominal times and different substrates. This may affect the number of paint-chip samples that must be collected as well as the length of time required for the inspection. Some XRF devices have different modes of operation with different nominal reading times. Inspectors must use the appropriate inconclusive ranges and other criteria specified on the *XRF Performance Characteristic Sheet* for each XRF model, mode of operation and substrate. For example, inconclusive ranges specified for a 30-second nominal reading cannot be used for a 5-second nominal reading, even for the same instrument and the same substrate.

D. XRF Calibration Check Readings

In addition to the manufacturer's recommended warm up and quality control procedures, the XRF operator should take the quality control readings recommended below, unless these are less stringent than the manufacturer's instructions. Quality control for XRF instruments involves readings to check calibration. Most XRFs cannot be calibrated on-site; actual calibration can only be accomplished in the factory.

1. Frequency and Number of Calibration Checks

For each XRF instrument, two sets of XRF calibration check readings are recommended at least every 4 hours. The first is a set of three nominal-time XRF calibration check readings to be taken before the inspection begins. The second occurs either after the day's inspection work has been completed, or at least every 4 hours, whichever occurs first. To reduce the amount of data that would be lost if the instrument

were to go out of calibration between checks, and/or if the manufacturer recommends more frequent calibration checks, the calibration check can be repeated more frequently than every 4 hours. If the XRF manufacturer recommends more frequent calibration checks, the manufacturer's instructions should be followed. Calibration should also be checked before the XRF is turned off (for example, to replace a battery or before a lunch break) and after it is turned on again. For example, if an inspection of a large house took 6 hours, there would be three calibration checks: one at the beginning of the inspection, another after 4 hours, and a third at the end of the inspection.

If the XRF is not turned off as the inspector travels from one dwelling unit to the next, calibration checks do not need to be done after each dwelling unit is completed. For example, in multifamily housing, calibration checks do not need to be done after each dwelling unit is inspected; once every 4 hours is usually adequate.

Some instruments automatically enter a "sleep" or "off" state when not being used continually to prolong battery life. It is not necessary to perform a calibration check before and after each "sleep" state episode, unless the manufacturer recommends otherwise.

2. Calibration Check Standard Materials

XRF calibration check readings are taken on the Standard Reference Material (SRM) paint film nearest to 1.0 mg/cm² within the National Institute of Standards and Technology (NIST) SRM used. These films can be obtained by calling (301) 975-6776 and referencing SRM 2579 (NIST is planning to release additional series of paint films in late 1997 or early 1998; the film nearest to 1.0 mg/cm² should be used for XRF calibration checks). The cost as of September 26, 1997, for the SRM 2579 set of five films, was \$320, including 2-day delivery. Calibration checks should be taken through the SRM paint film with the film positioned at least 1 foot (0.3 meters) away from any potential source of lead. The NIST SRM film should not be placed on a tool box, suitcase, or surface coated with paint, shellac, or any other coating to take calibration check readings. Rather, the NIST SRM film should be attached to a solid (not plywood) wooden board or other nonmetal rigid

substrate such as drywall, or attached directly to the XRF probe. The SRM should be positioned so that readings of it are taken when it is more than 1 foot (0.3 meters) away from a potential source of error. For example, the NIST SRM film can be placed on top of a 1 foot (0.3 meter) thick piece of Styrofoam or other lead-free material, as recommended by the manufacturer before taking readings.

3. Recording and Interpreting Calibration Check Readings

Each time calibration check readings are made, three readings should be taken. These readings should be taken using the nominal time which will be used during the inspection, selected from among those specified in the XRF's Performance Characteristic Sheet. The open shutter time should be adjusted, if necessary, to reflect the age of the radioactive source (see section IV.C, above). The readings can be recorded on the "Calibration Check Test Results" form (Form 7.2), on a comparable form, or stored in the instrument's memory, and printed out or transferred to a computer later. The average of the three calibration check readings should be calculated, rounded to the same number of decimal places as the XRF instrument displays, and recorded on the form.

Large deviations from the NIST SRM value will alert the inspector to problems in the instrument's performance. If the observed calibration check average is outside of the acceptable calibration check tolerance range specified in the instrument's *XRF Performance Characteristic Sheet*, the manufacturer's instructions should be followed to bring the instrument back into control. A successful calibration check should be obtained before additional XRF testing is conducted. Readings not accompanied by successful calibration checks at the beginning and end of the testing period are unreliable and should be repeated after a successful calibration check has been made. If a backup XRF instrument is used as a replacement, it must successfully pass the initial calibration check test before retesting the affected test locations.

This procedure assumes that the HUD/EPA lead-based paint standard of 1.0 mg/cm² is being used. If a different standard is being used, other NIST SRMs should be used to determine instrument performance against the different standard. At this time, however, no method for determining performance characteristics using different standards has been developed.

E. Substrate Correction

XRF readings are sometimes subject to systematic biases as a result of interference from substrate material beneath the paint. The magnitude and direction of bias depends on the substrate, the specific XRF instrument being used, and other factors such as temperature and humidity. Results can be biased in either the positive or negative direction and may be quite high.

1. When Substrate Correction Is Not Required

Some XRF instruments do not need to have their readings corrected for substrate bias. Other instruments may only need to apply substrate correction procedures on specific substrates and/or when XRF results are below a specific value. The *XRF Performance Characteristic Sheet* should be consulted to determine the requirements for a specific instrument and each mode of operation (e.g., nominal time, or time required for intended precision). XRF instruments which do not require correction for any substrate, or require corrections on only a few substrates, have an advantage in that they simplify and shorten the inspection process.

2. Substrate Correction Procedure

XRF results are corrected for substrate bias by subtracting a correction value determined separately in each house for each type of substrate where lead paint values are in the substrate correction range indicated on the *XRF Performance Characteristic Sheet*. In single-family housing, the substrate correction value is determined using the specific instrument(s) used in that house. The correction value (formerly called "Substrate Equivalent Lead" or "SEL") is an average of six XRF readings, with three taken from each of two test locations that have been scraped visually clean of their paint coating. The locations selected for removal of paint should have an initial XRF reading on the painted surface of less than 2.5 mg/cm², if possible. If all initial readings on a substrate type are greater than 2.5 mg/cm², the locations with the lowest initial reading should be chosen. Because available data indicate that surfaces with XRF readings in excess of about 3.0 mg/cm² or 4.0 mg/cm² are almost always coated with lead-based paint, and since bleed-through of lead into the substrate may occur, or pipes and similarly interfering building components may be behind the material being evaluated, locations with such high readings should be avoided for substrate correction.

After all XRF testing has been completed but before the final calibration check test has been conducted, XRF results for each substrate type should be reviewed. If any readings fall within the range for substrate correction for a particular substrate, obtain the substrate correction value.

On each selected substrate requiring correction, two different testing combinations must be chosen for paint removal and testing. For example, if the readings are inconclusive for some wooden baseboards, select two baseboards, each from a different room. If some wooden doors also require substrate correction, the inspector should take substrate correction readings on one door and one baseboard. Selecting the precise location of substrate correction should be based on the inspector's ability to remove paint thoroughly from the substrates, the similarity of the substrates, and their accessibility. The XRF probe faceplate must be able to be placed over the scraped area, which should be completely free of paint or other coatings.

The size of the area from which paint is taken depends on the size of the analytical area of the XRF probe faceplate; normally, the area is specified by the manufacturer. To ensure that no paint is included in the bare substrate measurement, the bare area on the substrate should be slightly larger than the analytical area on the XRF probe faceplate.

In all, six readings must be taken for each substrate type that requires correction. All six must be averaged together. Take three readings on the first *bare* substrate area. Record the substrate and XRF readings on the "Substrate Correction Values" form (Form 7.3) or a comparable form. Repeat this procedure for the second *bare* substrate area and record the three readings on the same form. Substrate correction values should be determined using the same instrument used to take readings on the painted surfaces. If more than one XRF model was used to take readings, apply the substrate correction values as specified on each instrument's *XRF Performance Characteristic Sheet*.

Compute the correction value for each substrate type that requires correction by computing the average of all six readings as shown below and recording the results on the "Substrate Correction Values" form. The formula given below should be used to compute the substrate bias correction value for XRF readings taken on a bare substrate that is not covered with NIST SRM film. A different formula should be used when SRM film must be placed over the bare substrate. The *XRF Performance Characteristic Sheet* specifies when this correction is necessary and provides the formula for computing the correction value.

For each substrate type requiring substrate correction, transfer the correction values to the "Single-Family Housing LBP Testing Data Sheet" (Form 7.1). Correct XRF readings for substrate interference by subtracting the correction value from each XRF reading.

Example: Suppose that a house has 50 testing combinations with wood substrates. The *XRF Performance Characteristic Sheet* states that a correction value for XRF results taken on those wood testing combinations that have values less than 4.0 mg/cm² must be computed. Select two test locations from the testing combinations that had uncorrected XRF results of less than 2.5 mg/cm².

Completely remove the paint from these two test locations and take three nominal-time XRF readings

on the bare substrate at each location. The six XRF readings at the two random locations are:

Selected Location	Reading (mg/cm ²)		
	First	Second	Third
Wood Master Bedroom Door	1.32	0.91	1.14
Kitchen Wood Baseboard (Room 4)	1.21	1.03	1.43

The correction value is the average of the six values:

$$\text{Correction value} = (1.32 + 0.91 + 1.14 + 1.21 + 1.03 + 1.43) \text{ mg/cm}^2 / 6 = 1.17 \text{ mg/cm}^2$$

In this same house, three different wood testing combinations were inspected for lead-based paint and the XRF results are: 1.63 mg/cm², 3.19 mg/cm², and 1.14 mg/cm². Correcting these three XRF measurements for substrate bias produces the following results:

$$\text{First corrected measurement} = 1.63 \text{ mg/cm}^2 - 1.17 \text{ mg/cm}^2 = 0.46 \text{ mg/cm}^2$$

$$\text{Second corrected measurement} = 3.19 \text{ mg/cm}^2 - 1.17 \text{ mg/cm}^2 = 2.02 \text{ mg/cm}^2$$

$$\text{Third corrected measurement} = 1.14 \text{ mg/cm}^2 - 1.17 \text{ mg/cm}^2 = -0.03 \text{ mg/cm}^2$$

The third corrected result shown above is an example of how random error in XRF measurements can cause the corrected result to be less than zero. (Random measurement error is present whenever measurements are taken). Note that correction values can be either positive or negative. In short, negative corrected XRF values should be reported if supported by the data.

Finally, suppose an XRF result of 1.24 mg/cm² has a correction value of negative 0.41 mg/cm². Subtracting a negative number is the same as adding its positive value. Therefore, the corrected measurement would be:

$$\begin{aligned} \text{Corrected result} &= 1.24 \text{ mg/cm}^2 - (-0.41 \text{ mg/cm}^2) = \\ &1.24 \text{ mg/cm}^2 + 0.41 \text{ mg/cm}^2 = 1.65 \text{ mg/cm}^2 \end{aligned}$$

3. Negative Values

If more than 20 percent of the corrected values are negative, the instrument's lead paint readings and/or the substrate readings are probably in error. Calibration should be checked and substrate measurements should be repeated.

F. Discarding Readings

If the manufacturer's instructions call for the deletion of readings at specific times, *only* readings taken at those specific times should be deleted. Similarly, readings between a successful calibration check and a subsequent unsuccessful calibration check must be

discarded. Readings should not be deleted based on any criteria other than what is specified by the manufacturer's instructions or the *HUD Guidelines*. For example, a manufacturer may instruct operators to discard the first XRF reading after a substrate change. If so, *only* the first reading should be discarded after a substrate change.

G. Classification of XRF Results

XRF results are classified as positive, negative, or inconclusive.

A *positive* classification indicates that lead is present on the testing combination at or above the HUD/EPA standard of 1.0 mg/cm². A positive XRF result is any

value greater than the upper bound of the inconclusive range, or greater than or equal to the threshold, as specified on the applicable *XRF Performance Characteristic Sheet*.

A *negative* classification indicates that lead is not present on the testing combination at or above the HUD/EPA standard. A negative XRF result is any value less than the lower bound of the inconclusive range, or less than the threshold, specified on the performance characteristic sheet.

An *inconclusive* classification indicates that the XRF cannot determine with reasonable certainty whether lead is present on the testing combination at or above the HUD/EPA standard. An inconclusive XRF result is any value falling within the inconclusive range on the performance characteristic sheet (including the boundary values defining the range). In single-family housing, all inconclusive results should be confirmed by laboratory analysis, unless the client wishes to assume that all inconclusive results are positive.

Positive, negative, and inconclusive results apply to the actual testing combination and to any repetitions of the testing combination that were not tested in the room equivalents. Positive results also apply to similar component types in room equivalents that were not tested. For example, suppose that one baseboard in a room equivalent is tested, and that the inspector decided that all four baseboards are a single testing combination. The single XRF result applies to all four baseboards in that room equivalent.

When an inconclusive range is specified on the *XRF Performance Characteristic Sheet*, XRF results are classified as positive if they are greater than the upper boundary of the inconclusive range, negative if they are less than the lower boundary of the inconclusive range, or inconclusive if in between. The inconclusive range on the *XRF Performance Characteristic Sheets* in Addendum 3 of these *Guidelines* includes its upper and lower bounds. Earlier editions of this guide and earlier *XRF Performance Characteristic Sheets* did not include the bounds of the inconclusive range as "inconclusive." This 1997 edition of Chapter 7 of the HUD Guidelines changes that system, but the specific XRF readings that are considered positive, negative, or inconclusive for a given XRF model and substrate remain unchanged, so previous inspection results are not affected.

For example, if the inconclusive range given in the *XRF Performance Characteristic Sheet* is 0.51 mg/cm² to 1.49 mg/cm², an XRF result of 0.50 mg/cm² is considered negative, because it is less than 0.51; a result of 0.6 mg/cm² is inconclusive; and a result of 1.5 mg/cm² is positive. A result of 0.51 mg/cm², 1.00 mg/cm², or 1.49 mg/cm² would be inconclusive.

Different XRF models have different inconclusive ranges, depending on the specific XRF model and the mode of operation. The inconclusive range may also be substrate-specific.

In some cases, the upper and lower limits of the inconclusive range are equal; that value is called the *threshold*. If the reading is less than the threshold, then the reading is considered negative. If the reading is equal to or greater than the threshold, then the reading is considered positive.

Use of the inconclusive range and threshold is detailed in the performance characteristic sheet. The categories include substrate-corrected results, if substrate correction is indicated. XRF's with *only* threshold values listed on the *XRF Performance Characteristic Sheet* are advantageous in that classifications of results are either positive or negative (no XRF readings are inconclusive).

H. Evaluation of the Quality of the Inspection

The person responsible for purchasing inspection services -- the homeowner, property owner, housing authority, prospective buyer, occupant, etc.; also known as the client -- should evaluate the quality of the work using one or more of the methods listed below. Evaluation methods include direct observation, immediate provision of results, repeated testing, and time-and-motion analysis. Direct observation of the inspection should be used whenever possible. The inspection contract should outline the financial penalties that will occur if an inspector fails to perform as contracted during any visit.

1. Direct Observation

An evaluation of a lead-based paint inspection is best made if a knowledgeable observer is present for as much of the XRF testing as possible. This is the only way to ensure that all painted, varnished, shellacked, wallpapered, stained, or other coated testing combinations are actually tested, and that all XRF

readings are recorded correctly. If possible, employ as the observer someone who is trained in lead-based paint inspection and who is independent of the inspection firm.

If it is not feasible for the client or the client's representative to be present throughout the inspection, that person should conduct unannounced and unpredictable visits to observe the inspection process. The number of unannounced visits will depend on the results of prior visits. When observing ongoing XRF testing, review the test results for the room equivalent currently being tested and for the previously inspected room equivalent. Even if the first visit is fully satisfactory, follow-up visits should be conducted throughout the inspection.

2. Immediate Provision of Results

The client, or a representative, should ask the inspector to provide copies or printouts of results on completed data forms immediately following the completion of the inspection or on a daily basis. Alternatively, visually review the inspector's written results to ensure that they are properly recorded for all surfaces that require XRF testing. If surfaces have been overlooked or recorded incorrectly, the inspection process should be stopped and considered deficient. Clients should retain daily results to ensure that the data in the final report are the same as the data collected in the home.

3. Repeated Testing of 10 Surfaces

Data from HUD's private housing lead-based paint hazard control program show that it is possible to successfully retest painted surfaces without knowing the exact spot which was tested.

Select 10 testing combinations at random from the already compiled list in the "Single-Family Housing LBP Testing Data Sheet" for retesting (see forms in Addendum 2 of this chapter). Observe the inspector during the retesting. If possible, the same XRF instrument used in the original inspection should be used in the retesting. If the XRF instrument used in the original inspection is not available and cannot be returned to the site, use an XRF of the same model for retesting. Use the same procedures to retest the 10 testing combinations. The 10 repeat XRF results should be compared with the 10 XRF results previously made on the same testing combinations.

The repeat readings and the original readings should not be corrected for substrate bias for the purpose of this comparison. The average of the 10 repeat XRF results should not differ from the 10 original XRF results by more than the retest tolerance limit. The procedure for calculating the retest tolerance limit is specified in the *XRF Performance Characteristic Sheet*. If the limit is exceeded, the procedure should be repeated using 10 different testing combinations. If the retest tolerance limit is exceeded again, the original inspection is considered deficient.

4. Time-and-Motion Analysis

Anyone who contracts for a lead-based paint inspection can also perform a simple check to determine if the inspector had sufficient time to complete the number of housing units reported as being tested in the time allotted. Usually, inspections require at least 1 to 2 hours per unit using existing technology. If the inspector's on-site time is significantly less than that, further investigation should be conducted to determine if the inspector actually completed the work in the report.

I. Documentation in Single-Family Housing

1. Data Forms

Data can be recorded on hand written forms, electronically, or by a combination of these two methods. XRF readings can be entered on handwritten forms, such as the set of forms (7.1, 7.1A, 7.2, and 7.3) provided at the end of this chapter (or comparable forms). Because handwriting can result in transcription errors, handwritten forms should be examined for missing data and copying errors.

2. Electronic Data Storage

Electronic data storage is recommended only if the data recorded are sufficient to allow another person to find the testing combination that corresponds to each XRF reading. Electronically stored data should be printed in hard copy either daily or at the completion of the inspection. The printout should be examined for extraneous symbols or missing data, including missing test location identification. In most cases, electronic data storage is supplemented by manual data recording of sampling location, operator name, and other information.

3. Final Report

The final report must include both a summary and complete information about the site, the inspector, the inspection firm, the inspection process, and the inspection results. The full report should include a complete data set, including:

- Housing unit identifiers;
- Date of the inspection;
- Identity of the inspector and the inspection firm and any relevant certifications or licenses held by the inspector and/or the firm;
- Building component and room equivalent identification or numbering system or sketches;
- All XRF readings (including calibration check readings);
- All paint chip analyses;
- Testing protocol used;
- Instrument manufacturer, model, serial number, mode(s) of operation and age of radioactive source;
- Information on the owner's legal obligation to disclose the inspection results to tenants and/or purchasers before obligation under 24 CFR part 35 and 40 CFR part 745 (published in the *Federal Register*, Volume 61, Number 45, March 6, 1996, starting on p. 9064; copies of the regulations and related materials can be obtained from the National Lead Information Center Clearinghouse, 1-800-424-LEAD); and
- Final classification of all testing combinations into positive or negative categories, including a list of testing combinations, or building component types and their substrates, that were classified but not individually tested. *(Note that the final report should not list inconclusive readings as a third category. If the client wishes to assume all inconclusive readings are positive, the report should state that assumption and present all readings and testing combinations for which the readings were inconclusive. It is not permissible to assume all inconclusive readings are negative. The report should include the actual readings for any testing combinations for which readings were inconclusive, but were classified as*

positive. Also note that final classifications are needed for building component types and their substrates that were not actually tested. For example, if the client wants to suspend testing on testing combinations that were found to be positive in the first five room equivalents and are assumed to be positive in the remaining rooms, the final report should list those testing combinations that are assumed to be positive).

The report should also contain a summary that answers two questions:

- (1) Is there lead-based paint in the house? *and*
- (2) if lead-based paint is present, where is it located?

The summary report should also include the house address where the inspection was performed, the date(s) of the inspection, the name, address and phone numbers of the inspector and inspection firm, any appropriate license or certification numbers, and the starting and ending times for each day when XRF testing was done. The summary should also contain language regarding disclosure, such as:

"A copy of this summary must be provided to new lessees (tenants) and purchasers of this property under Federal law (24 CFR part 35 and 40 CFR part 745) before they become obligated under a lease or sales contract. The complete report must also be provided to new purchasers and it must be made available to new tenants. Landlords (lessors) and sellers are also required to distribute an educational pamphlet and include standard warning language in their leases or sales contracts to ensure that parents have the information they need to protect their children from lead-based paint hazards."

Although 24 CFR part 35 and 40 CFR part 745 do not require that inspectors and owners keep copies of inspection reports for any specified period of time, future buyers are entitled to all available inspection reports, should the property be re-sold.

If no lead-based paint has been detected in the house, the summary should say so. The following language may be used:

"The results of this inspection indicate that no lead in amounts greater than or equal to 1.0 mg/cm² in paint was found on any building components, using the inspection protocol in Chapter 7 of the *HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (1997)*. Therefore, this dwelling qualifies for the exemption in 24 CFR part 35 and 40 CFR part 745 for target housing being leased that is free of lead-based paint, as defined in the rule. However, some painted surfaces may contain levels of lead below 1.0 mg/cm², which could create lead dust or lead-contaminated soil hazards if the paint is turned into dust by abrasion, scraping, or sanding. This report should be kept by the inspector and should also be kept by the owner and all future owners for the life of the dwelling."

Detailed documentation of the XRF testing should also be provided in the full report, including the raw data upon which it was based. The single-family housing forms provided at the end of this chapter or comparable forms would serve this purpose.

For a leased home, where no lead-based paint is identified during an inspection, the building owner is exempt from the requirements of the disclosure rule. However, when a housing unit with no lead-based paint is being sold, the owner still has responsibilities under the disclosure rule (e.g., providing a lead hazard information pamphlet to potential buyers). For selling and leasing properties where no lead-based paint is identified, it is strongly recommended that owners and inspectors retain inspection reports for the life of the building.

V. Inspections in Multifamily Housing

This section emphasizes the differences between single-family and multifamily housing paint inspections. The protocols mentioned in earlier sections are not repeated here. It will be necessary to read Section IV on single-family housing to implement the protocol for multifamily housing.

Use of the multifamily protocol is less time-consuming and more cost effective than inspecting all units in a given housing development or

building because in most instances a pattern can be determined after inspecting a fraction of the units. The number of units tested is based on the date of construction and the number of units in the housing development.

For purposes of this chapter only, multifamily housing is defined as any group of units that are similar in construction from unit to unit, with:

- 21 or more units, if any were built before 1960 or are of unknown age, or
- 10 or more units, if they were all built from 1960 through 1977.

Developments with fewer units should be treated as a series of single-family housing units.

A. Statistical Confidence in Dwelling Unit Sampling

The number of similar units, similar common areas or exterior sites to be tested (the sample size) is based on the total number units, similar common areas or exterior sites in the building(s), as specified in Table 7.3. Use the table for sampling each set of similar units, each set of similar common areas and each set of exterior sites. For pre-1960 or unknown-age buildings or developments with 1,040 or more similar units, similar common areas or exterior sites, test 5.8 percent of them, and round up any fraction to the next whole number. For 1960-77 buildings or developments with 1,000 or more units, test 2.9 percent of the units, and round up any fraction to the next whole number. For reference, the table shows entries from 1500 to 4000 in steps of 500. For example, in a development built in 1962, with 200 similar units, 20 similar common areas, and 9 similar exterior sites, sample 27 units, 16 common areas, and all 9 exterior sites.

If lead levels in *all* units, common areas or exterior sites tested are found to be below the 1.0 mg/cm² standard, these sample sizes provide 95 percent confidence that:

- For pre-1960 housing units, less than 5 percent or fewer than 50 (whichever is less) units, common areas or exterior sites, have lead at or above the standard; and
- For 1960 to 1977 housing units, less than 10 percent or fewer than 50 (whichever is less) units, common areas or exterior sites, have lead at or above the standard.

Refer to Appendix 12 of these Guidelines for the statistical rationale for this table. The Appendix shows the details of the calculation for pre-1960 housing; the calculation is the same for 1960-1977

housing, except for using the 10 percent criterion for 1960-1977 housing, rather than the 5 percent used for older housing.³

Table 7.3: Number of Units to be Tested in Multifamily Developments

Number of Similar Units, Similar Common Areas or Exterior Sites in a Building or Development	Pre-1960 or Unknown-Age Building or Development: Number to Test	1960-1977 Building or Development: Number to Test
1-9	All	All
10-13	All	10
14	All	11
15	All	12
16-17	All	13
18	All	14
19	All	15
20	All	16
21-26	20	16
27	21	17
28	22	18
29	23	18
30	23	19
31	24	19
32	25	19
33-34	26	19
35	27	19
36	28	19
37	29	19
38-39	30	20
40-48	31	21
49-50	31	22
51	32	22
52-53	33	22
54	34	22
55-56	35	22

Number of Similar Units, Similar Common Areas or Exterior Sites in a Building or Development	Pre-1960 or Unknown-Age Building or Development: Number to Test	1960-1977 Building or Development: Number to Test
57-58	36	22
59	37	23
60-69	38	23
70-73	38	24
74-75	39	24
76-77	40	24
78-79	41	24
80-88	42	24
89-95	42	25
96-97	43	25
98-99	44	25
100-109	45	25
110-117	45	26
118-119	46	26
120-138	47	26
139-157	48	26
158-159	49	26
160-177	49	27
178-197	50	27
198-218	51	27
219-258	52	27
259-279	53	27
280-299	53	28
300-279	54	28
380-499	55	28
500-776	56	28
777-939	57	28

Number of Similar Units, Similar Common Areas or Exterior Sites in a Building or Development	Pre-1960 or Unknown-Age Building or Development: Number to Test	1960-1977 Building or Development: Number to Test
940-1004	57	29
1005-1022	58	29
1023-1032	59	29
1033-1039	59	30
1500	87	44
2000	116	58
2500	145	73
3000	174	87
3500	203	102
4000	232	116

Although the data set used to develop sample sizes in multifamily housing⁴ was not randomly selected from all multifamily housing developments in the nation (no such data set is available), analyses drawn from the data are likely to err on the side of safety and public health for at least two reasons: First, the prevalence and amounts of lead-based paint are highest in pre-1960 housing developments. The sampling approach used here focuses inspection efforts on buildings where a greater chance of lead-based paint hazards exist.

Second, and perhaps more important, none of the 65 developments had lead-based paint in 5 to 10 percent of the units. That indicates lead-based paint in this range is likely to be quite rare and that plausible increases in sampling to improve detection in this range will fail to improve confidence in the results significantly. Most painting follows a pattern: Property owners or managers often paint all surfaces, all components within a room, or similar components in all rooms in a unit when there is tenant turnover. It is unlikely that lead-based paint distributions are completely random, as assumed in the 1995 edition of the *Guidelines*. From the available data, there appears to be no significant benefit to increasing the number of units to be sampled to detect a prevalence

rate of 5 to 10 percent, because few developments are likely to be in that range. In short, the sampling design presented here will yield a more targeted, cost-effective approach to identifying lead-based paint where it is most likely to exist.

B. Selection of Housing Units

The first step in selecting housing units is to identify buildings in the development with a common construction based on written documentation or visual evidence of construction type. Such buildings can be grouped together for sampling purposes. For example, if two buildings in the development were built at the same time by the same builder and appear to be of similar construction, all of the units in the two buildings can be grouped for sampling purposes. Units can have different sizes, floor plans, and number of bedrooms and still be grouped.

The specific units to be tested should be chosen *randomly* from a list of all units in each building or buildings. The "Selection of Units" form (Form 7.4) or a comparable form may be used to aid in the selection process. A complete list of all units in each group should be used and a separate identifying sequential number must be assigned to each unit. For

example, if apartment addresses are shown as 1A, 1B, 2A, 2B etc., they must be given a sequence number (1, 2, 3, 4, etc.).

Obviously, units without identifiers could not be selected for inspection and would thus bias the sampling scheme. The list of units should be complete and verified by consulting building plans or by a physical inspection of the development.

Specific units to be tested should be selected randomly using the formula below, and a table of random numbers or the random number function on a calculator. Tables of random numbers are often included in statistics books. Calculators with a random number function key can be obtained for less than \$20 and are easier to use than tables. Inspectors are, therefore, advised to use them to obtain the random numbers, which can then be used to select the specific numbered units. A unit number is selected by rounding up the product of the random number times the total number of units in the development to the *next* whole number. That is:

Housing Unit number = Random number *times* Total number, rounded *up*,

where:

Housing Unit number = the identification number for a unit in a list;

Random number = a random number between 0 and 1;
and

Total number = the total number of units in a list of units.

The same unit may be selected more than once by this procedure. Because each unit should be tested only once, duplicate selection should be documented and then discarded. The procedure should be continued until an adequate number of units has been selected.

The "Selection of Units" form (Form 7.4) is completed by filling in as many random numbers as are needed in the appropriate column. Numbers for the third column are obtained by multiplying the total development size by each random number. Numbers for the fourth column are obtained by rounding up from the previous calculation to the next whole number. If the whole

number in the fourth column has already been selected, that selection should not be entered again. The notation "DUP" should be entered to show that the selection was a duplicate. This process should continue until the required number of distinct sample numbers have been selected. Common areas and exterior room equivalents should be identified at this time, but they are not considered to be separate units.

C. Listing Testing Combinations

The "Multifamily Housing LBP Testing Data Sheet" form (Form 7.5) -- or a comparable form -- should be used to list the testing combinations in each unit, common area and exterior site that was selected for inspection. In multifamily housing, the inventory of testing combinations often will be similar for units that have the same number of bedrooms. The inspector should, however, list testing combinations that are unique to each tested unit. For example, some units may contain built-in cabinets while others do not. The selection of testing combinations should, therefore, be carried out independently in each inspected unit.

As in single family housing, take readings on all testing combinations in all room equivalents in each unit selected for testing.

1. Common Areas

Similar common areas and similar exterior sites must always be tested, but in some cases they can be sampled in much the same way that dwelling units are. Common areas and building exteriors typically have a similar painting history from one building to the next. In multifamily housing, each common area (such as a building lobby, laundry room, or hallway) can be treated like a dwelling unit. If there are multiple similar common areas, they may be grouped for sampling purposes in exactly the same way as regular dwelling units are. However, dwelling units, common areas and exterior sites cannot all be mixed together in a single group.

All testing combinations within each common area or on building exteriors selected for testing must be inspected. This includes playground equipment, benches and miscellaneous testing combinations located throughout the development. The specific

common areas and building exteriors to test should be randomly selected, in much the same way as specific units are selected using random numbers. (See Section IV.B, above).

The number of common areas to test should be taken from Table 7.3. In this instance, common areas and building exteriors can be treated in the same way as housing units (although they are not to be confused with true housing units).

D. Number of Readings on Each Testing Combination

The method for collecting XRF readings is identical for multifamily and single-family housing (see Section IV).

E. XRF Calibration Check Readings

The method for collecting and evaluating XRF calibration check readings is identical for multifamily and single-family housing (see Section IV.D).

F. Substrate Correction in Multifamily Housing

The method for correcting XRF readings for substrate bias is identical for multifamily and single-family housing (see Section IV.E) with one exception: For multifamily housing, randomly select two housing units to be used to collect substrate measurements for all substrates within the development that need correction, and use the results from those two units to perform substrate correction calculations in all tested units within the development or building. If substrates exist in common areas or on exterior sites that do not exist in residential areas, select two locations from these areas for substrate correction. Otherwise, the same substrate correction readings can be applied to dwelling units, common areas and exterior sites.

G. Classification of XRF Results in Multifamily Housing

The inspector should record each XRF reading for each testing combination on the "Multifamily Housing LBP Testing Data Sheet," (Form 7.5) or a comparable form, and indicate whether that testing combination was

classified as positive, negative, or inconclusive as described previously for single-family housing.

When the inspection is completed in all of the selected units and the classification rules have been applied to all XRF results, the "Multifamily Housing: Component Type Report" form (Form 7.6) or a comparable form should be completed. Building component types -- groups of like components constructed of the same substrate in the multifamily housing development -- are aggregated on this form. For example, grouping all interior walls would create an appropriate component type if all walls are plaster. Grouping all doors would not be appropriate, however, if some doors are metal and some are wood. At least 40 testing combinations of a given component type in a multifamily housing development must be tested to obtain the desired level of confidence in the results. (Refer to Appendix 12 of these *Guidelines* for the statistical rationale for this minimum number of component types to test.) If fewer than 40 testing combinations of a given component type were tested, test additional combinations of that component type. If less than 40 components of a given type exist in the units to be tested, test all of the components that do exist.

In some cases additional sampling of the specific component may not be necessary. If no lead at or above the standard is found on that component type, additional measurements should be taken in other units to increase the sample size to 40. However, if all or most of the sampled component types are positive, no further sampling is needed, provided that the building owner agrees with this reduction of testing. For example, if 20 out of 60 doors are tested, and the majority are positive for lead-based paint, all similar doors in the buildings may be presumed positive. Note, however, that all required XRF testing and laboratory analysis, if necessary, must be completed to conclude that all components included in a given component type are negative.

On the "Multifamily Housing: Component Type Report" form, the substrate, and component for each component type should be recorded under the heading "Description" (for example, wooden interior doors) as well as the total number of testing combinations included in the component type. In addition, for each component type, the aggregated positive, negative, and inconclusive classifications should be recorded as

described below. Record the number and percentage of testing combinations classified as:

- Positive for lead-based paint. This is based upon a positive XRF reading in accordance with the XRF's Performance Characteristic Sheet;
- Inconclusive and having XRF readings less than the midpoint of the XRF's inconclusive range ("low inconclusive");
- Inconclusive and having XRF readings equal to or greater than the midpoint of the XRF's inconclusive range ("high inconclusive"); and
- Negative for lead-based paint.

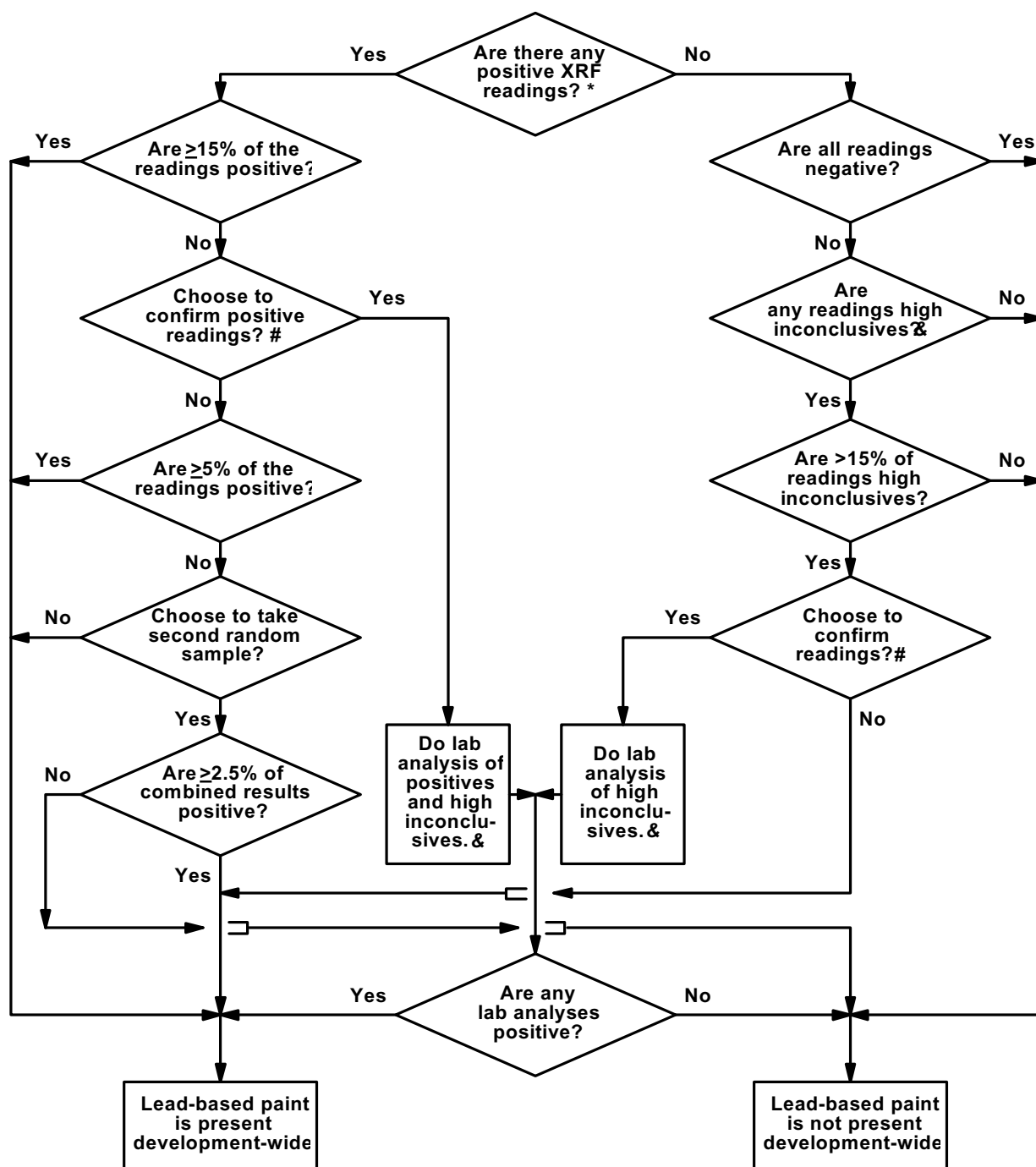
The "Multifamily Decision Flowchart" (Figure 7.1) should be used to interpret the aggregated XRF testing results in the "Multifamily Housing: Component Type Report" form. The flowchart is applied separately to each component/substrate type (wood doors, metal window casings, etc.) and shows one of the following results:

- **Positive:** Lead based-paint is present on one or more of the components.
- **Negative:** Lead based-paint is not present on the components throughout the development. (Lead may still be present at lower loadings and hazardous leaded dust may be generated during modernization, renovation, remodeling, maintenance, or other disturbances of painted surfaces.)

These results are obtained by following the flowchart. The decision that lead-based paint is present is reached with 99 percent confidence if 15 percent or more of the components are positive. (Refer to Appendix 12 for the statistical rationale for this percentage.) The decision that lead-based paint is not present throughout the development is reached if: (1) 100 percent of the

tested component types are negative, or (2) 100 percent of the tested component types are classified as either negative or inconclusive *and* all of the inconclusive classifications have XRF readings less than the midpoint of the inconclusive range for the XRF in use. Note that the midpoint of the inconclusive range is *not* a threshold; it is used only for classifying XRF readings in multifamily housing in conjunction with information about other XRF readings as described here. (See section 2 below for guidance on what to do when the percentage of positive readings is less than 5%). For cases with greater than or equal to 5% positives *and* less than 15% positives, as well as no positives but greater than 15% high inconclusives, some confirmatory laboratory testing may be needed to reach a final conclusion, unless the client wishes to assume the validity of the XRF results and that all inconclusives are positive. For each testing combination with an inconclusive XRF reading at or above the midpoint of the inconclusive range, a paint-chip sample should be analyzed by a laboratory recognized by the EPA National Lead Laboratory Accreditation Program. If all the laboratory-analyzed samples are negative, it is not necessary to test inconclusive XRF results below the midpoint of the inconclusive range. If, however, *any* laboratory results are positive on a component type, all inconclusives equal to or above the midpoint of the inconclusive range should be analyzed. Once all laboratory results have been reported, the "Multifamily Housing: Component Type Report" form should be updated to include the laboratory results and classifications (either positive or negative).

The "Multifamily Decision Flowchart" is based on data collected by EPA in a large field study of XRF instruments (EPA 1995). Percentages were chosen so that, for each component type, there is a 98 percent chance of correctly concluding that lead-based paint is either absent on all components or present on at least one component of a given



* "Positive," "negative," and "inconclusive" XRF readings are determined in accordance with the XRF instrument's Performance Characteristics Sheet as described in the HUD Guidelines for the Evaluation and Control of Lead Hazards in Housing, chapter 7.

& A high inconclusive reading is an XRF reading at or above the midpoint of the inconclusive range. For example, if the inconclusive range is 0.41 to 1.39, its midpoint (average) is 0.90; a reading in the range from 0.90 to 1.39 would be a high inconclusive reading.

Any paint or coating may be assumed to be lead-based paint, even without XRF or laboratory analysis. Similarly, any XRF reading may be confirmed by laboratory analysis.

Figure 7.1 Multifamily Decision Flowchart

type. Thus, the probability that a tested component type will be correctly classified is very high.

Percentages of positive or inconclusive results are computed by dividing the number in each classification group by the total number of testing combinations of the component type that were tested. For example, if 245 wooden doors in a multifamily housing development were tested and 69 were classified as inconclusive with XRF readings less than the midpoint of the inconclusive range, 28 percent $[(69 / 245) \times 100 \text{ percent} = 28.2 \text{ percent}]$ should be recorded on the form in the "<1.0 percent" columns under the heading "Inconclusive."

1. Unsampled Housing Units

If a particular component type in the sampled units is classified as positive, that same component type in the unsampled units is also classified as positive. For those cases where the number of positive components is small, further analysis may determine if there is a systematic reason for the specific mixture of positive and negative results.

For example, suppose that a few porch railings tested negative, but most tested positive. Examination of the sample results in conjunction with the building records showed that the porch railings classified as positive were all original and the railings classified as negative were all recent replacements. The records did not reveal which units had replaced railings, and due to historic preservation requirements, the replacement railings were identical in appearance to the old railings. Thus, all unsampled original porch railings could be classified as positive, and all unsampled recently replaced porch railings could be classified as negative if at least 40 of the replaced porch railings had been tested.

2. Fewer than 5% Positive Results

Where a small fraction of XRF readings, less than 5 percent, of a particular component type are positive, several choices are available:

- First, the inspector may confirm the results by laboratory analysis, which is considered definitive when performed as described in Section VI, below; a laboratory lead result of

1.0 mg/cm² or greater (or 0.5 percent by weight or greater) is considered positive.

- Second, the inspector may select a second random sample (using unsampled units only) and test the component type in those units. If less than 2.5% of the combined set of results is positive, the component type may be considered as not having lead-based paint development-wide, but, rather, having lead-based paint in isolated locations, with a reasonable degree of confidence. Individual components that are classified positive should be considered as being lead-based painted and managed or abated appropriately.
- Finally, if the client chooses not to confirm the results by laboratory analysis and not to take a second set of measurements, then the component type should be considered as having lead-based painted development-wide.

The inspector may wish to advise the client that the cost of additional XRF testing or laboratory analysis is usually much less than the cost of lead abatement or interim control projects, and that this is of particular interest in the situation where few results are positive, because there is a significant chance that the paint, development-wide, may not be lead-based.

Whatever approaches are used, all painted individual surfaces found to be positive for lead must be included in the inspection report, regardless of development-wide conclusions.

H. Evaluation of the Inspection

The methods for evaluating inspection services in multifamily housing are identical to those described for single-family housing (see Section IV.H) except for the retesting option: In multifamily housing, a total of 10 testing combinations should be selected for retesting in two units.

I. Documentation in Multifamily Housing

The method for documentation is identical for multifamily and single-family housing (see Section IV.I), with the following exception: Use forms 7.2

through 7.6 for multifamily housing (see Addendum 2) or comparable forms, not the single-family housing forms.

When lead-based paint has been found in some units it must be managed or treated as such in those units, even if the inspection indicates that it is not present development wide.

VI. Laboratory Testing for Lead in Paint

For inconclusive XRF results and areas that cannot be tested using an XRF instrument, a paint-chip sample should be collected using the protocol outlined here and in Appendix 13.2 of these *Guidelines*. The sample should be analyzed by a laboratory recognized under the EPA National Lead Laboratory Accreditation Program (NLLAP) using the analytical method(s) it used to obtain the laboratory's recognition. If a paint chip sample cannot be collected, the inspection report should include a list of surfaces where paint chip samples were needed but not taken (in this case, the client would assume that inconclusives requiring confirmation by laboratory analysis are positive).

A. Number of Samples

Only one paint-chip needs to be taken for each testing combination. Additional samples can be collected as a quality control measure, if desired.

B. Size of Samples

The paint-chip sample should be taken from a 4-square-inch (25-square-centimeter) area that is representative of the paint on the testing combination, as close as possible to any XRF reading location and, if possible, unobtrusive. This area may be a 2 by 2 inch (5 by 5 centimeter) square, or a 1 by 4 inch (2½ by 10 centimeter) rectangle, or have any other dimensions that equal at least 4 square inches (25 square centimeters). Regardless of shape, the dimensions of the surface area must be accurately measured (to the nearest millimeter or 1/16th of an inch) so that laboratory results can be reported in mg/cm². Results should be reported as percent by weight if the dimensions of the surface area cannot be accurately measured or if all paint within the sampled area cannot be removed. In these cases, lead should be reported in ppm or percent by weight, *not* in

mg/cm². Smaller surface areas can be used if acceptable to the laboratory.

The 4-square-inch (25-square-centimeter) area practically guarantees that a sufficient amount of paint will be collected for laboratory analysis. As a result, samples will sometimes weigh more than required for some laboratory analysis methods. Smaller-sized paint chips may be collected if permitted by the laboratory. (See ASTM E 1729). In all cases, the inspector should consult with the NLLAP recognized laboratory selected regarding specific requirements for the submission of samples for lead-based paint analysis.

C. Inclusion of Substrate Material

Inclusion of small amounts of substrate material in the paint-chip sample will result in minimal error if results are reported in mg/cm², but including any amount of substrate can result in less precise results, with worse effect as the amount of substrate increases. Substrate material may not be included if results are to be reported in weight percent (or ppm).

D. Repair of Sampled Locations

Areas from which paint-chip samples are collected should be repaired and cleaned, unless the area will be removed, encapsulated, enclosed, or repainted before occupancy. Repairs can be completed by repainting, spackling, or any other method of covering that renders the bare surface inaccessible. Cleanup should be done with wet wiping and rinsing, and it should be done on both the surface and the floor underneath the surface sampled. The new covering or coating should have the same expected longevity as new paint or primer. Repair is not necessary if analysis shows that the paint is not lead-based paint and leaving the damage is acceptable to the client and/or the owner.

E. Classification of Paint-Chip Sample Results

Any paint inspections may be carried out using only paint-chip sampling and laboratory analysis at the option of the purchaser of the inspection services. This option is not recommended because it is time consuming, costly, and requires extensive repairs. Paint-chip sampling also has opportunities for errors,

such as inclusion of substrate material (for results in weight percent), failure to remove all paint from an area (including paint that has bled into a substrate) and laboratory error. Nevertheless, paint-chip sampling generally has a smaller error than does XRF and is, therefore, appropriate as a final decisionmaking tool. Laboratory results of 1.0 mg/cm² or greater, or 0.5 percent or greater, are to be considered positive. If the laboratory reports both mg/cm² and weight percent for a sample, use whichever result is positive (if any) for final classification. In the rare situation where more than one paint-chip sample from a single testing combination is analyzed, the combination is considered positive if any of those samples is positive. All other results are negative. No inconclusive range is reported for laboratory measurements.

F. Units of Measure

Results should be reported in mg/cm², the primary unit of measure for lead-based paint analyses of surface coatings. Results should be reported as percent by weight only if the dimensions of the surface area cannot be accurately measured or if not all paint within the sampled area can be removed. In these cases, results should not be reported in mg/cm², but in weight percent.

Weight measurements are usually reported as micrograms per gram (μg/g), milligrams per kilogram (mg/kg), or parts per million (ppm) by weight. For example, a sample with 0.2 percent lead may also be reported as 2,000 μg/g lead, 2,000 mg/kg lead, or 2,000 ppm lead.

G. Sample Containers

Samples should be collected in sealable rigid containers such as screw-top plastic centrifuge tubes, rather than plastic bags which generate static electricity and make quantitative transfer of the entire paint sample in the laboratory impossible. Paint-chip collection should

include collection of all the paint layers from the substrate, but collection of actual substrate should be minimized. Refer to ASTM E 1729 and Appendix 13 of these *Guidelines* for further details on collection of paint-chip samples.

H. Laboratory Analysis Methods

Several standard laboratory technologies are useful in quantifying lead levels in paint-chip samples. These methods include, but are not limited to, Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES), Anodic Stripping Voltammetry (ASV), and Potentiometric Stripping Voltammetry (PSV).

For analytical methods that require sample digestion, samples should be pulverized so that there is adequate surface area to dissolve the sample before laboratory instrument measurement. In some cases, the amount of paint collected from a 4-square-inch (25-square-centimeter) area may exceed the amount of paint that can be analyzed successfully. It is important that the actual sample mass analyzed not exceed the maximum mass the laboratory has successfully tested using the specified method. If subsampling is required to meet analytical method specifications, the laboratory must homogenize the paint-chip sample (unless the entire sample will eventually be analyzed and the results of the subsamples combined). Without homogenization, subsampling would likely result in biased, inaccurate lead results (see ASTM E 1645). See ASTM PS 87 for an ultrasonic extraction method for preparing paint samples for subsequent analysis for lead.

If the sample is properly homogenized and substrate inclusion is negligible, the result can be reported in either milligrams per square centimeter (mg/cm²; the preferred unit), percent by weight, or both. The following equation should be used to report the results in milligrams per square centimeter:

$$\text{mg/cm}^2 = \frac{\text{weight of lead from subsample (in mg)} \times \frac{\text{total sample weight (in g)}}{\text{subsample weight (in g)}}}{\text{sample area (in cm}^2\text{)}}$$

To report results in weight percent, the following equation should be used:

Weight percent = weight of lead in the subsample/weight of subsample x 100.

To report results in micrograms per gram ($\mu\text{g/g}$), the following equation should be used:

$$\mu\text{g/g} = \frac{\text{weight of lead from subsample (in } \mu\text{g})}{\text{subsample weight (in g)}}$$

If the laboratory reports results in both mg/cm^2 and weight percent, and if one result is positive and the other negative, the sample is classified as positive.

Whatever the preparation techniques of paint-chip samples (including homogenization, grinding, and digestion), and instrument selection and operation selected, the inspector should verify, prior to the collection and submission of samples, that the laboratory is approved to perform the appropriate analytical methodologies. Methods should be applied to paint-chip materials of approximately the same mass and lead loading (also called area concentration, measured in mg/cm^2) as those samples anticipated from the field.

Because of the potential for sample mass to affect the precision of lead readings, laboratory analysis reference materials processed with field samples for quality assurance purposes should have close to the same mass as those used for paint-chip samples. Refer to ASTM E 1645 or equivalent methods for further details on laboratory preparation of paint-chip samples, and refer to ASTM E 1613, ASTM E 1775, ASTM PS 88, or equivalent methods on analysis of samples for lead.

I. Laboratory Selection

Only a laboratory recognized under EPA's National Lead Laboratory Accreditation Program (NLLAP) should be used for lead-based paint analysis. Such a laboratory is required to use the same analytical methods that it used to obtain accreditation. EPA established NLLAP to provide the public with laboratories that have a demonstrated capability for analyzing lead in paint chip, dust, and soil samples at the levels of concern stated in these *Guidelines*. In some states, an NLLAP laboratory *must* be used. To participate in NLLAP, a laboratory must:

- Participate successfully in the Environmental Lead Proficiency Analytical Testing Program (ELPAT). ELPAT is administered by the American Industrial Hygiene Association (AIHA) in cooperation with the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), and EPA. The proficiency testing samples used in ELPAT consist of variable levels of lead in paint, dust, and soil matrices.
- Undergo a systems audit, including an on-site visit. The systems audit must be conducted by an accrediting organization with a program recognized by EPA through a Memorandum of Understanding (MOU). Laboratory accrediting organizations participating in NLLAP have accrediting program requirements that meet or exceed NLLAP laboratory quality system requirements stated in the MOU.

An up-to-date list of fixed-site and mobile laboratories recognized by the EPA NLLAP for analysis of paint-chip samples may be obtained from the National Lead Information Center Clearinghouse by calling 1-800-424-LEAD or from the Lead Listing at <http://www.leadlisting.org>. Since December 1993, the American Association for Laboratory Accreditation (A2LA) and AIHA have been recognized as laboratory-accrediting organizations participating in NLLAP. NLLAP specifies quality control and data reporting requirements, as described in "Laboratory Quality System Requirements," which can be found in Appendix A of the NLLAP Model MOU. The MOU can also be obtained by calling the National Lead Information Center Clearinghouse, at the number above. The evaluation approach in ASTM E 1583 may be considered in selecting laboratories to use

from among available NLLAP-recognized laboratories.

J. Laboratory Report

The laboratory report for analysis of paint samples for lead should include both identifying information and information about the analysis. At a minimum, this should include:

- Laboratory identifying information: including the laboratory's name, address, and phone number, and NLLAP and other applicable certification and accreditation information; similarly, the client and/or project's name and address should be provided.
- Analytical method information: including the information provided in accordance with NLLAP procedures, and ASTM E 1613, ASTM PS 88 or equivalent method(s) for analysis for lead.
- Sample information: including field sample number and any information (e.g., sample type and/or location) given to the laboratory about the sample, unique laboratory sample number, analytical method (including a description of any variations from the standard method), quality control/quality assurance results, date of analysis, operational or testing problems or unusual occurrences.

VII. Radiation Hazards

Portable XRF instruments used for lead-based paint inspections contain radioactive isotopes that emit X rays and gamma radiation. Proper training and handling of these instruments is required to protect the instrument operator and any other persons in the immediate vicinity during XRF usage. The XRF instrument should be in the operator's possession at all times. The operator should never defeat or override any safety mechanisms of XRF equipment.

A. XRF Use Licenses and Certification

In addition to training and certification in lead-based paint inspection, a person using a portable XRF

instrument for inspection must have valid licenses or permits from the appropriate Federal, State, and local regulatory bodies to operate XRF instruments because of radioactive materials they contain. All portable XRF instrument operators should be trained by the instrument's manufacturer (or equivalent). XRF operators should provide related training, licensing, permitting, and certification information to the person who has contracted for their services before an inspection begins. Depending on the State, operators may be required to hold three forms of proof of competency: manufacturer's training certificate (or equivalent), a radiation safety license, and a State lead-based paint inspection certificate or license. To help ensure competency and safety, HUD and EPA recommend that clients hire only those inspectors who hold all three.

The regulatory body responsible for oversight of the radioactive materials contained in portable XRF instruments depends on the type of material being handled. Some radioactive materials are Federally regulated by the U.S. Nuclear Regulatory Commission (NRC); others are regulated at the State level. States are generally categorized as "agreement" and "non-agreement" States. An agreement State has an agreement with NRC to regulate radioactive materials that are generally used for medical or industrial applications. (Most radioactive materials found in XRF instruments are regulated by agreement States). For non-agreement States, NRC retains this regulatory responsibility directly. At a minimum, however, most State agencies require prior notification that a specific XRF instrument is to be used within the State. Fees and other details regarding the use of portable XRF instruments vary from State to State. Contractors who provide inspection services must hold current licenses or permits for handling XRF instruments, and must meet any applicable State or local laws or notification requirements.

Requirements for radiation dosimetry by the XRF instrument operator (wearing dosimeter badges to monitor exposure to radiation) are generally specified by State regulations, and vary from State to State. In some cases, for some isotopes, no radiation dosimetry is required. Because the cost of dosimetry is low, it should be conducted, even when not required, for the following four reasons:

- XRF instrument operators have a right to know the level of radiation to which they are exposed during the performance of the job. In virtually all cases, the exposure will be far below applicable exposure limits.
- Long-term collection of radiation exposure information can aid both the operator (employee) and the employer. The employee benefits by knowing when to avoid a hazardous situation; the employer benefits by having an exposure record that can be used in deciding possible health claims.
- The public benefits by having exposure records available to them.
- The need for equipment repair can be identified more quickly.

B. Safe Operating Distance

XRF instruments used in accordance with manufacturer's instructions will not cause significant exposure to ionizing radiation. But the instrument's shutter should never be pointed at anyone, even if the shutter is closed.

The safe operating distance between an XRF instrument and a person during inspections depends on the radiation source type, radiation intensity, quantity of radioactive material, and the density of the materials being surveyed. As the radiation source quantity and intensity increases, the required safe distance also increases. Placing materials, such as a wall, in the direct line of fire, reduces the required safe distance. According to NRC rules, a radiation dose to an individual in any unrestricted area must not exceed 2 millirems per hour. One of the most intense sources currently used in XRF instruments is a 40-millicurie ⁵⁷Co (Cobalt-57) radiation source. Other radiation sources in current use for XRF testing of lead-based paint generally produce lower levels of radiation. Generally, an XRF operator conducting inspections according to manufacturer's instructions would be exposed to radiation well below the regulatory level (State of Wisconsin 1994). Typically, XRF instruments with lower gamma radiation intensities can use a shorter safe distance provided that the

potential exposure to an individual will not exceed the regulatory limit.

Persons should not be near the other side of a wall, floor, ceiling or other surface being tested. Verify that this is indeed the case prior to initiating XRF testing activities, and check on it during testing.

If these practices are observed, the risk of excessive exposure to ionizing radiation is extremely low and will not endanger any inspectors or occupants present in the dwelling.

VIII. REFERENCES

EPA 1995. "A Field Test of Lead-Based Paint Testing Technologies: Technical Report, EPA 747-R-95-002b, U.S. Environmental Protection Agency, Washington DC, May 1995.

EPA and HUD 1996. 24 CFR 35, subpart H, and 40 CFR 745, subpart F. Requirements for Disclosure of Known Lead-Based Paint and/or Lead-Based Paint Hazards in Housing. Published, along with their preamble, in the *Federal Register*, volume 61, pp. 9064-9088, March 6, 1996. Implements Section 1018 of Title X.

EPA 1996. 40 CFR 745, subparts L and Q. Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities. Published, along with its preamble, in *Federal Register*, volume 61, pp. 45777-45830, August 29, 1996. Implements Sections 402 and 404 of the Toxic Substances Control Act.

State of Wisconsin 1994. Wisconsin Department of Health and Social Services, memo from Mark Chamberlain dated April 28, 1994. Measurements showed that exposures to radiation during operation of a Scitec MAP 3 XRF were 132 μ rem/day, which can be compared to about 1,400 μ rem/day from natural background radiation.

Addendum 1

Examples of Lead-Based Paint Inspections

A. Example of a Single-Family Housing Inspection

The inspector completed the "Single-Family Housing LBP Testing Data Sheet," recording "bedroom (room 5)" as the room equivalent and listing "plaster" as the first substrate. The completed inventory of testing combinations in the bedroom indicated the presence of wood, plaster, metal, and drywall substrates. Brick and concrete substrates were not present in the bedroom. Descriptions of all testing combinations in the bedroom were recorded. Completed Form 7.1 shows the completed inventory for all testing combinations in the bedroom. (Completed Forms are found in Addendum 3, after the blank forms.)

Before any XRF testing, the inspector performed the manufacturer's recommended warm up procedures. The film was placed more than 12 inches (0.3 meters) away from a painted or other surface. The inspector then took three calibration check readings (1.18 mg/cm², 0.99 mg/cm², and 1.07 mg/cm²) on the NIST SRM with a lead level of 1.02 mg/cm². Results of the first calibration check readings were recorded on the "Calibration Check Test Results" form (see Completed Form 7.2).

The inspector then averaged the three readings (1.08 mg/cm²), and computed the calibration difference (1.08 mg/cm² - 1.02 mg/cm² = 0.06 mg/cm²) and compared this to the calibration check tolerance shown in the *XRF Performance Characteristic Sheet* (see Completed Form 7.2). The calibration difference was not greater than the 0.20 calibration check limits around the NIST SRM standard of 1.02 mg/cm², that is, the difference was within the range of 0.82 mg/cm² to 1.22 mg/cm², inclusive. The instrument was considered in calibration, and XRF testing could begin.

The inspector recorded the results from the XRF testing in the bedroom on the "Single-Family Housing LBP Testing Data Sheet." At that point, the inspector was able to complete this form only through the XRF Reading column (see Completed Form 7.1). The remainder of the form was completed after the testing combinations in the house were inspected and correction values for substrate bias were computed. The inspector then moved on to inspect the next room equivalent.

The other bedroom, the kitchen, a living room, and a bathroom were also inspected. Three substrates -- wood, drywall, and plaster -- were found in these room equivalents. XRF testing for lead-based paint was conducted, using the same methodology employed in the first bedroom (room 5). After these five room equivalents were tested, the inspector noticed that all baseboards and all crown molding of the same substrate had XRF values of more than 5.0 mg/cm². The client had agreed earlier that testing could be abbreviated in this situation, so no further baseboard and crown molding testing combinations were tested in the remaining room equivalents. All similar remaining untested baseboard and crown molding with identical substrates were classified as positive in the final report based on the results of those tested. The raw data for the tested baseboards and crown moldings were also included in the final report.

Four hours after the initial calibration check readings, the inspector took another set of three calibration check readings. (If the inspection had taken less than 4 hours, as is common, the second calibration check test would have been conducted at the end of the inspection.) The readings were 1.45 mg/cm², 1.21 mg/cm², and 1.10 mg/cm²; the inspector recorded the results on the "Calibration Check Test Results" form (Completed Form 7.2). The inspector then averaged the three readings (1.25 mg/cm²), and computed the calibration difference (1.25 mg/cm² - 1.02 mg/cm² = 0.23 mg/cm²) and compared this to the calibration check tolerance shown in the *XRF Performance Characteristic Sheet* on Completed Form 7.2. The calibration difference exceeded the 0.20 calibration check tolerance. The inspector then marked "Failed calibration check" on the data sheets for those room equivalents that had been inspected since the last

successful calibration check test, and consulted the manufacturer's recommendations. After trying, the instrument could not be brought back into control. Consequently, the inspector began using a backup instrument, after performing a calibration check and manufacturer's warm up and quality control procedure. The calibration check test showed that the backup instrument was operating acceptably. The inspector used the backup instrument to reinspect the room equivalents checked with the first instrument, and then all the other room equivalents in the home. Next, because substrate correction was required for all results on wood and metal below 4.0 mg/cm² as specified in the *XRF Performance Characteristic Sheet* for the XRF model in use, the inspector prepared to take readings for use in the substrate correction computations. Using the random number function on a calculator and the list of sample location numbers, the inspector randomly selected two testing combinations each with wood and metal substrates where initial readings were less than 2.5 mg/cm², removed the paint from an area on each selected testing combination slightly larger than the faceplate of the XRF instrument, took three readings on the bare substrates, and recorded the readings on the "Substrate Correction Values" form (Completed Form 7.3). The inspector calculated the correction values for each substrate by averaging the six readings from the two test locations, rounded the result to the 2 places after the decimal point that the XRF instrument displayed, and recorded the information in the Correction Value row. The inspector then transferred the correction values to the "Single-Family Housing LBP Testing Data Sheet" for each corresponding substrate.

After the inspector had finished taking the readings needed to compute the substrate correction values, the inspector took another set of three calibration check readings. The inspector recorded the results on the "Calibration Check Test Results" form, under Second Calibration Check, for readings taken by the backup XRF instrument (Completed Form 7.2). The second (and final) calibration check average did not exceed the 0.20 calibration check tolerance. The inspector, therefore, deemed the XRF testing to be complete.

The inspector then calculated the corrected readings by subtracting the substrate correction value from each XRF result taken on a wood or metal substrate. The substrate correction value was obtained by averaging readings on bare surfaces that had initially measured less than 2.5 mg/cm² with the paint still on the surface (Completed Form 7.3). The inspector also used the inconclusive ranges obtained from the XRF Performance Characteristic Sheet (0.41 mg/cm² to 1.39 mg/cm²) for all substrates except plaster (inconclusive range 1.01 mg/cm² to 1.09 mg/cm²). Based on the valid window sill XRF readings, including substrate corrections for wood, there were initially 10 positive results, 2 inconclusive results, and 3 negative results in the bedroom. The two inconclusive results required paint-chip sampling with laboratory confirmation; this resulted in one positive and one negative result. The inspector then filled out the "Single-Family Housing: Component Type Report" (Completed Form 7.1A). A description of each component type was recorded in the first column, the total number of each tested component type was entered in the second column, and the number of testing combinations classified as positive for each component type from the "Single-Family Housing LBP Testing Data Sheet" (Completed Form 7.1) was calculated and entered in the third column. The inspector then did the same for the testing combinations classified as negative. Based upon the XRF results as modified by the laboratory confirmation of the two inconclusive samples, Completed Form 7.1A shows 11 positive and 4 negative results for wood window sills. The remaining component types were entered in a similar fashion.

B. Example of Multifamily Housing Inspection

This section presents a simple example of a multifamily housing development inspection. An actual inspection would have many more testing combinations than are provided here.

The inspector's first step was a visual examination of the development to be tested. During this pretesting review, buildings with a common construction and painting history were identified and the date of construction -- 1948 -- was determined. The construction and painting history of all the units was found to be similar, so that units in the development could be grouped together for sampling purposes. The inspector determined that the development had 55 units, and by consulting Table 7.3, determined that 35 units should be inspected.

The inspector used the "Selection of Housing Units" form (Completed Form 7.4) to randomly select units to inspect. The total number of units, 55, was entered into the first column of the form. The random numbers generated from a calculator were entered into the second column. The first random number, 0.583, was multiplied by 55 (the total number of units), and the product, 32.065, was entered in the third column. The product was rounded up from 32.065 to 33, and 33 was written in the fourth column, indicating that the 33rd unit would be tested. Other units were selected using the same procedure. When a previously selected unit was chosen again, the inspector crossed out the repeated unit number and wrote "DUP" (for duplicate) in the last column. The inspector continued generating random numbers until 35 distinct units had been selected for inspection. (In this case, it would have been faster to randomly determine the 20 units that would *not* be inspected ($55 - 35 = 20$) and then to select the remaining 35 units for inspection).

After identifying units to be inspected, the inspector conducted an inventory of all painted surfaces within the selected units. The inspector completed the "Multifamily Housing LBP Testing Data Sheet" for every testing combination found in each room equivalent within each unit. Completed Form 7.5 is an example of the completed inventory for the bedroom of the first unit to be inspected. The inventory showed that the bedroom was composed of four substrates and eight testing combinations of the following components: (1) one ceiling beam, (2) two doors, (3) four walls, (4) one window casing, (5) two door casings, (6) three shelves, (7) two support columns, and (8) one radiator. Where more than one of a particular component was present, except walls, one was randomly selected for XRF testing. Component location descriptions were recorded in the "Test Location" column. Drywall and brick substrates were not present in the bedroom.

Testing combinations not common to all units were added to the inventory list. The inspector also noted which types of common areas and exterior areas were associated with the selected units, identified each of these common and exterior areas as a room equivalent, and inventoried the corresponding testing combinations.

The inspector inventoried the remaining 34 units selected and their associated types of common areas and exterior areas before beginning XRF testing in the development. Alternatively, the inspector could have inventoried each room equivalent as XRF testing proceeded.

After completing the inventory, the inspector performed the XRF manufacturer's recommended warm up and quality control procedures successfully. Then the inspector took three calibration check readings on a 1.02 mg/cm² NIST SRM film. The calibration check was accomplished by attaching the film to a wooden board and placing the board on a flat wooden table. Readings were then taken with the probe at least 12 inches (0.3 meters) from any other potential source of lead. The following readings were obtained: 1.12, 1.00, and 1.08 mg/cm². These calibration check results were recorded on the "Calibration Check Test Results" form (Completed Form 7.2). The difference between the first calibration check average and 1.02 mg/cm² (NIST SRM) was not greater than the 0.3 mg/cm² calibration check tolerance limit obtained from the *XRF Performance Characteristic Sheet*, indicating that the XRF instrument was in calibration and that XRF testing could begin. (See the single-family housing example, in Section A, above, of this Addendum, for a description of what to do when the calibration check tolerance is exceeded).

The inspector began XRF testing in the bedroom by taking one reading on each testing combination listed on the inventory data sheet. XRF testing continued until all concrete, wood, and plaster component types were inspected in the bedroom. The XRF readings were recorded on the "Multifamily Housing LBP Testing Data Sheet" form (Completed Form 7.5). According to the *XRF Performance Characteristic Sheet*, the XRF instrument in use did not require correction for substrate bias for any of the substrates encountered in the development, so the XRF classification column was completed at that time. The inspector used single-family housing rules for classifying the XRF readings as positive, negative, or inconclusive. The inspector also used the inconclusive ranges obtained from the *XRF Performance Characteristic Sheet* (0.41 mg/cm² to 1.39 mg/cm²). The midpoint of the inconclusive range was then calculated to be 0.90 mg/cm² ($[0.41 \text{ mg/cm}^2 + 1.39 \text{ mg/cm}^2]/2 = 0.90 \text{ mg/cm}^2$). The results of the classifications were recorded in the Classification column of the "Multifamily Housing LBP Testing Data Sheet" form. Classifications for all testing combinations within the unit were computed in the same manner as for the bedroom.

Once inspections were completed in all of the 35 selected units of the development, the inspector completed the "Multifamily Housing: Component Type Report" form (Completed Form 7.6). A description of each component type was recorded in the first column, the total number of each tested component type was entered in the second column, and the number of testing combinations classified as positive for each component type from the "Multifamily Housing LBP Testing Data Sheet" (Completed Form 7.5) was calculated and entered in the third column. The inspector then did the same for the testing combinations classified as negative, that is, XRF readings up to and including 0.40 mg/cm², and for inconclusive classifications with XRF readings less than the midpoint of the inconclusive range, that is, XRF readings from 0.41 mg/cm² to 0.89 mg/cm², and for inconclusive classifications with XRF readings equal to or greater than the midpoint of the inconclusive range, that is 0.90 mg/cm² to 1.39 mg/cm². Using these readings and the total number of the component type sampled, the inspector computed and recorded the percentages of positive, negative, and inconclusive classifications for each component type.

After entering the number of testing combinations for each component type in the "Multifamily Housing Component Type Report" form, the inspector noticed that only 34 wood door casings had been inspected. Because it is necessary to test at least 40 testing combinations of each component type, the inspector arranged with the client to test six more previously untested door casings. Additional units were randomly selected from the list of unsampled units. An initial calibration check test was successfully completed and the six door casings were tested for lead-based paint. Another calibration check test indicated that the XRF instrument remained within acceptable limits. The inspector then updated the "Multifamily Housing: Component Type Report" form by crossing out with one line the row of the form that showed the original, insufficient number of component types for testing; the inspector then wrote the information on the full 40 wood door casings in a new row.

The inspector used the "Multifamily Decision Flowchart" (Figure 7.1) to evaluate the component type results. Because 100 percent of the plaster walls and metals baseboards tested negative for lead, the inspector concluded that no lead-based paint had been detected on any walls or baseboards in the development, including those in uninspected units, and entered "NEG" in the Overall Classification column. The inspector also observed that shelves, hall cabinets, and window casings had no positive results. For all of the other component types, 15% or more of the readings for each type were positive; after choosing *not* to perform additional XRF readings or laboratory analysis on those components, that is, to rely on the XRF readings, the inspector entered "POS" in the Overall Classification column for them. For the shelves, all the XRF results were negative or inconclusive and less than 0.90 mg/cm² ("low inconclusive") so the inspector, in accordance with the flowchart, entered "NEG" in the Overall Classification column. The hall cabinets and window casings were classified as inconclusive with some readings greater than or equal to 0.90 mg/cm² ("high inconclusive"). The inspector determined that over 15 percent of the readings taken on these component types were high inconclusives. The inspector chose to take additional samples for laboratory analysis, to see if any or all of the samples would be determined to be negative by laboratory analysis.

The inspector collected paint-chip samples from the inconclusive component types, but only from testing combinations where XRF readings were equal to or greater than 0.90 mg/cm², the midpoint of the inconclusive range. Paint-chip samples were taken from 32 sampling locations: 12 hall cabinets, 7 window casings and 13 metal radiators. The paint-chip samples were collected from a 4-square-inch (25-square-centimeter) surface area on each component. Each paint-chip sample was placed in a hard-shelled plastic container, sealed, given a uniquely-numbered label, and sent to the laboratory for analysis.

The laboratory returned the results to the inspector, who entered the laboratory results and classifications on the appropriate "Multifamily Housing LBP Testing Data Sheet" (Form 7.5). Laboratory results of all 5 paint-chip samples taken from the window casings were classified as negative. The laboratory results of 5 samples from the hall cabinets were classified as positive, and 7 as negative. The metal radiator results were classified as 9 positives and 4 negatives.

The "Multifamily Decision Flowchart" was applied to the results shown in the "Multifamily Housing: Component Type Report" to determine the appropriate classification for each component type. The inspector classified all shelves and

window casings as negative, based either on the XRF substrate-corrected readings or on laboratory confirmation analysis, respectively. Therefore, no further lead-based paint testing was required for the shelves and window casings. About 9.1 percent (none positive by XRF analysis and 5 positive by lab analysis of the 55 that were inspected) of all hall cabinets in the housing development had lead-based paint.

Final decisions made by the development client regarding the hall cabinets were based on various factors, including:

- The substantially lower cost of inspecting all hall cabinets in the development versus replacing all of those cabinets;
- Future plans, including renovating the buildings within three years; and
- The HUD/EPA disclosure rule requirements regarding the sale or rental of housing with lead-based paint.

In this case, the client arranged for testing hall cabinets in all of the unsampled units to determine which were positive, and which were negative. To verify the accuracy of the inspection services, the client asked the inspector to retest 10 testing combinations. The retest was performed according to instructions obtained from the *XRF Performance Characteristic Sheet*. The client appointed an employee to randomly select 10 testing combinations from the inventory list of 2 randomly selected units. The employee observed the inspector retesting the 10 selected testing combinations, using the same XRF instrument and procedures used for the initial inspection. A single XRF reading was taken from each of the 10 testing combinations. The average of the 10 repeat XRF results was calculated to be 0.674 mg/cm², and the average of the 10 previous XRF results was computed to be 0.872 mg/cm². The absolute difference between the two averages was computed to be 0.198 mg/cm² (0.872 mg/cm² minus 0.674 mg/cm²). The Retest Tolerance Limit, using the formula described in the *XRF Performance Characteristic Sheet*, was computed to be 0.231. Because 0.198 mg/cm² is less than 0.231 mg/cm², the inspector concluded that the inspection had been performed competently. The final summary report also included the address of the inspected units, the date(s) of inspection, the starting and ending times for each inspected unit, and other information described in Section V.I of Chapter 7.

At the end of the work shift, the inspector took a final set of three calibration check readings using the same procedure as for the initial calibration check. The following readings were obtained: 0.86, 1.07 and 0.94 mg/cm². The average of these readings is 0.97 mg/cm². The difference between 0.97 mg/cm² and the NIST SRM's 1.02 mg/cm² is -0.08 mg/cm², which is not greater in magnitude than the 0.30 mg/cm² calibration check tolerance for the instrument used. The inspector recorded that the XRF instrument was in calibration, and that the measurements taken between the first and second calibrations could be used.

Endnotes

1. Most XRF instruments detect K-shell fluorescence (X-ray energy), some L-shell fluorescence, and some K and L fluorescence. In general, L X rays released from greater depths of paint are less likely to reach the surface than are K X rays, which makes detection of lead in deeper paint layers by L X rays alone more difficult. However, L X rays are less likely to be influenced by substrate effects.
2. Westat, Inc. An Analysis and Discussion of the Single Family Inspection Protocol Under the 1995 HUD Guidelines: Draft Report. 1996.
3. Dixon, S., National Center for Lead-Safe Housing, Sample Size as a Function of Multifamily Development Size. 1997.
4. The statistical rationale and calculations used to develop sample sizes in multifamily housing is based on a data set which contains approximately 164,000 XRF readings from 23,000 room equivalents in 3,900 units located in 65 housing developments. Statistical and theoretical analyses completed for HUD are available through the Lead Clearinghouse and on HUD's World Wide Web Home Page.

Residential Lead-Based Paint Hazard Reduction Act of 1992--Title X

Public Law 102-550
102nd Congress -- 2nd Session
[H.R. 5334]
102 P.L. 550; 106 Stat. 3672
1992 Enacted H.R. 5334; 102 Enacted H.R. 5334
DATE: OCT. 28, 1992 -- PUBLIC LAW 102-550

SEC. 1001. SHORT TITLE.

This title may be cited as the "Residential Lead-Based Paint Hazard Reduction Act of 1992".

SEC. 1002. FINDINGS.

The Congress finds that --

- (1) low-level lead poisoning is widespread among American children, afflicting as many as 3,000,000 children under age 6, with minority and low-income communities disproportionately affected;
- (2) at low levels, lead poisoning in children causes intelligence quotient deficiencies, reading and learning disabilities, impaired hearing, reduced attention span, hyperactivity, and behavior problems;
- (3) pre-1980 American housing stock contains more than 3,000,000 tons of lead in the form of lead-based paint, with the vast majority of homes built before 1950 containing substantial amounts of lead-based paint;
- (4) the ingestion of household dust containing lead from deteriorating or abraded lead-based paint is the most common cause of lead poisoning in children;
- (5) the health and development of children living in as many as 3,800,000 American homes is endangered by chipping or peeling lead paint, or excessive amounts of lead-contaminated dust in their homes;
- (6) the danger posed by lead-based paint hazards can be reduced by abating lead-based paint or by taking interim measures to prevent paint deterioration and limit children's exposure to lead dust and chips;
- (7) despite the enactment of laws in the early 1970's requiring the Federal Government to eliminate as far as practicable lead-based paint hazards in federally owned, assisted, and insured housing, the Federal response to this national crisis remains severely limited; and
- (8) the Federal Government must take a leadership role in building the infrastructure -- including an informed public, State and local delivery systems, certified inspectors, contractors, and laboratories, trained workers, and available financing and insurance -- necessary to ensure that the national goal of eliminating lead-based paint hazards in housing can be achieved as expeditiously as possible.

SEC. 1003. PURPOSES.

The purposes of this Act are --

- (1) to develop a national strategy to build the infrastructure necessary to eliminate lead-based paint hazards in all housing as expeditiously as possible;
- (2) to reorient the national approach to the presence of lead-based paint in housing to implement, on a priority basis, a broad program to evaluate and reduce lead-based paint hazards in the Nation's housing stock;
- (3) to encourage effective action to prevent childhood lead poisoning by establishing a workable framework for lead-based paint hazard evaluation and reduction and by ending the current confusion over reasonable standards of care;
- (4) to ensure that the existence of lead-based paint hazards is taken into account in the development of Government housing policies and in the sale, rental, and renovation of homes and apartments;
- (5) to mobilize national resources expeditiously, through a partnership among all levels of government and the private sector, to develop the most promising, cost-effective methods for evaluating and reducing lead-based paint hazards;
- (6) to reduce the threat of childhood lead poisoning in housing owned, assisted, or transferred by the Federal Government; and
- (7) to educate the public concerning the hazards and sources of lead-based paint poisoning and steps to reduce and eliminate such hazards.

SEC. 1004. DEFINITIONS.

For the purposes of this Act, the following definitions shall apply:

- (1) Abatement. The term "abatement" means any set of measures designed to permanently eliminate lead-based paint hazards in accordance with standards established by appropriate Federal agencies. Such term includes --
 - (A) the removal of lead-based paint and lead-contaminated dust, the permanent containment or encapsulation of lead-based paint, the replacement of lead-painted surfaces or fixtures, and the removal or covering of lead contaminated soil; and
 - (B) all preparation, cleanup, disposal, and postabatement clearance testing activities associated with such measures.
- (2) Accessible surface. The term "accessible surface" means an interior or exterior surface painted with lead-based paint that is accessible for a young child to mouth or chew.

(3) Certified contractor. The term "certified contractor" means --

(A) a contractor, inspector, or supervisor who has completed a training program certified by the appropriate Federal agency and has met any other requirements for certification or licensure established by such agency or who has been certified by any State through a program which has been found by such Federal agency to be at least as rigorous as the Federal certification program; and

(B) workers or designers who have fully met training requirements established by the appropriate Federal agency.

(4) Contract for the purchase and sale of residential real property. The term "contract for the purchase and sale of residential real property" means any contract or agreement in which one party agrees to purchase an interest in real property on which there is situated 1 or more residential dwellings used or occupied, or intended to be used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of 1 or more persons.

(5) Deteriorated paint. The term "deteriorated paint" means any interior or exterior paint that is peeling, chipping, chalking or cracking or any paint located on an interior or exterior surface or fixture that is damaged or deteriorated.

(6) Evaluation. The term "evaluation" means a risk assessment, inspection, or risk assessment and inspection.

(7) Federally assisted housing. The term "federally assisted housing" means residential dwellings receiving project-based assistance under programs including --

(A) section 221(d) (3) or 236 of the National Housing Act;

(B) section 1 of the Housing and Urban Development Act of 1965;

(C) section 8 of the United States Housing Act of 1937; or

(D) sections 502(a), 504, 514, 515, 516 and 533 of the Housing Act of 1949.

(8) Federally owned housing. The term "federally owned housing" means residential dwellings owned or managed by a Federal agency, or for which a Federal agency is a trustee or conservator. For the purpose of this paragraph, the term "Federal agency" includes the Department of Housing and Urban Development, the Farmers Home Administration, the Resolution Trust Corporation, the Federal Deposit Insurance Corporation, the General Services Administration, the Department of Defense, the Department of Veterans Affairs, the Department of the Interior, the Department of Transportation, and any other Federal agency.

(9) Federally supported work. The term "federally supported work" means any lead hazard evaluation or reduction activities conducted in federally owned or assisted housing or funded in whole or in part through any financial assistance program of the Department of Housing and Urban Development, the Farmers Home Administration, or the Department of Veterans Affairs.

(10) Friction surface. The term "friction surface" means an interior or exterior surface that is subject to abrasion or friction, including certain window, floor, and stair surfaces.

(11) Impact surface. The term "impact surface" means an interior or exterior surface that is subject to damage by repeated impacts, for example, certain parts of door frames.

(12) Inspection. The term "inspection" means a surface-by-surface investigation to determine the presence of lead-based paint as provided in section 302(c) of the Lead-Based Paint Poisoning Prevention Act and the provision of a report explaining the results of the investigation.

(13) Interim controls. The term "interim controls" means a set of measures designed to reduce temporarily human exposure or likely exposure to lead-based paint hazards, including specialized cleaning, repairs, maintenance, painting, temporary containment, ongoing monitoring of lead-based paint hazards or potential hazards, and the establishment and operation of management and resident education programs.

(14) Lead-based paint. The term "lead-based paint" means paint or other surface coatings that contain lead in excess of limits established under section 302(c) of the Lead-Based Paint Poisoning Prevention Act.

(15) Lead-based paint hazard. The term "lead-based paint hazard" means any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-contaminated paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects as established by the appropriate Federal agency.

(16) Lead-contaminated dust. The term "lead-contaminated dust" means surface dust in residential dwellings that contains an area or mass concentration of lead in excess of levels determined by the appropriate Federal agency to pose a threat of adverse health effects in pregnant women or young children.

(17) Lead-contaminated soil. The term "lead-contaminated soil" means bare soil on residential real property that contains lead at or in excess of the levels determined to be hazardous to human health by the appropriate Federal agency.

(18) Mortgage loan. The term "mortgage loan" includes any loan (other than temporary financing such as a construction loan) that --

(A) is secured by a first lien on any interest in residential real property; and

(B) either --

(i) is insured, guaranteed, made, or assisted by the Department of Housing and Urban Development, the Department of Veterans Affairs, or the Farmers Home Administration, or by any other agency of the Federal Government; or

(ii) is intended to be sold by each originating mortgage institution to any federally chartered secondary mortgage market institution.

(19) Originating mortgage institution. The term "originating mortgage institution" means a lender that provides mortgage loans.

(20) Priority housing. The term "priority housing" means target housing that qualifies as affordable housing under section 215 of the Cranston-Gonzalez National Affordable Housing Act 942 U.S.C. 12745), including housing that receives assistance under subsection (b) or (o) of section 8 of the United States Housing Act of 1937 (42 U.S.C. 1437f(b) or (o)).

(21) Public housing. The term "public housing" has the same meaning given the term in section 3(b) of the United States Housing Act of 1937 (42 U.S.C. 1437a(b)(1)).

(22) Reduction. The term "reduction" means measures designed to reduce or eliminate human exposure to lead-based paint hazards through methods including interim controls and abatement.

(23) Residential dwelling. The term "residential dwelling" means --

(A) a single-family dwelling, including attached structures such as porches and stoops; or

(B) a single-family dwelling unit in a structure that contains more than 1 separate residential dwelling unit, and in which each such unit is used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of 1 or more persons.

(24) Residential real property. The term "residential real property" means real property on which there is situated 1 or more residential dwellings used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of 1 or more persons.

(25) Risk assessment. The term "risk assessment" means an on-site investigation to determine and report the existence, nature, severity and location of lead-based paint hazards in the residential dwellings, including --

(A) information gathering regarding the age and history of the housing and occupancy by children under age 6;

(B) visual inspection;

(C) limited wipe sampling or other environmental sampling techniques;

(D) other activity as may be appropriate; and

(E) provision of a report explaining the results of the investigation.

(26) Secretary. The term "Secretary" means the Secretary of Housing and Urban Development.

(27) Target housing. The term "target housing" means any housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any child who is less than 6 years of age resides or is expected to reside in such housing for the elderly or persons with disabilities) or any 0-bedroom dwelling. In the case of jurisdictions which banned the sale or use of lead-based paint prior to 1978, the Secretary, at the Secretary's discretion, may designate an earlier date.

SUBTITLE A -- LEAD-BASED PAINT HAZARD REDUCTION

SEC. 1011. GRANTS FOR LEAD-BASED PAINT HAZARD REDUCTION IN TARGET HOUSING.

(a) General Authority. The Secretary is authorized to provide grants to eligible applicants to evaluate and reduce lead-based paint hazards in priority housing that is not federally assisted housing, federally owned housing, or public housing, in accordance with the provisions of this section.

(b) Eligible Applicants. A State or unit of local government that has an approved comprehensive housing affordability strategy under section 105 of the Cranston-Gonzalez National Affordable Housing Act (42 U.S.C. 12705) is eligible to apply for a grant under this section.

(c) Form of Applications. To receive a grant under this section, a State or unit of local government shall submit an application in such form and in such manner as the Secretary shall prescribe. An application shall contain --

(1) a copy of that portion of an applicant's comprehensive housing affordability strategy required by section 105(b)(16) of the Cranston-Gonzalez National Affordable Housing Act (42 U.S.C. 12701 et seq.);

(2) a description of the amount of assistance the applicant seeks under this section;

(3) a description of the planned activities to be undertaken with grants under this section, including an estimate of the amount to be allocated to each activity;

(4) a description of the forms of financial assistance to owners and occupants of priority housing that will be provided through grants under this section; and

(5) such assurances as the Secretary may require regarding the applicant's capacity to carry out the activities.

(d) Selection Criteria. The Secretary shall award grants under this section on the basis of the merit of the activities proposed to be carried out and on the basis of selection criteria, which shall include --

(1) the extent to which the proposed activities will reduce the risk of lead-based paint poisoning to children under the age of 6 who reside in priority housing;

(2) the degree of severity and extent of lead-based paint hazards in the jurisdiction to be served;

(3) the ability of the applicant to leverage State, local, and private funds to supplement the grant under this section;

(4) the ability of the applicant to carry out the proposed activities; and

(5) such other factors as the Secretary determines appropriate to ensure that grants made available under this section are used effectively and to promote the purposes of this Act.

(e) Eligible Activities. A grant under this section may be used to --

(1) perform risk assessments and inspections in priority housing;

(2) provide for the interim control of lead-based paint hazards in priority housing;

(3) provide for the abatement of lead-based paint hazards in priority housing;

(4) provide for the additional cost of reducing lead-based paint hazards in units undergoing renovation funded by other sources;

(5) ensure that risk assessments, inspections, and abatements are carried out by certified contractors in accordance with section 402 of the Toxic Substances Control Act, as added by section 1021 of this Act;

(6) monitor the blood-lead levels of workers involved in lead hazard reduction activities funded under this section;

(7) assist in the temporary relocation of families forced to vacate priority housing while lead hazard reduction measures are being conducted;

(8) educate the public on the nature and causes of lead poisoning and measures to reduce the exposure to lead, including exposure due to residential lead-based paint hazards;

(9) test soil, interior surface dust, and the blood-lead levels of children under the age of 6 residing in priority housing after lead-based paint hazard reduction activity has been conducted, to assure that such activity does not cause excessive exposures to lead; and

(10) carry out such activities that the Secretary determines appropriate to promote the purposes of this Act.

(f) Forms of Assistance. The applicant may provide the services described in this section through a variety of programs, including grants, loans, equity investments, revolving loan funds, loan funds, loan guarantees, interest write-downs, and other forms of assistance approved by the Secretary.

(g) Technical Assistance and Capacity Building. --

(1) In general. The Secretary shall develop the capacity of eligible applicants to carry out the requirements of section 105(b)(16) of the Cranston-Gonzalez National Affordable Housing Act and to carry out activities under this section. In fiscal years 1993 and 1994, the Secretary may make grants of up to \$ 200,000 for the purpose of establishing State training, certification or accreditation programs that meet the requirements of section 402 of the Toxic Substances Control Act, as added by section 1021 of this Act.

(2) Set-aside. Of the total amount approved in appropriation Acts under subsection (o), there shall be set aside to carry out this subsection \$ 3,000,000 for fiscal year 1993 and \$ 3,000,000 for fiscal year 1994.

(h) Matching Requirement. Each recipient of a grant under this section shall make contributions toward the cost of activities that receive assistance under this section in an amount not less than 10 percent of the total grant amount under this section.

(i) Prohibition of Substitution of Funds. Grants under this subtitle may not be used to replace other amounts made available or designated by State or local governments for use for the purposes under this subtitle.

(j) Limitation on Use. An applicant shall ensure that not more than 10 percent of the grant will be used for administrative expenses associated with the activities funded.

(k) Financial Records. An applicant shall maintain and provide the Secretary with financial records sufficient, in the determination of the Secretary, to ensure proper accounting and disbursing of amounts received from a grant under this section.

(l) Report. An applicant under this section shall submit to the Secretary, for any fiscal year in which the applicant expends grant funds under this section, a report that --

- (1) describes the use of the amounts received;
- (2) states the number of risk assessments and the number of inspections conducted in residential dwellings;
- (3) states the number of residential dwellings in which lead- based paint hazards have been reduced through interim controls;
- (4) states the number of residential dwellings in which lead- based paint hazards have been abated; and
- (5) provides any other information that the Secretary determines to be appropriate.

(m) Notice of Funding Availability. The Secretary shall publish a Notice of Funding Availability pursuant to this section not later than 120 days after funds are appropriated for this section.

(n) Relationship to Other Law. Effective 2 years after the date of promulgation of regulations under section 402 of the Toxic Substances Control Act, no grants for lead-based paint hazard evaluation or reduction may be awarded to a State under this section unless such State has an authorized program under section 404 of the Toxic Substances Control Act.

(o) Authorization of Appropriations. For the purposes of carrying out this Act, there are authorized to be appropriated \$ 125,000,000 for fiscal year 1993 and \$ 250,000,000 for fiscal year 1994.

SEC. 1012. EVALUATION AND REDUCTION OF LEAD-BASED PAINT HAZARDS IN FEDERALLY ASSISTED HOUSING.

(a) General Requirements. Section 302 of the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4822) is amended --

(1) by striking the title of the section and inserting:

"REQUIREMENTS FOR HOUSING RECEIVING FEDERAL ASSISTANCE";

(2) in the first sentence of subsection (a) --

(A) by striking "The Secretary" and inserting the following:

"(1) Elimination of hazards. The Secretary"; and

(B) by inserting before the period "or otherwise receives more than \$ 5,000 in project-based assistance under a Federal housing program";

(3) by striking the second sentence of subsection (a) and inserting: "Beginning on January 1, 1995, such procedures shall apply to all such housing that constitutes target housing, as defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, and shall provide for appropriate measures to conduct risk assessments, inspections, interim controls, and abatement of lead-based paint hazards. At a minimum, such procedures shall require --

"(A) the provision of lead hazard information pamphlets, developed pursuant to section 406 of the Toxic Substances Control Act, to purchasers and tenants;

"(B) periodic risk assessments and interim controls in accordance with a schedule determined by the Secretary, the initial risk assessment of each unit constructed prior to 1960 to be conducted not later than January 1, 1996, and for units constructed between 1960 and 1978 --

"(i) not less than 25 percent shall be performed by January 1, 1998;

"(ii) not less than 50 percent shall be performed by January 1, 2000; and

"(iii) the remainder shall be performed by January 1, 2002;

"(C) inspection for the presence of lead-based paint prior to federally-funded renovation or rehabilitation that is likely to disturb painted surfaces;
"(D) reduction of lead-based paint hazards in the course of rehabilitation projects receiving less than \$ 25,000 per unit in Federal funds;
"(E) abatement of lead-based paint hazards in the course of substantial rehabilitation projects receiving more than \$ 25,000 per unit in Federal funds;
"(F) where risk assessment, inspection, or reduction activities have been undertaken, the provision of notice to occupants describing the nature and scope of such activities and the actual risk assessment or inspection reports (including available information on the location of any remaining lead-based paint on a surface-by-surface basis); and
"(G) such other measures as the Secretary deems appropriate."; and
(4) in the third sentence, by striking "The Secretary may" and inserting the following:
"(2) Additional measures. The Secretary may".

(b) Measurement Criteria. Section 302(b) of the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4822(b)) is amended by striking "for the detection" and all that follows through the end of paragraph (2) and inserting "for the risk assessment, interim control, inspection, and abatement of lead-based paint hazards in housing covered by this section shall be based upon guidelines developed pursuant to section 1017 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.".

(c) Inspection. Section 302(c) of the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4822(c)) is amended --
(1) in the second sentence, by striking "qualified" and inserting "certified"; and
(2) in the third and fourth sentences, by inserting "or 0.5 percent by weight" after "squared".

(d) Public Housing. Section 302(d)(1) of the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4822(d)(1)) is amended --
(1) in the heading, by striking "CIAP" and inserting "modernization"; and
(2) in the fourth sentence, by striking "to eliminate the lead-based paint poisoning hazards" and inserting "of lead-based paint and lead-based paint hazards".

(e) HOME Investment Partnerships. Section 212(a) of the Cranston-Gonzalez National Affordable Housing Act (42 U.S.C. 12742(a)) is amended by adding at the end the following new paragraph:
"(5) Lead-based paint hazards. A participating jurisdiction may use funds provided under this subtitle for the evaluation and reduction of lead-based paint hazards, as defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.".

(f) Community Development Block Grants. Section 105(a) of the Housing and Community Development Act of 1974 (42 U.S.C. 5305(a)) is amended --

(1) in paragraph (19), by striking "and" at the end;

(2) in paragraph (20), by striking the period at the end and inserting "; and"; and

(3) by adding at the end the following new paragraph:

"(21) lead-based paint hazard evaluation and reduction, as defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.".

(g) Section 8 Rental Assistance. Section 8(c)(2)(B) of the United States Housing Act of 1937 (42 U.S.C. 1437f(c)(2)(B)) is amended by adding at the end the following: "The Secretary may (at the discretion of the Secretary and subject to the availability of appropriations for contract amendments), on a project by project basis for projects receiving project-based assistance, provide adjustments to the maximum monthly rents to cover the costs of evaluating and reducing lead-based paint hazards, as defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.".

(h) HOPE for public and Indian Housing Homeownership. The United States Housing Act of 1937 (42 U.S.C. 1437 et seq.) is amended --

(1) in section 302(b) --

(A) by redesignating paragraphs (4) through (8) as paragraphs (5) through (9), respectively; and

(B) by inserting after paragraph (3) the following:

"(4) inspection for lead-based paint hazards, as required by section 302(a) of the Lead-Based Paint Poisoning Prevention Act;"; and

(2) in section 303(b) --

(A) by redesignating paragraphs (4) through (13) as paragraphs (5) through (14), respectively; and

(B) by inserting after paragraph (3) the following:

"(4) Abatement of lead-based paint hazards, as required by section 302(a) of the Lead-Based Paint Poisoning Prevention Act.".

(i) HOPE for Homeownership of Multifamily Units. The Cranston-Gonzalez National Affordable Housing Act (42 U.S.C. 12701 et seq.) is amended --

(1) in section 422(b) --

(A) by redesignating paragraphs (4) through (8) as paragraphs (5) through (9), respectively; and

(B) by inserting after paragraph (3) the following:

"(4) inspection for lead-based paint hazards, as required by section 302(a) of the Lead-Based Paint Poisoning Prevention Act;"; and

(2) in section 423(b) --

(A) by redesignating paragraphs (4) through (13) as paragraphs (5) through (14), respectively; and

(B) by adding after paragraph (3) the following:

"(4) Abatement of lead-based paint hazards, as required by section 302(a) of the Lead-Based Paint Poisoning Prevention Act.".

(j) HOPE for Homeownership of Multifamily Units. The Cranston-Gonzalez National Affordable Housing Act (42 U.S.C. 12701 et seq.) is amended --

(1) in section 422(b) --

(A) by redesignating paragraphs (4) through (8) as paragraphs (5) through (9), respectively; and

(B) by inserting after paragraph (3) the following:

"(4) inspection for lead-based paint hazards, as required by section 302(a) of the Lead-Based Paint Poisoning Prevention Act;"; and

(2) in section 443(b) --

(A) by redesignating paragraphs (4) through (10) as paragraphs (5) through (11), respectively; and

(B) by adding after paragraph (3) the following:

"(4) Abatement of lead-based paint hazards, as required by section 302(a) of the Lead-Based Paint Poisoning Prevention Act.".

(k) FHA Insurance for Single Family Homes. --

(1) Home improvement loans. Section 2(a) of the National Housing Act (12 U.S.C. 1703(a)) is amended in the fifth paragraph--

(A) by inserting after the first sentence the following:

"Alterations, repairs, and improvements upon or in connection with existing structures may also include the evaluation and reduction of lead-based paint hazards."; and

(B) by adding at the end the following: "(4) the terms 'evaluation', 'reduction', and 'lead-based paint hazard' have the same meanings given those terms in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.".

(2) Rehabilitation loans. Section 203(k)(2)(B) of the National Housing Act (12 U.S.C. 1709(k)(2)(B)) is amended by adding at the end the following: "The term 'rehabilitation' may also include measures to evaluate and reduce lead-based paint hazards, as such terms are defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.".

(l) FHA Insurance for Multifamily Housing. Section 221(d)(4)(iv) of the National Housing Act (12 U.S.C. 1715l(d)(4)(iv)) is amended by inserting after "rehabilitation" the first time it appears the following: "(including the cost of evaluating and reducing lead-based paint hazards, as such terms are defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992)".

(m) Rural Housing. Section 501(a) of the Housing Act of 1949 (42 U.S.C. 1471) is amended by adding at the end the following:

"(5) Definitions. For purposes of this title, the terms 'repair', 'repairs', 'rehabilitate', and 'rehabilitation' include measures to evaluate and reduce lead-based paint hazards as such terms are defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.".

SEC. 1013. DISPOSITION OF FEDERALLY OWNED HOUSING.

Section 302(a) of the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4822(a)) (as amended by section 1012(a)) is amended by striking the fourth sentence and adding at the end the following:

"(3) Disposition of federally owned housing. --

"(A) Pre-1960 target housing. Beginning on January 1, 1995, procedures established under paragraphs (1) and (2) shall require the inspection and abatement of lead-based paint hazards in all federally owned target housing constructed prior to 1960.

"(B) Target housing constructed between 1960 and 1978.

Beginning on January 1, 1995, procedures established under paragraphs (1) and (2) shall require an inspection for lead-based paint and lead-based paint hazards in all federally owned target housing constructed between 1960 and 1978. The results of such inspections shall be made available to prospective purchasers, identifying the presence of lead-based paint and lead-based paint hazards on a surface-by-surface basis. The Secretary shall have the discretion to waive the requirement of this subparagraph for housing in which a federally funded risk assessment, performed by a certified contractor, has determined no lead-based paint hazards are present.

"(C) Budget authority. To the extent that subparagraphs (A) and (B) increase the cost to the Government of outstanding direct loan obligations or loan guarantee commitments, such activities shall be treated as modifications under section 504(e) of the Federal Credit Reform Act of 1990 and shall be subject to the availability of appropriations. To the extent that paragraphs (A) and (B) impose additional costs to the Resolution Trust Corporation and the Federal Deposit Insurance Corporation, its requirements shall be carried out only if appropriations are provided in advance in an appropriations Act. In the absence of appropriations sufficient to cover the costs of subparagraphs (A) and (B), these requirements shall not apply to the affected agency or agencies.

"(D) Definitions. For the purposes of this subsection, the terms 'inspection', 'abatement', 'lead-based paint hazard', 'federally owned housing', 'target housing', 'risk assessment', and 'certified contractor' have the same meaning given such terms in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.

"(4) Definitions. For purposes of this subsection, the terms 'risk assessment', 'inspection', 'interim control', 'abatement', 'reduction', and 'lead-based paint hazard' have the same meaning given such terms in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992.

SEC. 1014. COMPREHENSIVE HOUSING AFFORDABILITY STRATEGY.

Section 105 of the Cranston-Gonzalez National Affordable Housing Act (42 U.S.C. 12705) is amended --

(1) in subsection (b)(14), by striking "and" at the end;

(2) in subsection (b)(15), by striking the period at the end and inserting "; and";

(3) by inserting after paragraph (15) of subsection (b) the following new paragraph:

"(16) estimate the number of housing units within the jurisdiction that are occupied by low-income families or very low-income families and that contain lead-based paint hazards, as defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, outline the actions proposed or being taken to evaluate and reduce lead-based paint hazards, and describe how lead-based paint hazard reduction will be integrated into housing policies and programs."; and

(4) in subsection (e) --

(A) by striking "When preparing" and inserting the following:

"(1) In general. When preparing"; and

(B) by adding at the end the following new paragraph:

"(2) Lead-based paint hazards. When preparing that portion of a housing strategy required by subsection (b)(16), a jurisdiction shall consult with State or local health and child welfare agencies and examine existing data related to lead-based paint hazards and poisonings, including health department data on the addresses of housing units in which children have been identified as lead poisoned.".

SEC. 1015. TASK FORCE ON LEAD-BASED PAINT HAZARD REDUCTION AND FINANCING.

(a) In General. The Secretary, in consultation with the Administrator of the Environmental Protection Agency establish a task force to make recommendations on expanding resources and efforts to evaluate and reduce lead-based paint hazards in private housing.

(b) Membership. The task force shall include individuals representing the Department of Housing and Urban Development, the Farmers Home Administration, the Department of Veterans Affairs, the Federal Home Loan Mortgage Corporation, the Federal National Mortgage Association, the Environmental Protection Agency, employee organizations in the building and construction trades industry, landlords, tenants, primary lending institutions, private mortgage insurers, single-family and multifamily real estate interests, nonprofit housing developers, property liability insurers, public housing agencies, low-income housing advocacy organizations, national, State and local lead-poisoning prevention advocates and experts, and community-based organizations located in areas with substantial rental housing.

(c) Responsibilities. The task force shall make recommendations to the Secretary and the Administrator of the Environmental Protection Agency concerning --

(1) incorporating the need to finance lead-based paint hazard reduction into underwriting standards;

(2) developing new loan products and procedures for financing lead-based paint hazard evaluation and reduction activities;

(3) adjusting appraisal guidelines to address lead safety;

- (4) incorporating risk assessments or inspections for lead-based paint as a routine procedure in the origination of new residential mortgages;
- (5) revising guidelines, regulations, and educational pamphlets issued by the Department of Housing and Urban Development and other Federal agencies relating to lead-based paint poisoning prevention;
- (6) reducing the current uncertainties of liability related to lead-based paint in rental housing by clarifying standards of care for landlords and lenders, and by exploring the "safe harbor" concept;
- (7) increasing the availability of liability insurance for owners of rental housing and certified contractors and establishing alternative systems to compensate victims of lead-based paint poisoning; and
- (8) evaluating the utility and appropriateness of requiring risk assessments or inspections and notification to prospective lessees of rental housing.

(d) Compensation. The members of the task force shall not receive Federal compensation for their participation.

SEC. 1016. NATIONAL CONSULTATION ON LEAD-BASED PAINT HAZARD REDUCTION.

In carrying out this Act, the Secretary shall consult on an ongoing basis with the Administrator of the Environmental Protection Agency, the Director of the Centers for Disease Control, other Federal agencies concerned with lead poisoning prevention, and the task force established pursuant to section 1015.

SEC. 1017. GUIDELINES FOR LEAD-BASED PAINT HAZARD EVALUATION AND REDUCTION ACTIVITIES.

Not later than 12 months after the date of enactment of this Act, the Secretary, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Labor, and the Secretary of Health and Human Services (acting through the Director of the Centers for Disease Control), shall issue guidelines for the conduct of all federally supported work involving risk assessments, inspections, interim controls, and abatement of lead-based paint hazards. Such guidelines shall be based upon criteria that measure the condition of the housing (and the presence of children under age 6 for the purposes of risk assessments) and shall not be based upon criteria that measure the health of the residents of the housing.

SEC. 1018. DISCLOSURE OF INFORMATION CONCERNING LEAD UPON
TRANSFER OF RESIDENTIAL PROPERTY.

(a) Lead Disclosure in Purchase and Sale or Lease of Target Housing. --

(1) Lead-based paint hazards. Not later than 2 years after the date of enactment of this Act, the Secretary and the Administrator of the Environmental Protection Agency shall promulgate regulations under this section for the disclosure of lead-based paint hazards in target housing which is offered for sale or lease. The regulations shall require that, before the purchaser or lessee is obligated under any contract to purchase or lease the housing, the seller or lessor shall --

(A) provide the purchaser or lessee with a lead hazard information pamphlet, as prescribed by the Administrator of the Environmental Protection Agency under section 406 of the Toxic Substances Control Act;

(B) disclose to the purchaser or lessee the presence of any known lead-based paint, or any known lead-based paint hazards, in such housing and provide to the purchaser or lessee any lead hazard evaluation report available to the seller or lessor; and

(C) permit the purchaser a 10-day period (unless the parties mutually agree upon a different period of time) to conduct a risk assessment or inspection for the presence of lead-based paint hazards.

(2) Contract for purchase and sale. Regulations promulgated under this section shall provide that every contract or the purchase and sale of any interest in target housing shall contain a Lead Warning Statement and a statement signed by the purchaser that the purchaser has --

(A) read the Lead Warning Statement and understands its contents;

(B) received a lead hazard information pamphlet; and

(C) had a 10-day opportunity (unless the parties mutually agreed upon a different period of time) before becoming obligated under the contract to purchase the housing to conduct a risk assessment or inspection for the presence of lead-based paint hazards.

(3) Contents of lead warning statement. The Lead Warning Statement shall contain the following text printed in large type on a separate sheet of paper attached to the contract:

"Every purchaser of any interest in residential real property on which a residential dwelling was built prior to 1978 is notified that such property may present exposure to lead from lead-based paint that may place young children at risk of developing lead poisoning. Lead poisoning in young children may produce permanent neurological damage, including learning disabilities, reduced intelligence quotient, behavioral problems, and impaired memory. Lead poisoning also poses a particular risk to pregnant women. The seller of any interest in residential real property is required to provide the buyer with any information on lead-based paint hazards from risk assessments or inspections in the seller's possession and notify the buyer of any known lead-based paint hazards. A risk assessment or inspection for possible lead-based paint hazards is recommended prior to purchase.".

(4) Compliance Assurance. Whenever a seller or lessor has entered into a contract with an agent for the purpose of selling or leasing a unit of target housing, the regulations promulgated under this section shall require the agent, on behalf of the seller or lessor, to ensure compliance with the requirements of this section.

(5) Promulgation. A suit may be brought against the Secretary of Housing and Urban Development and the Administrator of the Environmental Protection Agency under section 20 of the Toxic Substances Control Act to compel promulgation of the regulations required under this section and the Federal district court shall have jurisdiction to order such promulgation.

(b) Penalties for Violations. --

(1) Monetary penalty. Any person who knowingly violates any provision of this section shall be subject to civil money penalties in accordance with the provisions of section 102 of the Department of Housing and Urban Development Reform Act of 1989 (42 U.S.C. 3545).

(2) Action by secretary. The Secretary is authorized to take such lawful action as may be necessary to enjoin any violation of this section.

(3) Civil liability. Any person who knowingly violates the provisions of this section shall be jointly and severally liable to the purchaser or lessee in an amount equal to 3 times the amount of damages incurred by such individual.

(4) Costs. In any civil action brought for damages pursuant to paragraph (3), the appropriate court may award court costs to the party commencing such action, together with reasonable attorney fees and any expert witness fees, if that party prevails.

(5) Prohibited act. It shall be a prohibited act under section 409 of the Toxic Substances Control Act for any person to fail or refuse to comply with a provision of this section or with any rule or order issued under this section. For purposes of enforcing this section under the Toxic Substances Control Act, the penalty for each violation applicable under section 16 of that Act shall not be more than \$10,000.

(c) Validity of Contracts and Liens. Nothing in this section shall affect the validity or enforceability of any sale or contract for the purchase and sale or lease of any interest in residential real property or any loan, loan agreement, mortgage, or lien made or arising in connection with a mortgage loan, nor shall anything in this section create a defect in title.

(d) Effective Date. The regulations under this section shall take effect 3 years after the date of the enactment of this title.

SUBTITLE B -- LEAD EXPOSURE REDUCTION

SEC. 1021. CONTRACTOR TRAINING AND CERTIFICATION.

(a) Amendment to the Toxic Substances Control Act. The Toxic Substances Control Act (15 U.S.C. 2601 et seq.) is amended by adding after title III the following new title:

"TITLE IV -- LEAD EXPOSURE REDUCTION

"SEC. 401. DEFINITIONS.

"For the purposes of this title:

"(1) Abatement. The term 'abatement' means any set of measures designed to permanently eliminate lead-based paint hazards in accordance with standards established by the Administrator under this title. Such term includes --

"(A) the removal of lead-based paint and lead-contaminated dust, the permanent containment or encapsulation of lead-based paint, the replacement of lead-painted surfaces or fixtures, and the removal or covering of lead-contaminated soil; and

"(B) all preparation, cleanup, disposal, and postabatement clearance testing activities associated with such measures.

"(2) Accessible surface. The term 'accessible surface' means an interior or exterior surface painted with lead-based paint that is accessible for a young child to mouth or chew.

"(3) Deteriorated paint. The term 'deteriorated paint' means any interior or exterior paint that is peeling, chipping, chalking or cracking or any paint located on an interior or exterior surface or fixture that is damaged or deteriorated.

"(4) Evaluation. The term 'evaluation' means risk assessment, inspection, or risk assessment and inspection.

"(5) Friction surface. The term 'friction surface' means an interior or exterior surface that is subject to abrasion or friction, including certain window, floor, and stair surfaces.

"(6) Impact surface. The term 'impact surface' means an interior or exterior surface that is subject to damage by repeated impacts, for example, certain parts of door frames.

"(7) Inspection. The term 'inspection' means

"(A) a surface-by-surface investigation to determine the presence of lead-based paint, as provided in section 302(c) of the Lead-Based Paint Poisoning Prevention Act, and

"(B) the provision of a report explaining the results of the investigation.

"(8) Interim controls. The term 'interim controls' means a set of measures designed to reduce temporarily human exposure or likely exposure to lead-based paint hazards, including specialized cleaning, repairs, maintenance, painting, temporary containment, ongoing monitoring of lead-based paint hazards or potential hazards, and the establishment an operation of management and resident education programs.

"(9) Lead-based paint. The term 'lead-based paint' means paint or other surface coatings that contain lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight or

"(A) in the case of paint or other surface coatings on target housing, such lower level as may be established by the Secretary of Housing and Urban Development, as defined in section 302(c) of the Lead-Based Paint Poisoning Prevention Act, or

"(B) in the case of any other paint or surface coatings, such other level as may be established by the Administrator.

"(10) Lead-based paint hazard. The term 'lead-based paint hazard' means any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-contaminated paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects as established by the Administrator under this title.

"(11) Lead-contaminated dust. The term 'lead-contaminated dust' means surface dust in residential dwellings that contains an area or mass concentration of lead in excess of levels determined by the Administrator under this title to pose a threat of adverse health effects in pregnant women or young children.

"(12) Lead-contaminated soil. The term 'lead-contaminated soil' means bare soil on residential real property that contains lead at or in excess of the levels determined to be hazardous to human health by the Administrator under this title.

"(13) Reduction. The term 'reduction' means measures designed to reduce or eliminate human exposure to lead-based paint hazards through methods including interim controls and abatement.

"(14) Residential dwelling. The term 'residential dwelling' means--

"(A) a single-family dwelling, including attached structures such as porches and stoops; or

"(B) a single-family dwelling unit in a structure that contains more than 1 separate residential dwelling unit, and in which each such unit is used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of 1 or more persons.

"(15) Residential real property. The term 'residential real property' means real property on which there is situated 1 or more residential dwellings used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of 1 or more persons.

"(16) Risk assessment. The term 'risk assessment' means an on-site investigation to determine and report the existence, nature, severity and location of lead-based paint hazards in residential dwellings, including --

"(A) information gathering regarding the age and history of the housing and occupancy by children under age 6;

"(B) visual inspection;

"(C) limited wipe sampling or other environmental sampling techniques;

"(D) other activity as may be appropriate; and

"(E) provision of a report explaining the results of the investigation.

"(17) Target housing. The term 'target housing' means any housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any child who is less than 6 years of age resides or is expected to reside in such housing for the elderly or persons with disabilities) or any 0-bedroom dwelling. In the case of jurisdictions which banned the sale or use of lead-based paint prior to 1978, the Secretary of Housing and Urban Development, at the Secretary's discretion, may designate an earlier date.

"SEC. 402. LEAD-BASED PAINT ACTIVITIES TRAINING AND CERTIFICATION.

"(a) Regulations. --

"(1) In general. Not later than 18 months after the date of the enactment of this section, the Administrator shall, in consultation with the Secretary of Labor, the Secretary of Housing and Urban Development, and the Secretary of Health and Human Services (acting through the Director of the National Institute for Occupational Safety and Health), promulgate final regulations governing lead-based paint activities to ensure that individuals engaged in such activities are properly trained; that training programs are accredited; and that contractors engaged in such activities are certified. Such regulations shall contain standards for performing lead-based paint activities, taking into account reliability, effectiveness, and safety. Such regulations shall require that all risk assessment, inspection, and abatement activities performed in target housing shall be performed by certified contractors, as such term is defined in section 1004 of the Residential Lead-Based Paint Hazard Reduction Act of 1992. The provisions of this section shall supersede the provisions set forth under the heading 'Lead Abatement Training and Certification' and under the heading 'Training Grants' in title III of the Act entitled 'An Act making appropriations for the Departments of Veterans Affairs and Housing and Urban Development, and for sundry independent agencies, commissions, corporations, and offices for the fiscal year ending September 30, 1992, and for other purposes', Public Law 102-139, and upon the enactment of this section the provisions set forth in such public law under such headings shall cease to have any force and effect.

"(2) Accreditation of training programs. Final regulations promulgated under (1) shall contain specific requirements for the accreditation of lead-based paint activities training programs for workers, supervisors, inspectors and planners, and other individuals involved in lead-based paint activities, including, but not limited to, each of the following:

"(A) Minimum requirements for the accreditation of training providers.

"(B) Minimum training curriculum requirements.

"(C) Minimum training hour requirements.

"(D) Minimum hands-on training requirements.

"(E) Minimum trainee competency and proficiency requirements.

"(F) Minimum requirements for training program quality control.

"(3) Accreditation and certification fees. The Administrator (or the State in the case of an authorized State program) shall impose a fee on --

"(A) persons operating training programs accredited under this title; and

"(B) lead-based paint activities contractors certified in accordance with paragraph (1).

The fees shall be established at such level as is necessary to cover the costs of administering and enforcing the standards and regulations under this section which are applicable to such programs and contractors. The fee shall not be imposed on any State, local government, or nonprofit training program. The Administrator (or the State in the case of an authorized State program) may waive the fee for lead-based paint activities contractors under subparagraph (A) for the purpose of training their own employees.

"(b) Lead-Based Paint Activities. For purposes of this title, the term 'lead-based paint activities' means --

"(1) in the case of target housing, risk assessment, inspection, and abatement; and

"(2) in the case of any public building constructed before 1978, commercial building, bridge, or other structure or super-structure, identification of lead-based paint and materials containing lead-based paint, deleading, removal of lead from bridges, and demolition.

For purposes of paragraph (2), the term 'deleading' means activities conducted by a person who offers to eliminate lead-based paint or lead-based paint hazards or to plan such activities.

"(c) Renovation and Remodeling. --

"(1) Guidelines. In order to reduce the risk of exposure to lead in connection with renovation and remodeling of target housing, public buildings constructed before 1978, and commercial buildings, the Administrator shall, within 18 months after the enactment of this section, promulgate guidelines for the conduct of such renovation and remodeling activities which may create a risk of exposure to dangerous levels of lead. The Administrator shall disseminate such guidelines to persons engaged in such renovation and remodeling through hardware and paint stores, employee organizations, trade groups, State and local agencies, and through other appropriate means.

"(2) Study of certification. The Administrator shall conduct a study of the extent to which persons engaged in various types of renovation and remodeling activities in target housing, public buildings constructed before 1978, and commercial buildings are exposed to lead in the conduct of such activities or disturb lead and create a lead-based paint hazard on a regular or occasional basis. The Administrator shall complete such study and publish the results thereof within 30 months after the enactment of this section.

"(3) Certification determination. Within 4 years after the enactment of this section, the Administrator shall revise the regulations under subsection (a) to apply the regulations to renovation or remodeling activities in target housing, public buildings constructed before 1978, and commercial buildings that create lead-based paint hazards. In determining which contractors are engaged in such activities, the Administrator shall utilize the results of the study under paragraph (2) and consult with the representatives of labor organizations, lead-based paint activities contractors, persons engaged in remodeling and renovation, experts in lead health effects, and others. If the Administrator determines that an category of contractors engaged in renovation or remodeling does not require certification, the Administrator shall publish an explanation of the basis for that determination.

"SEC. 403. IDENTIFICATION OF DANGEROUS LEVELS OF LEAD.

"Within 18 months after the enactment of this title, the Administrator shall promulgate regulations which shall identify, for purposes of this title, and the Residential Lead-Based Paint Hazard Reduction Act of 1992, lead-based paint hazards, lead-contaminated dust, and lead-contaminated soil.

"SEC. 404. AUTHORIZED STATE PROGRAMS.

"(a) Approval. Any State which seeks to administer and enforce the standards, regulations, or other requirements established under section 402 or 406, or both, may, after notice and opportunity for public hearing, develop and submit to the Administrator an application, in such form as the Administrator shall require, for authorization of such a State program. Any such State may also certify to the Administrator at the time of submitting such program that the State program meets the requirements of paragraphs (1) and (2) of subsection (b). Upon submission of such certification, the State program shall be deemed to be authorized under this section, and shall apply in such State in lieu of the corresponding Federal program under section 402 or 406, or both, as the case may be, until such time as the Administrator disapproves the program or withdraws the authorization.

"(b) Approval or Disapproval. Within 180 days following submission of an application under subsection (a), the Administrator shall approve or disapprove the application. The Administrator may approve the application only if, after notice and after opportunity for public hearing, the Administrator finds that --

"(1) the State program is at least as protective of human health and the environment as the Federal program under section 402 or 406, or both, as the case may be, and

"(2) such State program provides adequate enforcement. Upon authorization of a State program under this section, it shall be unlawful for any person to violate or fail or refuse to comply with any requirement of such program.

"(c) Withdrawal of Authorization. If a State is not administering and enforcing a program authorized under this section in compliance with standards, regulations, and other requirements of this title, the Administrator shall so notify the State and, if corrective action is not completed within a reasonable time, not to exceed 180 days, the Administrator shall withdraw authorization of such program and establish a Federal program pursuant to this title.

"(d) Model State Program. Within 18 months after the enactment of this title, the Administrator shall promulgate a model State program which may be adopted by any State which seeks to administer and enforce a State program under this title. Such model program shall, to the extent practicable, encourage States to utilize existing State and local certification and accreditation programs and procedures. Such program shall encourage reciprocity among the States with respect to the certification under section 402.

"(e) Other State Requirements. Nothing in this title shall be construed to prohibit any State or political subdivision thereof from imposing any requirements which are more stringent than those imposed by this title.

"(f) State and Local Certification. The regulations under this title shall, to the extent appropriate, encourage States to seek program authorization and to use existing State and local certification and accreditation procedures, except that a State or local government shall not require more than 1 certification under this section for any lead-based paint activities contractor to carry out lead-based paint activities in the State or political subdivision thereof.

"(g) Grants to States. The Administrator is authorized to make grants to States to develop and carry out authorized State programs under this section. The grants shall be subject to such terms and conditions as the Administrator may establish to further the purposes of this title.

"(h) Enforcement by Administrator. If a State does not have a State program authorized under this section and in effect by the date which is 2 years after promulgation of the regulations under section 402 or 406, the Administrator shall, by such date, establish a Federal program for section 402 or 406 (as the case may be) for such State and administer and enforce such program in such State.

"SEC. 405. LEAD ABATEMENT AND MEASUREMENT.

"(a) Program To Promote Lead Exposure Abatement. The Administrator, in cooperation with other appropriate Federal departments and agencies, shall conduct a comprehensive program to promote safe, effective, and affordable monitoring, detection, and abatement of lead-based paint and other lead exposure hazards.

"(b) Standards for Environmental Sampling Laboratories. (1) The Administrator shall establish protocols, criteria, and minimum performance standards for laboratory analysis of lead in paint films, soil, and dust. Within 2 years after the enactment of this title, the Administrator, in consultation with the Secretary of Health and Human Services, shall establish a program to certify laboratories as qualified to test substances for lead content unless the Administrator determines, by the date specified in this paragraph, that effective voluntary accreditation programs are in place and operating on a nationwide basis at the time of such determination. To be certified under such program, a laboratory shall, at a minimum, demonstrate an ability to test substances accurately for lead content.

"(2) Not later than 24 months after the date of the enactment of this section, and annually thereafter, the Administrator shall publish and make available to the public a list of certified or accredited environmental sampling laboratories. "(3) If the Administrator determines under paragraph (1) that effective voluntary accreditation programs are in place for environmental sampling laboratories, the Administrator shall review the performance and effectiveness of such programs within 3 years after such determination. If, upon such review, the Administrator determines that the voluntary accreditation programs are not effective in assuring the quality and consistency of laboratory analyses, the Administrator shall, not more than 12 months thereafter, establish a certification program that meets the requirements of paragraph (1).

"(c) Exposure Studies.

(1) The Secretary of Health and Human Services (hereafter in this subsection referred to as the 'Secretary'), acting through the Director of the Centers for Disease Control, (CDC), and the Director of the National Institute of Environmental Health Sciences, shall jointly conduct a study of the sources of lead exposure in children who have elevated blood lead levels (or other indicators of elevated lead body burden), as defined by the Director of the Centers for Disease Control.

"(2) The Secretary, in consultation with the Director of the National Institute for Occupational Safety and Health, shall conduct a comprehensive study of means to reduce hazardous occupational lead abatement exposures. This study shall include, at a minimum, each of the following --

"(A) Surveillance and intervention capability in the States to identify and prevent hazardous exposures to lead abatement workers.

"(B) Demonstration of lead abatement control methods and devices and work practices to identify and prevent hazardous lead exposures in the workplace. "(C) Evaluation,

in consultation with the National Institute of Environmental Health Sciences, of health effects of low and high levels of occupational lead exposures on reproductive, neurological, renal, and cardiovascular health.

"(D) Identification of high risk occupational settings to which prevention activities and resources should be targeted.

"(E) A study assessing the potential exposures and risks from lead to janitorial and custodial workers.

"(3) The studies described in paragraphs (1) and (2) shall, as appropriate, examine the relative contributions to elevated lead body burden from each of the following:

"(A) Drinking water.

"(B) Food.

"(C) Lead-based paint and dust from lead-based paint.

"(D) Exterior sources such as ambient air and lead in soil.

"(E) Occupational exposures, and other exposures that the Secretary determines to be appropriate.

"(4) Not later than 30 months after the date of the enactment of this section, the Secretary shall submit a report to the Congress concerning the studies described in paragraphs (1) and (2).

"(d) Public Education. (1) The Administrator, in conjunction with the Secretary of Health and Human Services, acting through the Director of the Agency for Toxic Substances and Disease Registry, and in conjunction with the Secretary of Housing and Urban Development, shall sponsor public education and outreach activities to increase public awareness of --

"(A) the scope and severity of lead poisoning from household sources;

"(B) potential exposure to sources of lead in schools and childhood day care centers;

"(C) the implications of exposures for men and women, particularly those of childbearing age;

"(D) the need for careful, quality, abatement and management actions;

"(E) the need for universal screening of children;

"(F) other components of a lead poisoning prevention program;

"(G) the health consequences of lead exposure resulting from lead-based paint hazards;

"(H) risk assessment and inspection methods for lead-based paint hazards; and

"(I) measures to reduce the risk of lead exposure from lead-based paint.

"(2) The activities described in paragraph (1) shall be designed to provide educational services and information to --

"(A) health professionals;

"(B) the general public, with emphasis on parents of young children;

"(C) homeowners, landlords, and tenants;

"(D) consumers of home improvement products;

"(E) the residential real estate industry; and

"(F) the home renovation industry.

"(3) In implementing the activities described in paragraph (1), the Administrator shall assure coordination with the President's Commission on Environmental Quality's education and awareness campaign on lead poisoning.

"(4) The Administrator in consultation with the Chairman of the Consumer Product Safety Commission, shall develop information to be distributed by retailers of home improvement products to provide consumers with practical information related to the hazards of renovation and remodeling where lead-based paint may be present.

"(e) Technical Assistance. --

"(1) Clearinghouse. Not later than 6 months after the enactment of this subsection, the Administrator shall establish, in consultation with the Secretary of Housing and Urban Development and the Director of the Centers for Disease Control, a National Clearinghouse on Childhood Lead Poisoning (hereinafter in this section referred to as 'Clearinghouse'). The Clearinghouse shall--

"(A) collect, evaluate, and disseminate current information on the assessment and reduction of lead-based paint hazards, adverse health effects, sources of exposure, detection and risk assessment methods, environmental hazards abatement, and clean-up standards;

"(B) maintain a rapid-alert system to inform certified lead-based paint activities contractors of significant developments in research related to lead-based paint hazards; and

"(C) perform any other duty that the Administrator determines necessary to achieve the purposes of this Act.

"(2) Hotline. Not later than 6 months after the enactment of this subsection, the Administrator, in cooperation with other Federal agencies and with State and local governments, shall establish a single lead-based paint hazard hotline to provide the public with answers to questions about lead poisoning prevention and referrals to the Clearinghouse for technical information.

"(f) Products for Lead-Based Paint Activities. Not later than 30 months after the date of enactment of this section, the President shall, after notice and opportunity for comment, establish by rule appropriate criteria, testing protocols, and performance characteristics as are necessary to ensure, to the greatest extent possible and consistent with the purposes and policy of this title, that lead-based paint hazard evaluation and reduction products introduced into commerce after a period specified in the rule are effective for the intended use described by the manufacturer. The rule shall identify the types or classes of products that are subject to such rule. The President, in implementation of the rule, shall to the maximum extent possible, utilize independent testing laboratories, as appropriate, and consult with such entities and others in developing the rules. The President may delegate the authorities under this subsection to the Environmental Protection Agency or the Secretary of Commerce or such other appropriate agency.

"SEC. 406. LEAD HAZARD INFORMATION PAMPHLET.

"(a) Lead Hazard Information Pamphlet. Not later than 2 years after the enactment of this section, after notice and opportunity for comment, the Administrator of the Environmental Protection Agency, in consultation with the Secretary of Housing and Urban Development and with the Secretary of Health and Human Services, shall publish, and from time to time revise, a lead hazard information pamphlet to be used in connection with this title and section 1018 of the Residential Lead-Based Paint Hazard Reduction Act of 1992. The pamphlet shall --

"(1) contain information regarding the health risks associated with exposure to lead;

"(2) provide information on the presence of lead-based paint hazards in federally assisted, federally owned, and target housing;

"(3) describe the risks of lead exposure for children under 6 years of age, pregnant women, women of childbearing age, persons involved in home renovation, and others residing in a dwelling with lead-based paint hazards;

"(4) describe the risks of renovation in a dwelling with lead-based paint hazards;

"(5) provide information on approved methods for evaluating and reducing lead-based paint hazards and their effectiveness in identifying, reducing, eliminating, or preventing exposure to lead-based paint hazards;

"(6) advise persons how to obtain a list of contractors certified pursuant to this title in lead-based paint hazard evaluation and reduction in the area in which the pamphlet is to be used;

"(7) state that a risk assessment or inspection for lead-based paint is recommended prior to the purchase, lease, or renovation of target housing;

"(8) state that certain State and local laws impose additional requirements related to lead-based paint in housing and provide a listing of Federal, State, and local agencies in each State, including address and telephone number, that can provide information about applicable laws and available governmental and private assistance and financing; and

"(9) provide such other information about environmental hazards associated with residential real property as the Administrator deems appropriate.

"(b) Renovation of Target Housing. Within 2 years after the enactment of this section, the Administrator shall promulgate regulations under this subsection to require each person who performs for compensation a renovation of target housing to provide a lead hazard information pamphlet to the owner and occupant of such housing prior to commencing the renovation.

"SEC. 407. REGULATIONS.

"The regulations of the Administrator under this title shall include such recordkeeping and reporting requirements as may be necessary to insure the effective implementation of this title. The regulations may be amended from time to time as necessary.

"SEC. 408. CONTROL OF LEAD-BASED PAINT HAZARDS AT FEDERAL FACILITIES.

"Each department, agency, and instrumentality of executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in a lead-based paint hazard, and each officer, agent, or employee thereof, shall be subject to, and comply with, all Federal, State, interstate, and local requirements, both substantive and procedural (including any requirement for certification, licensing, recordkeeping, or reporting or any provisions for injunctive relief and such sanctions as may be imposed by a court to enforce such relief) respecting lead-based paint, lead-based paint activities, and lead-based paint hazards in the same manner, and to the same extent as any nongovernmental entity is subject to such requirements, including the payment of reasonable service charges. The Federal, State, interstate, and local substantive and procedural requirements referred to in this subsection include, but are not limited to, all administrative orders and all civil and administrative penalties and fines regardless of whether such penalties or fines are punitive or coercive in nature, or whether imposed for isolated, intermittent or continuing violations. The United States hereby expressly waives any immunity otherwise applicable to the United States with respect to any such substantive or procedural requirement (including, but not limited to, any injunctive relief, administrative order, or civil or administrative penalty or fine referred to in the preceding sentence, or reasonable service charge). The reasonable service charges referred to in this section include, but are not limited to, fees or charges assessed for certification and licensing, as well as any other nondiscriminatory charges that are assessed in connection with a Federal, State, interstate, or local lead-based paint, lead-based paint activities, or lead-based paint hazard activities program. No agent, employee, or officer of the United States shall be personally liable for any civil penalty under any Federal, State, interstate, or local law relating to lead-based paint, lead-based paint activities, or lead-based paint hazards with respect to any act or omission within the scope of his official duties.

"SEC. 409. PROHIBITED ACTS.

"It shall be unlawful for any person to fail or refuse to comply with a provision of this title or with any rule or order issued under this title.

"SEC. 410. RELATIONSHIP TO OTHER FEDERAL LAW.

"Nothing in this title shall affect the authority of other appropriate Federal agencies to establish or enforce any requirements which are at least as stringent as those established pursuant to this title.

"SEC. 411. GENERAL PROVISIONS RELATING TO ADMINISTRATIVE PROCEEDINGS.

"(a) Applicability. This section applies to the promulgation or revision of any regulation issued under this title.

"(b) Rulemaking Docket. Not later than the date of proposal of an action to which this section applies, the Administrator shall establish a rulemaking docket for such action (hereinafter in this subsection referred to as a 'rule'). Whenever a rule applies only within a particular State, a second (identical) docket shall be established in the appropriate regional office of the Environmental Protection Agency.

"(c) Inspection and Copying. (1) The rulemaking docket required under subsection (b) shall be open for inspection by the public at reasonable times specified in the notice of proposed rulemaking. Any person may copy documents contained in the docket. The Administrator shall provide copying facilities which may be used at the expense of the person seeking copies, but the Administrator may waive or reduce such expenses in such instances as the public interest requires. Any person may request copies by mail if the person pays the expenses, including personnel costs to do the copying.

"(2) (A) Promptly upon receipt by the agency, all written comments and documentary information on the proposed rule received from any person for inclusion in the docket during the comment period shall be placed in the docket. The transcript of public hearings, if any, on the proposed rule shall also be included in the docket promptly upon receipt from the person who transcribed such hearings. All documents which become available after the proposed rule has been published and which the Administrator determines are of central relevance to the rulemaking shall be placed in the docket as soon as possible after their availability.

"(B) The drafts of proposed rules submitted by the Administrator to the Office of Management and Budget for any interagency review process prior to proposal of any such rule, all documents accompanying such drafts, and all written comments thereon by other agencies and all written responses to such written comments by the Administrator shall be placed in the docket no later than the date of proposal of the rule. The drafts of the final rule submitted for such review process prior to promulgation and all such written comments thereon, all documents accompanying such drafts, and written responses thereto shall be placed in the docket no later than the date of promulgation.

"(d) Explanation. (1) The promulgated rule shall be accompanied by an explanation of the reasons for any major changes in the promulgated rule from the proposed rule.

"(2) The promulgated rule shall also be accompanied by a response to each of the significant comments, criticisms, and new data submitted in written or oral presentations during the comment period.

"(3) The promulgated rule may not be based (in part or whole) on any information or data which has not been placed in the docket as of the date of such promulgation.

"(e) Judicial Review. The material referred to in subsection (c) (2) (B) shall not be included in the record for judicial review.

"(f) Effective Date. The requirements of this section shall take effect with respect to any rule the proposal of which occurs after 90 days after the date of the enactment of this section.

"SEC. 412. AUTHORIZATION OF APPROPRIATIONS.

"There are authorized to be appropriated to carry out the purposes of this title such sums as may be necessary."

(b) Technical and Conforming Amendments. The Toxic Substances Control Act (15 U.S.C. 2610) is amended as follows:

(1) In paragraph (1) of section 7(a), strike "or 6"and insert "6, or title IV"and after "5"insert "or title IV."

(2) In the first sentence of subsection (a) of section 11:

(A) Strike "or mixtures"before "are manufactured"and insert ", mixtures, or products subject to title IV".

(B) Insert "such products,"before "or such articles".

(3) In paragraph (1) of subsection (b) of section 11, strike "or mixtures"and insert ", mixtures, or products subject to title IV".

(4) In paragraph (1) of section 13(a) strike "or 6"in each place it appears and insert ", 6, or title IV"and strike "or 7"and insert ", 7 or title IV".

(5) In section 16, insert "or 409" after "section 15"each place it appears.

(6) In section 17, amend subsection (a) to read as follows:

"(a) Specific Enforcement. (1) The district courts of the United States shall have jurisdiction over civil actions to--

"(A) restrain any violation of section 15 or 409,

"(B) restrain any person from taking any action prohibited by section 5, 6, or title IV, or by a rule or order under section 5, 6, or title IV,

"(C) compel the taking of any action required by or under this Act, or

"(D) direct any manufacturer or processor of a chemical substance, mixture, or product subject to title IV manufactured or processed in violation of section 5, 6, or title IV, or a rule or order under section 5, 6, or title IV, and distributed in commerce, (i) to give notice of such fact to distributors in commerce of such substance, mixture, or product and, to the extent reasonably ascertainable, to other persons in possession of such substance, mixture, or product or expose to such substance, mixture, or product, (ii) to give public notice of such risk of injury, and (iii) to either replace or repurchase such substance, mixture, or product, whichever the person to which the requirement is directed elects."

(7) In the first sentence of subsection (b) of section 17--

(A) strike "or mixture"after "Any chemical substance"and inserting ", mixture, or product subject to title IV"; and

(B) insert "product,"before "or article"in each place that it appears.

- (8) In section 19 --
(A) In the first sentence of subsection (a), after "title II" insert "or IV".
(B) Before the semicolon at the end of subsection (a) (3) (B) insert "and in the case of a rule under title IV, the finding required for the issuance of such a rule".
(9) In section 20(a) (1) after "title II" insert "or IV" in each place it appears.
(10) Add at the end of the table of contents in section 1 the following:

"TITLE IV -- LEAD EXPOSURE REDUCTION

"Sec. 401. Definitions.

"Sec. 402. Lead-based paint activities training and certification.

"Sec. 403. Identification of dangerous levels of lead.

"Sec. 404. Authorized State programs.

"Sec. 405. Lead abatement and measurement.

"Sec. 406. Lead hazard information pamphlet.

"Sec. 407. Regulations.

"Sec. 408. Control of lead-based paint hazards at Federal facilities.

"Sec. 409. Prohibited acts.

"Sec. 410. Relationship to other federal law.

"Sec. 411. General provisions relating to administrative proceedings.

"Sec. 412. Authorization of appropriations.".

(c) Short Title. This subtitle may be cited as the "Lead- Based Paint Exposure Reduction Act".

SUBTITLE C -- WORKER PROTECTION

SEC. 1031. WORKER PROTECTION.

Not later than 180 days after the enactment of this Act, the Secretary of Labor shall issue an interim final regulation regulating occupational exposure to lead in the construction industry. Such interim final regulation shall provide employment and places of employment to employees which are as safe and healthful as those which would prevail under the Department of Housing and Urban Development guidelines published at Federal Register 55, page 38973 (September 28, 1990) (Revised Chapter 8). Such interim final regulations shall take effect upon issuance (except that such regulations may include a reasonable delay in the effective date), shall have the legal effect of an Occupational Safety and Health Standard, and shall apply until a final standard becomes effective under section 6 of the Occupational Safety and Health Act of 1970.

SEC. 1032. COORDINATION BETWEEN ENVIRONMENTAL PROTECTION AGENCY AND DEPARTMENT OF LABOR.

The Secretary of Labor, in promulgating regulations under section 1031, shall consult and coordinate with the Administrator of the Environmental Protection Agency for the purpose of achieving the maximum enforcement of title IV of the Toxic Substances Control Act and the Occupational Safety and Health Act of 1970 while imposing the least burdens of duplicative requirements on those subject to such title and Act and for other purposes.

SEC. 1033. NIOSH RESPONSIBILITIES.

Section 22 of the Occupational Safety and Health Act of 1970 is amended by adding the following new subsection at the end thereof:

"(g) Lead-Based Paint Activities. --

"(1) Training grant program.

"(A) The Institute, in conjunction with the Administrator of the Environmental Protection Agency, may make grants for the training and education of workers and supervisors who are or may be directly engaged in lead-based paint activities.

"(B) Grants referred to in subparagraph (A) shall be awarded to nonprofit organizations (including colleges and universities, joint labor-management trust funds, States, and nonprofit government employee organizations) --

"(i) which are engaged in the training and education of workers and supervisors who are or who may be directly engaged in lead-based paint activities (as defined in title IV of the Toxic Substances Control Act),

"(ii) which have demonstrated experience in implementing and operating health and safety training and education programs, and

"(iii) with a demonstrated ability to reach, and involve in lead-based paint training programs, target populations of individuals who are or will be engaged in lead-based paint activities.

Grants under this subsection shall be awarded only to those organizations that fund at least 30 percent of their lead-based paint activities training programs from non-Federal sources, excluding in-kind contributions. Grants may also be made to local governments to carry out such training and education for their employees.

"(C) There are authorized to be appropriated, at a minimum, \$ 10,000,000 to the Institute for each of the fiscal years 1994 through 1997 to make grants under this paragraph.

"(2) Evaluation of programs. The Institute shall conduct periodic and comprehensive assessments of the efficacy of the worker and supervisor training programs developed and offered by those receiving grants under this section. The Director shall prepare reports on the results of these assessments addressed to the Administrator of the Environmental Protection Agency to include recommendations as may be appropriate for the revision of these programs. The sum of \$ 500,000 is authorized to be appropriated to the Institute for each of the fiscal years 1994 through 1997 to carry out this paragraph.".

SUBTITLE D -- RESEARCH AND DEVELOPMENT

PART 1 -- HUD RESEARCH

SEC. 1051. RESEARCH ON LEAD EXPOSURE FROM OTHER SOURCES.

The Secretary, in cooperation with other Federal agencies, shall conduct research on strategies to reduce the risk of lead exposure from other sources, including exterior soil and interior lead dust in carpets, furniture, and forced air ducts.

SEC. 1052. TESTING TECHNOLOGIES.

The Secretary, in cooperation with other Federal agencies, shall conduct research to --

- (1) develop improved methods for evaluating lead-based paint hazards in housing;
- (2) develop improved methods for reducing lead-based paint hazards in housing;
- (3) develop improved methods for measuring lead in paint films, dust, and soil samples;
- (4) establish performance standards for various detection methods, including spot test kits;
- (5) establish performance standards for lead-based paint hazard reduction methods, including the use of encapsulants;
- (6) establish appropriate cleanup standards;
- (7) evaluate the efficacy of interim controls in various hazard situations;
- (8) evaluate the relative performance of various abatement techniques;
- (9) evaluate the long-term cost-effectiveness of interim control and abatement strategies; and
- (10) assess the effectiveness of hazard evaluation and reduction activities funded by this Act.

SEC. 1053. AUTHORIZATION.

Of the total amount approved in appropriation Acts under section 1011(o), there shall set aside to carry out this part \$ 5,000,000 for fiscal year 1993, and \$ 5,000,000 for fiscal year 1994.

PART 2 -- GAO REPORT

SEC. 1056. FEDERAL IMPLEMENTATION AND INSURANCE STUDY.

(a) Federal Implementation Study. The Comptroller General of the United States shall assess the effectiveness of Federal enforcement and compliance with lead safety laws and regulations, including any changes needed in annual inspection procedures to identify lead-based paint hazards in units receiving assistance under subsections (b) and (c) of section 8 of the United States Housing Act of 1937.

(b) Insurance Study. The Comptroller General of the United States shall assess the availability of liability insurance for owners of residential housing that contains lead-based paint and persons engaged in lead-based paint hazard evaluation and reduction activities. In carrying out the assessment, the Comptroller General shall --

- (1) analyze any precedents in the insurance industry for the containment and abatement of environmental hazards, such as asbestos, in federally assisted housing;
- (2) provide an assessment of the recent insurance experience in the public housing lead hazard identification and reduction program; and
- (3) recommend measures for increasing the availability of liability insurance to owners and contractors engaged in federally supported work.

SUBTITLE E -- REPORTS

SEC. 1061. REPORTS OF THE SECRETARY OF HOUSING AND URBAN DEVELOPMENT.

(a) Annual Report. The Secretary shall transmit to the Congress an annual report that --

- (1) sets forth the Secretary's assessment of the progress made in implementing the various programs authorized by this title;
- (2) summarizes the most current health and environmental studies on childhood lead poisoning, including studies that analyze the relationship between interim control and abatement activities and the incidence of lead poisoning in resident children;
- (3) recommends legislative and administrative initiatives that may improve the performance by the Department of Housing and Urban Development in combating lead hazards through the expansion of lead hazard evaluation and reduction activities;

(4) describes the results of research carried out in accordance with subtitle D; and
(5) estimates the amount of Federal assistance annually expended on lead hazard evaluation and reduction activities.

(b) Biennial Report. --

(1) In general. 24 months after the date of enactment of this Act, and at the end of every 24-month period thereafter, the Secretary shall report to the Congress on the progress of the Department of Housing and Urban Development in implementing expanded lead-based paint hazard evaluation and reduction activities.

(2) Contents. The report shall --

(A) assess the effectiveness of section 1018 in making the public aware of lead-based paint hazards;

(B) estimate the extent to which lead-based paint hazard evaluation and reduction activities are being conducted in the various categories of housing;

(C) monitor and report expenditures for lead-based paint hazard evaluation and reduction for programs within the jurisdiction of the Department of Housing and Urban Development;

(D) identify the infrastructure needed to eliminate lead-based paint hazards in all housing as expeditiously as possible, including cost-effective technology, standards and regulations, trained and certified contractors, certified laboratories, liability insurance, private financing techniques, and appropriate Government subsidies;

(E) assess the extent to which the infrastructure described in subparagraph (D) exists, make recommendations to correct shortcomings, and provide estimates of the costs of measures needed to build an adequate infrastructure; and

(F) include any additional information that the Secretary deems appropriate.

APPENDIX B

Inspection Checklist Sheet

LEAD-BASED PAINT INSPECTION CHECKLIST

Project Name: _____ **Project Number:** _____

Technician: _____ **Date:** _____

Planning Phase	
Contact facility management informing them of your arrival time.	
Contact Name:	
Contact Number:	
Review existing inspections and drawings of facility.	
Key Location:	
Inspection Phase	
Conduct on-site informational meeting and discuss sampling protocol/ Fill Out JSA	
Perform initial walk through of building.	
Identify different phases of construction.	
Walk exterior of building.	
Complete Field Drawing	
Fill out building information sheet.	
Develop XRF and/or sampling strategy. Collect XRF readings and collect any bulk samples and fill out chain-of-custody. Clean surrounding area of paint chips and note sample location on drawings.	
Collect samples and fill out chain-of-custody (if required).	
Note sample location on drawings (if Required).	
Photograph homogeneous areas using identifier in photo.	
Check out with Facility Staff/ Return Key	
Post Field Work Phase	
Ship Samples – Verify Samples, TAT, and Lab (if required).	
Photo Copy COC (if required).	
Place Field Materials in File Location.	
Download Photos.	
Discuss Project with Project Manager.	

APPENDIX C

Building Information Sheet

BUILDING INFORMATION SHEET

Project Name: _____
 Building Name/Number: _____
 Building Address: _____
 City/State: _____
 Site of Contact: _____

Project No.: _____
 Date: _____
 Inspected by: _____
 Site Phone No.: _____

General Building Information	
Original construction date (year)	Number of floors
Renovation or building additions (year)	Number of basement levels
Building size (square feet)	Number of attic or penthouse levels
General Building Exterior Information	General Building Interior Information
Siding material	Wall material
Roof type and material	Floor material
Window material	Ceiling material
Foundation Coating	Base cove material
	Building insulation
HVAC System Location:	
Heating System ☐ Boiler Units ☐ Other ☐ Forced Air Furnaces Comments:	Fuel Type ☐ Natural Gas ☐ Oil ☐ Electric ☐ Other ☐ Steam Comments:
Mechanical Piping Route ☐ Above Ceilings ☐ Crawl Spaces ☐ Pipe Tunnels ☐ Floor Slab ☐ Wall Chases/ Pipe Chases ☐ Other Comments:	

Comments: _____

APPENDIX D

Chain-of-Custody Sheet



**CHAIN OF CUSTODY RECORD
BULK LEAD-BASED PAINT SAMPLES**

Tetra Tech

618 SOUTH 25TH STREET
BILLINGS, MONTANA 59101

Phone (406) 248-9161

Fax (406) 248-9282

Project or Site Name

Project Number

Sampler Name (Printed)

Sampler Signature

Contact Name

Report to (Agency or Firm)

Address

Turn Around Time

LABORATORY NUMBER	SAMPLE NUMBER	SAMPLE DESCRIPTION AND LOCATION		DATE COLLECTED	ANALYSIS REQUIRED	RESULTS
Date	Time	Relinquished by	Total Samples Shipped	Date	Time	Received by
Date	Time	Relinquished by	Total Samples Shipped	Date	Time	Received by
Date	Time	Relinquished by	Total Samples Shipped	Date	Time	Received by



TETRA TECH

Standard Operating Procedures

for

Mercury Visual Inspection

Prepared By:

Tetra Tech

7100 Commercial Avenue, Suite 4
Billings, Montana 59101

January 2019

complex world

CLEAR SOLUTIONS™

TABLE OF CONTENTS

1.0	INTRODUCTION	2
2.0	EQUIPMENT	3
3.0	PLANNING AND PREPARATION	4
4.0	TYPICAL MERCURY-CONTAINING COMPONENTS	5
4.1	Batteries	6
4.2	Paint	7
4.3	Fluorescent Lamps	7
4.4	Thermometers	8
4.5	Thermostats	8
4.6	Switches	8
4.7	Consumer Products with Intentional Use of Mercury	8
4.8	Industrial Products with Intentional Use of Mercury	9
5.0	INSPECTION	10
5.1	Mercury Labeling and Equipment Type Designations	10
6.0	DOCUMENTATION	11
6.1	Field Notes	11
6.2	Photographs	12
6.3	Figures	12
6.4	Final Report	12
7.0	REFERENCES	13

LIST OF APPENDICES

Appendix A: Phase-Out of Mercury Switches & Relays Used as a Component in Products

1.0 INTRODUCTION

Mercury is a unique metal with many industrial applications. Mercury conducts electricity, has a high surface tension, and is very dense. As a liquid, mercury has a high surface tension that causes it to form its trademark small spherical beads. These properties make it a useful metal in industrial equipment such as electrical switches and seals. As a vapor, mercury is used in lighting such as fluorescent lamps, ultraviolet lights, and street signs. However, mercury can also pose a threat to public health and the environment if not managed properly.

Mercury is a potential toxin when released into the environment. Health effects depend on the intensity, duration, and route of exposure as well as the form of mercury.

Elemental mercury can evaporate at room temperature, creating mercury vapor. Inhalation of mercury vapor can cause respiratory and neurological disorders and is of concern to system operators working around elemental mercury or exposed to a mercury spill. Spills of even one gram of mercury can have adverse impacts on human health from the inhalation of resulting mercury vapor.

If mercury enters the environment through spills or improper disposal, it can bio-accumulate in food chains and, thus, poses a risk to human health and ecosystems. In water, mercury may undergo chemical reactions to become methyl-mercury, which builds up in tissues of organisms such as fish. People who eat these fish are exposed to mercury, which can lead to gastrointestinal and heart problems, kidney failure, and neurological disorders.

In order to ensure that each inspector working for Tetra Tech is conducting the inspection of Mercury in accordance with current industry standards, this Standard Operating Procedure (SOP) for Mercury Visual Inspection has been developed. This SOP is intended as a guide for new inspectors as well a reminder for experienced inspectors.

Please take time to read through this SOP to be sure that you are conducting mercury visual inspection in accordance with the procedures outlined in this document. State regulations are not included in this SOP, as each State regulation may vary from State to State.

2.0 EQUIPMENT

- Ladder to access areas.
- Flashlight to aid in visibility.
- Indelible ink pen for field forms.
- Camera for photographic documentation.
- Disposable protective clothing, gloves and bootees.
- Personal respirator, either a negative pressure full or half mask with HEPA (P100) cartridges.
- Safety Equipment required for the particular site (safety glasses, hearing protection, hard hat, steel-toed boots, etc.).

3.0 PLANNING AND PREPARATION

Prior to commencing building inspection activities, the following tasks should be performed.

- Contact management of the facility to inform them as to what will take place during the inspection.
- Determine the hours of operation for the facility.
- Develop a project schedule agreeable to the management of the facility including arrival time at the site and time of initial meeting with site personnel.
- Review existing as-built drawings, if available to become familiar with the facility as to the mechanical system layout, and materials used in construction. Develop drawings from as-built drawings, if provided by the management of the facility, for use in the inspection.
- Review any previous Mercury visual inspection that may have been conducted in the past.
- Collect all materials necessary for the inspection.

4.0 TYPICAL MERCURY-CONTAINING COMPONENTS

Mercury has been employed in a multitude of applications, many of which are still in use today, including electric switches, sensors, gauges, and meters used by a variety of industries, (U.S. EPA, 2002; IMERC, 1999; Huber, 1997). However, many manufacturers have phased out mercury-containing components and developed alternative technologies for use in historically mercury containing components. Nevertheless, older equipment and some newer types of equipment may still contain mercury.

A basic list of mercury-added products and processes used in manufacturing are listed in the table below.

Category	Product Examples	Purpose or End Uses of Product
Measurement Devices	Barometer, manometer, gages, meters, hydrometer, psychrometer, flow meter, pyrometer, sphygmomanometer	Measurement of weather, pressure, airflow, steam or gas or fuel flow, fluid levels, humidity, porosity, electricity distribution, pH meter, blood pressure, motor calibration
Lighting	Fluorescent bulbs	Buildings/facilities, backlit LCD display panels in a host of electronic, navigational screens, vehicle lights, black lights
Lighting	High-intensity discharge (HID), sodium, argon-mercury (certain neon colors), capillary, ultraviolet (UV), xenon-mercury-halide, cold cathode	Facility and outdoor lighting, vehicle headlamps, signs, germicidal, UV curing, bug zappers
Mercury	Various consumables that remain in or on the final product	Sealants and adhesives for ships and aircraft, metal finishing, vaccine preservative
Mercury compounds	Various compounds used in processes where mercury does not remain in the final product	Photo developing solutions, magnetic media for flight data recorders), metal coloring/finishing, tanneries
Mercury	Reagent	Lab and medical analysis, plastic production
Electrodes	Mercury drop electrode, mercury oxide reference electrode	Trace analysis for lead, cadmium, silver and other metals, electroanalysis, battery production, production of manganese dioxide
Control devices	Thermostats, regulators, switches, relays, synchronizers	Temperature control, alarms, gas and electricity distribution, motor calibration
Switches	Float, pressure, motion, tilt, tip-over, vibration, transfer, angle, reed	Test/calibration equipment, appliances, level controls, water treatment equipment, conveying/material handling equipment, aircraft, alarms, anti-tamper devices, pumps, fluid meters, boiler controls, timers, vehicles and motor homes (e.g., light activation, fuel cut-off for roll-over, ride control, suspension leveling), telecommunication equipment, laptop screens, riding mowers, bilge/septic tanks, ships and boats, appliance turn-off (when not in use)

Category	Product Examples	Purpose or End Uses of Product
Relays	Wetted reed, displacement	Control devices, oven controls, welding, high-current power switching, aircraft, flight simulators, printed circuit boards, consumer electronics, office-automation equipment
Sensors	Flame sensor, acceleration sensor, proximity, tilt sensor with potentiometer, other	Flame: gas fired boilers, commercial and residential gas appliances Acceleration: anti-lock brakes
Electronics	Advanced mercury alloys, (e.g., Hg-Cd-Te), and wet deposition process of Hg-Cd-Te on wafers	Semiconductors (especially for use in defense and satellites), solar cells, oscillators, converters
Slip ring	Strain gages, thermocouples, rotating or rolling equipment	Packaging equipment, material handling equipment, paper mill rollers
Valve	Heat-activated	Fire suppression sprinkler heads
Mercury salts	Chemical Oxygen Demand (COD) testing kits	COD analysis in process water by food processors and others.
Operating fluid	Diffusion pumps, weights, vibration dampers	Diffusion and chemical-feed pumps, gastrointestinal tubes, electron microscopes

4.1 Batteries

Manufacturers around the world have long used mercury in batteries to prevent the buildup of hydrogen gas, which can cause the battery to bulge and leak. Global battery production still accounts for about a third of total global demand for mercury based on data for the year 2000, and over 95% of this usage is attributed to battery makers outside the United States.

In the U.S., however, the use of mercury in consumer batteries has declined sharply. In the early 1980s, U.S. battery manufacture constituted the largest single domestic use of mercury - over 1,000 tons annually. By 1993, many battery manufacturers had begun selling mercury-free alkaline batteries. This became the national standard in 1996 with passage of the federal Mercury-Containing Battery Management Act. Most batteries made in the U.S. do not contain added mercury. The two exceptions are mercuric oxide batteries and button cell batteries.

4.1.1 Mercuric Oxide Batteries

In mercuric oxide batteries, mercury is used as an electrode rather than an additive to control gas buildup. The mercury accounts for up to 40% of the battery weight and cannot be reduced without reducing the energy output of the battery. Mercuric oxide button cells once were widely used in hearing aids but now are prohibited under federal law. Larger mercuric oxide batteries still are produced for military and medical equipment where a stable current and long service life is essential. Federal law allows these batteries to be sold, but only if the manufacturer has established a system to collect the waste batteries and ensure that the mercury is properly managed. Users are prohibited from disposing of spent mercuric oxide batteries except through the collection system established by the manufacturer.

4.1.2 Button Cell Batteries

Button cell batteries are miniature batteries in the shape of a coin or button that are used to provide power for small portable electronic devices. The four major technologies used for miniature batteries are: lithium, zinc air, alkaline, and silver oxide. Lithium miniature batteries contain no intentionally-added mercury. However, small amounts of mercury are still added to most zinc air, alkaline and silver oxide miniature batteries in order to prevent the formation of internal gases that can cause leakage. Zinc air batteries are used mainly in hearing aids; silver oxide batteries are used in watches and cameras; and alkaline manganese batteries are used in digital thermometers, calculators, toys and a myriad of other products requiring a compact power source.

While the federal Battery Management Act of 1996 prohibits the sale of mercuric oxide button cells, it specifically allows the sale of alkaline manganese button cells containing mercury content of up to 25 milligrams (mgs). At that time, the technology did not exist to control the formation of gas in miniature batteries without using mercury. The Battery Act is silent regarding the mercury content of silver oxide and zinc air button cell batteries. Button cell batteries sold by U.S. manufacturers in 2002 had the following average mercury content: silver oxide, 2.5 mg; zinc air, 8.5 mg; and alkaline, 10.8 mg. U.S. manufacturers continue to pursue the development of reliable “no mercury” formulas to eliminate mercury altogether from these button cell batteries. (Lithium button cell batteries currently do not contain mercury but they may pose a fire risk, according to the National Electrical Manufacturers Association).

Mercury from button cell batteries can be released to the environment during various stages of the product life cycle, but primarily during manufacturing and disposal. The use and disposal of mercury-added button cells are unregulated at the federal level. They do not have to be labeled; it is legal to dispose of them in the household trash; and they rarely are collected for recycling in most U.S. jurisdictions. Some states are now considering whether the disposal of button cell batteries should be regulated or whether recycling should be encouraged. Because button batteries currently are not widely targeted for recycling, almost all of this mercury presumably ends up in the municipal solid waste stream where it is either incinerated or landfilled.

4.2 Paint

In the past mercury was used in many water-based latex paints as a fungicide to prevent the growth of bacteria. Its use in interior and exterior latex paint was discontinued in the United States in 1991.

4.3 Fluorescent Lamps

Fluorescent and high intensity discharge (HID) lighting are widely used in homes, offices, and business operations due to their energy efficiency. HID lighting may be used for security lighting or other outdoor applications.

Mercury content varies by manufacturer and lamp type. A typical fluorescent lamp is 50% more efficient than an incandescent lamp. However, fluorescent lamps are glass tubes coated with phosphor powders, filled with rare gases such as argon, neon, and krypton, and charged with a drop of mercury. Fluorescent lighting can contain 4 to 12 mg of mercury per bulb depending on the bulb type (NEMA, 2001). A HID lamp can contain between 20 and 250 mg of mercury per lamp (U.S. EPA, 2002).

4.4 Thermometers

Mercury has a uniform volume expansion over a wide temperature range, from -30 to 900°F, and is commonly used in industrial thermometers. Thermometers can contain up to 3 grams of mercury and are commonly found in labs, buildings, and control or alarm indicators for liquid cooling systems, pressure and temperature monitors, and recirculating water cooling systems.

4.5 Thermostats

Thermostats may contain a mercury switch consisting of a durable glass tube attached to a metal strip that absorbs shocks. Switches may contain up to 3 grams of mercury and a single thermostat may contain multiple switches (Huber, 1997). In a drinking water system, mercury switches may be found in wall mounted thermostats used to control building heating and cooling systems and furnaces.

4.6 Switches

Mercury is contained in temperature-sensitive switches and mechanical tilt switches. Mercury tilt switches are small tubes with electrical contacts at one end of the tube. Reed switches are small circuit controls that are used in electronic devices. A third type, float switches, is used in sump pumps and bilge pumps to turn the equipment off when water reaches a certain level.

4.7 Consumer Products with Intentional Use of Mercury

Identified below are typical consumer products which have been identified historically to include the intentional use of mercury.

- Thermometers and other measuring devices;
- Appliances;
 - Refrigerators and freezers
 - Gas stoves
 - Washing machines
 - Space heaters
 - Commercial water heaters
 - Electric stoves
 - Pressure control systems
- Electrical and electronic switches, contacts, and relays;
- Light sources (i.e. light bulbs and ballasts)
- Batteries;
- Biocides and pesticides;
- Paints;
- Pharmaceuticals;
- Cosmetics

4.8 Industrial Products with Intentional Use of Mercury

Identified below are typical industrial products which have been identified historically to include the intentional use of mercury.

- Manometers and gauges devices;
- Laboratory chemicals and equipment

5.0 INSPECTION

Provided below is a step-by-step approach to mercury identification.

Step 1 Determine possible target locations for mercury inspection.

Step 2. At the target location(s), determine potential mercury-containing applications.

Step 3. Match equipment with manufacturing companies' information on mercury-containing products. Consult:

- https://imerc.newmoa.org/publicsearch/NEWMOA_IMERC.aspx#/CustomizedSearch
- Manufacturers' Literature, Maintenance Records, and Trade Associations
- Phase-Out of Mercury Switches & Relays Used as a Component in Products (Appendix A)

Step 4. For closed and partially closed applications and unclassified components, inspect for indications of mercury trade names. Consult:

- https://imerc.newmoa.org/publicsearch/NEWMOA_IMERC.aspx#/CustomizedSearch
- Manufacturers' Literature, Maintenance Records, and Trade Associations

Step 5. For potential mercury-containing open applications, consult:

- https://imerc.newmoa.org/publicsearch/NEWMOA_IMERC.aspx#/CustomizedSearch
- Manufacturers' Literature, Maintenance Records, and Trade Associations

Step 6. At the target location(s), determine potential mercury-containing wastes.

5.1 Mercury Labeling and Equipment Type Designations

Historically, many large companies designed their own method for mercury identification. Items that may have mercury classification and concentration labels include: light bulbs, ballasts, batteries, and relays. Caution should be used concerning old labels for they may be inaccurate; it may be prudent to re-examine the contents of such items when the equipment is removed from service.

If one is unable to test chemically for mercury, some of the following assumptions may be appropriate for certain types of electrical equipment. One should assume that all bulbs and ballasts contain Mercury unless the label or nameplate information, manufacturer's literature, or chemical analysis states that it does not contain.

6.0 DOCUMENTATION

6.1 Field Notes

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be completed and accurate enough to permit reconstruction of field activities. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual(s) making the entries. Language will be factual, objective, and free of personal opinions. At a minimum, the following information will be recorded, if applicable, during the collection of each sample.

- Inspector's name(s)
- Date and time of inspection
- Type of component
- Location of component
- Field observations and details related to condition and/ or status of component

In addition to inspection information, the following specifics may also be recorded in the field logbook for each day of inspection:

- Team members and their responsibilities
- Time of arrival on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with any potentially responsible parties, or
- Representatives of any federal, state, or other regulatory agency
- Deviations from inspection plans or site safety plan procedures
- Changes in personnel and responsibilities, as well as reasons for the change
- Levels of safety protection
- Record of photographs

6.2 Photographs

Photographs will be taken at representative inspection locations. They will verify information entered in the field logbook. When a photograph is taken, the following information will be written on the logbook or will be recorded in the field photography log:

- Date, location
- Description of the subject photographed
- Name of person taking the photograph

6.3 Figures

If present, mercury-containing components will be identified on field drawings completed at the time of inspection. Following the conclusion of inspection services, field drawings will be utilized to derive Computer Aided Design (CAD) figures that depict the location of identified components.

6.4 Final Report

A final report will be provided documenting the findings of the inspection services. The report will be utilized to generate abatement designs/ specifications on an as needed basis.

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APPENDIX A

PHASE-OUT OF MERCURY SWITCHES & RELAYS USED AS A COMPONENT IN PRODUCTS

Phase-Out of Mercury Switches & Relays Used as a Component in Products			
Company	Product Category	Mercury Component	Date of Phase-Out
Aero Coach, Inc.	Recreational vehicles	Oven pilot valve	March 2004
Agilent Technologies	Measuring devices and chemical analyzer	Relays	December 2004
Ameri-Camp	Trailers and fifth wheels	Oven pilot valve	2005
Atwood Mobile Products, Inc.	Recreational vehicles	Oven pilot valve	2004
Bombardier Recreational Products	Personal watercraft	Rollover shut-off switch	2005
Carrier Commercial Refrigeration	Cooking equipment	Relays	2005
Carriage, Inc.	Recreational vehicles	Oven pilot valve	2005
Cequent Electrical Products (also known as Tekonsha Engineering)	Electric brake controls	Tilt switch	2002
Coachmen Recreational Vehicles	Recreational vehicles	Thermostat Safety valve Sensing unit	2004
DaimlerChrysler Corp.	Anti-lock braking systems (ABS)	Inertia switch	2002
Dutchmen Manufacturing Inc.	Recreational vehicles	Shut-off Valve	March 2004
Electrolux Home Products North America, Inc.	Gas ranges	Safety valve	2007
Elster Electricity (formerly ABB)	Circuit board Electricity meters	Tilt switch Switches	December 2002 2005
Fleetwood Enterprise	Recreational vehicles	Oven pilot valve	2004
Ford Motor Company	Automobiles	Convenience light switch	2001
Forest River, Inc.	Recreational vehicles	Oven pilot valve	2004
Four Winds International, Inc.	Recreational vehicles	Hydraulic leveling device switch Oven pilot valve	2003 2005
General Motors Corp.	Automobiles	Convenience light switch	January 2003
Georgie Boy Manufacturing	Motor homes	Safety valve	2004
Gulf Stream Coach, Inc.	Recreational Vehicles	Switches	2005
Heat-Timer Corp.	HVAC control system	Switch	2007
Hill-Rom	Hospital bed	Tilt switch	July 2004
Hopkins Manufacturing Corp.	Trailer braking systems	Inertia switch	2003

International Truck & Engine Corp.	Trucks	Tilt switches for hood and door	January 2003
Keystone RV Company	Recreational vehicles	Oven pilot valve	January 2006
Lancaster Pump	Pumps	Float switch	2004
Lance Camper Mfg. Corp.	Camper	Oven pilot valve	2004
Lazy Daze, Inc.	Motor homes	Oven pilot valve	2004
Maytag Appliance	Ovens	Gas supply valve	2006
Monaco Coach Corporation	Leveling jack sensor TV antenna Satellite antenna	Switches	2004
Newmar Corp.	Recreational Vehicles	Gas flow switch	2004
PACCAR Inc.	Trucks	Switches	2002
Pitco Frialator	Cooking equipment	Electric relay	2004
Play-Mor Trailers, Inc.	Recreational Vehicles	Flame sensor	2004
Skyline Corp.	Recreational Vehicles	Oven pilot valve	2004
Suburban Mfg. Co.	Recreational Vehicles	Oven pilot valve	2005
Sunline Coach	Recreational Vehicles	Switches	2004
SunnyBrook RV, Inc.	Recreational Vehicles	Oven pilot valve	2004
Thor America, Inc.	Recreational Vehicles	Oven pilot valve	2004
Tiffin Motor Homes, Inc.	Recreational Vehicles	Level sensing switch Oven pilot valve	2002 2004
Volvo Trucks No. America, Inc.	Trucks	Roll over switch and hood tilt switch	2002
Whirlpool Corporation	Range	Safety switch	2005
Winnebago Industry, Inc.	Recreational Vehicles	Level sensing switch 2002	Oven pilot valve 2005
Zoeller Pump Co., LLC	Pumps	Control switch	2005



TETRA TECH

Standard Operating Procedures

for

PCBs Visual Inspection

Prepared By:

Tetra Tech

7100 Commercial Avenue, Suite 4
Billings, Montana 59101

January 2019

complex world

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TABLE OF CONTENTS

1.0	INTRODUCTION	2
2.0	EQUIPMENT	3
3.0	PLANNING AND PREPARATION	4
4.0	TYPICAL PCB-CONTAINING COMPONENTS	5
4.1	Closed Applications	5
4.2	Partially Closed Applications	8
4.3	Open Applications	9
5.0	PCB VISUAL INSPECTION	10
5.1	Inspection	10
5.2	PCB Labeling and Equipment Type Designations	11
5.3	Identification of Capacitors and Ballasts Containing PCBs	11
6.0	DOCUMENTATION.....	13
6.1	Field Notes.....	13
6.2	Photographs	14
6.3	Figures.....	14
6.4	Final Report	14
7.0	REFERENCES.....	15

LIST OF APPENDICE

Appendix A: Step-by-Step Approach for PCB Identification

1.0 INTRODUCTION

Public concern has been growing about the use of polychlorinated biphenyls (PCBs) in commercial products. PCBs are chemical substances which are persistent, bio-accumulate, and pose a risk of causing adverse effects to human health and the environment. They can be transported long distances, and have been detected in the furthest corners of the globe, including places far from where they were manufactured or used. In order to ensure that each inspector working for Tetra Tech is conducting the inspection of PCBs in accordance with current industry standards, this Standard Operating Procedure (SOP) for PCBs Visual Inspection has been developed. This SOP is intended as a guide for new inspectors as well a reminder for experienced inspectors.

Please take time to read through this SOP to be sure that you are conducting PCBs visual inspection in accordance with the procedures outlined in this document. State regulations are not included in this SOP, as each State regulation may vary from State to State.

2.0 EQUIPMENT

- Ladder to access areas.
- Flashlight to aid in visibility.
- Indelible ink pen for field forms.
- Camera for photographic documentation.
- Disposable protective clothing, gloves and bootees.
- Personal respirator, either a negative pressure full or half mask with HEPA (P100) cartridges.
- Safety Equipment required for the particular site (safety glasses, hearing protection, hard hat, steel-toed boots, etc.).

3.0 PLANNING AND PREPARATION

Prior to commencing building inspection activities, the following tasks should be performed.

- Contact management of the facility to inform them as to what will take place during the inspection.
- Determine the hours of operation for the facility.
- Develop a project schedule agreeable to the management of the facility including arrival time at the site and time of initial meeting with site personnel.
- Review existing as-built drawings, if available to become familiar with the facility as to the mechanical system layout, and materials used in construction. Develop drawings from as-built drawings, if provided by the management of the facility, for use in the inspection.
- Review any previous PCBs visual inspection that may have been conducted in the past.
- Collect all materials necessary for the inspection.

4.0 TYPICAL PCB-CONTAINING COMPONENTS

PCBs have been employed in a multitude of applications, many of which are still in use today, including dielectric fluids in electrical equipment, heat-transfer fluids in mechanical operations, plasticizers, lubricants, inks, and surface coatings. The subsections below identify and discuss PCB use areas based on their presence in closed, partially closed, and open systems. These designations refer to how easily the PCBs contained within a product can escape to the surrounding environment (i.e., PCBs in closed systems cannot readily escape to the environment). Generally, closed and partially closed systems contain PCB oils or fluids. The PCBs in open systems take on the form (type of media) of the product they have been used in as an ingredient. Therefore, PCBs in open applications may be found in forms ranging from paint, to plastic, to rubber.

4.1 Closed Applications

A closed PCB application is one in which the PCBs are held completely within the equipment. Under ordinary circumstances, no PCBs would be available for exposure to the user or the environment. However, PCB emissions may occur during equipment servicing/repairing and decommissioning, or as a result of damaged equipment. The two most significant examples of closed PCB-applications are capacitors and transformers.

In general, it is often difficult to determine the presence of PCBs in sealed equipment, since breaking open the equipment to ascertain this information will usually be inappropriate. Consequently, the first step should always be to refer to maintenance records, manufacturers' literature, trade associations, and equipment manufacturing companies to find information on dielectric fluids contained in the product. Equipment should at a minimum be inspected for any indications of leaks, such as oil stains near the equipment, seepage marks on the equipment, or gross physical damage. These are signs that the equipment needs to be analytically tested for PCBs and repaired or possibly replaced. Following are useful details for identifying closed applications of PCBs in electrical applications.

4.1.1 Transformers

The transformer is a very important component in many different types of electrical circuits, from small-signal electronic circuits to high-voltage power transmission systems. The physical size and shape of transformers vary greatly, from not much bigger than a pea up to the size of a small house. The main structure of a transformer consists of one or more electrical coils (or windings) linked together magnetically by a magnetic circuit or core. For most large transformers, the entire unit is filled with a dielectric fluid (often an oil possibly containing PCBs) to increase the insulation between and to cool the electric coils. Thus, any damage to the transformer's outer casing may result in PCB-fluid leakage. It is important to note that although mineral oil transformers do not intentionally contain PCBs, they often become contaminated by the use of common filling equipment or maintenance filling with used or recycled oil.

Distribution transformers are commonly found near the top of electric utility poles where they function to lower the voltage on the distribution line for household use. Synthetic PCB-oils are commonly used where fire resistant transformers are required, as inside buildings and in nuclear power plants. Transformers are also found in many communication circuits where they function to match a load to a line for improved power transfer and to improve transmission quality. Most transformers are within the control of the electricity generating and distributive companies, although some industries privately generate electricity. These industries, such as

military installations, steel mills, assembly and manufacturing plants, and railroads, often have transformers on site. Appendix A, Tables A.1, A.2, and A.4 provide additional PCB-containing transformer identification information, including common locations, a list of company names that manufactured PCB-containing transformers, equipment type designations, and PCB mixture trade names.

4.1.2 Capacitors

There are many types of capacitors and they differ primarily in the type of material used as a dielectric. Typical dielectrics are plastic-film, mica, ceramic, and oil-impregnated paper. In ballast capacitors manufactured with oil-impregnated paper, one of the oils used was PCBs.

A capacitor is a device for accumulating and holding a charge of electricity. The main structure of a capacitor consists of electrical conducting surfaces separated by a dielectric material, frequently a dielectric fluid that may or may not contain PCBs. Typically, a capacitor that contains PCBs is a completely sealed metal can with two electrical leads or contacts. The entire can is usually filled with the PCB-containing fluid. Identifying capacitors containing PCB dielectric fluids may be complicated because capacitors are often difficult to locate. They are usually plain boxes that can be remote from switch rooms or found on individual items within a building. Following are descriptions of three major types/uses of capacitors that may contain PCBs. In addition, Appendix A, Tables A.1, A.3, and A.4 provide PCB-containing capacitor identification information, including common locations, a list of company and product names, equipment type designations, production dates, and PCB mixture trade names.

- Power Factor Correction Capacitors: Power factor correction capacitors are large capacitors that are generally of uniform size (60 cm x 30 cm x 15 cm) and may contain about 1.4 kg of 100% PCB fluid. Power factor correction capacitors are usually located near transformers, often in racks at power stations. Potential facilities containing capacitors include factories, offices, schools, hospitals, stores, and military installations. Large capacitors would likely be found near sizable power supply units within these facilities (e.g., computer equipment rooms, and central heating and cooling systems).
- Motor Start Capacitors: Motor start capacitors are small capacitors that are used with single-phase motors to provide starting torque. The capacitors can be found in electrical appliances including hair dryers, washing machines, clothes dryers, down-well water pumps, ventilating fans, and air conditioners. These small capacitors generally contain less than 1.4 kg of dielectric fluid.

4.1.3 Light Ballasts

Lighting ballasts can be found within fluorescent, mercury, and sodium lighting fixtures, and neon lights. Ballasts are composed of a small transformer, a capacitor, and a thermal cut-off switch. The capacitor is the only component that may contain PCBs, typically approximately 0.1 kg of PCB fluid. In fluorescent lights, the ballast is located under the metal cover plate that is behind the lighting tubes (lamps). Ballasts manufactured in the US after 1978 are labeled "No PCBs," and therefore any unlabeled ballast from a US source should be assumed to contain PCBs (US EPA 1993). Appendix A, Tables A.1 and A.4 provide additional PCB identification information, including common locations, and PCB mixture trade names.

Fluorescent and High Intensity Discharge (HID) lamps require ballasts. A ballast is designed to maintain a constant current through it, despite variations in applied voltage or changes in the rest of the circuit. As current passing through the ballast increases, the ballast increases in impedance; likewise, the ballast decreases in impedance as the current passing through it decreases. The ballast acts, therefore, as a variable load on the system, differing from "load resistors" which have a constant resistance. The required ballast action is obtained by using a reactive and capacitive component to limit the lamp current. Any increase in the current passing through the ballast causes an increase in the temperature which results in a slight increase in resistance and reduces the current.

Ballasts are used to compensate for any variations in the line voltage or to compensate for negative volt-ampere characteristics of other devices, such as fluorescent lamps and other vapor lamps. Ballasts permit the economical dimming and flashing of rapid-start lamps, providing a range of applications and control not possible with previous lamp types. These rapid-start lamps are commonly used in flashing signs, and in residential and commercial lighting where continuously variable illumination levels are desired.

4.1.4 Fluorescent Lamp Ballasts

There are several different types of fluorescent lamp ballasts. The most common is the rapid-start ballast used to operate two, four-foot fluorescent lamps. Fluorescent lamp ballasts are usually mounted between the fluorescent tubes on the light fixture and are shielded with a metal protective device which reduces heat radiation.

4.1.5 High Intensity Discharge (HID) Lamp Ballasts

High Intensity Discharge (HID) lamps differ in appearance from fluorescent lamps but have similar electrical characteristics and require ballasts for starting and controlling the lamp circuit. The main types of HID lamps are mercury, metal halide, and high-pressure sodium. High Intensity Discharge ballasts can be found both outdoors (e.g., in streetlamps) and indoors (e.g., in indoor parking garages). The ballast is either enclosed in its own box and fastened to the outside of the light fixture or located inside the light housing.

4.1.6 Light Ballasts Construction

4.1.6.1 Fluorescent Lamp Ballasts

The housing of a typical ballast for two, 40-watt lamps is heavy-gauge steel. Typical ballasts contain a reactor (a core and coil assembly), a capacitor, and a thermal protector. It is the capacitor that could contain PCBs.

When the ballast is manufactured, the core and coil assembly are mounted inside the ballast housing and are connected to the capacitor. The color-coded, interconnecting wires are designed primarily for ease of installation. Fluorescent ballasts are filled with an asphalt/silica compound which is mixed with very fine silica powder. This compound serves to dissipate heat, protect from moisture, and reduce sound produced by the core and coil assembly.

Fixture safety specifications require that the ballast case temperatures not exceed 90° C under normal operation. Furthermore, the thermal protector within the ballast de-energizes the circuit when the internal temperature exceeds 105° C. The thermal protector may be either an automatic resettable type or a non-resettable type. Once the non-resettable protector is deactivated by high temperature, the ballast must be replaced. Some ballasts are designed to de-energize at 120° C, at which temperature a small amount of asphalt compound may soften and leak out.

4.1.6.2 High Intensity Discharge (HID) Ballasts

Because most HID lamps operate at much higher wattage than fluorescent lamps, the average HID ballast requires much higher reactance and capacitance than the typical fluorescent ballast. Some HID ballasts do not have an asphalt seal and some have more than one capacitor. The PCB content of the capacitor depends on its voltage and capacitance ratings. These ratings depend on the size and type of lamp and the performance specifications of the ballast. Generally, metal halide lamps require higher voltage than mercury lamps. Most HID ballasts contain between 0.091 kg and 0.386 kg of PCBs.

4.1.6.3 Potential for PCB Release from Ballasts

Because of the elaborate physical containment of the components in fluorescent lamp ballasts and their low normal operating temperatures, it is unlikely that PCBs will escape into the environment. It is possible, however, for a ballast to overheat and some of the asphalt compound to leak out. It is this small amount of asphalt compound that is generally mistaken for a PCB leakage. When cooled to room temperature, the asphalt will re-harden; however, the PCB dielectric from a capacitor, if present, will remain as a heavy oil.

High Intensity Discharge ballasts without asphalt sealant have a greater potential for leakage due to puncture or perforation of the capacitor. These ballasts are sometimes located where they are exposed to moisture and road salt.

4.2 Partially Closed Applications

Partially closed PCB applications are those in which the PCB oil is not directly exposed to the environment, but may become so periodically during typical use. These types of uses may also lead to PCB emissions, through air or water discharge. Examples of partially closed systems include heat transfer and hydraulic systems, and vacuum pumps. Commonly used partially closed uses of PCBs and typical locations are listed below.

Application	Typical Location(s)
Heat transfer fluids	Inorganic chemical, organic chemical, plastics and synthetics, and petroleum refining industries
Hydraulic fluids	Mining equipment; aluminum, copper, steel, and iron forming industries
Vacuum Pumps	Electronic components manufacture; laboratory, instrument and research applications; and waste water discharge sites
Switches	Electric utilities
Voltage Regulators	Electric utilities
Liquid Filled Electrical Cables	Electric utilities, and private generation facilities (e.g. military installations)
Liquid Filled Circuit Breakers	Electric utilities

4.3 Open Applications

Open systems are applications in which PCBs are in direct contact with their surroundings and thereby may be easily transferred to the environment. Direct PCB contact with the environment is of greater concern for open uses than it is for closed applications. Plasticizers are the largest group of open applications and are used in PVC (polyvinyl chloride), neoprene, and other chlorinated rubbers. In addition, PCBs have been used in a number of other open uses including in paints as flame-retardants, adhesives as plasticizers, and in surface coatings as flame-retardants. Common open applications for PCBs are listed below.

Application	Typical Location(s)
Lubricants	Immersion oils for microscopes, brake linings, cutting oils, lubricating oils (i.e. natural gas air compressors)
Casting Waxes	Pattern waxes for investment castings
Surface Coatings	Paints, surface treatment for textiles; carbonless copy paper; flame retardants on ceiling tiles, on furniture and walls; dust control, dust binders, asphalt, natural gas pipelines.
Adhesives	Special adhesives, adhesives for waterproof wall coatings
Plasticizers	Gasket sealers, filler material in joints of concrete
Inks	Dyes, printing inks
Other Uses	Insulating material, pesticides

5.0 PCB VISUAL INSPECTION

5.1 Inspection

Provided below is a step-by-step approach to PCB identification using several specified guidance tables. These directions refer to tables and text provided in both Appendix A and the main document. Tables beginning with the letter “A” are located in Appendix A. All other tables and sections noted are located in the main document. The step-by-step approach is repeated in Appendix A.

Step 1 Determine possible target locations for PCB inspection. Consult:

- Table A.1 PCB Applications by Location

Step 2. At the target location(s), determine potential PCB-containing applications. Consult:

- Table A.1 PCB Applications by Location
- Section 3 Initial Identification of Potential PCB-Containing Materials

Step 3. For all transformers and capacitors, inspect equipment for initial indication of PCBs. Match equipment with manufacturing companies’ information on PCB-containing products. Consult:

- Table A.2 PCB-Containing Transformer Manufacturing Companies
- Table A.3 PCB-Containing Capacitors
- Section 3.1.1 Closed Applications
- Manufacturers’ Literature, Maintenance Records, and Trade Associations

Step 4. For other closed and partially closed applications and unclassified transformers and capacitors, inspect for indications of PCB mixture trade names. Consult:

- Table A.4 Trade Names and Synonyms for PCB Mixtures
- Section 3 Initial Identification of Potential PCB-Containing Materials
- Manufacturers’ Literature, Maintenance Records, and Trade Associations

Step 5. For potential PCB-containing open applications. Consult:

- Table 3 Open Applications of PCBs (page 9 of the main document)
- Section 3.1.3 Open Applications

Step 6. At the target location(s), determine potential PCB-containing wastes. Consult:

- Table A.5 PCB-Containing Wastes
- Section 3.2 PCB-Containing Wastes

5.2 PCB Labeling and Equipment Type Designations

Historically, many large companies designed their own method for PCB identification. The Aroclor series of PCBs manufactured by Monsanto Chemical Company, for example, uses a four-digit code for identification. In the Monsanto codes, the first two digits “12” represent a biphenyl and the last two digits represent the percent of chlorine in the mixture by weight (e.g., Aroclor 1260 is a polychlorinated biphenyl with 60 percent chlorine). Other company codes may represent mean numbers of chlorine atoms in the components (e.g., Clophen A60, Phenoclor DP6, and Kanechlor 600 all are biphenyls averaging about 6 chlorine atoms per molecule) (Dobson and van Esch 1993).

Items that may have PCB classification and concentration labels include: PCB containers, transformers, capacitors, electric motors, hydraulic systems, heat-transfer systems, PCB-article containers, storage areas, and transport vehicles. (Standard PCB labels for the US are square and come in 2.5 cm increments from 5 cm X 5 cm to 15 cm X 15 cm.). For example, US-based items are labeled no-PCBs if they are known to have less than 5 ppm of PCBs. Caution should be used concerning old labels for they may be inaccurate; it may be prudent to re-examine the contents of such items when the equipment is removed from service.

If one is unable to test chemically for PCBs, some of the following assumptions may be appropriate for certain types of electrical equipment. One should assume that all capacitors contain PCBs unless the label or nameplate information, manufacturer's literature, or chemical analysis states that it does not contain PCBs (Goodwin 1998). Similarly, if there is no nameplate on an old transformer and it contains an unknown type of dielectric fluid, then the transformer should be assumed to contain a 500 ppm or greater PCB concentration. If a transformer is known to contain mineral oil dielectric fluid but has no nameplate, then one should assume the transformer contains between 50-499 ppm PCBs.

5.3 Identification of Capacitors and Ballasts Containing PCBs

Manufacturers of ballasts and capacitors use distinct catalogue and date codes to identify their product, its date of manufacture, and, for some capacitors, its dielectric fluid. In a ballast filled with asphalt, the capacitor is not very accessible. Therefore, correctly interpreting the manufacturer's codes on the ballast is very important in determining whether a ballast could contain a PCB capacitor. The following section contains information to assist in interpreting these codes.

5.3.1 GE Lighting Ballasts

All high-power-factor fluorescent lamp ballasts manufactured by GE Lighting prior to May 1977 include a small metal capacitor (an electronic device used to store an electrical charge) that contains approximately 10 grams of PCB fluid. The capacitors in GE fluorescent lamp ballasts manufactured after January 1, 1979, do not contain PCBs.

Ballasts manufactured between May 1977 and January 1, 1979, may include either type of capacitor. To determine if the GE Lighting ballast contains PCBs, look for the two-letter date code that's stamped into the mounting feet at one end of the fluorescent ballast, and then check the chart below to find the month and year of manufacture. Ballasts manufactured after January 1, 1979, do not contain PCBs. If the ballast was manufactured between May 1977 and January 1, 1979, look additionally for the catalog number on the label attached to the top of the ballast. If the catalog number contains a "W," the ballast does NOT contain PCBs. (Ballasts manufactured after January 1, 1979, have "No PCB" printed on the label.)

1965	Jan AA	Feb BA	Mar CA	Apr DA	May EA	Jun FA	Jul GA	Aug HA	Sep JA	Oct KA	Nov LA	Dec MA
1966	AB	BB	CB	DB	EB	FB	GB	HB	JB	KB	LB	MB
1967	AC	BC	CC	DC	EC	FC	GC	HC	JC	KC	LC	MC
1968	AD	BD	CD	DD	ED	FD	GD	HD	JD	KD	LD	MD
1969	AE	BE	CE	DE	EE	FE	GE	HE	JE	KE	LE	ME
1970	AF	BF	CF	DF	EF	FF	GF	HF	JF	KF	LF	MF
1971	AG	BG	CG	DG	EG	FG	GG	HG	JG	KG	LG	MG
1972	AH	BH	CH	DH	EH	FH	GH	HH	JH	KH	LH	MH
1973	AJ	BJ	CJ	DJ	EJ	FJ	GJ	HJ	JJ	KJ	LJ	MJ
1974	AK	BK	CK	DK	EK	FK	GK	HK	JK	KK	LK	MK
1975	AL	BL	CL	DL	EL	FL	GL	HL	JL	KL	LL	ML
1976	AM	BM	CM	DM	EM	FM	GM	HM	JM	KM	LM	MM
1977	AN	BN	CN	DN	EN	FN	GN	HN	JN	KN	LN	MN
1978	AP	BP	CP	DP	EP	FP	GP	HP	JP	KP	LP	MP
1979	AR	BR	CR	DR	ER	FR	GR	HR	JR	KR	LR	MR
1980	AS	BS	CS	DS	ES	FS	GS	HS	JS	KS	LS	MS
1981	AT	BT	CT	DT	ET	FT	GT	HT	JT	KT	LT	MT
1982	AU	BU	CU	DU	EU	FU	GU	HU	JU	KU	LU	MU
1983	AW	BW	CW	DW	EW	FW	GW	HW	JW	KW	LW	MW
1984	AX	BX	CX	DX	EX	FX	GX	HX	JX	KX	LX	MX
1985	AY	BY	CY	DY	EY	FY	GY	HY	JY	KY	LY	MY
1986	NA	OA	PA	RA	SA	TA	UA	VA	WA	XA	YA	ZA
1987	NB	OB	PB	RB	SB	TB	UB	VB	WB	XB	YB	ZB

6.0 DOCUMENTATION

6.1 Field Notes

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be completed and accurate enough to permit reconstruction of field activities. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual(s) making the entries. Language will be factual, objective, and free of personal opinions. At a minimum, the following information will be recorded, if applicable, during the collection of each sample.

- Inspector's name(s)
- Date and time of inspection
- Type of component
- Location of component
- Field observations and details related to condition and/ or status of component

In addition to inspection information, the following specifics may also be recorded in the field logbook for each day of inspection:

- Team members and their responsibilities
- Time of arrival on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with any potentially responsible parties, or
- Representatives of any federal, state, or other regulatory agency
- Deviations from inspection plans or site safety plan procedures
- Changes in personnel and responsibilities, as well as reasons for the change
- Levels of safety protection
- Record of photographs

6.2 Photographs

Photographs will be taken at representative inspection locations. They will verify information entered in the field logbook. When a photograph is taken, the following information will be written on the logbook or will be recorded in the field photography log:

- Date, location
- Description of the subject photographed
- Name of person taking the photograph

6.3 Figures

If present, PCB-containing components will be identified on field drawings completed at the time of inspection. Following the conclusion of inspection services, field drawings will be utilized to derive Computer Aided Design (CAD) figures that depict the location of identified components.

6.4 Final Report

A final report will be provided documenting the findings of the inspection services. The report will be utilized to generate abatement designs/ specifications on an as needed basis.

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APPENDIX A
STEP-BY-STEP APPROACH
FOR PCB IDENTIFICATION

STEP-BY-STEP APPROACH FOR PCB IDENTIFICATION

This Appendix provides a step-by-step approach to PCB identification using several specified guidance tables. This Appendix is intended to be used in conjunction with the main document. It is highly advised to carefully read the main document first, and then use this Appendix as a quick reference tool. The tables provided in this Appendix are as follows:

- Table 1 PCB Applications by Location
- Table 2 PCB-Containing Transformer Manufacturing Companies
- Table 3 PCB-Containing Capacitors
- Table 4 Trade Names and Synonyms for PCB Mixtures
- Table 5 PCB-Containing Wastes

Step-By-Step PCB Identification

Step 1. Determine possible target locations for PCB inspection. Consult:

- Table 1 PCB Applications by Location

Step 2. At the target location(s), determine potential PCB-containing applications. Consult:

- Table 1 PCB Applications by Location
- Section 3 Initial Identification of Potential PCB-Containing Materials

Step 3. For all transformers and capacitors, inspect equipment for initial indication of PCBs. Match equipment with manufacturing companies' information on PCB-containing products. Consult:

- Table 2 PCB-Containing Transformer Manufacturing Companies
- Table 3 PCB-Containing Capacitors
- Manufacturers' Literature, Maintenance Records, and Trade Associations

Step 4. For other closed and partially closed applications and unclassified transformers and capacitors, inspect for indications of PCB fluid trade names. Consult:

- Table 4 Trade Names and Synonyms for PCB Mixtures
- Manufacturers' Literature, Maintenance Records, and Trade Associations

Step 5. For potential PCB-containing open applications, consult:

- Table 3 Open Applications of PCBs

Table 1 PCB Applications by Location

Possible Target Locations ^a	Common PCB-Containing Applications	Reference Tables	Additional Explanation
Electric Utilities (including distribution networks)	Transformers Large Capacitors Small Capacitors Switches Voltage Regulators Liquid Filled Electrical Cables Circuit Breakers Lighting Ballasts	Table 2 Table 3 Table 4	Section 3.1.1 Section 3.1.2 Section 3.3
Industrial Facilities (including aluminum, copper, Iron and steel, cement, chemicals, plastics, synthetics, and petroleum refining industries)	Transformers Large Capacitors Small Capacitors Heat Transfer Fluids Hydraulic Fluids (equipment) Voltage Regulators Circuit Breakers Lighting Ballasts	Table 2 Table 3 Table 4 Table 5	Section 3.1.1 Section 3.1.2 Section 3.3
Railroad Systems	Transformers Large Capacitors Voltage Regulators Circuit Breakers	Table 2 Table 3 Table 4	Section 3.1.1 Section 3.1.2 Section 3.3
Underground Mining Operations	Hydraulic Fluids (equipment) Earthing Coils	Table 4	Section 3.1.2

Table 1 PCB Applications by Location (Continued)

Possible Target Locations ^a	Common PCB-Containing Applications	Reference Tables	Additional Explanation
Military Installations	Transformers Large Capacitors Small Capacitors Circuit Breakers Voltage Regulators Hydraulic Fluids (equipment)	Table 2 Table 3	Section 3.1.1 Section 3.1.2 Section 3.3
Residential/Commercial Buildings (including hospitals, schools, households, offices, and stores)	Small Capacitors (in washing machines, hair dryers, neon tubes, dishwashers, power supply units, etc.) Circuit Breakers Lighting Ballasts	Table 3 Table 4	Section 3.1.1 Section 3.1.2 Section 3.3
Research Laboratories	Vacuum Pumps Fluorescent Light Ballasts Small Capacitors Circuit Breakers	Table 3 Table 4	Section 3.1.1 Section 3.1.2 Section 3.3

Electronics Manufacturing Plants	Vacuum Pumps Lighting Ballasts Small Capacitors Circuit Breakers	Table 3 Table 4 Table 5	Section 3.1.1 Section 3.1.2 Section 3.3
Waste Water Discharge Facilities	Vacuum Pumps Well Motors	Table 4 Table 5	Section 3.1.2 Section 3.2
Automobile Service Stations	Re-Used Oil	Table 5	Section 3.2
Landfills (including industrial and municipal waste sites)	Decommissioned Equipment Building Demolition Fluff Spills	Table 5	Section 3.2

^a PCB testing of open applications should be conducted at all locations (see Sections 3.1.3 and 4).

Notes for Tables 2 and 3

PCB Equipment Type Designations: Historically, many large companies designed their own method for PCB identification with assigned number codes on equipment labels. In Tables 2 and 3, some company names are followed by information on how to identify specific transformer and capacitor models containing PCBs. This is denoted in the tables as type designation.

Items that may have PCB classification and concentration labels include: transformers, capacitors, electric motors, hydraulic systems, heat-transfer systems, PCB-containers, and storage areas. When inspecting equipment, look for the type designations on name plates, product labels, and in manufacturers' literature.

Production Dates: The dates provided show only the production period of the product. It is important to consider that products may have been sold well after the production time frame provided. Furthermore, the re-use (recycling) of oils and other PCB-containing substances can lead to contamination of newer products. Additional production date data will be incorporated as it becomes available.

Table 2 PCB-Containing Transformer Manufacturing Companies

USA	R.E. Uptegraff Mfg. Co.
Westinghouse	H.K. Porter
General Electric Company	Van Tran Electric Co.
Research-Cottrell	Esco Manufacturing Co.
Niagara Transformer Corp.	GERMANY
Standard Transformer Co.	AEG (Divisions in Germany)
Helena Corp.	Type designation- The letter C followed by a 3 or 4 digit
Hevi-Duty Electric	number stating the power rating.
Kuhlman Electric Co.	Trafo Union (TU)
Electro Engineering Works	Type designation – The letters TC followed by 4 digits.

Sources: Dobson and van Esch 1993; Swedish Occupational Health and Safety Board 1985; Durfee 1976.

Table 3 PCB-Containing Capacitors

Commercial Product Name or Company Name	Production Dates ^a
ASEA and SIEVERTS - Shunt series capacitors; furnace capacitors Type designations: CHA, CHF, CTDA, CKTA, CR, CRS, CPNI, CHX - High frequency capacitors Type designations: CHF-31, CVF-31, CVFA, CTVA, CVGA - Low voltage capacitors Type designations: CLD, CLFA, CRA, CRK, CRKS, CLEO1, CLDO1 - Special capacitors Type designations: CLFL, CRU, CUD, CVH, HMRV	
SIEMENS (Divisions in Germany) - All power capacitors for 50 Hz and rated over 1 kV (year given by first two digits following the letter D of manufacturing number) - Low voltage capacitors Type designations: CO, CD, 4RA, and 4RL	1950-1975
NOKIA - Low voltage capacitors (year given by first two digits in manufacturing number) and: Two letter type designation; or A, D, E, I, O, or U as a third letter in the type designation - High voltage: Two letter type designation; or I, K, O, P, S, U, or V as a third letter in the type designation	1960-1976 1960-1978

Table 3 PCB-Containing Capacitors (Continued)

Commercial Product Name or Company Name	Production Dates^a
SPRAGUE (USA) • Capacitors marked Chlorinol	
AEG or Hydrowerk (Divisions in Germany) • Units with impregnation fluid marked as: Clophen 5 CD, 4 CD, 3 CD	
ACEC • High voltage capacitors Type designation: CAN 50	
NATIONAL INDUSTRY • High voltage capacitors Type designation: FPF-U 2C-20100A03	
GENERAL ELECTRIC (USA) • High voltage capacitors Type designation: UNIFILM 100	
WESTINGHOUSE (USA) • High voltage capacitors Type designation: DV	
LILJEHOLMEN • Low voltage capacitors Type designation: DRA	
AEROVOX (USA)	
UNIVERSAL MANUFACTURING CORP. (USA)	
SPA "CONDENSATOR" (Russian Federation) • Capacitors Type designation: KSK	Through 1988
CORNELL DUBILIER (USA)	
P.R. MALLORY & CO., INC. (USA)	
SANGAMO ELECTRIC CO. (USA)	
ELECTRIC UTILITY CO. (USA)	
CAPACITOR SPECIALISTS (USA)	
JARD CORP. (USA)	
YORK ELECTRONICS (USA)	
MCGRAW-EDISON (USA)	
RF INTERONICS (USA)	
AXEL ELECTRONIC, INC. (USA)	
TOBE DEUTSCHMANN LABS (USA)	
CINE-CHROME LAB, INC. (USA)	

^a The dates provided only note the production period of the product. Products may have been sold after the time frame provided and re-use of oils and other PCB-containing substances could have contaminated newer products. Additional production dates will be incorporated as they become available.

Sources: Dobson and van Esch 1993; Swedish Occupational Health and Safety Board 1985; Durfee 1976.

Note for Table 4

Table 4 provides an alphabetical list of the many trade names and synonyms commonly given to PCB mixtures. Readers should note that translation or transliteration may account for some of the small variations in otherwise similar names shown in the table. Additionally, trade names for PCB mixtures are usually not specific to applications, but rather can be the name of the PCB mixture used in any application. PCB mixture trade names most likely will only be useful for identification purposes with closed and partially closed applications where equipment labels and manufacturer literature may provide information on the employment of PCB-containing mixtures. In the case of open applications, most often the containers that held the original materials have been discarded.

Aceclor (t)	Cloresil	Montar
Adkarel	Clorphen (t)	Nepolin
ALC	Delor (Czech Rep.)	Niren
Apirollo (t, c)	Diaclor (t, c)	No-Famol
Aroclor (t, c)	Dialor (c)	No-Flamol (t, c) (USA)
(USA) Aroclor 1016 (t, c)	Disconon (c)	NoFlamol
Aroclor 1221 (t, c)	Dk (t, c)	Nonflammable liquid
Aroclor 1232 (t, c)	Ducanol	Pheneclor
Aroclor 1242 (t, c)	Duconol (c)	Phenoclor (t, c) (France)
Aroclor 1254 (t, c)	Dykanol (t, c) (USA)	Phenochlor
Aroclor 1260 (t, c)	Dyknol	Phenochlor DP6
Aroclor 1262 (t, c)	EEC-18	Plastivar
Aroclor 1268 (t, c)	Electrophenyl T-60	Pydraul (USA)
Areclor (t)	Elemex (t, c)	Pyrallene (t, c) (France)
Abestol (t, c)	Eucarel	Pyranol (t, c) (USA)
Arubren	Fenchlor (t, c) (Italy)	Pyrochlor
Asbestol (t, c)	Hexol (Russian Federation)	Pyroclor (t) (USA)
ASK	Hivar (c)	Saf-T-Kuhl (t, c)
Askarel ^a (t, c) (USA)	Hydol (t, c)	Saft-Kuhl
Bakola	Hydrol	Santotherm (Japan)
Bakola 131 (t, c)	Hyvol	Santotherm FR
Biclor (c)	Inclor	Santoterm
Chlorextol (t)	Inerteen (t, c)	Santovac
Chlorinated Diphenyl	Kanechlor (KC) (t, c) (Japan)	Santovac 1
Chlorinol (USA)	Kaneclor	Santovac2
Chlorobiphenyl	Kaneclor 400	Siclonyl (c)
Clophen (t, c)	Kaneclor 500	Solvot (t, c) (Russian Federation)
(Germany) Clophen-A30	Keneclor	Sovol
Clophen-A50	Kennechlor	Sovtol (Russian Federation)
Clophen-A60	Leromoll	Therminol (USA)
Clophen Apirorlio	Magvar	Therminol FR
	MCS 1489	

Note for Table 5

PCB-containing wastes can be found in numerous locations and as a result of many different activities. Table 5 pairs activities and sources of PCB wastes with locations in which one would most likely find those wastes. One can use this table to trace the existence of PCB-waste back to its original source activity or to predict where PCB waste may be found as a result of a specific PCB-producing activity.

Table 5 PCB-Containing Wastes

Activity / Sources	Typical Locations
Fluff ^a	Landfills (Municipal and Industrial)
Inadvertent Production by Chemical Plants	Industrial Waste Disposal Sites Industrial Waste Water Streams
Navigational Dredging	Dredged Water Bodies and Their Sediments
Transfer Spillage ^b	Soil or Water near Landfills and Industrial Sites and along the Roads between Locations
Accidents/Fires	Power Distribution Networks (e.g., transformers) Industrial Sites Materials from Burnt Buildings
Vacuum Pump Cooling Water or Condensate	Water Discharge Sites and leakage
Floor and Equipment Clean-Up Wastes	Landfills Industrial Dump Sites
Building Demolition	Landfills Waste Disposal Sites
Various Recycling Operations Reused Oil Practices	Recycled Oil in Equipment Industrial Plants Pesticide Formulations Soft Soap Formulations Natural Gas Pipelines (from compressors) Automobile Service Stations

^a Waste (upholstery, padding, and insulation material) derived from the shredding of cars and appliances.

^b PCB leakage that may take place during the transfer of PCB-containing waste from one location to another.
Sources: Dobson and van Esch 1993; Durfee 1976; Franklin Associates 1984; ICF 1989a.

APPENDIX E – LABORATORY CHAIN OF CUSTODY FORMS



CA Labs
1929 Old Denton Rd.
Carrollton, TX 75006

Phone: 972-242-2754
Fax: 972-242-2798
Mobile: 469-222-6967

Chain of Custody

Client Name:	_____	CA Labs Job #	CAL
Client Address:	_____	Billing Address:	_____
	_____	(if different)	_____
Phone Number:	_____	P.O. #:	_____
Fax Number:	_____	Project Name:	_____
Send Reports to:	_____	Project Number:	_____
		Report Results:	_____
Contact:	_____	Via: Email	FAX _____ Verbal _____
Total # Samples Submitted:	Total # Samples to be Analyzed:	Material Matrix: Air / Bulk / Water	

Please indicate appropriate turn around time.

Asbestos: *please call ahead for availability of all rush and/or after hours samples*

TEM	TA Time	PLM	TA Time	Optical / IAQ	TA Time
<i>Circle analysis and select TA time</i>		<i>Circle analysis and select TA time</i>	2 hour	PCM: NIOSH 7400	Note TAT
AHERA	4 hour	EPA 600	4 hour	Allergen Particle:	24 hour
EPA Level II	8 hour		8 hour	tape/bulk/swab	2 days
Drinking Water	16 hour		16 hour	Cyclex-d cassettes	3 days
Wipe	24 hour	AHERA	24 hour	Air-o-cell cassettes	5 days
Micro-vac	2 days		2 days	Anderson cultures	Specify
NIOSH 7402	3 days	Point Count -	3 days	Bulk/swab cultures	Mold or
Chatfield Bulk	5 days	(NESHAPS)	5 days	Bacteria cultures	bacteria

Lead: *Circle analysis and select TA time*

Matrix:	Paint Chips	Soil	Air	Wipes	Wastewater
TA Time:	8 hour	1 day	2 days	3 days	5 days

Sample Information:

Sample Number:	Sample Location:	Sample Date/Time:	Sample Volume (L):

Custody Information:

Samples relinquished: _____
Signature / Date / Time

Samples relinquished: _____
Signature / Date / Time

Samples received: _____
Signature / Date / Time

Samples received: _____
Signature / Date / Time



www.energylab.com

Page of

Report Information *(if different than Account Information)*

Comments

Company/Name		
Contact		
Phone		
Mailing Address		
City, State, Zip		
Email		
Receive Invoice	☐ Hard Copy	☐ Email
Receive Report	☐ Hard Copy	☐ Email
Purchase Order	Quote	Bottle Order

Company/Name
Contact
Phone
Mailing Address
City, State, Zip
Email
Receive Report ☐ Hard Copy ☐ Email
Special Report/Formats:
☐ LEVEL IV ☐ NELAC ☐ EDD/EDT (<i>contact laboratory</i>) ☐ Other _____

Matrix Codes

Project Name, PWSID, Permit, etc.	
Sampler Name	Sampler Phone
Sample Origin State	EPA/State Compliance ☐ Yes ☐ No
URANIUM MINING CLIENTS MUST indicate sample type. ☐ NOT Source or Byproduct Material ☐ Source/Processed Ore (Ground or Refined) **CALL BEFORE SENDING ☐ 11e.(2) Byproduct Material (Can ONLY be Submitted to ELI Casper Location)	

Matrix Codes

A - Air
W- Water
S - Soils/
Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking
Water

Analysis Requested[illegible]

See Attached

All turnaround times are standard unless marked as RUSH.

Energy Laboratories
MUST be contacted prior to
RUSH sample submittal for
charges and scheduling –
See Instructions Page

[illegible]

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	Signature

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check_____	Amount \$	Receipt Number (cash/check only)

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

Chain of Custody

– Environmental Lead –

Contact Information

Client Company: _____
Office Address: _____
City, State, Zip: _____
Fax Number: _____
Email Address: _____

Project Number: _____
Project Name: _____
Primary Contact: _____
Office Phone: _____
Cell Phone: _____

iATL is accredited by the National Lead Laboratory Accreditation Program (NLLAP) to perform analytical testing of environmental samples for lead (Pb). The accreditation is through AIHA-LAP, LLC and several other nationally recognized state programs.

Matrix/Method:

- ☐ Paint by AAS: ASTM D3335-85a, 2009
☐ Wipe/Dust by AAS: SW 846: 3050B: 700B, 2010
☐ Air by AAS: NIOSH 7082, 1994
☐ Soil by AAS: EPA SW 846 (Soil)
☐ Water by AAS-GF: ASTM D3559-03D, US EPA 200.9
☐ Other Metals (Cd, Zn, Cr) by AAS
☐ Toxicity Characteristic Leaching Procedure (TCLP) by AAS: US EPA 1311
☐ Other _____

Special Instructions:

Turnaround Time

Preliminary Results Requested Date: _____

☐ Verbal ☐ Email ☐ Fax

Specific date / time

☐ 10 Day ☐ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization): _____	Date: _____	Time: _____
Received (Name / iATL): _____	Date: _____	Time: _____
Sample Login (Name / iATL): _____	Date: _____	Time: _____
Analysis(Name(s) / iATL): _____	Date: _____	Time: _____
QA/QC Review (Name / iATL): _____	Date: _____	Time: _____
Archived / Released: _____ QA/QC InterLAB Use: _____	Date: _____	Time: _____

APPENDIX B: Glossary

GLOSSARY TERMS AND DEFINITIONS

Accuracy: a measure of the overall agreement of a measurement to a known value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; EPA recommends using the terms “*precision*” and “*bias*,” rather than “accuracy,” to convey the information usually associated with accuracy.

Assessment: the evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer-review, inspection, or surveillance.

Audit: a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

Bias: systematic or persistent distortion of a measurement process that causes errors in one direction. The extent of bias will be determined by an evaluation of the following laboratory parameters: initial calibration/continuing calibration verifications, laboratory control spikes/laboratory control spike duplicates, blank spikes, MS/MSDs, and Method Blanks.

Blind sample: a blind sample is a sample submitted to an analyst without their knowledge of its identity or composition. Blind samples are used to test the laboratory’s expertise in performing the sample analysis.

Calibration: comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Chain-of-custody: an unbroken trail of accountability that ensures the physical security of samples, data, and records.

Contract Laboratory Program (CLP): the EPA’s Contract Laboratory Program. The CLP provides analytical services to the 10 EPA Regions through contracted commercial laboratories.

Comparability: a measure of the confidence with which one data set or method can be compared to another.

Completeness: a measure of the amount of valid data obtained from a measurement system.

Contractor: any organization or individual that contracts to furnish services or items or perform work; a supplier in a contractual situation.

Data quality assessment: a scientific and statistical evaluation of the data to determine if data obtained from environmental operations are of the right type, quality, and quantity to support their intended use.

Data quality indicators: the quantitative statistics and qualitative descriptors used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, comparability, completeness, representativeness, and sensitivity.

Data quality objectives (DQOs): the qualitative and quantitative statements derived from the DQO Process that clarifies study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Data turnaround time: The maximum length of time allowed for laboratories to submit analytical data to EPA in order to avoid liquidated damages. Data turnaround time begins at the validated time of sample receipt (VTSR) at the laboratory.

Data usability: the process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

Detection limit (DL): applied to both methods and equipment, the lowest concentration or amount of the target analyte that can be determined to be greater than zero by a single measurement at a stated level of probability. DLs are analyte and matrix-specific and may be laboratory-dependent. (See *method detection limit*).

Duplicate sample: used for quality control, two samples taken at the same time from, and representative of, the same site that are carried through all assessment and analytical procedures in an identical manner. Duplicate samples are used to measure natural variability as well as the precision of a method, monitor, and/or analyst. More than two duplicate samples are referred to as *replicate samples*.

Environmental conditions: the description of a physical medium (e.g., air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

Equipment or rinsate blank: used for quality control, types of field blanks used to check specifically for carryover contamination from reuse of the same sampling equipment (see *field blank*).

Field blank: a clean analyte-free sample which is carried to the sampling site and then exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample. This blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport.

Fraction: a specific subunit of an analytical protocol. For example, for low/medium organics, the fractions are volatiles, semi-volatiles, and pesticides/Aroclors.

Guidance: a suggested practice that is not mandatory, intended as an aid or example in complying with a standard or specification.

Holding time: the period of time a sample may be stored before analysis. While exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualifying or “flagging” of any data not meeting all of the specified acceptance criteria.

Instrument detection limit: the lowest concentration of a given substance or analyte that can be reliably detected by analytical equipment or instruments (see also *detection limit*).

Matrix: a matrix is a specific type of medium, such as water, soil, or sediment, in which the analyte of interest may be contained.

Matrix spike sample: a sample prepared by adding a known amount of the target analyte to a specified amount of a matrix. Spiked samples are used, for example, to determine the effect of the matrix on a method’s recovery efficiency.

Method detection limit (MDL): the MDL is the lowest concentration of a given substance or analyte that can be reliably detected by an analytical procedure (see *detection limit*).

PARCCS: “PARCCS parameters” consist of 6 primary DQIs that include measures of precision, accuracy (used in this context to denote bias), representativeness, comparability, completeness, and sensitivity. Precision, bias, and sensitivity describe properties that are readily measured quantitatively, so they are considered to be quantitative DQIs and they are controlled through the use of acceptance criteria within an analytical quality control (QC) program. Representativeness, comparability, and completeness are considered to be qualitative DQIs. Representativeness and comparability are critically important to the scientifically valid interpretation of analytical data, but estimating the degree of representativeness or comparability often requires the exercise of professional judgment in BOTH the science generating the data (e.g., analytical chemistry) and in the science involved in interpreting and using the data (e.g., designing a treatment system or modeling contaminant extent or migration).

Precision: the degree of agreement among repeated measurements of the same property under identical, or substantially similar, conditions and is expressed as the relative percent difference (RPD) between the sample pairs. Overall sample precision will be monitored using a duplicate or replicate sample for each matrix. Acceptance criteria in RPD are: water $\pm 20\%$, soil $\pm 35\%$, and sediment $\pm 35\%$.

Preservative: a chemical added to inorganic and volatile water samples to maintain the integrity of the sample. Some common preservatives include nitric acid, hydrochloric acid, and sodium hydroxide.

Quality Assurance (QA): an integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Assurance Program Plan (QAPP): a formal written document describing in comprehensive detail the necessary quality assurance procedures and quality control activities that need to be implemented to ensure that the results of the work performed will satisfy the stated performance or acceptance criteria.

Quality Control (QC): the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the specifications established by the customer; operational techniques and activities that are used to fulfill the need for quality.

Quality control sample: an uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Quality Management Plan (QMP): a document that describes the quality system in terms of the organization's structure, the functional responsibilities of management and staff, the lines of authority, and the interfaces for those planning, implementing, and assessing all activities conducted.

Record: a completed document that provides objective evidence of an item or process. Records may include photographs, drawings, magnetic tape, and other data recording media.

Recovery: the act of determining whether or not the methodology measures all of the analyte contained in a sample.

Representativeness: the measure of the degree to which data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, a process condition, or an environmental condition at the time a sample was collected.

Sample: a single, discrete portion of the environment collected from a specified physical location at a specific time. The single sample may be placed in multiple vessels.

Sample container: the individual bottle that contains the sample or an aliquot of the sample. The type of sample container varies for different sample fractions and concentrations.

Sample custody: legal possession of and responsibility for a sample. Documentation of sample custody is maintained on the chain-of-custody part of the traffic report or packing list. The sample is in your custody if any of the following criteria are met: 1) the sample is in your possession or is in your view after being in your possession, 2) the sample was in your possession and then locked up or sealed to prevent tampering, or 3) you have placed the sample in a secured area.

Sample label: taped or adhesive labels that provide the sample numbers to be assigned to the samples.

Sample number: the sample number from the sample label that identifies the sample or an aliquot of the sample.

Sensitivity: the capability of a method or instrument to discriminate between small differences in analyte concentration. Detection limits and project requirements will be compared in order to select a method with the necessary detection limits to meet the project goals.

Spike samples: used for quality control, a sample to which a known concentration of the target analyte has been added. When analyzed, the difference between an environmental sample and the analytes concentration in a spiked sample should be equivalent to the amount added to the spiked sample. Spike duplicates are used to assess measurement precision.

Split samples: two or more representative portions taken from one sample in the field or in the laboratory and analyzed by different analysts or laboratories. Split samples are quality control samples that are used to assess analytical variability and comparability.

Standard deviation(s): used in the determination of *precision*, the most common calculation used to measure the range of variation among repeated measurements. The standard deviation of a set of measurements is expressed by the positive square root of the variance of the measurements.

Standard operating procedure (SOP): a document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps to be followed. It is officially approved as the method for performing certain routine or repetitive tasks.

Station location: the specific location where samples are collected on a site.

TAL: Target Analyte List. TALs list the target analytes to test for in inorganic analyses.

TCL: Target Compound List. TCLs list the target compounds to test for in organic analyses.

Validation: an analyte and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set.

Variance: a statistical term used in the calculation of *standard deviation*, variance is the sum of the squares of the difference between the individual values of a set and the arithmetic mean of the set, divided by one less than the numbers in the set.

Verification: the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications.

Volume: the amount of sample collected. Volume requirements differ between some laboratories, matrices, fractions, and concentrations.

VOA: Volatile Organic Analysis. Used synonymously with VOC.

VOC: Volatile Organic Compound.

APPENDIX C: Performance Criteria Summary and Data Validation

Table 1: Performance Criteria Summary			
Parameter/Types of Error	QC Program	Evaluation Criteria	Summary of QA/QC Goals
Precision			
The measurement of agreement among replicate measurements of the same property under identical or substantially similar conditions	Field Duplicate Pairs	Relative Percent Difference (RPD)	RPDs will be established site-specifically, but will generally be consistent with EPA guidance. As an example, water samples will be +/- 20% when detected concentrations is $\geq$ 10x the practical Quantification Limit (i.e., Detection Limit (DL)); when the detected concentration is $<10x$ the DL, the RPD limit will be +/- the DL; soil and sediments RPDs will be +/- 35%
Systematic Errors Bias			
Systematic or persistent distortion in the measurement process. Measurement of the closeness of an individual measurement to the true value (low bias + high precision)	LCS	LCS Percent Recovery	Adopt Percent Recovery limit for LCS established by the laboratory
	MS/MSD	Percent Recovery and RPD	Adopt Percent Recovery limit and RPD limit for MS/MSD established by the laboratory
	Method Blanks	Detection Limit	Less than DL
	Equipment Blanks	Detection Limit	Less than DL
	Initial Calibration and Calibration Verification Blanks (ICB/CVB)	Detection Limit	Less than DL (Verified in Case Narrative)
	Initial Calibration and Continuing Calibration Verification (ICV/CCV)	Percent Recovery	(Verified in Case Narrative)

Parameter/Types of Error	QC Program	Evaluation Criteria	Summary of QA/QC Goals
Representativeness			
Measure the degree to which the sample data accurately and precisely represent the environmental condition	SOPs	Qualitative determination of SOP adherence	All Samples collected following SOPs
	Hold Times	Holding Times	Evaluate compliance with holding times
	Field/Equipment Blanks	Detection Limit Qualitative Evaluations Metric units	Results below DL
Comparability			
The confidence that two data sets can be directly compared	Units of Measure	Metric units	
	Analytical Methods	Approved methods	
	Standardized Sampling	Quality determination of SOP adherence	All samples collected following SOPs
	QC Samples • 10% Field Duplicates • 10% Field Blanks • Lab QA	• Verify • Verify • Verify	• 100% compliance • 100% compliance • 100% compliance
Completeness			
The amount of valid data	Complete Sampling	Percent Valid Data	Evaluate completeness with respect to the data set

Insert Data Validation Guidance from Webpage

Figure 1: Brownfields Program Organizational Chart

