Quality Assurance Project Plan

Brownfield Hazardous Substance Cleanup
EPA Cooperative Agreement #00D47716-0

Former Rail Depot
124 Railroad Street
Pickens, Pickens County, SC

August 2, 2017
Terracon Project No.: 86167240

Prepared for:
City of Pickens
Pickens, South Carolina

Prepared by:
Terracon Consultants, Inc.
Greenville, South Carolina

terracon.com

Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

A1: TITLE AND APPROVAL SHEET

Quality Assurance Project Plan for City of Pickens Brownfield Cleanup Project

Revision 0

Conducted Under USEPA Cooperative Agreement No. 00D47716-0
Brownfield Hazardous Substance Cleanup: Former Rail Depot

Prepared for:
City of Pickens
219 Pendleton Street
Pickens, SC 29671

Prepared by:
Terracon Consultants, Inc.

Approval:

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(Signature) (Date)

TERRACON REMEDIATION PLAN COORDINATOR/PROJECT REVIEWER:

George Flores, P.E.
(Signature) (Date)

TERRACON QA/QC REVIEWER:

8/3/17 Michael Schrum, P.E.
(Signature) (Date)

CITY OF PICKENS BROWNFIELDS PROGRAM DIRECTOR:

8-7-17 Bruce Evilsizor
(Signature) (Date)

USEPA REGION 4 BROWNFIELDS PROJECT OFFICER / DESIGNATED APPROVING OFFICIAL (DAO):

Bushra Jawaid 8/3/17 Barbara Alfano
(Signature) (Date)

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APPENDICES

Appendix A Region 4 QAPP Checklist

Appendix B Terracon Corporate Quality Program Manual
Terracon Standard Operating Procedures
Terracon Asbestos Phase Contrast Microscopy Quality Assurance Program Manual
Terracon IHPAT Results
SC DHEC R. 61-86.1 - Standards of Performance for Asbestos Projects

Appendix C EMSL QMS Manual – Module A – Asbestos

Appendix D Typical Field Forms

A-3: DISTRIBUTION LIST

The personnel listed below will receive hard copies of the QAPP:

EPA Region 4 Brownfields Program

- Barbara Alfano, Brownfields Project Officer/DAO, US Environmental Protection Agency (USEPA) Region 4, Atlanta Federal Building, 61 Forsyth Street SW, Atlanta, GA 30303, Phone: (404) 562-8923, Email: alfano.barbara@epa.gov.

SCDHEC Brownfields Program

- Alex Fulmer, Brownfields Project Manager, South Carolina Department of Health and Environmental Control, Bureau of Land & Waste Management, 2600 Bull Street, Columbia, SC 29201, (803) 898-0932, Email: fulmerwa@dhec.sc.gov.

City of Pickens

- Bruce Evilsizor, Brownfields Project Director, City of Pickens, 219 Pendleton Street, P.O. Box 217, Pickens, SC 29671, Phone (864) 898-8160, Email: bevilsizor@pickenscity.com.

- Becky Horace, Brownfields Project Manager, City of Pickens, 219 Pendleton Street, P.O. Box 217, Pickens, SC 29671, Phone (864) 952-9660, Email: bhorace@pickenscity.com.

Environmental Consultant, Terracon

- Tice Welborn, P.G., Project Manager, Terracon Consultants, Inc., 72 Pointe Circle, Greenville, SC 29615, Phone (864) 293-7365, Email: tice.welborn@terracon.com.

- George Flores, Remediation Plan Coordinator/Authorized Project Reviewer, Terracon Consultants, Inc., 72 Pointe Circle, Greenville, SC 29615, Phone (864) 293-7342, Email: george.flores2@terracon.com.

- Michael Schrum, QA/QC Reviewer, Terracon Consultants, Inc., 2020 East Starita Road, Charlotte, NC 28206, Phone (704) 509-1777, Email: mike.schrum@terracon.com.

- Belinda Richard, National Brownfields Program Manager, Terracon Consultants, Inc., 5463 West Waters Avenue, Suite 830, Tampa, FL 33634, Phone (813) 321-0345, Email: belinda.richard@terracon.com.

- Jeffrey Gurrie, Field Team Leader, Terracon Consultants, Inc., 72 Pointe Circle, Greenville, SC 29615, Phone (864) 293-7344, Email: jeff.gurrie@terracon.com.

Analytical Laboratory

- Lee Plumley, Laboratory Manager, EMSL Analytical, Inc., 376 Crompton Street, Charlotte, NC 28273, Phone (704) 525-2205, Email: lplumley@EMSL.com.

Remediation Contractor

To Be Determined.

A-4: PROJECT/TASK ORGANIZATION

A-4.1 Introduction

The United States Environmental Protection Agency (EPA) awarded the City of Pickens, South Carolina, a Brownfields Hazardous Substances Cleanup Grant totaling $127,000 (Cooperative Agreement No. 00D47716-0). Grant funds will be used to conduct public outreach, create a cleanup design (cleanup plan) and conduct the oversight and removal of asbestos in building materials from the former railroad depot building prior to demolition of the building. The City of Pickens (City) must have an EPA approved Quality Assurance Project Plan (QAPP) in place before the collection and use of environmental data using the federal grant funds under its EPA Brownfield Assessment Grant. This QAPP describes in detail the quality assurance (QA), quality control (QC), and other technical activities that will be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. Project-specific data quality concerns will be fully developed in this QAPP and serve to fully develop EPA's quality process for the site.

Terracon Consultants, Inc. (Terracon) has developed this QAPP to address specific QA/QC requirements prescribed by the Cooperative Agreement and the specific EPA quality documents including "Guidance for Quality Assurance Project Plans, EPA QA/R-5" (EPA/240/B-01/003 Reissued May 2006). This QAPP will provide the basis of a quality process for conducting sample collection activities. This will produce ongoing data and decisions of similar quality within limits set for the Brownfields project. The process will include the preparation of a cleanup design (cleanup plan) that will detail specific objectives, methods of building material cleanup, investigation, sampling and analyses to be performed. A completed "Region 4 QAPP Review Checklist" is contained in Appendix A.

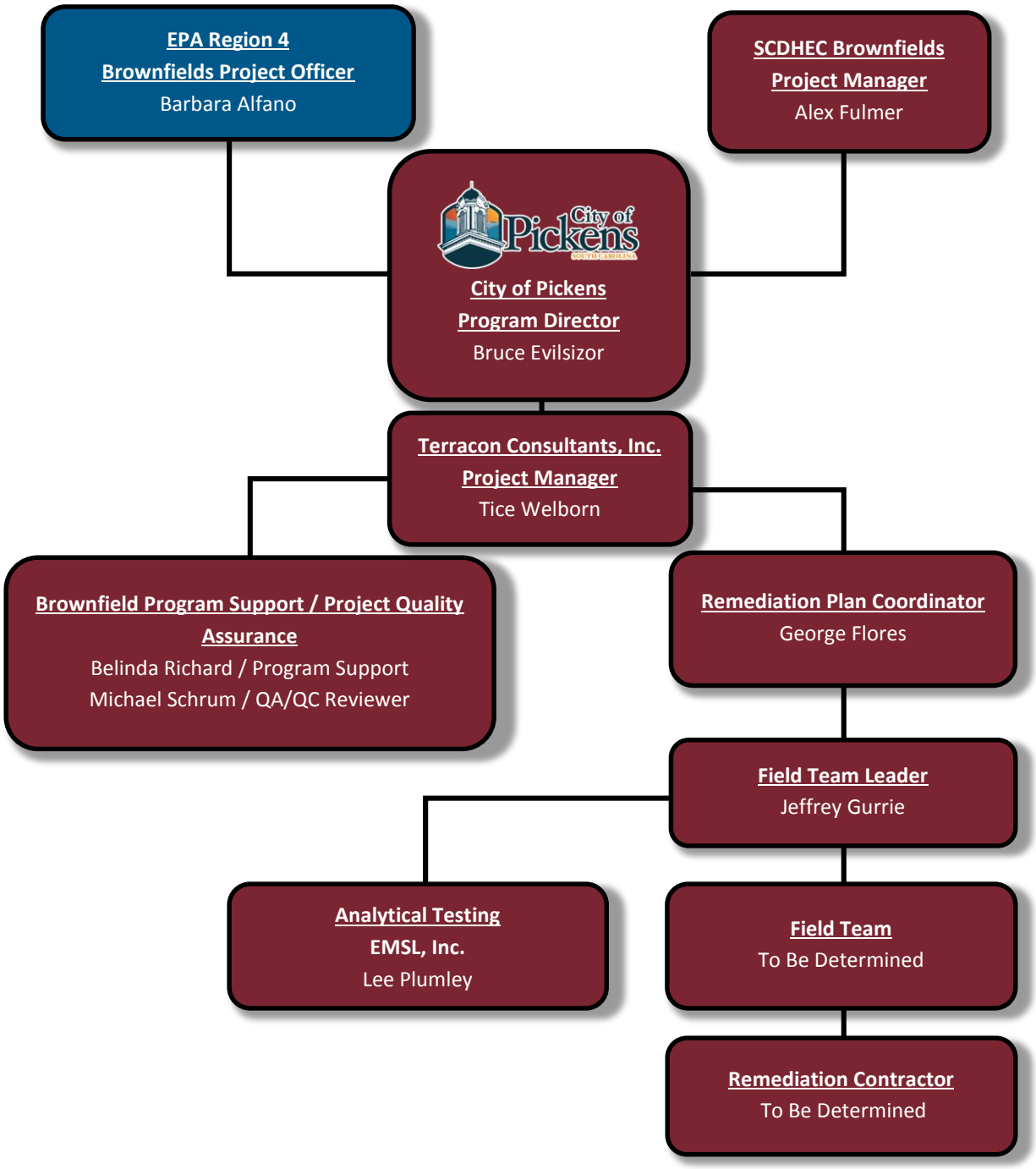
The work described will be performed in general accordance with this QAPP in conjunction with the following:

- Terracon Corporate Quality Program Manual provided as Appendix B. This manual outlines internal quality control procedures, formal review procedures, and standard company practice.
- Terracon Standard Operating Procedures (TSOPs) provided in Appendix B.
- Terracon Asbestos Phase Contrast Microscopy (PCM) Quality Assurance Program Manual provided in Appendix B.
- EMSL, Inc. (EMSL) QMS Manuals provided in Appendix C.

A-4.2 Project and Task Orientation

The *project organizational chart* below illustrates the projected project team for site specific cleanup activities. Subsequent sections provide key personnel roles associated with each project. Remediation subcontractors have not been selected at this time.

Figure 1: Project Organizational Chart



The QAPP provides a plan to provide a quality process in conducting the required cleanup and confirmation sampling activities. As stated previously, the Terracon Project Manager will distribute the approved QAPP, and subsequent revisions throughout the project to those identified in Section A.3. Project activities will be organized and conducted in accordance with the City of Pickens Brownfields Hazardous Substances Cleanup Cooperative Agreement and Work Plan (November 11, 2016), this QAPP, and the Professional Services Contract between the City of Pickens and Terracon. Grant activities will be performed using appropriate Terracon resources, relevant subcontractor resources, and management guidance and oversight from the EPA. The local Terracon office for this project is in Greenville, South Carolina.

A-4.2.1 USEPA Project Officer/Project Manager

The EPA Region 4 Project Officer, Barbara Alfano, has the responsibility to oversee and monitor the grant. As part of that responsibility, she will ensure the Tasks described in the work plan are followed.

A-4.2.2 SCDHEC Brownfields Project Manager

While asbestos abatement designs and reports are not subject to review by SCDHEC, the assigned SCDHEC Brownfields Project Manager, Alex Fulmer, will provide comments concerning the QAPP and clean-up plans and reports as needed. The SCDHEC Brownfields Project Manager will also ensure applicable reports and plans are in compliance with SCDHEC rules and regulations and approve as necessary.

A-4.2.3 USEPA Brownfields Region 4 QA Manager's Designated Approving Officer

When the EPA Project Officer is not the Designated Approving Official (DAO), the Brownfields Region 4 QA Manager's DAO provides a technical assistance role to Region 4 Project Officer/Manager working on Brownfields sites. The DAO's role is to provide technical reviews of the QAPPs and additional addenda that are generated. This includes the approval of the QAPP and any additional QAPP Addenda, respectively, and any revisions.

A-4.2.4 Grantee

The City, as the Grantee, is responsible to oversee the daily activities of the EPA Brownfields Grant Program and provide updates to EPA. The City will ensure that the terms and conditions of the grant are met. Bruce Evilsizor, the City's Brownfields Program Director, will perform this role.

A-4.2.6 Terracon Contract/Project Manager

The Terracon Project Manager, Tice Welborn, P.G., will provide technical guidance, administration, and resources to direct project QA on behalf of the Grantee. The Terracon Project Manager will be the primary decision maker for the project and will consult with the Grantee based on the data to determine whether or not further action is required at the site. This individual will also coordinate the project activities and is responsible for plan preparation, scheduling and the completion of field activities, conducting data evaluations, and reporting. The Terracon Project Manager will be responsible for the development of the Work Plans, HASPs, and cleanup plans and ensuring that field procedures are conducted in accordance with the QAPP, task order, and state and federal guidance. This individual will manage and oversee field procedures and will conduct technical QA/QC audits of field methods. It will be the responsibility of this individual to ensure implementation of field methods according to relevant QC documents, and to coordinate QA/QC efforts with other subcontractors. The Project Manager has the authority to make project decisions and to implement corrective actions for problems encountered during field activities. This individual is responsible for communication with the City's Brownfields Project Staff regarding project status and preparing reports for submittal to the City, SCDHEC, and/or EPA.

A-4.2.7 Terracon QA/QC Review

The QA/QC Reviewer will remain independent of the groups responsible for data generation and will provide QA/QC assistance to the Contract/Project Manager. The QA/QC Reviewer will also be responsible for final internal review and approval of the QAPP, internal QA audits, reporting audit results to the Project Manager, and review implemented corrective actions, when necessary. Michael Schrum will perform this role. The QA/QC Reviewer will also conduct and/or oversee data review processes and assist in usability determinations as described in Section D of this document.

A-4.2.7.1 Brownfield Program Support

Terracon's Brownfields Support Program provides a level of highly skilled senior practitioners. These individuals provide key advice and guidance on technical and programmatic issues that may require expertise beyond typical "project level'" concerns. These individuals also function as a regulatory liaison.

Belinda Richard from Terracon's Southeast Brownfields Program will fill this role. Mrs. Richard will support general QA/QC efforts and provide input on key technical issues, as well as provide project steering and evaluation of each assessment with respect to project-specific data quality objectives and overall Brownfields redevelopment goals.

A-4.2.8 Terracon Remediation Plan Coordinator

The Remediation Plan Coordinator, Mr. George Flores, P.E., develops and implements the technical cleanup work scope, including quality assurance and control, with the Terracon Project Manager. The Coordinator assists the Project Manager in maintaining programmatic reports on behalf of the City. The Coordinator is responsible for the implementation of the technical scope of work and ensuring that data quality is met in the field through the Field Team Leader. Coordinators are responsible for developing and implementing the QAPP and health and safety plans for site activities. The Coordinator is responsible for project QA/QC and the training of field staff through the Field Team Leader.

A-4.2.9 Terracon Field Team Leader

Terracon implements the QAPP in the field through the Field Team Leader. Mr. Jeffrey Gurrie will serve as Field Team Leader for this project. The Field Team Leader is to be skilled in their respective area of assessment and selected by the Project Manager. Field Team Leaders report to the Coordinator, but may also respond to direct requests by others for documents or observations relative to completing audits for the quality process.

The Field Team Leader is responsible for implementing the technical scope of work on the site, including quality assurance audits and inspections of the QAPP. They are also responsible for conveying the requirements of the QAPP and cleanup plans and requirements to the field team. The Field Team Leader retains the reference copy of the QAPP, applicable SOPs, and HASP in the field during completion of field activities. The Field Team Leader has the authority to stop field work if necessary and would contact the Project Manager immediately if this occurred. This individual is also responsible for Health and Safety implementation in accordance with the HASP.

A-4.2.10 Terracon Field Team Technicians

These individuals will perform the actual fieldwork per the QAPP and applicable cleanup planning and guidance documents at the direction of the Field Team Leader. The field team typically consists of one to two people and will be named at a later date by the Field Team Leader.

A-4.2.11 Contract Laboratory Quality Assurance Director

The contract laboratory QA Director (Lee Plumley) of EMSL, will be responsible for coordinating the analysis of the samples and laboratory validation of the data. This individual will coordinate the receipt of the samples at the laboratory, select the analytical team, ensure internal laboratory audits are conducted per the laboratory QMS Manual; and will distribute the applicable sections of the QAPP and subsequent revisions to members of the analytical team. The laboratory QA Director is responsible for instituting corrective actions for problems

encountered during laboratory analyses and will also report laboratory problems affecting the project data to the Terracon Project Manager and QA/QC Reviewer. Corrective actions for laboratory analyses will be detailed in a QA report that will be provided to the Terracon Project Manager via electronic mail.

A-4.2.12 Subcontractors

Terracon expects to communicate needs for QA/QC to respective participants through the respective contractor Quality Assurance Managers.

A-5: PROBLEM DEFINITION/BACKGROUND

The 1.86 acre site was developed as a passenger train depot with railway yard and shipping warehouses as early as 1889. The warehouse operation expanded in 1930. A majority of the warehouse buildings reportedly burned down in the 1950s. The existing building and open shed were built in the 1960s and operated as a box car assembly operation until approximately 1982 under various entities including Golden Tye, National Railway Utilization Corporation (NRUC) and Emergent Group. After 1982, the facility provided repair services for the box cars until 1995, at which point, the operations were changed to railroad locomotive repair and refurbishing (Pickens Railroad Company). The latest railroad operation involved locomotive dismantling and diesel engine removal, undercarriage renovation, new diesel engine installation and repainting.

The City of Pickens purchased the facility in 2013 along with the 7.5 mile rail line. In 2015, the Doodle Trail, a multi-use asphalt trail, was constructed on the 7.5 mile rail line between the Cities of Pickens and Easley. The 1.86 acre rail depot site currently sits idle waiting for cleanup and redevelopment into a trail head for the Doodle Trail. The site is situated along State Route 8, a main route into the City of Pickens, located at the southeast corner of the historic downtown. The site buildings, which are a considered a blight in the community, are contaminated with asbestos-containing materials (ACM) and is perceived as unsafe due to the appearance of the dilapidated buildings and the perceived environmental stigma associated with the site. The appearance and structural integrity of the building has only declined due to vacancy and will continue to decline if left in its current state. The roof and interior of the structure have declined to a point where they are becoming unstable and pose a safety and health risk to local residents and visitors to the Doodle Trail. While the City is taking precautions at the site to prevent asbestos exposure to the community, the declining structural integrity of the site building creates the potential for a release of asbestos into the nearby environment, therefore placing the targeted community at risk.

The principal end user of project information will be the City of Pickens as Grantee. The grantee will use the previously prepared asbestos and lead-containing paint survey report to develop a design plan for asbestos cleanup. The design plan will define specific cleanup work practices and procedures, including the clearance criteria for the identified asbestos to be

abated and properly disposed. The clearance criteria will be based on the South Carolina Department of Health and Environmental Control (SC DHEC) Regulation 61-86.1 – *Standards for Asbestos Projects*, and, where applicable, the South Carolina Environmental Solid Waste Policy and Management Act (SC R.44-96) and the South Carolina Hazardous Waste Management Act SC R.44-56).

The QAPP discusses the desired quality of the study results to meet Grantee goals. The objectives are a blend of qualitative and quantitative statements that:

- clarify the intended use of the data relative to the Grantee's Brownfields cleanup project,
- preemptively define the type of data that may be required to support the primary decision for evaluating whether cleanup is complete at the site within the grant,
- identify conditions under which specific types of data should be collected relative to goals of the grant and future redevelopment for community benefit; and,
- specify tolerable limits appropriate for the use of data for the project that address the probability and effect of making a decision error due to uncertainty in the data.

A-5.1 Brownfields Project Decision

The decision is to determine whether cleanup activities conducted on the site have met the project requirements for future use of the site. Remediation activities will be conducted on the site as described in the ABCA. Remediation clearance air sampling will be conducted in order to produce data of a quality useful to this project decision.

A-5.2 Historical Context

The EPA selected the City of Pickens for a Brownfields Cleanup Grant for asbestos abatement at the former Pickens Railway Depot building (site) located at 124 Railroad Street in Pickens, South Carolina. The site is a 20,000-square foot, vacant structure known as the former railroad depot. Previous assessment on the site identified the presence of asbestos-containing materials and lead-containing paint. Abatement of asbestos from site buildings will prepare the building for demolition (at which point lead-containing paint systems will be addressed) and the site for future development.

A-5.3 Regulatory Framework

The asbestos cleanup activities on the site will be subject to South Carolina Department of Health and Environmental Control (SC DHEC) R.61-86.1, SC R.44-96 and SC R.44-56, EPA 40 Code of Federal Regulations (CFR) Asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP), and Occupational Safety and Health Administration (OSHA) Asbestos Construction Standard 29 CFR 1926.1101.

A-6: PROJECT/TASK DESCRIPTION AND SCHEDULE

Currently, the site is a 20,000-square foot, vacant building known as the former railroad depot. Previous assessments conducted on the site identified various asbestos and lead-containing materials.

Asbestos (greater than 1%) was identified in various building components consisting of: silver paint and tar on metal roofing, base flashing, window/door caulking, window glazing compound, various flooring materials, joint compound, thermal system insulation debris, and sink undercoating. Additionally, various flooring mastics were found to contain less than 1% asbestos. These materials will also be removed as asbestos-containing.

Lead-containing paint was identified in various paints at the site. Concentrations of lead were not above the EPA definition of lead-containing paint (0.5% by weight or 1.0 mg/cm^2 by XRF); however, they were above the SCDHEC threshold of 0.06% for waste disposal. Deteriorated paints will be removed/stabilized during the demolition phase and will not be directly addressed by the City's Brownfields Program. Remaining paint containing lead will be disposed in accordance with SCDHEC solid waste regulations.

EPA brownfields cleanup funding will be used to abate ACM from the site structure prior to demolition using other funding sources. This allows immediate and definitive resolution of the public health issue, while final demolitions can then proceed on a schedule that time and resources allows without worry or expense of maintaining and isolating damaged materials from public exposure. Throughout demolition, all paint systems will be managed and disposed of as "lead-containing."

A-6.1 Purpose/Background

The purpose of this project is to document the proper removal and disposal of the identified asbestos-containing materials for the site building through visual inspections and supporting air monitoring.

A-6.2 Anticipated Measurements

Future use of this site involves razing the structure to accommodate for future development. Measurements collected as part of this Project must provide information indicating that the identified asbestos-containing materials have been removed. The post cleanup clearance testing will consist of a visual inspection of the abated asbestos, at locations and/or components conducted by appropriately state licensed personnel. Analytical testing will also be performed to document the efficacy of the cleanup activities. The analytical testing will consist of air samples in each applicable regulated cleanup area.

A-6.2.1 Physical Measurements (Visual Inspection)

Once the cleanup of the asbestos is completed in containment or a regulated area, a final visual inspection of the abated areas will be performed to verify the complete removal of the confirmed hazardous materials.

A-6.2.2 Analytical Testing

The analytical testing will consist of aggressive air sampling for the asbestos cleanup. The analytical testing for asbestos will be performed in accordance with established regulatory clearance criteria for asbestos cleanup.

Table 1: Analytical Testing

Material	Parameter	Method
Asbestos	Air Samples	NIOSH 7400
Asbestos	Air Samples	AHERA 40 CFR Part 763 Appx. A, Subpart E

During the asbestos cleanup, daily air samples will be collected, at a minimum in the following locations: inside containment, outside containment, negative air exhaust, and clean room of the decontamination system. Sample locations will vary daily based on contractor containment setup and daily work areas. At the conclusion of the cleanup, after the asbestos removal has been visually verified, aggressive air clearance sampling will be conducted inside the containment area. The air samples will be collected and analyzed by Phase Contrast Microscopy (PCM) in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 7400 as defined in the South Carolina Department of Health and Environmental Control (SC DHEC) R. 61-86.1. Final clearance sampling after the removal of regulated asbestos-containing materials will be analyzed by Transmission Electron Microscopy (TEM) in accordance with AHERA (40 CFR Part 763 Appendix A, Subpart E).

In addition, throughout the cleanup of the asbestos, the contractor will be required to comply with the following applicable Occupational Safety and Health Administration (OSHA) regulation: Asbestos Standard 29 CFR 1926.1101.

A-6.2.3 Applicable Technical Standards and Criteria

The site will be subject to SC DHEC, EPA 40 Code of Federal Regulations (CFR) Asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP) Occupation Safety and Health Administration (OSHA) Asbestos Construction Standard 29 CFR 1926.1101.

A-6.3 Special Personnel and Equipment

Implementation of the response action activities in conjunction with the Grant Project requires field personnel experienced in the design of asbestos, oversight of contractors conducting cleanup activities, and the collection of daily air samples and final clearance air samples during asbestos cleanup. These personnel must be appropriately licensed in accordance with SC DHEC regulations. The personnel also must have an understanding and practical experience in the performance of inspection and monitoring activities associated with hazardous materials cleanup. The trained staff will also be able to recognize site safety and field hazards associated with projects of this nature.

A-6.4 Work Schedule

Terracon will develop an asbestos abatement design for the project in accordance with applicable asbestos regulations. As part of the design a project schedule will be developed, which will establish milestones for project completion.

A-6.5 Critical Documentation

The following documentation must be maintained as essential to tracking and controlling the quality of project work. The documents will be essential in documenting corrections and identifying compliance with the QAPP. Selected documents are shown hereafter with the assigned responsibility.

A-6.5.1 Daily Field Reports

During field activities, Terracon professionals will coordinate, oversee and provide documentation of the cleanup activities. This documentation will include daily air monitoring, visual inspections for regulatory compliance and preparation of daily logs. The information will be documented on the appropriate Field Forms, as attached in Appendix D. The field forms will be maintained on-site during cleanup, and at Terracon, and will be available for review upon request of the EPA Brownfields Grant Manager.

A-6.5.2 Field Logbook

During field activities, Terracon professionals performing the response action activities will compile and complete a daily logbook. The Field Team Leader will maintain the logbook on-site during cleanup and stored at Terracon upon completion of cleanup. The logbook will be available for review upon request of the EPA Brownfields Grant Manager. The Field Logbook will include the following:

- Copy of the Asbestos Abatement Design, which will include a drawing of the cleanup area identifying the location and extent of the asbestos containing materials to be abated.
- Daily sample results for asbestos cleanup, and final asbestos clearance results.
- Drawings depicting the location of clearance samples collected in the facility.
- Full descriptions of deviation from standard operating procedures, the Proposed Project Plan and/or the QAPP.
- A daily log which will describe the daily cleanup activities, any deviations from the scope of cleanup, description of daily field sampling conditions and physical parameters as appropriate to the methods and media involved.

A-6.5.3 Quality Assurance Project Plan

The QAPP will be maintained and distributed as indicated in Section A3. The QAPP shall contain the elements set forth herein and have been approved by the EPA prior to implementation.

A-6.5.4 Field Standard Operating Procedures

Standard procedures for sampling, physical measurements, decontamination and calibration procedures for field equipment will be used. These will accompany the Field Teams. The TSOPs are included in Appendix B. Discrepancies and corrections in the field will be recorded in the Field Logbook.

A-6.5.5 Analytical Standard Operating Procedures

The Laboratory Quality Assurance Manager of the respective analytical laboratories shown in Section A4 will maintain standard procedures on file that include, but are not limited to, procedures used, sample tracking and log-in procedures pertinent to activities under the QAPP. Details are provided in Appendix C.

The daily and final air clearance samples for asbestos cleanup will be analyzed at Terracon's local laboratory or by EMSL. Terracon and EMSL are AIHA accredited laboratories; copies of the appropriate licenses are provided in Appendix B (Terracon) and Appendix C (EMSL). The

air samples will be analyzed with appropriate QA/QC procedures employed as defined in the analytical procedures.

A-6.5.6 Laboratory Deliverables

The Laboratory Quality Assurance Manager of the analytical laboratories shown in Section A4 will maintain the narrative descriptions and explanation deliverables. These will contain the following:

- The level of analytical data review and the resulting data qualifiers indicating the direction of bias, based on the assessment of Quality Control samples (e.g., blanks, duplicates, reference sample analysis, microscope calibration).
- The results of each analyte and sample quantified for analytical limitations.
- Sample quantitation limits and detection limits reported, with any qualifications.

The on-site project manager will maintain the narrative descriptions and explanation deliverables for the air samples collected and analyzed for asbestos and fungal contamination cleanup. These will contain the following:

- The level of analytical data review and the resulting data qualifiers indicating the direction of bias, based on the assessment of Quality Control samples (e.g., blanks, duplicates, reference sample analysis, microscope calibration, etc.).
- The results of each air sample collected and quantified for analytical limitations.
- Sample location, quantitation limits and detection limits reported, with any qualifications.
- Irregularities or anomalies identified in the samples collected in comparison to established regulatory guidelines.

A-6.5.7 Custody Records

The Field Team Leader will maintain a copy of completed chain-of-custody (COC) records for samples during field activity for samples shipped to EMSL. Field analysis by NIOSH 7400 will utilize Terracon's fiber count worksheet to document sample custody. COC records will be maintained with the Field Logbook. After field activities, COC records will be maintained by the Project Manager.

The Laboratory Quality Assurance Manager of the analytical laboratory will maintain the original COC records with the sampling data and will annotate the data with laboratory custody information. The original COC records will be provided to the Project Manager with the written laboratory reports.

A-7: QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the purpose, quality, and/or quantity of the environmental data required to support management and remedial decisions at each site. DQOs are predicated in accordance with the anticipated end uses of the data that are to be collected. This DQO process was developed within the framework of the *Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4*, and *Section 3 of Quality Assurance Guidance for Conducting Brownfields Site Assessment,* which is outlined in the following seven steps:

Step 1 – State the Problem

In November 2015, Terracon completed an asbestos survey of the site structure which identified regulated quantities of asbestos in building materials. Abatement of ACM is needed in order to proceed with proposed development activities.

During abatement activities asbestos is disturbed and requires ambient air monitoring. The most important objective of air monitoring is to provide reliable sampling data to confirm the controls used during abatement activities do not impact the site or general public, and more importantly, to test the air following asbestos abatement prior to removing site engineering controls to ensure the safety of the general public.

Step 2 – Identify the Decision

The objective is to determine, to the extent feasible, that site engineering controls are checked by reliable air monitoring data. The results of the final visual inspection, clearance air sampling, and daily air sampling during the cleanup of asbestos-containing materials will be documented for regulatory compliance. Air results will be compared to established EPA limits for asbestos removal projects. The data and interpretation will answer the questions:

> *Based on the air sample data, are the engineering controls utilized by the contractor effective during abatement? And, following abatement activities is the work area clean and uncontaminated so the site can be reoccupied for further development?*

Step 3 – Identify Information Inputs

The daily and final air sampling design during the course of the project will be as follows, as defined in the Abatement Design Plan approved by SC DHEC:

<u>Analytical Procedures</u>: The following methods will be utilized at the discretion of the Project Manager in collecting and analyzing air samples:

- Phase Contrast Microscopy (NIOSH 7400 Method, Issue 2, Revision 3 or OSHA Reference Method)
- Transmission Electron Microscopy (40 CFR Part 763, Subpart E, Appendix A)

Step 4 - Define the Boundaries of the Study

The number and volume of air samples collected will generally be in accordance with the schedule outlined below. Sample quantities, locations, volumes and methodologies may vary depending upon the analytical method, project layout, contractor's set-up of engineering controls, and procedures used. The boundaries for asbestos abatement will be limited to the building on site.

Daily Sample Schedule (per 8-hour work period): Generally collect the following samples on a daily (8-hour work period) basis as specified. The number of samples may vary according to the Contractor's work sequence and on authorization of the Project Manager.

Base Line Sample Schedule (prior to beginning cleanup activities):

Location Sampled	Minimum Number of Samples	Type of Collection Media	Minimum Volume (Liters)	Analytical Method
Each Work Area	5	0.8 µm MCE	1,250	NIOSH 7400

Daily Sample Schedule (per 8-hour work period): Generally collect the following samples on a daily (8-hour work period) basis during cleanup activities:

Location Sampled	Minimum Number of Samples	Type of Collection Media	Minimum Volume (Liters)	Analytical Method
Each Work Area	1	0.8 µm MCE	500	NIOSH 7400
Outside Each Work Area/Adjacent to Work Area	1	0.8 µm MCE	500	NIOSH 7400
Decon Clean Room	1	0.8 µm MCE	500	NIOSH 7400
Negative Air Exhaust	1	0.8 µm MCE	500	NIOSH 7400

Final Air Clearance Sample Schedule: Collect the following air samples to determine air clearance at the conclusion of cleanup. The number of samples may vary according to the Contractor's work sequence, the site plan, and on authorization of the Project Manager.

Location Sampled	Minimum Number of Samples	Type of Collection Media	Minimum Volume (Liters)	Analytical Method
Each Work Area <3,000 SF	5	0.8 µm MCE	1,250	NIOSH 7400
Each Work Area >3,000 SF	5	0.45 µm MCE	1,250	TEM, AHERA

Step 5 – Develop the Analytic Approach

The decision rule is predicated on answering the question(s) related in Step 2 above. Determining actions will be based on air sampling results compared to the EPA clean air threshold in 40 CFR §763, Subpart E for asbestos abatement actions of 0.01 f/cc when analyzed by PLM or 70 str./mm^2 when analyzed by TEM. Decisions will be based on the above thresholds and actions include:

- Below 0.01 f/cc or 70 st/mm^2 – No action, monitoring meets regulatory requirements
- Above 0.01 f/cc or 70 st/mm^2 – Stop work, take corrective action, re-clean area.

Additionally, decisions will be based on visual inspections. Asbestos must be visually removed from the substrate regardless of air testing results.

Step 6 – Specify Limits of Decision Errors

Project goals will be based largely on the precision and accuracy of the data along with completeness of the data set. One common problem resulting in decision error when comparing site data with regulatory criteria is overcoming matrix interferences or elevated detection limits, which can often be resolved by adjusting air volume since the method of analysis is microscopic.

This project will accept the "false acceptance" of the results above established guidelines as this provides a more conservative approach for corrective action. Accepting results above established guidelines, even when not true, provides an additional safety factor to the general public. Alternatively, if the air result approaches 80% of the established guidelines, the project manager may have the contractor review their removal methods and engineering controls. This 80% value was selected as the basis as most established analysists have a coefficient of variation of approximately 0.20 using NIOSH Method 7400. Upper and lower confidence limits are discussed in detail in Section D 1.4.1

Additionally, daily data will be accepted based on sample recount data as described in Section D 1.4.2. If recount data is not acceptable, all samples analyzed by the analyst will be rejected for the day. Upon that decision, the quality manager may elect to have the air samples analyzed by a third party, or determine that additional samples be collected.

Step 7 – Optimize the Design

The project is utilizing SC DHEC R. 61-86.1, *Standards of Performance for Asbestos Projects* to achieve and accurately document the successful completion of the asbestos abatement. The established clearance criteria for asbestos cleanup as defined in SC DHEC R. 61-86.1 will be used to document the successful completion of cleanup. Deviations or adjustments to the design will be documented in the field and in addenda to the prepared cleanup design for the project. A copy of this regulation is attached in **Appendix B**. Additionally the written abatement removal specifications prepared by Terracon address site specific air monitoring requirements.

The SC DHEC regulation states targeted sampling locations for removal of regulated materials. At a minimum four sampling locations will be collected daily. Terracon may also add additional samples dependent on the contractors work methods or in areas of concern during containment constructions in effort to answer the questions in Step 2 above.

A-7.1 Specifying Data Collection Objectives

The objective of the QAPP is to determine, to the extent feasible, that site response actions are implemented by reliable air monitoring data. The results of the final visual inspection, clearance air sampling, and daily air sampling during the cleanup of asbestos-containing materials will be documented for regulatory compliance. Air results will be compared to established EPA limits for asbestos removal projects. This will aid in the evaluation of whether the site meets the future property use requirements.

Since this Brownfield project involves a single property and land use, this study provides site-specific data and objectives.

<u>Air Sampling</u>
The post cleanup clearance testing will consist of a visual inspection of the abated asbestos surfaces and/or components conducted by appropriately state licensed personnel. Analytical testing will also be performed to document the efficacy of the abatement activities. The analytical methods must be quantitative for comparison with applicable state and federal clearance criteria for asbestos abatement projects.

A-7.2 Testing the Preliminary Design Approach

The hazardous materials cleanup design will define the specific locations and extent of the materials/components to be abated with each regulated area. The cleanup will be performed

using sampling protocols and procedures that are defined in the previously referenced applicable state and federal regulations.

A-7.3 Adjustments to Designs

The project is utilizing SC DHEC R. 61-86.1, *Standards of Performance for Asbestos Projects* to achieve and accurately document the successful completion of the asbestos abatement. The established clearance criteria for asbestos cleanup as defined in SC DHEC R. 61-86.1 will be used to document the successful completion of cleanup. Deviations or adjustments to the design will be documented in the field and in addenda to the prepared cleanup design for the project. A copy of this document is attached in **Appendix B**.

A-7.4 QA/QC Requirements (NIOSH 7400)

The assessment results will be submitted with the final report. The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analyses and data reporting that will provide results meeting SC DHEC regulations for asbestos cleanup (SC DHEC R. 61-86.1). The primary goal of the program is to ensure that the data generated are representative of environmental conditions at the site.

A-7.5 Laboratory Quality Assurance

Laboratory quality assurance is a very significant part of the project quality assurance plan.

The laboratory's quality assurance program should be generally consistent with:

1. The International Organization for Standardization "Guide 25: General Requirements for the Competence of Calibration and Testing Laboratories (ISO 25, 3rd edition, 1990)", as amended, or
2. The quality standards outlined in the National Environmental Laboratory Accreditation Program, as amended, or
3. The quality standards outlined in the National Voluntary Laboratory Accreditation Program, as amended.
4. The quality standards outlined in the American Industrial Hygiene Association, Proficiency Analytical Testing Program for analysis of asbestos air samples.

The laboratory performing the analytical methods should demonstrate that the data generated meets the intra-laboratory performance standards for the method and that the performance standards are sufficient to meet the bias, precision, sensitivity, representativeness, comparability and completeness, as specified in the project data quality objectives.

1. The bias of the method may be demonstrated through the use of reference materials, comparison to alternative methods or spiked samples.

2. The precision of the method may be determined by evaluation of relative standard deviation or the relative percent difference through the use of replicate analyses.
3. In order to address sensitivity requirements, the laboratory shall select a standard available analytical method that provides a method quantitation limit below the necessary level of required performance for purposes of assessment as well as demonstration of conformance with recognized SC DHEC regulations. If it is not possible to achieve a sample quantitation limit below the necessary level of required performance, and the analyte of concern does not meet the conditions of the SC DHEC regulations, then the laboratory shall select the standard available analytical method that provides the lowest possible sample quantitation limit for that analyte.
4. The method detection limit shall be verified after major instrument maintenance, a change in analyst or major changes in instrumentation or instrument conditions. The laboratory shall ensure and document an initial demonstration of proficiency for the analysis of each chemical of concern and each method used. The laboratory shall also demonstrate and document, in a scientifically valid manner, the achievable method detection. This demonstration and documentation shall be preparatory and method specific and shall include any cleanup method used. The method detection limit should be routinely checked for reasonableness.
5. The representativeness of the method may be demonstrated by the laboratory through the use of proper storage, preparation and subsampling techniques.
6. The standard available method may either be a documented method from the U. S. EPA, American Society for Testing and Materials (ASTM), or other organizations nationally recognized as having scientifically acceptable methods or a laboratory method that is completely documented in an appropriate Standard Operating Procedure. All methods derived by a laboratory must meet the quality control criteria recommended in U.S. EPA Test Methods for Evaluation of Solid Waste, Update III, as amended, unless the project and/or samples require less stringent quality control requirements than those recommended in U.S. EPA Test Methods for Evaluation of Solid Waste, Update III, as amended. Such projects or samples that require less stringent quality control shall be clearly identified and the rationale for lower levels of quality control shall be documented.
    (A) Application of the method shall include the use of instrument calibration that brackets the value reported or includes a low standard that is below the necessary level of required performance, unless the sample quantitation limit has been determined to be the necessary level of required performance. The calibration range shall yield results that demonstrate that the sample reporting level has not exceeded the necessary level of required performance after correction for sample weight or volume.
    (B) Laboratory control samples must be used to demonstrate that the method can produce results for the chemicals of concern that meet the bias and precision requirements at or below the necessary level of required performance or at the sample quantitation limit in a clean laboratory matrix. The matrix must be similar to the medium of the environmental samples.

Results for a sample spike may be substituted for the laboratory control samples if the bias and precision criteria have been met.

The analytical laboratory shall:

- report all results (corrected for sample weight or volume, sample preparations and/or laboratory adjustments) greater than the method detection limit that meet the qualitative identification criteria recommended in the analytical method used.
- use a qualifier flag on all results reported as greater than the method detection limit and less than the sample quantitation limit.
- report all non-detected results as “less than” the value of the method detection limit.

A-7.6 Laboratory Quality Assurance Management

The laboratories will also meet their respective quality plans/programs that generally include the following:

- Preventative maintenance;
- Audits;
- Corrective action;
- Quality Process.

A Laboratory Quality Assurance Management program generally consists of the following core components:

1. Clear assignment of responsibilities for all laboratory personnel with respect to maintaining compliance with the laboratory’s data quality objectives.
2. Careful evaluation and log-in of samples with strict control of sample integrity via internal custody procedures and storage monitoring.
3. Analysis of samples using:
   a) fully developed and approved analytical methods for which the laboratory has documented its capabilities (i.e. detection/reporting limits, precision/accuracy).
   b) calibration procedures utilizing standards and reagents that are traceable to specific source materials of known purity.
   c) internal quality control checks with evaluation against statistical quality control charts or other applicable acceptance criteria.

Preventative maintenance for laboratory equipment is essential to minimize turn-around times and help insure optimum data quality. The selected laboratory shall maintain specific operator manuals that pinpoint steps in the preventive maintenance scheme for individual instruments. Please see the attached laboratory Quality Management Plans for the selected laboratories attached in Appendix C.

A-8: SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS

The City recognizes the importance of having all cleanup and remediation activities performed under its EPA Brownfield Grant in a professional and competent manner as set forth in its Professional Consulting Services Contract with Terracon, who has been retained as the City's Environmental Consultant under this grant award. Terracon is required under its Contract with the City to maintain all required professional licenses and certifications for performance of this sampling work in accordance with federal and state statues, rules, regulations, and the terms and conditions of the Brownfields Assessment Cooperative Agreement between the City and EPA. Terracon further represents in its Contract that all of its personnel engaged in this site cleanup and remediation activities will be fully qualified and authorized or permitted under state and local law to perform such work and has the requisite knowledge and expertise to perform the duties assigned.

Field personnel have access to review activity-specific SOPs and sampling protocols established by EPA Regulation 40 CFR 763 (AHERA) and SC DHEC R.61-86.1 while in the field for verification of procedural documentation requirements. Terracon field staff also complete in-house training modules through Terracon University, an on-line training system available via live webcasts, recorded webcasts, and self-paced on-line and off-line options. Materials covered include: safety training presented through our Incident and Injury-Free (IIF) program and sample collection protocols. Terracon University also includes "lessons learned" elements designed to familiarize field staff with common problems encountered during field data collection and the appropriate corrective measures as a response to those problems.

A-8.1 Training

The Brownfields project must consider special training and requirements necessary to the response action activities. The purpose of this element is to ensure that the personnel conducting project activities have the requisite specialized training necessary to complete the project tasks. The project has identified special needs as part of the quality process in Section A6. In addition, the following skills/training are necessary to achieve quality completion of the project.

A-8.1.1 Licensed Asbestos Consultant

Develop a site-specific asbestos cleanup plan and technical specifications for the removal and disposal of the ACM previously identified, conduct a pre-bid walkthrough with qualified bidders and provide direction to field personnel throughout the cleanup process. The asbestos consultant will be licensed with SC DHEC.

A-8.1.2 Field Project Manager/Air Monitoring Technician (FPM)

The Field Project Manager (FPM) will be on-site during the asbestos cleanup activities for the project. The FPM will coordinate and provide documentation of the cleanup activities and air monitoring services for the duration of the cleanup project. The FPM will be licensed as an air monitor with SC DHEC.

A-8.1.3 Health and Safety

The study area is not anticipated, on the basis of current knowledge of the site, to be a hazardous waste disposal site listed on state databases. However, the condition of portions of the site includes the presence of asbestos and lead-containing paint coated building materials.

Personnel will have current licenses and certification with current applicable refresher training as required by the SC DHEC.

Property-specific safety plans will be reviewed and approved by a professional trained and experienced in the field of health and safety. The safety plans will be kept in the project file for the duration of the response action process. Prior to the initiation of field activities and at the start of each work day during the field activities, a “tail-gate” safety meeting will be held by the Terracon FPM and or his designee and will include the Contractor’s employees and subcontractors (if applicable). The safety plan will include signature pages for attendees to indicate that the meetings were conducted and their content. A copy of the safety plan, and the daily sign-in sheets will remain on the project site for the duration of the field activities.

A-8.1.4 Data Quality Process

The successful implementation of the plan and data quality process requires an understanding of the underlying procedures, limits and criteria of decision-making. The QAPP will include review by a Terracon Brownfields QA/Authorized Project Reviewer who has received documented EPA quality process training.

A-8.2 Certification

Technical training is provided through both external and internal formal training programs. External training programs provide documentation and certification of training.

Technical proficiency is a requirement under Terracon’s CQMP, setting the qualifications and requirements for reviewers in Levels 1 through 3. The CQMP documents a process for evaluating and documenting this proficiency.

Documentation and certification as to the requisite skills and training necessary in A8.1 will be required and documented. All training records will be maintained in Terracon's Corporate Headquarters in Olathe, Kansas. Please refer to the Terracon Corporate Quality Program Manual included as Appendix B for more information related to training. Copies of staff resumes demonstrating practical project experience will also be filed with training certifications for each position in A8.1 and shown in Section A4.

EMSL is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for Asbestos Fiber Analysis and the American Industrial Hygiene Association (AIHA) Laboratory Accreditation Program for Industrial Hygiene and Environmental Lead. Documentation of these accreditations is included in Appendix C.

A-9: DOCUMENTATION AND RECORDS

This element sets forth the types of data that will be retained in project files, as well as the proper retention and disposition of project documents.

A-9.1 Purpose and Background

The City of Pickens redevelopment effort is an EPA Brownfields Cleanup project conducted under a federal grant. Document control is crucial for quality assurance within this process. The project team has identified the following documents to be critical to the control and review process.

A-9.1.1 Field Records

The field forms used to develop a written record of assessment activities will include the following (examples are included in Appendix D):

- Daily Field Reports;
- Field Logbook;
- Air Sample Analysis Forms;
- Sample Custody Records; and,
- Daily Sign-In Log

A HASP prepared to address site-specific hazards is included as a separate document. The HASP will be reviewed and signed daily by field personnel prior to fieldwork, indicating that they understand the plan and its requirements. A copy of the HASP will be maintained onsite and made available to personnel during field activities. Further information regarding health and safety considerations, including special protective equipment (PPE) requirements will be included in the HASP.

A-9.1.2 Laboratory Records

Please see the detailed laboratory records information attached in the Quality Assurance Project Manuals in Appendix C. Baseline and daily air samples to be analyzed by PCM will be collected by Terracon's licensed air monitor(s) and analyzed by AIHA Accredited Terracon staff within 24-hours of the close of each workday. The standard laboratory turnaround time for final clearance samples submitted to subcontract laboratory for analysis by TEM is 24 hours after receipt by the laboratory.

A-9.2 Data Reporting Package Format and Control

Field documents will be recorded on standard Terracon paper formats using pre-printed forms (examples in Appendix D), logbooks and indelible ink. Lined-through corrections with initials and the date will be made in lieu of erasures. The Field Team Leader/Project Coordinator will retain project documents within his physical control at the end of any project field day. Pre-field, interim or post-field periods will see the project field documents delivered to the Project Coordinator and retained in project files, each specific to an enrolled property.

Electronic filing of data transferred to electronic platforms will be stored on the Terracon Network server with a nightly backup by separate means. The electronic file protocol for the City of Pickens Brownfield Project will consist of documentation and recordkeeping, consistently labeling electronic folders with the hard file names and identifiers. Electronic platforms and formats for the project will consist of the following standards:

Word Processing:	Microsoft® Word
Spreadsheets:	Microsoft® Excel
Drafting:	AUTOCAD®

A-9.3 Document Retention and Retrieval

Document distribution will be as indicated for the QAPP and described in Section A3. Document retention will be as follows:

- Final plans and reports as hardcopy files at City offices by the Brownfields Program Director or successor for a minimum of five (5) years beyond closeout of the grant.
- "FILE" copies of final plans and reports will be maintained at Terracon-Greenville offices for a minimum of five (5) years beyond closeout of the grant. After a period of two (2) years from reporting, documents will be transferred to inactive status and archived. Archived files will be kept for a minimum of 30 years.
- Electronic copies of report text, drawings and spreadsheets will be maintainedfor a period of at least one (1) year from final reporting and close of project prior to transfer to compact disc for a minimum of an additional five (5) years of storage.

Retrieval of hard copy records by authorized parties can be accomplished from City files through the Brownfields Program Director.

Retrieval of hard copy records by authorized parties can be accomplished from Terracon records through the Terracon Project Manager.

A-9.4 Updates and Distribution

As stated previously, the Terracon Project Manager will distribute the approved QAPP and subsequent revisions throughout the project to those identified in Section A.3.

B-1: SAMPLING PROCESS DESIGN

This element of the QAPP describes the technical and practical implementation of the designs developed and discussed in Section A7.

B-1.1 Purpose and Background

The post-response action final clearance sampling will be conducted in accordance with current SC DHEC regulations for asbestos. The design must produce quality, defensible data sufficient to a balance of needs for Grantee decision-making and the strictures of federal Brownfields funding.

B-1.2 Scheduled Project Activities

The response action activities are anticipated to be conducted over an approximate 30 working day period of time, not accounting for inclement weather or other unforeseen project delays. As areas of cleanup are completed, final clearance sampling will be conducted to insure that the defined clearance criteria are achieved to document the completion of the response actions.

B-1.3 Rationale for the Design

The development and discussion of data quality objectives in Section A7 will be to collect data that can be utilized to properly evaluate the completeness of the response actions relative to the proposed future use of the site.

B-1.4 Assumptions of the Design

The following baseline assumption was considered in the quality process and is set forth herein summary.

- Hazardous materials are present on or in various building materials and substrates that will be impacted by proposed site redevelopment activities. These materials will not likely be affected by local changes in weather or seasons within the period of the response action.

At this time, no contingency plan to account for conditions and exceptions yet unknown can be formulated. If such conditions are identified as part of the response actions, the Terracon Project Manager will provide proper documentation in accordance with current SC DHEC regulations prior to implementing contingency procedures.

B-1.5 Locating Samples and Sample Frequency – Air Samples

Baseline, daily, and post-response action final clearance sampling will be collected in accordance with the prepared asbestos cleanup design in accordance with SC DHEC regulations previously discussed. The baseline, daily, and final clearance air samples collected are considered critical.

The number and volume of air samples will be in accordance with the following schedule:

Before Start of Work

The following air samples will be collected to establish a baseline before start of work.

Location Sampled	Number of Samples	Analytical Method	Minimum Detection Limit (Fibers/cc)	Minimum Volume (L)	Flow Rate (LPM)
Within each work area and adjacent to the work area	5	NIOSH 7400	0.005	1200	3.0-12.0

From start of work through the project decontamination, representative daily samples will be collected inside and outside each work area as described in SCDHEC R. 61-86.1

Location Sampled	Number of Samples	Analytical Method	Detection Limit (Fibers/cc)	Flow Rate (LPM)
Inside &Outside Each Work Area	4-6	NIOSH 7400	0.01	3.0-12.0

If interior airborne fiber counts exceed 0.1 f/cc, additional samples will be taken as necessary to monitor fiber levels.

If any air samples taken outside of the work area exceeds the 0.01 f/cc then abatement contractor will be required to immediately and automatically stop all work and take remedial action.

Final Clearance sampling following abatement inside each work area will be conducted as described in SCDHEC R. 61-86.1 and in Section 02081.

Location Sampled	Number of Samples	Analytical Method	Criteria Limit	Minimum Volume (L)	Flow Rate (LPM)
Within each Work Area	5	NIOSH 7400 TEM AHERA	0.01 f/cc 70 Str./mm^2	1200	3.0-10.0

No additional analytical method requirements or non-standard methods have been identified for this project.

B-2: SAMPLING METHODS REQUIREMENTS

This element of the QAPP sets forth the procedures for collecting samples and identifies the sampling methods. It includes protocols for sample collection, handling, documentation, transport, testing and disposition within the assessment project.

Terracon will make use of a number of internally standardized procedures for collecting data that have been formulated as TSOPs. These TSOPs incorporate both industry protocols and internal procedures and are enumerated in Appendix B. Copies of the appropriate TSOPs will be available for field use and, upon request, to the EPA Brownfields Project Officer and City's Brownfields Program Director.

B-2.1 Purpose

The QAPP for the Brownfields project intends to set forth the methods and procedures for collecting final clearance samples after the cleanup is completed.

B-2.2 Sample Collection, Preparation and Decontamination

The following common elements are identified as generic issues to maintain and direct the quality of samples collected for the Brownfields study decision process.

B-2.2.1 Appropriate Sampling Methods

The previously referenced asbestos established sampling protocols identify or recommend specific sample locations for asbestos air samples. This information will be defined in Terracon's Asbestos Abatement Plan.

B-2.2.2 Base Requirement of Methods

It is essential to the quality of the samples in the study area to use field methods and procedures that will:

- Retain sufficient volume as to provide the minimum amount of sample necessary for analysis by the laboratory; and,

- In general, methods acceptable for sampling and testing must meet the criteria of the state program for end use. Methods and procedures are detailed in the TSOPs that meet these criteria. Analytical procedures have defaulted to the limits of standard methods prescribed as adequate to the preliminary characterization for feasibility in this Brownfields study. Analytical limits are detailed in Appendix B and Appendix C. Preservation, storage and container requirements are detailed below.

Table 2. Preservation, Storage and Container Requirements

Analysis	Approved Method	Air				Soil/Solid		
		Volume (L)	Container	Preservation	Holding Time	Volume (oz)	Container	Holding/ Extraction Time
Asbestos	NIOSH 7400	>1.250	0.8 µm MCE	-	-	-	-	-
Asbestos	AHERA	>1,250	0.45 µm MCE	-	-	-	-	-

GA=Glass (amber) MCE=Mixed Cellulose Ester Filter PCF=Polycarbonate Filter

B-2.2.3 Cleaning and Decontamination

Field cleaning procedures for each method are described in general as TSOPs E.2410 and E.2420; these are located in Appendix B.

Analytical cleaning and decontamination are provided by the limits of laboratory procedure and standard methods prescribed in Appendix B and Appendix C as adequate to the preliminary characterization for feasibility in this Brownfields study.

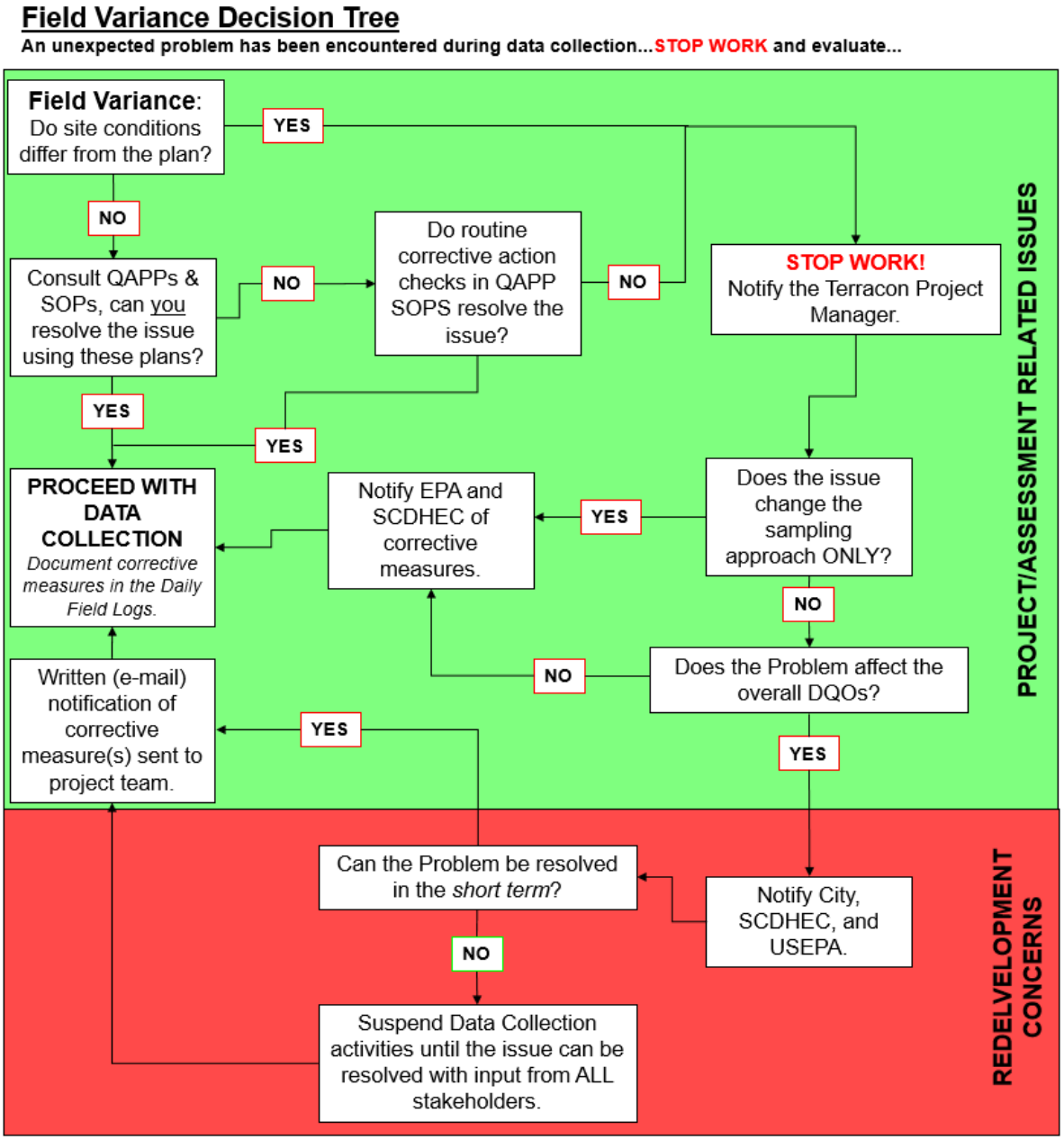
B-2.3 Adequacy of Support Facilities

The laboratory support facilities chosen for analysis of asbestos air samples will be analyzed by a laboratory who participates in the Proficiency Analytical Testing Program. Additional certification information is available in Appendix B and Appendix C.

B-2.4 System Failure Response and Corrective Action Process

In general, the Terracon Project Manager is responsible for the quality of the field data and exercises final corrective action responsibility in producing resolution and determinations of suitability of data regarding failures. Even with the best planning, data collection activities are always subject to field variances, which may require changes to the planned approach. The linchpin of data quality is the ability of field staff to make sound decisions with regard to corrective measures. Routine corrective measures during all sampling activities will be taken at the discretion of the Field Team Leader and Project Manager. All corrective measures will be thoroughly documented in field logs. However, difficulties may arise when issues are encountered and decisions on corrective actions move “beyond the routine.” Whenever there appears to be a problem that could adversely affect data quality and resulting decisions affecting response actions pertaining to this project, the *Field Variance Decision Tree*, included in Figure 2 below, has been developed, with respect to the *Project Organizational Chart* in Section A-4.2, to provide a clear picture of the response process for field variances.

Figure 2: Field Variance Decision Tree



B-2.4.1 Field Sampling Failures

The Terracon Project Manager is responsible for auditing and controlling the overall quality and implementation of field sampling to produce acceptable data. Field sampling failures will be documented using appropriate forms (Appendix D). During field audits by the Terracon Project Manager, failures noted and corrected will be documented using appropriate forms (Appendix D).

The Project Coordinator is responsible for similar management control while on the site. The Project Coordinator will make similar use of the referenced forms.

B-2.4.2 Laboratory System Failures

Laboratory failures will be addressed within the procedures of Appendix B and Appendix C. Method-specific corrective action and evaluation are set forth in Appendix B and Appendix C respective to the standard method.

B-2.5 Sampling Equipment, Preservation and Holding Times

The design for field sampling has been made with a bias to single-use, disposable equipment and materials whenever possible. The specific types are described and specified in the TSOPs in Appendix B. Where disposable equipment is not practical, cleaning procedures have been stipulated for field equipment.

Laboratory prevention and monitoring to provide against sample interference by cross or extraneous contamination will be addressed within the criteria of the standard methods and as set forth in procedures in Appendix B and Appendix C and other cross-references.

Proper sample size and control are essential. TSOPs in Appendix B describe specific parameters of control for specific field activities. Laboratory controls will be within the criteria of the standard methods and as set forth in procedures in Appendix B and Appendix C.

B-2.6 References

The QAPP has been prepared considering applicable portions of the following guidance relative to sampling designs and procedures to deliver a quality of data with sufficient confidence for the purposes of estimating feasibility and conducting preliminary planning for future development.

- *Guidance for the Data Quality Objectives Process – EPA QA/G-4*, OSWER, USEPA, EPA/600-R-96/055, August 2000;
- *EPA Requirements for Quality Assurance Project Plans - EPA QA/R-5*, March 2001 EPA/240/B-01/003;
- *Guidance for Quality Assurance Project Plans – EPA QA/G-5*, OSWER, USEPA, December 2002, EPA/240/R-02/009;
- *South Carolina Department of Health and Environmental Control – R. 61-86.1, R. 44-56, R. 44-96*

The laboratory methods referenced and bibliography used in preparation of their respective quality management programs are provided in Appendix Band Appendix C.

B-3: SAMPLE HANDLING AND CUSTODY REQUIREMENTS

This section sets forth the requirements and provisions for sample control and proper custody in the field, during transport and in the laboratory. Examples of the handling and chain-of-custody (COC) documents discussed below are included in Appendix D.

B-3.1 Purpose

The cleanup activities conducted in conjunction with the City of Pickens project do not involve enforcement action or other civil penalties which might result from data use and do not necessitate an upper level stringency of the custody procedure. Reports will carry a written notice regarding limitations of reuse or reliance by others on the data provided to the City for the feasibility decision.

The transfer of sample custody will be limited between Terracon personnel, the express carrier and laboratory personnel. The primary objective of custody requirements for this project is simply to track that samples are handled by authorized personnel, and to document that handling occurred within the parameters of the Plan. Individual custody seals will not be necessary unless the samples are held overnight by the Field Team Leader.

In general, the outline for sample handling and custody will be as follows:

- The Project Coordinator will brief sampling personnel on custody procedures.
- Samples will be in the custody of the field team at all times.
- Samples will be removed from the project site to the laboratory on a daily basis.
- Laboratory will implement tracking and custody documentation.
- Post-analysis samples will be properly disposed.
- Terracon will maintain COC documentation after reporting.

B-3.2 Sample Custody Procedures

COC protocol will be adhered to during all phases of the sample collection, storage, shipment and analysis procedures.

B-3.2.1 Mobilization

The Project Coordinator will assemble and designate a Field Team Leader and Field Sampling Team of qualified staff. COC documents, forms and labels will be assembled in advance of site work. The Project Coordinator will review for appropriateness to the QAPP. The process and procedure for sample handling and custody will be stressed in the pre-field briefing prior to field mobilization.

Original laboratory analytical reports and COC forms will be maintained with the project files.

B-3.2.2 Field Labeling and Chain-of-Custody

Maintaining the COC in the field will be the responsibility of the Field Team Leader or authorized surrogate. The Field Team Leader or authorized surrogate will perform and/or direct the collection, handling, field analysis and/or shipment of samples collected from the site through the sampling personnel assigned. Samples collected will be prepared immediately for shipment, remaining in the immediate custody of the Sampling Team until received the same day by the Field Team Leader. Until receipt, samples will reside in a locked vehicle if not in the immediate possession of the Sampling Team.

Samples collected in the field will be placed in proper sample containers, labeled and stored inside a storage receptacle from the time of collection through sample shipment. The container labels will indicate the following:

- Time and date of collection;
- Name of person collecting the sample;
- Type of sample;
- Sample designation and depth;
- Name of site;
- Project Number;
- Requested Analysis.

The laboratory-prepared containers will have labels affixed indicating the date, time, collector's name, sample location, type of matrix, and analysis to be performed. Terracon will place the samples into an appropriate receptacle while at the physical location of the sampling area.

A COC record will accompany all samples during collection and shipment. Each COC record will be filled out and signed in ink by a Terracon field team member. The COC records will include the following information:

- Sample identification;
- Signature of Field Team Leader or designated individuals(s) responsible for sample custody;
- Date and time of collection;
- Sample type;
- Number of sample containers;
- Laboratory analysis to be performed;
- Signature of laboratory person(s) receiving samples;
- Inclusive dates and times of possession.

Whenever feasible for samples, but required for time-critical samples, samples will be removed from the project site on a daily basis. This will be done under the supervision of the

Field Team Leader and shipped by Federal Express, as the designated carrier for Overnight Express Delivery, to the laboratory by 10 AM the following morning. This allows an electronic tracking mechanism for identifying the samples location and handling between field and laboratory. The laboratory will provide for Saturday receipt of samples from the carrier.

Should non-time critical samples be collected which need not be shipped on the same day, samples will be held in a locked receptacle under the supervision of the Field Team Leader to maintain custody until the next shipping day. COC documentation will reflect this retention. Before sealing and placing in the shipping container, a carbon copy or photocopy will be made of the COC record.

B-3.2.3 Laboratory Procedures and Disposal

Upon receipt, the laboratory will implement tracking and custody documentation as set forth in Appendix B and Appendix C. Original copies of documentation, signed by the laboratory QA staff, will be returned with test reports to the Project Manager. The designated laboratories under Appendix B and Appendix C will dispose of samples according to the procedures outlined in the respective laboratory SOPs.

B-3.2.4 Post-Reporting Retention

Original chain-of-custody documentation will be maintained in the Active Project File by the Project Manager until reports are complete. Thereafter, Terracon will maintain documents for a period of thirty (30) years in archives as set forth earlier in this document.

B-4: ANALYTICAL METHODS REQUIREMENTS

This section identifies the detailed and specific criteria for conducting, maintaining and checking the analytical process in the laboratory to provide useful, quality data. As noted earlier in Section A7.5, laboratory quality assurance is a very significant part of the project quality assurance plan.

B-4.1 Purpose and Background

The data must be sufficient to the City's need to complete cleanup activities and to prepare the site for future redevelopment. Data will not be used for enforcement action or civil litigation.

The designated laboratories have previously provided their Quality Assurance Management Plan / Quality Assurance Project Plan, which are attached in Appendix B and Appendix C.

B-4.2 Preparation of Samples

Preparation of laboratory samples is described in general in Appendix B and Appendix C. Specific preparation protocols will be within recommended procedures of standard methods.

B-4.3 Analytical Methods

Laboratory sample analyses are described in general in Table 2 (Section B-2.2.2) and Appendix C. Specific analytical protocols will be within recommended procedures of standard methods. Baseline and daily air samples to be analyzed by PCM will be collected by Terracon's licensed air monitor(s) and analyzed by AIHA Accredited Terracon staff within 24-hours of the close of each workday. The standard laboratory turnaround time for final clearance samples submitted to subcontract laboratory for analysis by TEM is 24 hours after receipt by the laboratory. No additional analytical method requirements or non-standard methods have been identified for this project.

B-4.4 References

Laboratory documents and manual references are presented in Appendix B and Appendix C.

B-5: QUALITY CONTROL REQUIREMENTS

This section implements the quality controls necessary to monitor the proper working of the data quality program in process, both as affected in the field and in the laboratory environment.

B-5.1 Purpose

The purpose is to set up a series of quality checks that identify if the data quality process is being implemented within bounds supportive of the decision process. The procedures should be in-process and deliver information in a timely fashion appropriate to enact corrective action.

Programs routinely rely on limits of standard methods to limit the instrumental and laboratory bias. This process will similarly rely on field quality control checks and those of standard methods to mitigate instrumental and analytical bias. Brownfields funds will be focused on monitoring and correcting human or operational errors in the process.

The City's decision regarding redevelopment feasibility is related to the determination that known hazardous materials on the site are removed or that the remedial measures are protective for future planned renovation activities on the site. The data quality need only be sufficient to this end. The degree of field quality control should be of a low to moderate level. The laboratory checks should be as extensive as recommended by published standard methods.

B-5.2 Other QC Check Systems

The following table sets forth the field checks and the frequencies at which they will be performed.

Table 3. Quality Control Checks and Schedules

ASSESSMENT ACTIVITY	AGENCY	FREQUENCY OF ACTIVITY
Recounts	Terracon	10% of filters counted
Field Split	EPA Region 4	Discretionary
Field Split	SCDHEC	Discretionary

Acceptance criteria, corrective action, and procedures used to calculate quality control statistics are described in section D-1.4 of this QAPP.

B-6: INSTRUMENT AND EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

The equipment used to make measurements must be reliable and must not present a potential source for data failure for the Brownfield study.

B-6.1 Purpose

The QAPP must directly include or indirectly reference the procedures which will be used to verify that all instruments and equipment are maintained in sound operating condition and are capable of operating at acceptable performance levels.

B-6.2 Testing, Inspection and Maintenance

The following describes the process to implement the stated purpose.

B-6.2.1 Field Equipment

The asbestos air samples will be collected using low and high flow air sampling pumps appropriately calibrated. The asbestos air samples will be analyzed on-site by Phase Contrast Microscopy (PCM) with a microscope that has also been appropriately calibrated.

B-6.2.2 Laboratory Equipment

Appendix B and Appendix C presents the laboratory instrumentation and equipment specific to laboratory analysis and the schedules of maintenance and testing.

B-7: INSTRUMENT CALIBRATION AND FREQUENCY

This section presents the identification of instruments and documentation for the checking of physical measurements against accepted standards.

B-7.1 Instrument Identification

Instruments used for collecting field environmental measurements that must be compared with acceptable performance standards are as follows:

- High and Low flow air sampling pumps (rotameters)
- Phase Contrast Microscope
- Bright Field Microscope

Standard Operating Procedures (SOPs) for pumps and microscopes are included in the attached TSOPs (E.4010) and Terracon's Asbestos PCM Quality Assurance Program Manual both included in **Appendix B**.

B-7.2 Calibration Methods

Measuring equipment will be routinely calibrated and the calibration documented. The air sampling pumps will be calibrated in the field using a rotameter (secondary calibration standard) that has been calibrated against a primary calibration standard. The microscope will be calibrated prior to use with a phase telescope and a HSE/NPL test slide. Check standards will be relied upon as certified and presented by the industry and as recommended by the manufacturer and the referenced methods for the instrument. Calibration methods for measuring equipment are described in the attached TSOPs (E.4010) and Terracon's Asbestos PCM Quality Assurance Program Manual both included in **Appendix B**.

B-7.2.1 Field Equipment: Bench Calibration

Field instruments will receive scheduled bench calibration to check measurement response to accepted check standards. Calibration methods and results will be documented on calibration logs and placed in the project file.

B-7.2.2 Field Equipment: On-site Calibration

Field instruments will receive regular and scheduled calibrations in the field to check measurement response to calibration standards.

B-7.3 Calibration Apparatus

No special calibration apparatus other than that provided by the manufacturer is necessary for field or laboratory equipment.

B-7.4 Calibration Standards

Calibration standards for field equipment will be as referenced in referenced NIOSH Methods and the manufacturer's manual appended to the respective laboratory quality manuals identified in Appendix B and Appendix C.

Calibration standards for laboratory instrumentation will be as referenced in Appendix B and Appendix C.

B-8: INSPECTION AND ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Terracon maintains centralized control of field sampling expendables, supplies and materials for conducting environmental assessments through the position of Environmental Equipment Manager (EEM). Only the Project Manager is authorized to make purchases of approved supplies from listed vendors selected by Terracon. Materials are purchased and stored in the Terracon facility under the supervision of the EEM. The EEM approves all materials logged into the facility to and from the project Field Team Leader and Sampling Team on a project-specific basis.

Laboratory responsibilities and procedures to control and monitor supplies and expendables are as referenced in Appendix B and Appendix C.

B-9: DATA ACQUISITION REQUIREMENTS FOR NON-DIRECT MEASUREMENTS

The use of data from non-measurement will be utilized for this project in the form of a visual inspection of the remediated asbestos surfaces associated with the facility. Visual inspection shall be performed by the site air monitor in general accordance with ASTM E1368-14, Section 8.4, *Inspection at the Conclusion of the Project*, and will consist of visual observations for visual accumulations of asbestos debris in the work area after abatement. If asbestos debris

is observed during the visual inspection, the abatement contractor shall resume abatement activities until the work area is in compliance.

B-10: DATA MANAGEMENT

Data may be produced in two locations: onsite and at the laboratory. Data collected on-site will be recorded in field logbooks and field log sheets, which become part of the project file and data are included in the assessment report appendices. Select field logs are contained in Appendix D. The Project Manager will submit copies of the field data worksheets, field equipment calibration logs and the field activity reports to the QA/QC Reviewer. Documents and records are maintained in general accordance with the USEPA Region 4 Science and Ecosystem Support Division (SESD) Field Branches Quality System and Technical Procedures. A computer compatible with MS Office Suite® will be used to help process, compile, and manage the data. Adherence to SOPs will also ensure that applicable Office of Information Resource Management requirements are satisfied. Terracon maintains project records in a project-specific folder identified by a project number. Field data forms are scanned and placed in an electronic project folder, which also includes, laboratory reports, and final reports. The Terracon Information Technology Department maintains the security of the network with up to date software and virus protection. The restricted access network retains sample results provided from the laboratory in protected electronic form to ensure that laboratory reports remain in their original format.

The laboratory will manage the original raw laboratory data from this project (hard copy or electronic format). The laboratory QA Director retains and maintains laboratory records. Laboratory records will be managed in accordance with the Terracon Asbestos PCM Quality Assurance Program Manual (Appendix B) and the EMSL QMS Manual (Appendix C). The laboratory Project Manager will submit laboratory data to the Terracon Project Manager. Upon receipt, the data is reviewed by the QA/QC reviewer as described in Section D-2 and D-3 prior to evaluating project management decisions. The Project Manager will be responsible for ensuring the analytical report meets requirements and for forwarding it to the City's Brownfields Program Director when applicable.

A copy of all the final documents will reside for a period of not less than five years, on file with the Grantee. Terracon maintains electronic files on the local office server. This information is backed up daily from Terracon's Corporate Data Center. Hard copies and electronic files are retained at our local Greenville, SC Terracon office for a minimum of five years. These records will be archived and kept for a minimum of 30 years.

C-1: ASSESSMENTS AND RESPONSE ACTIONS

The Field Team Leader in consultation with the Project Manager will be responsible for corrective actions related to field activities. Corrective measures will be thoroughly documented in field logs. If there appears to be a problem that could adversely affect data

quality, the *Field Variance Decision Tree* provided in Section B-2 was developed with respect to the *Project Organizational Chart* in Section A-4.2, to provide a clear picture of the response process for field variances.

This section lists and describes the oversight activities to be conducted on the City of Pickens Brownfield Project to meet the City's data needs in rendering a decision associated with site cleanup activities.

C-1.1 Purpose

This element describes the internal and external checks to provide that;

- elements of the QAPP are correctly implemented;
- the quality of the data produced by the QAPP is sufficient to the quality screening decision; and,
- effectiveness of the corrective actions is confirmed.

The end use of the data is commensurate with a determination of whether the site is acceptable for the proposed future use by the City. The end use of the data will be for comparison to established acceptance clearance criteria in the referenced state and federal regulations.

C-1.2 Assessment Activities

To accomplish the objectives of C-1.1, the following will be conducted as set forth in the following table.

Table 4. Assessment Assignments and Schedules

ASSESSMENT ACTIVITY	AGENCY NAME	PROJECT POSITION	FREQUENCY OF ACTIVITY
Project Field Check	EPA Region 4	EPA Grant Manager, Grantee	Discretionary
Field Check	Terracon	Remediation Plan Coordinator	Once per project
Technical Methods Audit	Terracon	QA Reviewer	Minimum 1 per month, from daily records
Project QA Review	Terracon	QA Reviewer	Following project completion
Project Files Check	Terracon	Administrative Support	Following project completion
Field Methods Check	Terracon	Remediation Plan Coordinator	Weekly, from daily records
Field Methods Audit	Terracon	Remediation Plan Coordinator	Weekly, from daily records
Laboratory System Audit	Terracon / EMSL	QA Reviewer or designee	Appendix B and Appendix C
Laboratory Certification	AIHA	Laboratory QA	AIHA Proficiency Testing

C-1.3 Assessment Criteria and Documentation

The following criteria will be used for evaluation as part of the assessments listed in C-1.2.

C-1.3.1 Field Check

These will consist of an unannounced in-progress visit to the site during on-property response action activities to observe the activities and management of the project. The City will make no formal written deliveries, but findings and observations will be conveyed verbally to the Terracon Project Manager.

C-1.3.2 Technical Methods Audit

These will be conducted at random and unannounced as in-progress checks of requested copies of daily records from the Remediation Plan Coordinator relative to the performance of the specific activities. Documentation of the events will be delivered to the Project Manager and/or QA Manager. The auditor copies will remain resident in the project file.

C-1.3.3 Project Files/Media Check

This will be conducted at random and unannounced as an in-progress check of resident hardcopy and electronic project files. This will result in written documentation of the event being delivered to the Project Manager and/ or QA Manager. The auditor copy will remain resident in the project file.

C-1.3.4 Field Methods Check

These will be conducted at random and unannounced as in-progress checks of requested copies of daily records provided by the Field Team Leader or authorized surrogate relative to the performance of the specific activities. Written documentation of the events will be delivered to the Project Manager and/ or QA Manager. The auditor copy will remain resident in the project file.

C-1.3.5 Technical Design Check

These will be conducted at random and unannounced as in-progress checks of requested copies of daily records directly from the Field Team Leader or authorized surrogate relative to the performance of the specific activities. Non-compliance will be verbally communicated immediately to the Remediation Plan Coordinator. Documentation of the events will be delivered to the Project Manager and/ or QA Manager. The auditor copies will remain resident in the project file.

C-1.3.6 Laboratory Certifications and Performance Audits

This Brownfield Project will occur on the schedules, of the content and at the discretion allowed by programs of the regulating and certifying agency as set forth in public programs. Reporting will be consistent with those programs. Any non-compliance or serious failure of the program which revokes or impugns the accreditation necessary to this project will be immediately reported in writing to the Terracon Project Manager.

C-2: REPORTS TO MANAGEMENT

Communication is essential in this cleanup project. Field conditions may change on a daily basis, altering the critical decisions. Quality is enhanced when this communication is regular and routine. Terracon management will act promptly to understand the impact and assist in resolution of corrective action on a continuous basis.

C-2.1 Project Reports

The reports described and submitted to parties and on schedules described in C-1.3 will be made part of the permanent data quality record. In addition, routine reports describing project

activity, the need for resolution amongst participating parties and the need to distribute schedule changes will be made both electronically and in writing. These are summarized in the following table.

Table 5. Routine Reports

Document	Party	Prepared By	Distribute	Frequency
Grant Reports	Terracon	Project Manager	Section A3	As determined by the City and at the end of the project.
Weekly Job Reports	Terracon	Remediation Plan Coordinator/ Field Team Leader	Project Manager	Weekly when field work is in progress.
Project Status Reports	Terracon	Project Manager	Section A3	Monthly and as determined by the City.
Performance Evaluation and Audits	See Table 4 (pg 42)	See Table 4 (pg 42)	Varies	See Table 4 (pg 42)
Data Quality Assessments	See Table 4 (pg 42)	See Table 4 (pg 42)	Varies	See Table 4 (pg 42)

C-2.2 Laboratory Reports

Laboratory quality is enhanced through a formalized process and management system of reporting relative to communicating issues on data quality, identification/resolution of problems and corrective action. These will be accomplished to maintain project laboratory data quality within the limits of the standard methods. Reporting occurs consistent with Appendix B and Appendix C.

C-2.3 Public Reports

In addition to data quality reports, the Brownfields study has an obligation to report both technical data for decision-making by the City and public information through community outreach portions of the project. The content of reports will be sufficient to the future land use needs of the City and, for future use, relative to state-specific programs. These needs and deliverables are set forth in the *Brownfields Cleanup Cooperative Agreement Work Plan* dated November 11, 2016 and the *Proposal for Professional Consulting Services* between Terracon and the City dated September 29, 2016. Necessary deviations documented through the Field Variance Decision Tree will be discussed accordingly. The significance of any deviations requiring corrective action will be evaluated by the Terracon Contract Manager before report development.

D-1: DATA REVIEW, VALIDATION, AND VERIFICATION

The City of Pickens's Brownfields Project conducted with end comparison under state-specific requirements does not require the detailed statistical and numerical comparison of traditional CERCLA or other enforcement activities.

D-1.1 Purpose

The focus will be on the completeness and accuracy of field methods, proper sample handling and a reliance on the validation and verification of the laboratory operating within its NVLAP program certification and associated protocols. This approach, supported by the other elements of the QAPP discussed previously, is consistent with or exceeds current levels of industry practice for work within the state programs.

The Terracon Project Manager will be responsible for conducting a full-package review of the field process and data produced for the site. The laboratory and Terracon QA Reviewer or an appropriate designee will conduct validation and reporting consistent with Appendix B and Appendix C.

The project must review designs for conformance to determine that procedures, measurements and data produced are requisite of and proper to comparison for a Brownfields decision, which determines whether the property has been sufficiently remediated relative to state and federal clearance criteria for cleanup.

D-1.2 General

The resultant data and information produced through implementation of the QAPP will be reviewed on a specific basis to the objectives set forth in A-7. The review and verification will check that the stipulated methods were implemented, and where failures occurred, assess the relative impact to the quality process.

Qualified or corrected procedures and data for the comparison to the state program standards will be acceptable if consistent with and sufficient to satisfy the project objectives.

D-1.3 Field Methods and Measurements

The site will receive a review of the implementation of methods and measurement criteria of Section B of the QAPP.

D-1.4 Laboratory Methods and Measurements

Data validation will include a review of the following items: chain-of-custody reporting and analytical completeness.

The Remediation Plan Coordinator will calculate, record and report failures of acceptance for replicate samples analyzed by the laboratory to the Terracon Project Manager. Calculations will be conducted relative to project-specific criteria of acceptance set forth in Section A-7. The Terracon Project Manager will discuss and evaluate failures relative to usability of the data and potential influence on project decision(s).

After validation of each laboratory package is completed, the laboratory results will be summarized in tabular form. The data summary report will include tabular summaries of analytical testing results, laboratory reports and a summary of data validation conclusions. In addition to the data summary report, data collected during the project will be summarized in the final report.

Measurements and procedures compliance will be compared to the QAPP with specific emphasis on performance within parameters of standard methods. The quality of the laboratory test results will be assessed through an evaluation of the results of the submitted QA/QC samples and laboratory internal QA/QC results. The laboratory data assessment procedures will consider the following items as set forth through Appendix B and Appendix C:

- Analytical Precision;
- Recounts;
- Completeness;
- Representativeness;
- Comparability;
- Sensitivity;
- Instrument calibrations;
- Data reduction and processing.

D-1.4.1 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, expressed in terms of Coefficient of Variation (CV) or relative standard deviation S_r. Analytical precision will be evaluated by comparing results from reference samples for each sample matrix analyzed in each of the following ranges: 5 to 20 fibers in 100 graticule fields, >20 to 50 fibers in 100 graticule fields, and >50 to 100 fibers in 100 graticule fields to obtain interlaboratory precision of fiber counts by analyst. For example:

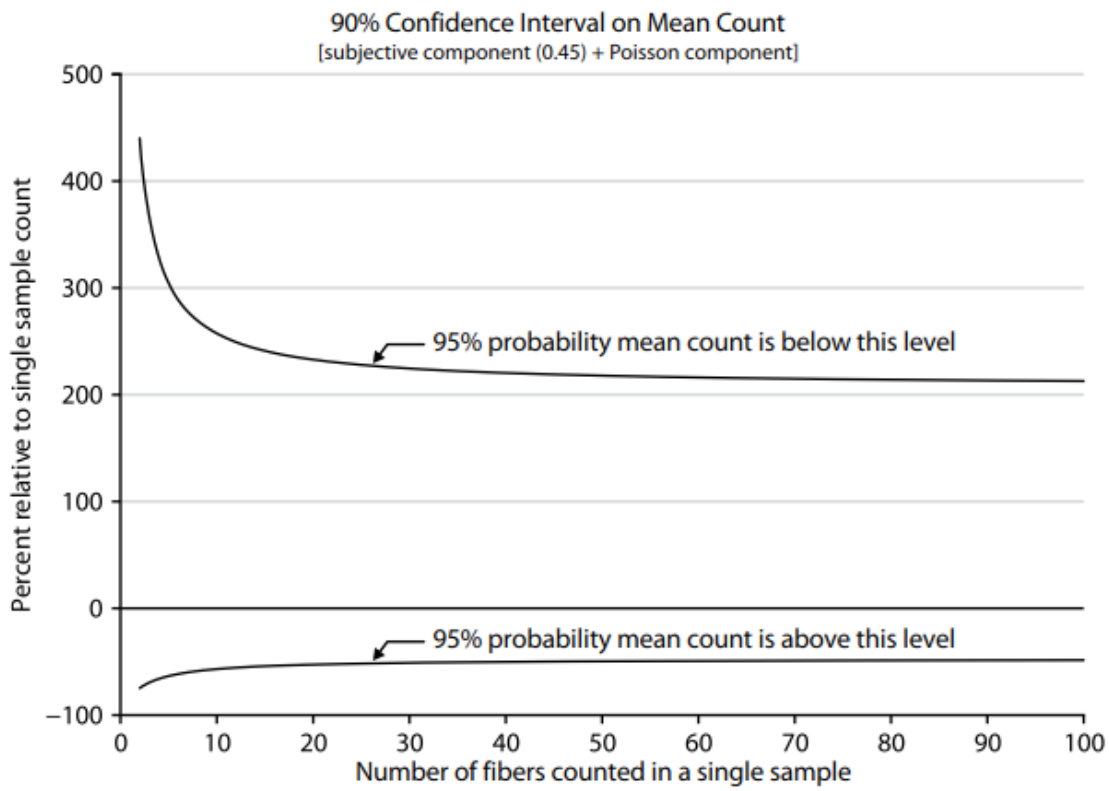


Figure 1. Interlaboratory precision of fiber counts.

The curves in Figure 1 are defined by the following equations:

$$U_{CL} = \frac{2X + 2.25 + [(2.25 + 2X)^2 - 4(1 - 2.25S_r^2)X^2]^{1/2}}{2(1 - 2.25S_r^2)} \text{ and}$$

$$L_{CL} = \frac{2X + 4 - [(4 + 2X)^2 - 4(1 - 4S_r^2)X^2]^{1/2}}{2(1 - 4S_r^2)},$$

where S_r = subjective interlaboratory relative standard deviation, which is close to the total interlaboratory S_r when approximately 100 fibers are counted,
X = total fibers counted on sample,
L_{CL} = lower 95% confidence limit, and
U_{CL} = upper 95% confidence limit.
Note that the range between these two limits represents 90% of the total range.

D-1.4.2 Recounts

Recounts are performed on 10% of the filters counted to ensure analysis agreement within specified parameters. The following test will be used to determine whether a pair of counts by the same counter on the same filter should be rejected because of possible bias: The sample will be discarded if the absolute value of the difference between the square roots of the two counts (in fiber/mm²) exceeds 2.77(X)(S'$_r$) where X = average of the square roots of

the two fiber counts (in fiber/mm²) and $S'_r = S_r / 2$ where S_r is the intracounter relative standard deviation for the appropriate count range (in fibers) determined in the Precision Section.

D-1.4.3 Accuracy

At this time, there is no independent means for assessing the overall accuracy of this method. One measure of reliability is to estimate how well the count for a single sample agrees with the mean count from multiple laboratories.

D-1.4.4 Completeness

Completeness is the amount of valid data obtained from a measurement system. Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The intent of this program is to attempt to achieve a goal of 100 percent completeness. Realizing that under normal conditions this goal may not be achievable, the completeness goal for this program is 95 percent. Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

Completeness = (Valid Measurements/Measurements Taken) * 100 %

D-1.4.5 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents environmental conditions and parameter variations at a sampling location. Representativeness is the selection of analytical methods and sampling protocols and locations such that results are representative of the media being sampled and conditions being measured. Representativeness is a qualitative parameter most concerned with the proper design of the sampling program. The representativeness criterion is best satisfied by assuring that sampling locations are properly selected, and a sufficient number of investigative samples are collected. Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the field sampling plan is followed and proper sampling techniques are used. Representativeness in the laboratory is ensured by using the proper analytical procedures and analyzing and assessing field duplicate samples.

D-1.4.6 Comparability

Comparability of the data collection activities must consider field conditions as well as sampling and analytical techniques. Comparability is an expression of the confidence with which one data set can be compared to another. Comparability cannot be ensured through the use of standard methods and protocols alone. In order to compare data, various important

elements will be considered. During this project, three elements will be evaluated for data comparability. These three elements include the following:

- Analytical methods;
- Quality of data; and
- Sampling design.

If after the initial evaluation, data do not appear comparable, the Laboratory Quality Assurance Manager will attempt to identify other components possibly affecting comparability, including field conditions, sampling protocols and the occurrence of true data anomalies. Comparability is dependent upon proper design and consistent execution of the sampling program. Analytical data will be comparable when similar analytical methods are used and documented.

D-1.4.7 Sensitivity

Sensitivity is the ability of the method or instrument to detect target compounds at the level of interest. Detection and quantification limits vary with the specific instruments used and analytical methods applied. Accordingly, specific laboratory methods have been selected based on method detection capabilities and laboratory-specific detection capabilities outlined in laboratory Quality Assurance Manuals.

In most cases, analyte-specific concentrations will be compared to established SC DHEC clearance criteria for asbestos. Consequently, QC with regard to laboratory sensitivities will require detection and quantification limits below these values for the specific contaminants of concern. Detection and quantification limits below other relevant standards will be sought when necessary.

The significance of elevated detection or quantification limits will be evaluated by the Terracon Project Manager and QA Reviewer on a sample-specific basis. Sample re-analysis may be sought if determined necessary to meet overall data quality objectives.

D-2: VALIDATION AND VERIFICATION METHODS

The Brownfields feasibility decision by the City is for use in evaluating whether response actions have removed asbestos-containing materials such that planned redevelopment activities may be completed. The data will be compared to the previously referenced state and federal clearance criteria for asbestos cleanup. The validation procedures of the Brownfields Project will be general and will focus on determining the proper collection, preservation and delivery of proper amounts of material under proper conditions to the laboratory for measurement and use in the final decision.

The Terracon Field Team Leader will be responsible for the validation of real time data generated during clearance sampling which will be conducted in order to decide if data generated is of sufficient quality to determine whether cleanup activities conducted at the site have met the project requirements for future use of the site. Once it is determined that cleanup activities have met the project requirements and site cleanup activities have concluded, a final cleanup report will be prepared.

An authorized QA Manager identified in Section A-4 will conduct a review of the final cleanup report. The review will consist of a comparison of a draft Response Action Completion Report and supporting field documents relative to compliance to the quality process and QAPP. The review will specifically address the following:

- A7: Quality Objectives and Criteria for Measurement Data.
- B1: Sampling Process Design.
- B2: Sampling Methods.
- B3: Sample Handling and Custody Requirements.
- B5: Quality Control Requirements.

The QA Manager will summarize deficiencies in writing to the Terracon Project Manager for resolution and evaluation of effect on the project decision(s).

The Terracon Project Manager will rely on standard methods conformance and the laboratory data packages to support valid analytical data.

D-2.1 Field and Management

The review will specifically evaluate the implementation of the following relative to field and management procedures as they apply to the Brownfields study. They will be property-specific regarding the quality of resultant data and will include the following:

- Conformance to design parameters of the QAPP and Quality Process of A-7.
- A sampling design as detailed in the project technical specifications.

- Sample collection procedures as prescribed in TSOPs of Appendix B and compared to field documentation and corrective audits of Section C-1.2.
- Sampling will be considered complete if 100% of the samples are obtained pursuant to the design.
- Sampling will be considered accurate if 100% of the TSOP procedures stipulated were used and documentation supports proper use.
- Sample handling protocols and chain of custody will be reviewed and holding and transport times must be met for the sample to be considered valid.
- Quality control checks will be conducted as they relate to field influences on data quality.

D-2.2 Laboratory Data

The Laboratory QA Reviewers will be responsible for validation of laboratory project implementation measures of success. The QA Reviewer will be responsible for the submittal of data packages to the Terracon Project Manager to support the quality management plans in Appendix B and Appendix C.

D-3: RECONCILIATION WITH USER REQUIREMENTS

The decision process by the City is an evaluation to assess whether the response actions were effective and the site may be redeveloped. The decision, including the data to support the decision, is considered quantitative for technical implementation. The data are the sole determinants in deciding if the property is feasible for the future planned renovation and office use.

With the increased reliance on laboratory systems to produce quality data, a significant failure to validate project data will be less likely to be used in the process. Laboratory data failures will be given more extensive consideration and will result in a written opinion by the Terracon Project Manager as to usability relative to the quality process and by the City. Key to the reconciliation will be the following considerations:

- Is the invalid or qualified data point the sole determinant?
- Does inclusion of the flawed method or qualified data point/set skew the resultant TAC 350 comparison?

If the resultant opinion of the Terracon Project Manager indicates that the data is not usable, additional samples will be required in order to meet the requirements of the QAPP and the project decision relative to the TAC 350 thresholds.

EPA suggests periodic QAPP review and updates relative to project parameters and program or regulatory guidance. The anticipated period of cleanup activity governed by the QAPP is indicated to be less than 4 months. No update or review is anticipated after approval.

This QAPP was prepared for the exclusive use of the Grantee for the specific application to the project discussed and has been prepared in accordance with generally accepted environmental engineering practices. No warranties, either express or implied are intended or made. In the event any changes in project parameters or regulatory guidance as referenced in this plan are identified, the QAPP cannot be considered valid unless the changes are reviewed and the conclusions of the plan are modified or verified in writing by Terracon's Project Manager.

ACRONYMS AND ABBREVIATIONS

μmhos/cm ..... micromhos per centimeter
AAI ..... All Appropriate Inquiry
ACM ..... Asbestos-Containing Material
AHERA ..... Asbestos Hazard Emergency Response Act
ARARs ..... Applicable or Relevant and Appropriate Requirements
AST ..... Aboveground Storage Tank
ASTM ..... American Society for Testing and Materials
BTEX ..... Benzene, Toluene, Ethylbenzene, and Xylenes
CAD ..... Computer-Aided Drafting
CERCLIS ..... Comprehensive Environmental Response, Compensation, and Liability Information System
CFR ..... Code of Federal Regulations
COC ..... Contaminants of Concern
CORRACTS ..... RCRA TSD Corrective Action Facilities
CSM ..... Conceptual Site Model
CWM ..... Clear Wide Mouth Glass Jar
DAO ..... Designated Approving Official
DO ..... Dissolved Oxygen
DQO ..... Data Quality Objective
EPA ..... Environmental Protection Agency
ESA ..... Environmental Site Assessment
eV ..... electron-volt
f/cc ..... fibers per cubic centimeter of air
GC ..... Gas Chromatograph
GIS ..... Geographical Information System
GPS ..... Geographical Positioning System
HASP ..... Health and Safety Plan
HAZWOPER ..... Hazardous Waste Operations and Emergency Response
HCl ..... Hydrochloric Acid
HNO_3 ..... Nitric Acid
HUD ..... United States Department of Housing and Urban Development
ICP ..... Inductively Coupled Plasma
IDW ..... Investigation Derived Waste
L ..... liter
LCP ..... Lead-Containing Paint
LCS ..... Laboratory Control Sample
LQAP ..... Laboratory Quality Assurance Programs
LQM ..... Laboratory Quality Manual
LUST ..... Leaking Underground Storage Tank

ACRONYMS AND ABBREVIATIONS (cont.)

MCL ..... Maximum Contaminant Level
mg/kg ..... milligrams per kilogram
mL ..... milliliter
MS/MSD ..... Matrix Spike/Matrix Spike Duplicate
MWSR ..... Monitoring Well Sampling Record
NaOH ..... Sodium Hydroxide
NELAC ..... National Environmental Laboratory Accreditation Conference
NESHAP ..... National Emissions Standards for Hazardous Air Pollutants
NFR ..... No Further Remediation
NIST ..... National Institute of Standards and Technology
NLLAP ..... National Lead Laboratory Accreditation Program
NTU ..... Nephelometric Turbidity Units
OSHA ..... Occupational Health and Safety Administration
OVM ..... Organic Vapor Meter
oz ..... ounce
PAH ..... Polycyclic Aromatic Hydrocarbon
PCB ..... Polychlorinated Biphenyl
PE ..... Professional Engineer
PPE ..... Personal Protective Equipment
PG ..... Professional Geologist
PLM ..... Polarized Light Microscopy
PQL ..... Practical Quantitation Limit
QA ..... Quality Assurance
QAPP ..... Quality Assurance Project Plan
QAMP ..... Quality Assurance Management Plan
QC ..... Quality Control
RCRA ..... Resource Conservation and Recovery Act
RPD ..... Relative Percent Difference
RSL ..... Regional Screening Level
SCDHEC ..... South Carolina Department of Health and Environmental Control
SESD ..... Science and Ecosystem Support Division
SOP ..... Standard Operating Procedure
SVOC ..... Semivolatile Organic Compound
TCLP ..... Toxicity Characteristic Leaching Procedure
TLS ..... Terracon Learning System
USEPA ..... United States Environmental Protection Agency
VOC ..... Volatile Organic Compound

APPENDIX A
Region 4 QAPP Checklist

REGION 4 QAPP REVIEW CHECKLIST
P = Present & Acceptable; NP = Not Present; I = Incomplete; NA = Not Applicable

QAPP Title: Quality Assurance Project Plan Rev. 0 for City of Pickens Brownfield Cleanup Project
Project Location: Former Pickens Rail Depot – 124 Railroad Street, Pickens, SC
Originating Organization: Terracon Consultants, Inc.
QAPP Date:
Receipt Date:
Review Date:
Reviewer:
SESD Project # (for QAPP review)_____

USEPA
REGION 4 OFFICE of QUALITY ASSURANCE and DATA INTEGRATION
QAPP REVIEW CHECKLIST

P = Present & Acceptable; NP = Not Present; I = Incomplete; NA = Not Applicable

ELEMENT	COMMENTS/PAGE
A1. Title and Approval Sheet	i
Title	i
Organization's name	i
Dated signature of project manager	i
Dated signature of quality assurance officer	i
Other signatures, as needed	i
A2. Table of Contents	ii-iv
A3. Distribution List	1-2
A4. Project/Task Organization	2-8
Identifies key individuals, with their responsibilities (data users, decision-makers, project QA manager, subcontractors, etc.)	4-8
Organization chart shows lines of authority and reporting responsibilities	4
A5. Problem Definition/Background	8-10
Clearly states problem or decision to be resolved	8-9
Provides historical and background information	8-10
A6. Project/Task Description	10-14
Lists measurements to be made	11
Cites applicable technical, regulatory, or program-specific quality standards, criteria, or objectives	11-12
Notes special personnel or equipment requirements	12
Provides work schedule	12
Notes required project and QA records/reports	12-14
A7. Quality Objectives and Criteria for Measurement Data	15-21
States project objectives and limits, both qualitatively and quantitatively	15-21

REGION 4 QAPP REVIEW CHECKLIST
P = Present & Acceptable; NP = Not Present; I = Incomplete; NA = Not Applicable

ELEMENT	COMMENTS/PAGE
States and characterizes measurement quality objectives as to applicable action levels or criteria	15-21
A8. Special Training Requirements/Certification Listed	22-24
States how provided, documented, and assured	22-24
A9. Documentation and Records	24-26
Lists information and records to be included in data report (e.g., raw data, field logs, results of QC checks, problems encountered)	24
States requested lab turnaround time	25
Gives retention time and location for records and reports	25-26
B1. Sampling Process Design (Experimental Design) States the following:	26-28
Type and number of samples required	26-28
Sampling design and rationale	26
Sampling locations and frequency	26-28
Sample matrices	26-28
Classification of each measurement parameter as either critical or needed for information only	26
Appropriate validation study information, for nonstandard situations	28
B2. Sampling Methods Requirements	28-32
Identifies sample collection procedures and methods	28-29
Lists equipment needs	32; Appendix B
Identifies support facilities	30
Identifies individuals responsible for corrective action	30-32
Describes process for preparation and decontamination of sampling equipment	29; Appendix B
Describes selection and preparation of sample containers and sample volumes	29; Table 2
Describes preservation methods and maximum holding times	32; Appendix B & C
B3. Sample Handling and Custody Requirements	33-35
Notes sample handling requirements	33-35
Notes chain-of-custody procedures, if required	34-35
B4. Analytical Methods Requirements	35-35; Table 2 (pg 29)
Identifies analytical methods to be followed (with all options) and required equipment	36; Table 2 (pg 29)
Provides validation information for nonstandard methods	36
Identifies individuals responsible for corrective action	36
Specifies needed laboratory turnaround time	36
B5. Quality Control Requirements	36-37

REGION 4 QAPP REVIEW CHECKLIST
P = Present & Acceptable; NP = Not Present; I = Incomplete; NA = Not Applicable

ELEMENT		COMMENTS/PAGE
	Identifies QC procedures and frequency for each sampling, analysis, or measurement technique, as well as associated acceptance criteria and corrective action	37; Table 3; 45-48
	References procedures used to calculate QC statistics including precision and bias/accuracy	37; 45-48
B6.	Instrument/Equipment Testing, Inspection, and Maintenance Requirements	37-38
	Identifies acceptance testing of sampling and measurement systems	37-38; Appendix B & C
	Describes equipment preventive and corrective maintenance	37-38; Appendix B & C
	Notes availability and location of spare parts	37-38; Appendix B & C
B7.	Instrument Calibration and Frequency	38-39
	Identifies equipment needing calibration and frequency for such calibration	38
	Notes required calibration standards and/or equipment	39; Appendix B & C
	Cites calibration records and manner traceable to equipment	38
B8.	Inspection/Acceptance Requirements for Supplies and Consumables	39
	States acceptance criteria for supplies and consumables	39; Appendix B & C
	Notes responsible individuals	39
B9.	Data Acquisition Requirements for Non-direct Measurements	39-40
	Identifies type of data needed from non-measurement sources (e.g., computer databases and literature files), along with acceptance criteria for their use	39-40
	Describes any limitations of such data	NA
	Documents rationale for original collection of data and its relevance to this project	39-40
B10. Data Management		40
	Describes standard record-keeping and data storage and retrieval requirements	40
	Checklists or standard forms attached to QAPP	40
	Describes data handling equipment and procedures used to process, compile, and analyze data (e.g., required computer hardware and software)	40
	Describes process for assuring that applicable Office of Information Resource Management requirements are satisfied	40
C1.	Assessments and Response Actions	40-43
	Lists required number, frequency and type of assessments, with approximate dates and names of responsible personnel (assessments include but are not limited to peer reviews, management systems reviews, technical systems audits, performance evaluations, and audits of data quality)	41-42; Table 4
	Identifies individuals responsible for corrective actions	40

REGION 4 QAPP REVIEW CHECKLIST

P = Present & Acceptable; NP = Not Present; I = Incomplete; NA = Not Applicable

ELEMENT	COMMENTS/PAGE
C2. Reports to Management Identifies frequency and distribution of reports for:	43-44
Project status	44; Table 5
Results of performance evaluations and audits	44; Table 5
Results of periodic data quality assessments	44; Table 5
Any significant QA problems	44; Table 5
Preparers and recipients of reports	44; Table 5
D1. Data Review, Validation, and Verification	45-49
States criteria for accepting, rejecting, or qualifying data	45-49
Includes project-specific calculations or algorithms	45-49
D2. Validation and Verification Methods	50-51
Describes process for data validation and verification	50-51
Identifies issue resolution procedure and responsible individuals	50
Identifies method for conveying these results to data users	50
D3. Reconciliation with User Requirements	51-52
Describes process for reconciling project results with DQOs and reporting limitations on use of data	51-52

Final QAPP disposition:

___ *Approved, no comments*

___ *Approved with comments, resubmittal* ***not*** *required*

___ *Conditionally approved, comments must be addressed, resubmittal required*

___ *Not approved, comments must be addressed, resubmittal required*

References

EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, March 2001, EPA/240/B-01/003,
Guidance for Quality Assurance Project Plans, EPA QA/G-5, December 2002, EPA/240/R-02/009
(Available from EPA's Website: http://www.epa.gov/quality)

APPENDIX B

1 – Terracon Corporate Quality Program Manual

2 – Terracon Standard Operating Procedures

3 – Terracon Asbestos Phase Contrast Microscopy Quality Assurance Program Manual

4 – Terracon IHPAT Results

5 – SCDHEC – R. 61-86.1, R. 44-56, R. 44-96

Corporate Quality Program Manual

Prepared by:
Quality Program Committee

Approved by:
Executive Committee
05.06.2015

Revision:
Rev. 04.20.2015

Quality

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Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

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1. OVERVIEW

1.1 Corporate Philosophy on Quality Services

Terracon has adopted a Quality Program as described in this Corporate Quality Program Manual (QPM). Terracon's Quality Program is based on a continuous improvement philosophy that involves our employees and, when applicable, subconsultants, vendors, and users of our services. Quality service for our clients is achieved by following the methods and practices that have been developed at Terracon for the services being provided.

Terracon is committed to providing quality services to our clients and assigning qualified and dedicated staff to every project. This commitment is a key component of our "Delivering Success to Employees, Clients and Communities" mission statement. Commitment to quality begins with the President and extends to every member of Terracon's staff. Terracon is committed to providing professional services that:

- are consistent with professional practice;
- provide accurate tests and measurements;
- are openly communicated with our clients; and
- adhere to the agreed upon contractual requirements

Terracon also continuously seeks to find improvements in practices and procedures to better serve our clients' needs. Services are supervised by senior professionals and managers who have experience and knowledge in the service(s) being provided. Terracon will not perform work for which we are not adequately experienced or knowledgeable, or if we are unable to provide an appropriate quality of service.

1.2 Program Components

Terracon has established specific operational positions, procedures, practices, and programs to ensure quality service to our clients at the individual project level. They include:

- lines of responsibility, authority, and accountability;
- standard processes and practices;
- quality control of project execution; and
- project quality assurance

Terracon also continually evaluates internal policies at the corporate and office levels by examining individual implementation of these policies. Policy evaluation is accomplished through the following Corporate-level positions, committees, policies, and practices:

- Director of Quality and Project Delivery,
- Executive Committee,
- Quality Program Committee,
- APR Review Committee,
- Service Line Committees,
- Office and Laboratory Quality Audits,

- Manuals and Practice Guidelines, and
- Nuclear Quality Assurance-1 (NQA-1) Quality Program

Each of these positions, committees, policies, and practices combine to help us achieve quality service for our clients. Each is discussed in more detail below.

1.3 Program Implementation

The Director of Quality and Project Delivery (DQPD) is responsible for developing and monitoring the Quality Program. Terracon's Legal Department maintains the QPM and related materials. Program implementation at the corporate level has been assigned to the Service Line Directors. Implementation functions include preparation, distribution, and revision of program documents; staff training; and internal system review.

Responsibility for promoting and enforcing the Quality Program at the operational level lies with the Division Managers. These responsibilities include promoting the program within their divisions; assigning responsibility, authority and accountability to appropriate managers; and enforcing implementation. Office Managers, Project Managers, Authorized Project Reviewers, LEVEL 1 Reviewers, and staff are responsible for day-to-day implementation of the Quality Program for project work.

2. DEFINITIONS

As used in this Manual, the following terms have the following meanings:

Authorized Project Reviewer (APR) is a senior technical professional within Terracon who has been recognized in his/her service line as capable and qualified to mentor project managers and review project deliverables and performance as required in our Project Quality Review Manual. An APR is authorized to perform a LEVEL 1, LEVEL 2, or LEVEL 3 review in his/her area of experience.

APR Review Committee (APRRC) is a committee made up of senior APRs (representing each division and service line) appointed by Service Line Directors in conjunction with Division Managers. Their responsibilities are to identify potential APR candidates and mentor them through the APR selection process, participate in evaluating the performance of existing APRs, support and lead APR training at the division level, identify and assist in remediation of any division/service line quality issues, and serve as a "committee" for the service lines to help lead and support any quality initiatives that may occur.

Director of Quality and Project Delivery (DQPD) reports directly to the President and is responsible for continually monitoring the quality of our services and is responsible for developing and monitoring the Quality Program and the review processes of the Project Quality Review Manual.

Large/Complex Projects are those that, as determined by the Office Manager because of their size or scope, carry significant investments by our clients or significant risk to Terracon and require a LEVEL 3 review.

LEVEL 1 Reviewer is approved by the Office Manager and is authorized to review project deliverables or tasks relating to field and laboratory observations and test data collection that do not contain opinions, recommendations, or conclusions**.**

Manuals are documents prepared by Service Line Committees or corporate staff to describe Terracon's operational and administrative procedures and practices to meet quality objectives. Manuals are prepared as needed to cover specific practices or services (e.g., Quality Systems Manual for Materials Laboratory, Project Quality Review Manual, etc.).

Office Manager includes both Office Managers and Regional Managers with Office Manager responsibilities over a specific office.

Practice Alerts are communications by the various Service Line Committees to notify practitioners of current issues in the practice. The publication's purpose is to communicate timely information and to provide technical references to resources on a current topic affecting the service line. This publication is not designed to act as best practice guidelines or to establish service line procedures. Publications are prepared as needed.

Practice Guidelines are publications prepared by the various Service Line Committees to provide internal best practice guidelines and to establish procedures for specific technical services. The publications' purpose is to provide training and guidance for Terracon practitioners. Publications are prepared as needed.

Project Manager is a technical professional within Terracon who is responsible for overall quality, project delivery, and client service of projects he/she manages.

NQA-1 Program Quality Director (NQA-1 PQD) is Terracon's lead auditor responsible for compliance with all NQA-1 procedures, oversees audits, and interfaces with Division, Office and Operating Group Managers on compliance and performance on NQA-1 projects. The NQA-1 PQD must be a Terracon-certified NQA-1 Lead Auditor. The NQA-1 PQD can also serve as the Project Quality Assurance Manager on an NQA-1 Project.

Project Quality Assurance Manager (PQAM) is Terracon's assigned technical professional who oversees quality assurance on designated projects that have a project-specific quality assurance program, such as nuclear or "safety-related" projects. The DQPD designates specific projects and assigns the PQAM. For projects that require NQA-1 quality requirements, the PQAM must be a Terracon-certified NQA-1 Lead Auditor.

Project Quality Review Manual is an internal document where the specific quality control review requirements established by this Manual are set out in detail.

Quality Control consists of the procedures and practices established for executing Terracon's services to achieve quality objectives. This means establishing those

measurements (i.e., standards, specifications, or criteria) and then controlling, monitoring, or measuring the services performed through checks, tests, or confirmations so quality objectives are met.

Quality Assurance is the assessment process of reviewing, monitoring, and auditing to verify that quality control procedures and practices are fully incorporated and are meeting quality objectives.

Quality Program summarizes Terracon's overall approach, policies, and procedures relating to quality and is formally documented in the Corporate Quality Program Manual.

Quality Program Committee (QPC) is a committee appointed by the Executive Committee to oversee Terracon's Quality Program. The committee is co-chaired by the DQPD and General Counsel, and includes Service Line directors and representative members from the respective service lines and operating groups.

Service Line Committee is a group of senior technical professionals within Terracon that is responsible for overseeing the practices and activities of an individual service line.

Service Line Director is the senior technical professional within Terracon appointed to supervise the policies, practices, and activities of our individual service lines.

TerraNet is Terracon's electronic intranet, supplying valuable information, policies, and procedures to our employees in an easily accessible format and access to the service line and office sites.

Lead Project Auditor (LPA) is Terracon's assigned auditor for quality assurance of project activities and/or testing laboratories for specific projects designated by the DQPD.

Certified NQA-1 Lead Auditor is a technical professional who has received and passed industry-recognized NQA-1 Lead Auditor Training and meets NQA-1 specified experience that has been approved by the Terracon DQPD. The company certification is on an annual basis.

3. QUALITY PROGRAM AT THE PROJECT LEVEL

Terracon has specific lines of responsibility at all employee levels to ensure quality service. Specific lines of responsibility exist for all phases of each project, and projects are subject to multiple levels of review depending on their size and complexity. These lines of responsibility help to ensure the quality of our service at the project level.

3.1 Individuals' Responsibility

Our primary mechanism for achieving quality on every project lies with the individual performing the work. Each employee of Terracon has responsibilities for professional,

technical, or administrative quality, whether on client projects or internal service assignments. Those responsibilities include:

- adhering to the requirements of the Quality Program;
- clearly understanding the needs of the client;
- conducting the assignment in accordance with quality control requirements and documenting quality control where applicable;
- participating in appropriate technical training; and
- supporting and maintaining quality control procedures and initiating system improvements when deficiencies are noted

3.2 Project Manager Responsibility

Terracon's Project Managers are accountable for the overall quality of projects they manage. Each project is assigned to a professional with the necessary skills to manage the project. The assigned professional serves as Project Manager and is responsible for verifying that the applicable quality control criteria, project quality review, and company policies have been followed for all phases of the project. The Project Manager is also responsible for knowing licensing and certification requirements and ensuring that they are met. Checks and reviews are conducted by the Project Manager, as required, as the work progresses.

3.3 Project Review

3.3.1 Levels of Project Review

Terracon provides a wide variety of services to its clients. These services range from simple data acquisition to engineering and project management for large, complex projects. Consequently, the required level of Quality Control varies from project to project. Three Quality Control processes have been established by this Manual and outlined in specific detail in Terracon's Project Quality Review Manual. Levels 1 through 3 are of increasing intensity. While LEVEL 1 refers specifically to review of facts and data, LEVEL 2 and LEVEL 3 refer to overall quality processes, including involvement in projects from beginning to completion, review and advisement at critical junctures, deliverable reviews and project manager mentorship. In those two cases, we refer to LEVEL 2 and LEVEL 3 as 'Quality Processes' to reinforce the role of the APR is more than just review of deliverables.

LEVEL1 review applies to project deliverables or tasks containing field and laboratory observations and test data collection that **do not** contain opinions, recommendations, or conclusions. It requires the involvement of an approved LEVEL 1 Reviewer.

As mentioned, the LEVEL 2 and LEVEL 3 processes, apply to project deliverables that contain opinions, recommendations, and conclusions. They require the involvement of an Authorized Project Reviewer (APR). In addition to project deliverables, APRs are

expected to be involved in proposal reviews and to engage on the project at its earliest stages, as further defined in the PQRM.

- A LEVEL 2 process must be provided by an APR and is required on all project deliverables containing opinions, recommendations, or conclusions regardless of the project size or complexity.

- A LEVEL 3 process is an additional, independent oversight required for Large/Complex Projects. This is in addition to the required LEVEL 2 APR process. A LEVEL 3 process must be performed by an APR who works in a different office from the one providing the LEVEL 2 oversight.

The table on the following page outlines these processes and responsibilities in detail:

LEVELS OF QUALITY PROCESSES

Quality Process Level	Project Type	Description and Documentation
LEVEL 1: (Assigned by Project Manager)	Project deliverables or tasks providing field and laboratory observations and test data collection. Do not contain opinions, recommendations, or conclusions.	(a) Independent check of field and laboratory observations, data and calculations by a LEVEL 1 Reviewer approved by the Office Manager. (b) Documentation by initials and dates on deliverables.
LEVEL 2: (Assigned by Department Manager)	Projects where opinions, recommendations, or conclusions are provided.	LEVEL 1 plus: (a) Appointment of APR to review of data quality, data interpretation, analytical methods, calculations, results, opinions, recommendations, and conclusions. (b) Mentors Project Managers on aspects of project delivery (c) Document by signature of APR on project deliverables. (d) Involved at the earliest possible stage of the project (e) Dual signatures, with at least one APR, are required on proposal and project deliverables, as outlined in the PQRM (with exceptions noted therein)
LEVEL 3: (Assigned by Office Manager)	Required on Large/Complex Projects. A large or complex project is one that, because of its size or scope, carries a significant investment by either Terracon or its clients, such as a high-rise structure, large-scale commercial or brownfield development, large industrial manufacturing/processing facility, or an extensive infrastructure/transportation project. More detail is provided in the PQRM. **NOTE:** In accordance with Section 3.4 of this manual, certain projects require mandatory LEVEL 3 reviews.	LEVEL 2 plus: (a) Additional independent oversight by an APR in the same discipline outside the local office who is not already involved in the project. Includes proposal review by both LEVEL 2 and 3 APRs. (b) On unique technical projects, an additional independent review by a specialist or consultant from outside the company that is recommended by the LEVEL3 APR and approved by the Office Manager. (c) Written documentation of independent review (form in Appendix J) should be placed in the project file and a copy should be provided to the appropriate Service Line Director. Third signature on project documents is not required.

3.3.2 Project Reviewer Responsibility

All project deliverables or tasks require a secondary review by an additional person who is not the generator of the deliverable or task. The specific level and extent of review depend on the deliverable or task (LEVEL 1, 2, or 3 as described above) and the review must be performed by individuals authorized to perform the required review. LEVEL 1 Reviewers and APRs are selected and approved according to processes outlined in the Project Quality Review Manual. If the author of the document is an APR, the review of the work by an APR shall be done by someone who is qualified by experience and technical expertise to perform such review.

In addition to the 'review of deliverables', the LEVEL 2 and 3 APRs are also assigned to mentor the project manager on all aspects of the project beyond the final work products. APRs are to be involved at project start up, critical junctures, status evaluations of project execution, including assessment of ability to meet scope, schedule and budget. All client interactions that relate to our technical work products, ability to meet contractual obligations, or discussions on changes to the project should also involve the APR.

3.3.3 Quality Assurance for Designated Projects (Non NQA-1)

When appropriate or required by project contract, a Project Quality Assurance Manager (PQAM) will be assigned by the DQPD. It is the duty of the LEVEL 3 Reviewer to notify the DQPD of such activities so the PQAM can be assigned. The Project Manager will prepare a project-specific quality program manual approved by the PQAM prior to providing services for such designated projects. The quality control manual should indicate control and verification measures that should be planned, documented and implemented at predetermined points throughout the life cycle of the project. The manual should provide control from initiation of activities through their completion.

Certain types of projects require specific levels of quality assurance. Those projects, which shall be designated by the DQPD, will include audits of project activities and/or testing laboratories, scheduled in a manner to provide coverage and coordination with on-going activities based on the importance and status of the activity. The frequency of audits and the selection of the audit team is the responsibility of the PQAM. The Lead Project Auditor (LPA) will be designated for each audit by the PQAM, in concert with the DQPD.

3.3.4 Quality Assurance for NQA-1 Projects

When an NQA-1 Quality Program is required by project contract, a Project Quality Assurance Manager (PQAM) will be assigned by the DQPD, with input from the NQA-1 PQD. It is the duty of the APR to notify the DQPD and NQA-1 PQD of such activities so the PQAM can be assigned. The NQA-1 project shall adhere to the Terracon NQA-1 Quality Assurance Manual, and all requirements and procedures shall be implemented and followed. In addition, the Project Manager will prepare a project-specific quality plan approved by the NQA-1 PQD prior to providing services for the NQA-1 project. The

quality plan shall include project-specific quality and work procedures for the contracted work.

NQA-1 projects require specific levels of quality assurance that include audits of project activities and/or testing laboratories, scheduled on at least an annual basis. The NQA-1 PQD will direct and oversee the implementation of the NQA-1 PQAM. The frequency of audits and the selection of the audit team is the responsibility of the NQA-1 PQD. The NQA-1 Lead Auditor will be designated for each audit by the NQA-1 PQD, in concert with the DQPD and the Service Line Director.

Although NQA-1 designated projects are subject to the Terracon NQA-1 Quality Assurance Manual, the requirements and expectations of this Corporate Quality Program Manual still apply. Additionally, NQA-1 projects may develop and implement a project-specific NQA-1 Quality Program Manual, as necessary or as required.

3.4 Specific Quality Control and Quality Assurance Responsibilities

Terracon has established specific Quality Control and Quality Assurance responsibilities for its projects. The Table on the following page outlines and summarizes Terracon's Quality Control and Quality Assurance responsibilities.

TERRACON QUALITY CONTROL AND QUALITY ASSURANCE RESPONSIBILITIES

Role	Quality Control (Controlling operations to achieve quality)	Quality Assurance (Quality verification)
Performs project services consistent with company methods, practices, and core values.	Individual responsibility of all staff	
Reviews projects deliverables or tasks relating to field and laboratory observations and test data collection that do not contain opinions, recommendations, or conclusions.	LEVEL 1 Reviewer	
Responsible for overall quality, product delivery, and client service of project.	Project Manager	
Assigns LEVEL 2 APR to projects containing deliverables with opinions, recommendations, or conclusions. Works with the Project Manager to ensure that qualified staff is assigned to the project.	Department Manager	
Provides technical oversight of LEVEL 1 Reviewer. Provides LEVEL 2 project guidance, mentoring and review of deliverables containing opinions, conclusions, or recommendations. Provides LEVEL 3 independent review on Large/Complex Projects when required.	Authorized Project Reviewer (APR)	
Function as representatives of the service line and divisions to assist in the implementation of the quality program, including identifying potential APR candidates and mentoring them through the APR selection, participating in the APR evaluation and project review process, supporting and leading APR training at the division level, identifying and assisting in remediation of any division/service line quality issues and serving as a “committee” for the service lines to help lead and support any quality initiatives that may occur.	APR Review Committee (APRRC)	
Responsible for implementing policies and systems necessary to achieve project quality. Determines whether LEVEL 3 review is required on a project and appoints appropriate LEVEL 3 APR.	Office Manager	

Role	Quality Control (Controlling operations to achieve quality)	Quality Assurance (Quality verification)
Promotes and enforce Quality Program procedures. Assumes responsibility, authority, and accountability for quality of projects within Division.	Division Manager	
Assumes responsibility, authority, and accountability for quality of projects within Operating Group.		Operating Group Manager
Implements Quality Program and recommends continuous improvements.		Service Line Director
Develops and monitors Quality Program.		Director of Quality and Project Delivery
Sets corporate philosophy regarding quality. Promotes attitudes, processes, and procedures necessary to achieve quality.		President

4. QUALITY PROGRAM AT THE CORPORATE LEVEL

Terracon is committed at a corporate level to maintaining high levels of quality and client service. To that end, Terracon constantly evaluates internal operations to improve the quality of our client service. Various positions, committees, and programs described below have been established to monitor and analyze the performance of our services with an emphasis on improving quality. The President sets corporate policy regarding quality and promotes attitudes, processes, and procedures that are necessary to achieve quality services.

4.1 Director of Quality and Project Delivery

Terracon created a senior officer level position devoted solely to maintaining and improving the quality of our service. The DQPD answers directly to the President. The DQPD is charged with continually monitoring the quality of our services and is responsible for developing and monitoring the Quality Program and the Project Quality Review process. This individual works with Division Managers, Service Line Directors, and practitioners to improve our quality of service to our clients and studies our current operations to determine areas of quality improvement.

4.2 Executive Committee

Terracon's Executive Committee meets regularly to discuss issues and set policy regarding operations and client services. This committee is composed of the President, Operating Geographic Managers and other key senior managers. This committee continuously evaluates

the processes and procedures of our operations to find areas of improvement. Client service, product delivery, and achieving quality are top priorities of the Executive Committee.

4.3 Quality Program Committee

Terracon established the Quality Program Committee (QPC) to oversee Terracon's Quality Program. The committee is co-chaired by the DQPD and General Counsel, and includes Service Line Directors and representatives from operating groups. The QPC meets monthly and continuously evaluates the quality of our services. The QPC provides oversight to the respective Service Line Committees on quality-related issues and designs and implements quality-related improvements to our operations.

4.4 Technical Service Line Committees

Terracon has established specific Service Line Directors and Service Line Committees for the core services we provide to clients. Each committee meets regularly and discusses a variety of issues that relate solely to the performance of the specific service line. These committees seek continual improvement of the quality in the specific service line to better serve our client needs. The committees conduct internal training and publish Manuals, Practice Guidelines, and Practice Alerts to assist employees at all levels.

4.5 APR Review Committee

The APR Review Committee (APRRC) is designated by the Service Line Directors and Division Managers to assist in implementation of the APR program within their Divisions. The APRRC members have a specific responsibility to mentor staff who are desirous to become APRs, and to make sure they are prepared and ready to take on the responsibility of an APR. In addition, the APRRC assists the Division Manager in training APRs, and leads evaluation of APRs. Each APR is evaluated on a three-year cycle regarding their performance as an APR. The overall evaluation process and feedback to the APR are led by the APRRC members. In addition, the APRRC members work together to identify common issues in the company regarding implementation of the APR program and assist in leading efforts across the company to improve quality through improving the performance, training, and preparation of each APR.

4.6 Manuals, Practice Guidelines, and Practice Alerts

Manuals, Practice Guidelines, and Practice Alerts are used to assist staff with the procedures and requirements for specific services. These publications set forth specific practices and procedures for the service line and/or provide timely updates on current technical issues affecting each service line. They are available through individual Service Line Directors or electronically through TerraNet.

5. COMMITMENT TO QUALITY

Terracon is committed to providing quality services with experienced technical and professional staff through a comprehensive Quality Program. As evidence of our commitment to evaluating and improving our quality, we consistently audit our quality service procedures with both internal and external reviews. An officer of the company is responsible for the program and is devoted to improving the quality of our services. As outlined in this Corporate Quality Program Manual, fundamental aspects of the Quality Program include training and experience requirements for various technical and professional positions, senior-level deliverable review requirements, and APR performance reviews. Through these programs, our technical and professional staff receives training in technical issues as well as communication and client service. Quality audits of each office are conducted on a regular basis as part of the Quality Program. With the help of these procedures, we are able to deliver our services on a timely basis with consistently high value and attention to clients' needs.

E.10
PROJECT MOBILIZATION

Last Review / Revision: December 2013
Reviewer / Office: DEK/Corporate

OBJECTIVE

Allow field personnel an opportunity to review the requirements and objectives for performing the necessary field tasks and discuss with the project manager concerns associated with the project, safety, and methodologies.

Key to Terracon's Incident and Injury Free culture is pre-task planning. Pre-Task Planning is the most proactive skill we can learn to create and sustain an IIF workplace and make sure all of our employees go home safely every day. It is required from the very beginning when preparing proposals and starting projects, as well as when we assign work and execute the tasks throughout the day. This includes mobilization for projects.

PROCEDURE

Field personnel should discuss the proposed field activities with the project manager prior to initiating the site work. This will be a formal "sit down, face-to-face" transfer of project information and objectives from the Project Manager to the designated field or task manager. All parties will engage in the planning. This should include, but not be limited to, discussions on:

Project Objectives

Assure that personnel have an understanding of the objectives prior to initiating the field activities. This will provide a greater insight and allow field personnel to make appropriate decisions based on site specific conditions. This briefing provides background information which allows the field personnel to think about field operations in a way which will optimize performance and data gathering efficiency.

Discuss the regulatory framework within which the report and results of field work will be used. Identify special requirements of specific regulatory programs.

Specific to EPA Brownfield Grant or Pilot Projects of Any Type
The mobilization Team will have in hand as part of planning mobilization copies of the following;

- Site eligibility determination approved by EPA Project Officer
- Access agreement signed by the property owner, not a tenant
- EPA-approved Quality Assurance Project Plan (QAPP)
- EPA-approved Sampling and Analysis Plan

Site Safety Plan (SSP)

Staff will implement IIF using the Terracon *Pre-Task Planning Quick Reference Sheet*, available here if viewing this electronically or it can be printed from the Terranet Corporate Safety Website under the IIF Toolbox section.

The team will then review the SSP with the project manager and sign the acknowledgement. Confirm that you have the proper monitoring equipment, protective clothing and respiratory device and confirm that you are aware of the monitoring requirements and safety level.

Permits/Right of Entry (R.O.E.)/Utility Clearance

Make sure that the proper permits, R.O.E. and utility clearance have been secured. This will avoid delays at the job-site. Determine that all parties, including the client, property owner or tenant, and regulatory official have been notified, if necessary.

Drilling/Development/Sampling Requirements

Review the drilling/development/sampling requirements to allow for satisfactory completion. Determine location of all borings/monitoring wells and the soil and groundwater sampling sequence for chemical analysis and definition of the stratigraphy.

Decontamination

Review cleaning procedures and TSOPs for the drilling equipment and/or sampling equipment. This is imperative to minimize cross-contamination and maintain safe site conditions.

Communications

Establish a communications link in the event that field personnel must consult with the project manager or designee in instances when the project manager cannot be reached.

Chain-of-Custody

Review the procedures to provide for proper Chain-of-Custody maintenance from sample collection through analysis.

Equipment

Confirm that the proper equipment is available, functional, cleaned, and calibrated. The project manager should provide a checklist of all equipment required, especially when the equipment needs to vary from the norm.

DOCUMENTATION

The project manager is responsible for providing the following documentation to the field crews prior to field activities:

- Site Safety Plan (completed)
- Mobilization Sheet
- Site Location Map
- Site Diagram
- Field manuals and references as appropriate
- Site photography, when appropriate and allowed

E.20
STANDARD SAFE OPERATING PROCEDURES FOR HAZARDOUS WASTE OPERATIONS

Last Review or Revision: June 2010

I. PURPOSE

This document defines standard safe operating procedures for use on project sites where intrusive activities will be preformed and where soil/groundwater contaminants are known or are reasonably expected to exist. These procedures will be incorporated in the project safety and health plan which is mandatory for intrusive activities conducted at all such project sites.

II. SAFETY AND HEALTH RESPONSIBILITY

A. The Project Manager is ultimately responsible for ensuring that work on environmental investigation/remediation projects are performed in accordance with provisions outlined in the project safety and health plan. A Site Safety and Health Officer (SSO) will be designated at each project site to monitor compliance with this safety-related practices during field activities. The SSO will ensure that a copy of the safety and health plan is available on site for the duration of project activities.

B. The Corporate Safety and Health Manager will be consulted for each intrusive environmental investigation/remediation project. The Corporate Safety and Health Manager will develop the site safety and health plan, and will be available to consult with Project Manager/SSO in the event of questions, concerns or changed site conditions. The Corporate Safety and Health Manager will specify air monitoring and personal protective equipment requirements for the project, and will assist in obtaining specialized equipment required for the project.

C. If hazardous conditions develop during the course of project activity, the SSO in conjunction with the Terracon Corporate Safety and Health Manager, will coordinate actions required to safeguard site personnel and members of the general public. Additional safety measures will be verbally communicated to all project personnel, recorded in writing and appended to the site safety and health plan.

D. Terracon and subcontractor task leaders will be responsible for:

- Presenting the contents of the site safety and health plan to all subordinate site personnel.
- Monitoring compliance with applicable provisions of the safety and health plan.

- Periodically inspecting heavy equipment and other machinery and maintaining such equipment in compliance with applicable federal, state or local safety regulations.

- Enforcement of corrective actions.

III. MEDICAL SURVEILLANCE

A. All Terracon personnel participating in intrusive projects with known or reasonably anticipated contaminants must be enrolled in the Terracon Medical Surveillance Program. Each project participant will be certified by a licensed physician as fit for respirator and semi-permeable/impermeable protective equipment use. Medical clearance will be current to within one year of the project start date.

B. Certificates of medical examination for all project personnel will be maintained by the Corporate Safety and Health Manager and/or by the SSO in the project command center or support vehicle.

C. At the discretion of the Terracon consulting physician, an "exit" physical examination will be conducted at the completion of project activities or upon termination of a project participant. Follow-up medical examinations will also be provided in the event of job site injury or unprotected exposure to contaminants in excess of eight-hour time weighted average permissible exposure limits.

IV. TRAINING REQUIREMENTS

A. Terracon personnel participating in hazardous waste operations will have completed 40 hour Hazardous Waste Operations Training and at least three days supervised field activity. A current 8-hour annual refresher training certificate will be required for all personnel. Training certificates for all project personnel will be maintained by the Corporate Safety and Health Manager.

B. The SSO will conduct a pre-project safety and health briefing for all project participants. The personnel responsible for project safety and health will be addressed, as will site history, scope of work, site control measures, emergency procedures and site communications. The briefing will address site contaminants, air monitoring protocols, action levels for upgrade/downgrade of personal protective equipment and level of personal protective equipment to be employed for each project task.

C. Project participants will sign the Acknowledgment of Instruction form contained in each safety and health plan following the initial site briefing.

V. CHEMICAL HAZARDS

A. The Project Manager is responsible for obtaining available information regarding site contaminants, including analytical information obtained from samples previously collected at the project site, and for forwarding the information to the Corporate Safety and Health Manager for research and hazard analysis. A site specific safety and health plan will be developed notifying personnel of the

potential chemical contaminants, their health hazards, routes of entry, warning properties and symptoms of exposure.

B. Evaluation of chemical contaminants/concentrations will be used in the development of the air monitoring and personal protective equipment requirements contained in the site safety and health plan.

VI. PHYSICAL HAZARDS

A. Drilling Projects

- All personnel working around drill rigs will be familiarized with emergency shut-down procedures and the position of "kill" switches.
- No loose fitting clothing, jewelry or unsecured long hair is permitted near the rig.
- Keep hands and feet away from all moving parts while drilling is in progress. Shovel auger cuttings with long handled shovel. *DO NOT* use hands or feet.
- Daily inspection of all ropes, cables and moving parts is mandatory.
- A first aid kit and fire extinguisher will be immediately available at all times.
- All drill crews shall consist of at least two persons.
- No drilling is permitted during impending electrical storms, tornadoes or when rain creates a hazardous work environment.
- A minimum horizontal and vertical clearance distance of **10 feet** must be maintained between the drill rig and overhead power lines; use spotters to help rig operator position the vehicle when near overhead power lines.

B. Excavation Project Sites

- Wherever possible, soil samples will be collected from backhoe buckets. Personnel will enter excavations only as a final option and only in accordance with the regulatory requirements outlined above.
- AT NO TIME WILL TERRACON PERSONNEL ENTER EXCAVATIONS TO COLLECT SOIL SAMPLES UNTIL A PROPER MEANS OF EGRESS/EXIT IS PROVIDED AND THE EXCAVATION HAS BEEN INSPECTED BY A COMPETENT PERSON AND APPROPRIATELY SHORED OR SLOPED IN ACCORDANCE WITH THE OSHA EXCAVATIONS STANDARD (29 CFR 1926, SUBPART P).
- Personnel will remain at least 3 feet from the sides of excavations during sample collection and excavation observation.
- Personnel will remain outside the swing radius of backhoe buckets during excavation, and will stand behind the backhoe or within line-of-sight contact with the backhoe operator at all times.

VII. ACCIDENT PREVENTION

- The Site Safety Officer will hold daily safety briefings at the beginning of each day of site activity.

- Traffic control measures will be arranged for all projects conducted within or immediately adjacent to active roadways. Signage, warning and/or channelizing devices will conform to the Manual on Uniform Traffic Control Devices. Flagging operations will be conducted only by personnel who have received training in proper traffic flagging procedures. The preferred method of traffic control will be to contract these services to a reputable traffic control service knowledgable in local traffic control regulations.

- Safety orange work vests will be worn by personnel working within 10 feet of any active roadway.

- The Site Safety Officer will ensure that unauthorized personnel do not enter the work zone. Authorized visitors will be briefed on site contaminants, personal protective equipment requirements and the decontamination provisions of the site safety and health plan.

- The Site Safety Officer will continually inspect the work area for infractions of safety and health requirements as contained in the site specific safety and health plan.
- The Site Safety Officer will investigate and immediately report all accidents to the Corporate Safety and Health Manager.

- Site activities will be conducted only during daylight hours unless adequate portable lighting is mobilized to the project site.

- The "buddy system" will be observed at all times during intrusive site investigations. A minimum of two people will work together and remain within eye sight or not greater than 100 ft. apart.

- Teamwork and the use of mechanical lifting devices will be employed where practical to ease lifting tasks and reduce the potential for muculoskeletal injury.

VIII. SITE CONTROL

A. An Exclusion Zone, Contaminant Reduction Zone and a Support Zone will be established on hazardous waste operations sites requiring Level C or Level Bpersonal protective equipment. Defined access and egress points will be established and personnel will enter only through those points.

B. As permitted by site topography, the area within a 50 foot radius of a drill rig and 100 foot radius of UST removal excavations will be considered the Exclusion Zone. Only those personnel designated by the Project Manager/SSO are allowed to enter the Exclusion Zone. Where practical, or where their use will prevent public injury, temporary signs or barricade fencing will be established to define the Exclusion Zone. ABSOLUTELY NO SMOKING WILL BE PERMITTED WITHIN

THE EXCLUSION OR CONTAMINANT REDUCTION ZONES ON ANY PETROLEUM CONTAMINATED SITE.

C. If unauthorized personnel attempt to enter the exclusion zone, the SSO will verbally inform the individual(s) to leave the project site. If unauthorized individuals refuse to leave the Exclusion Zone or are considered in danger or pose danger to project personnel, the SSO will cease project activities (i.e., shut down drill rigs, excavation equipment, etc.) and notify the client representative or the local police of the situation.

IX. AIR MONITORING

A. Air monitoring protocols will be designed to prevent personnel exposure to airborne contaminants in excess of established permissible exposure limits. The results of field air monitoring will be used to determine the continued adequacy of initial personal protective equipment.

B. Task Leader(s) will be knowledgeable in the operation and troubleshooting of air monitoring equipment. A manual on the operation of each air monitoring instrument and an appropriate calibration kit will be mobilized to the project site with the instrument. Air monitoring instruments will be calibrated under field conditions each day prior to use. Task Leaders are instructed to consult the operator's manual for appropriate calibration gas and calibration techniques.

X. PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment requirements for each hazardous waste operations site and task will be specified in the site safety and health plan. Personal protective equipment selection will be based upon the site contaminants and tasks to be performed. Personal protective equipment ensembles will be selected in general accordance with standard EPA levels of protection as follows:

A. **Level A** - To be selected when the greatest level of skin, respiratory, and eye protection is required. Level A personal protective equipment ensembles will consist of:

1. Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved NIOSH.
2. Totally-encapsulating chemical-protective suit.
3. Coveralls.(optional, as appropriate)
4. Long underwear.(optional, as appropriate)
5. Gloves, outer, chemical-resistant.
6. Gloves, inner, chemical-resistant.
7. Boots, chemical-resistant, steel toe and shank.
8. Hard hat (under suit).(1)
9. Disposable protective suit, gloves and boots

B. **Level B** - To be selected when the highest level of respiratory protection is necessary but a lesser level of skin protection is required. Level B personal protective equipment ensembles will consist of:

1. Positive pressure, full-facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.(optional, as appropriate)
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots, outer, chemical-resistant steel toe and shank.
7. Hard hat.

C. **Level C** - To be specified when the identity and approximate concentration of airborne contaminants is known and the criteria for using air purifying respirators are met. Level C personal protective equipment ensembles shall consist of the following:

1. Full-face (typically) air purifying respirators (NIOSH approved).
2. Chemical-resistant clothing (coveralls; two-piece chemical-splash suit; disposable chemical- resistant overalls, as appropriate).
3. Gloves, outer, chemical-resistant.
4. Gloves, inner, chemical-resistant.
5. Boots (outer), chemical-resistant steel toe and shank.
6. Disposable boot-covers, outer, chemical-resistant (optional)
7. Hard hat.(1)

D. **Level D** - A work uniform affording minimal protection. Level D or modified Level D personal protective equipment will be used when contaminant concentrations are low and not readily absorbable through the skin and where atmospheric monitoring indicates no need for respiratory protection. The following constitute Level D equipment; it may be used as appropriate:

1. Coveralls.
2. Chemical-resistant gloves.(style selected based on contaminants)
3. Boots/shoes, chemical-resistant steel toe and shank.
4. Boots, outer, chemical-resistant (disposable).
5. Safety glasses or chemical splash goggles (where appropriate).
6. Hard hat.

XI. DECONTAMINATION

A. Equipment decontamination is necessary on all contaminated project sites. Personnel decontamination for projects below personal protective Level C will consist of washing off safety footwear, proper cleaning or disposal of outer and inner gloves and thorough washing of face, arms and hands. A full body shower will be required as soon as possible upon leaving the project site.

B. For projects involving personal protective equipment at Level C or above, a decontamination station will be established on the interface of the Exclusion Zone. A Contaminant Reduction Zone will be established and will extend 10 feet beyond the decontamination station.

- Two Wash Tubs
- Scrub Brush
- Plastic Bags
- Water and Alconox Detergent

The wash tub on the exclusion zone side of the site will contain a solution of water and Alconox detergent; the second wash tub will contain clean rinse water. Personnel decontamination will consist primarily of detergent washing and rinsing of reusable exterior protective gear. Coveralls will be removed by turning the clothing inside out.

Personnel may not leave the contaminant reduction zone without proceeding through the decontamination sequence described below.

- Wash work gloves, boots and polylaminated protective coveralls,
- Rinse work gloves, boots and coveralls,
- Remove tape at wrists and ankles,
- Remove protective coveralls,
- Remove respirator
- Dispose of spent cartridges; wash and rinse respirator
- Remove outer gloves
- Remove inner gloves

Expendable personal protective equipment will be placed in plastic trash bags, sealed and disposed of per client agreement. Decontamination solutions will be containerized or disposed of as arranged by Project Manager.

C. Decontamination of equipment will be performed to limit the migration of contaminants off-site. All equipment will be cleaned prior to site entry to remove grease, oil and encrusted soil. Decontamination of large equipment will consist of physically removing gross contamination with shovels, brushes etc. followed by detergent and water high pressure wash with a clean water rinse. The Project Manager is responsible for determining if decontamination solutions must be containerized. If so, a decontamination sump or polyethylene sheeting and fluid containers will be mobilized and established in the decontamination area. Decontamination of hand samplers and similar small equipment will be performed at a designated location within the Contaminant Reduction Zone. Decontamination of such equipment will consist of detergent solution wash and clean water rinse. Specialized decontamination solutions (acids, solvents, biocidal, etc.) may be specified in site specific site safety and health plans.

XII. SITE COMMUNICATIONS

Communication between personnel on most hazardous waste project sites will be via verbal communication or hand signals. Visual contact between members of task teams should be possible throughout the course of project activities. Contact with the SSO will be through direct

verbal communication. The following hand signals will be used whenever verbal communication is limited:

Signal	Meaning
Thumbs Up	OK, all is well
Grab throat with both hands	Can't breathe
Shake head, thumbs down	NO, negative
Point right (when facing equipment operator)	Move/steer left
Point left when facing equipment operator)	Move/steer right
Grab partner's wrist	Leave area immediately

XIII. EMERGENCY RESPONSE PROCEDURES

A. The Project Manager is responsible for obtaining and recording emergency telephone contacts in the appropriate section of the site safety and health plan prior to site mobilization: A mobile telephone will typically be available on hazardous waste operations project sites.

B. In the case of personal injury, appropriately trained personnel will be requested to provide first aid and emergency rescue. For minor injuries, such as cuts, burns, exhaustion, heat cramps, insect stings, etc., the affected employee will be removed to an uncontaminated area. The SSO or other designated employee trained in first aid procedures will administer appropriate first aid. If the injury requires additional medical attention, the injured employee will be cleaned and transported to the nearest hospital or emergency medical facility.

C. For more serious injuries the SSO or designee will summon an ambulance to the project site. No attempt will be made by Terracon personnel to move the victim, without the aid and/or instructions of qualified medical personnel.

D. If the victim cannot be safely moved without a stretcher or other specialized equipment, the victim will be removed at the earliest possible moment by appropriately attired Terracon personnel with the direction and/or assistance of qualified medical response personnel. The injured employee will be immediately decontaminated and transported to the nearest medical facility. A crew member designated by the SSO will inform the ambulance crew of contaminants of concern and provide assistance with additional decontamination if required.

XIV. EVACUATION AND SHUTDOWN PROCEDURES

A. On project sites posing a significant risk of chemical or physical hazard exposure, the site safety and health plan will instruct the SSO to establish and notify site personnel of emergency "rally" points. In the event of a site emergency, personnel will immediately exit the site and assemble at the designated rally point. Evacuation routes will be dependent on site topography and wind conditions. The routes will be selected and presented by the SSO daily prior to site activity.

B. If emergency evacuation becomes necessary, the SSO will sound the emergency alarm (e.g. support vehicle horn or compressed air horn). Personnel will safely

shutdown all electrical and mechanical equipment and quickly proceed to closest designated rally point. The SSO will then account for each crew member on site.

C. In the event that a Terracon employee does not report to the designated rally point within 5 minutes of the evacuation alarm, the SSO will perform an immediate assessment of site conditions. If site conditions do not pose an immediate hazard to life or health, the SSO will initiate search and rescue efforts utilizing two crew members attired in appropriate personal protective equipment.

E.25
BASIC RECORDKEEPING AND FIELD DOCUMENTATION

LAST REVIEW/REVISION: February 2014
REVIEWER/OFFICE: DEK/Corporate

OBJECTIVE

To provide a basic level and quality of documentation throughout Brownfield projects that complements and supports other data collection forms in the course of conducting field activities during environmental assessments, sampling, or remediation. The intent is not to place into writing an extensively detailed "diary" of every activity, but rather to log and record significant information that is useful as a measure of field activities during report writing and discussions with clients and agencies. The information should be legible and readily understood by other than the author; later being used as a reference by managers, other project staff and quality assurance reviewers.

PROCEDURES

Appropriate documentation will be maintained to track project activities and document quality control. The following sections describe the specific records that will be maintained through the duration of the project.

Individual TSOPs, agency- or client-approved sampling plans or other referenced guidance may prescribe specific additional documentation that staff will complete specific to field tasks. These forms will be fully completed unless otherwise approved by the Project Manager. Errors in all documents shall be deleted with one line through the erroneous text, and initialed by the author. At the start and end of work day on the site, the time shall be noted and each initialed or signed by the author.

Common and routine field documentation includes, but is not limited to the following;

Safety

Every environmental project should be accompanied by a formal project-specific Health and Safety Plan (HASP or HSP). The on-site copy of the HSP will be incorporated into field documentation for on-site use, reference and field notations of required safety measurements. Any pre-task planning should be included.

Copies of Work Scope

The on-site copy of the final site-specific sampling and analysis plan will be incorporated into field documentation for reference and field notations relative to field-dictated changes in sample collection, field screening, and laboratory analysis procedures. Field copy of the sampling plans will include drawings and maps that illustrate property location, property features, and proposed sampling locations relative to these features. The rationale behind each proposed location and laboratory analysis will be provided in text and/or tables of the sampling plan for reference by field staff.

If a formal sampling and analysis plan is not required for the sampling activity or if the plan is field-derived (i.e., Triad approach), a field copy of the final proposal with scope of work will be incorporated into field documentation for reference and field notations relative to field-dictated changes in sample collection.

If a formal Quality Assurance Project Plan (QAPP) is required for the sampling activity, a field copy of the QAPP will be maintained with field documents for in-progress reference and discussions with off-site managers/supervisors during the course of field activities.

Field Logbook

Field site managers will document activities on daily log forms. The site manager will maintain the daily log forms with a field copy of the QAPP and Property-Specific Sampling and Analysis Checklists. Between field mobilizations, the Terracon Project Manager or Field Site Manager will maintain the daily log forms in a project file that will be placed at a central file location (see Sections **Error! Reference source not found.** and **Error! Reference source not found.**) following completion of the project. The daily log forms will include documentation relative to observed site conditions, sample collection information, problems encountered, sampling plan deviations, photograph logs, and other relevant information.

Custody Records

Field site managers will maintain a copy of completed chain-of-custody records for collected laboratory samples. The Field Site Manager will provide the Terracon Project Manager copies of the completed chain-of-custody forms following completion of field activities. The Project Manager will subsequently maintain these records at the central office file location.

Photographic Documentation

A photographic log will be maintained to document project activities and site conditions. Photographs will be taken during each day of major field activity. Photographs will be stored electronically and as hard copies with the project file. Logs will be maintained to document photograph details such as date, direction, photographer, and photo descriptions.

In taking photographs to document site conditions, field staff should keep in mind the following general rules;

- Include objects of scale in the photographs. Preferably items of known dimension in close-up pictures (e.g., rulers, tape measures, survey rods) and common objects for wider view documentation of the property (e.g., car, street sign).
- Keep in mind how the documentation will be used and presented in the final report. If unsure, ask the Project Manager.
- To the extent practical, document the site from a distance and from different directions so that other users have a perspective of the “total” site.
- Take and document more pictures than you will need for the final report.

E.30
CHAIN OF CUSTODY DOCUMENTATION

Last Revision: June 2010

OBJECTIVE AND APPLICATION

This document defines standard operating procedures for documenting sample collection using proper chain-of-custody techniques. The purpose of proper chain-of-custody techniques is to provide accountability for and documentation of sample integrity from the time samples are collected until sample disposal.

This procedure is intended to document sample possession during each stage of a sample's life cycle, that is, during collection, shipment, storage, and the process of analysis.

EQUIPMENT

- Terracon chain-of-custody record(s) or laboratory-specific chain-of-custody forms (typically supplied with sample containers),
- If samples are being shipped via courier, custody seals for coolers,
- Indelible ink marker, and
- Zip top bag.

PROCEDURE

Sample containers will be labeled in advance of sampling with the sample date, location (well identifier), sampler's initials, and project name. Written sample custody procedures will be followed whenever samples are collected, transferred, stored, analyzed, or destroyed, in order to trace possession and handling of a sample from collection to disposal. Accountability for a sample begins when the sample is collected. Each sample will be accounted for with the use of sample labels, chain-of-custody forms, a record of sample collection, and field data notebooks.

The following chain-of-custody procedures will be implemented by the field staff:

- Entries in the field notebook and chain-of-custody form will be made in ink. Documentation of each sample must be completed at the time of sampling.
- The chain-of-custody should include at a minimum:
  - Project name and/or number
  - Name and contact information for the sampler collector
  - Collector's signature
  - Sample designation

  - Date sampled
  - Time sampled
  - Sample media
  - Number and size of containers for each sample
  - Types of sample preservatives used
  - Analyses requested
- The original chain-of-custody must accompany the samples at all times after collection, until receipt at the analytical laboratory. A copy of the chain-of-custody form will be kept by the field staff until filing at the office.
- The original chain-of-custody form should be sealed in a Ziplock bag if shipping samples on ice via courier. The sealed Ziplock bag will protect the document from moisture that may be present due to sample preservation. The chain-of-custody should be the last item packed in a sample cooler, so that it is easily accessible if the cooler is misplaced by the courier or shipped to an incorrect address.
- If shipping samples, a chain-of-custody specific to the contents of each cooler will be packaged with the respective samples. Chain-of-custody forms should not be shipped in separate containers than the samples they document. At least one custody seal should be completed by the collector and applied to each cooler sent to the laboratory. The custody seal should be affixed to the cooler in such a manner as to ensure breakage of the seal upon opening of the cooler (e.g., across the cooler lid opening).
- When the possession of samples is transferred, the individuals relinquishing and receiving the samples will sign, date, and note the time on the chain-of-custody form.
- If samples are shipped, strict chain-of-custody is violated. However, at the discretion of the project manager the procedures can still be followed.

ATTACHED REFERENCES

Terracon Form COC-7/92 *Chain-of-Custody Record*, revised 4/93

Quality Environmental Containers *Custody Seal*

OTHER SUPPORTING DOCUMENTS

ASTM D4840-99 *Standard Guide for Sampling Chain-of-Custody Procedures*

E.2240
SITE SECURITY PROCEDURES

Last Review or Revision: June 2010

Objective
To establish procedures for the security of the subject site and remediation systems during hours when employees are not present.

Equipment

a) Keyed-a-like locks.

b) Site key file box.

c) Site diagrams.

d) Operation and Maintenance procedures.

e) Materials specified by the Project Manager.

Procedures

a) Site Security

The Project Manager will determine the specific security requirements for each site. Coordination with the client may be necessary to provide additional keys if needed. Keyed-a-like locks should be the same throughout the entire system. A benchstock of commonly used locks is maintained for the field crews to replace broken or damaged locks. If open excavations or sensitive materials are located on-site, the Project Manager may specify the use of access control, such as fencing or barricading.

b) Key Control

Keys for each system will be maintained in the central key control box in the Terracon Office. Additional keys may be maintained by field crews and the project manager for routine access. The site keys will be contained on a tab and clearly marked with the site name, job number and location.

c) Site Monitoring

The field crew conducting field services is responsible for the security of the site. A final review must be conducted daily prior to leaving the site to check and document site security. The field crew will complete the "Daily Job Report" to indicate that the site is secure or that exceptions were encountered at the site. The project manager will then be able to schedule the necessary corrective action.

d) Site Documentation

Documentation must be maintained at each remediation site to assist field crews in routine operation, maintenance, and emergency activities. The following documents are to be maintained on site:

1. Site diagram of all wells associated with the site;
2. Schematic of the system including free product and water lines;
3. Electrical diagram;
4. Site Safety Plan;
5. Maintenance checklist and schedule;
6. Current settings and operational limits of the system (switch settings, and flow rates);
7. Summary of system operational characteristics (flow rates, inventory levels,
8. Operational and Maintenance manuals for all system components;

All components of the system are to be labeled for identification. This includes pump controls, flow lines, product lines, level probes, and valves.

e) Signs

Each site should have a sign identifying the site and indicating critical information concerning the operation of the system in the event unusual operations are encountered. This could include the client's name and phone number, or Terracon's name and phone number.

f) Vehicles

Secure all vehicles left on-site during non-working hours. Lock all doors and close all windows. Store the keys in the central key control box.

Following is an example of a Daily Job Report. Either this form or another similar form will be utilized to document daily on-site activities.

Terracon

Job No _____

Test Date _____

DAILY JOB REPORT

Time on Job _____

Time in Lab _____

Time in Office _____

Travel Time _____

TOTAL CHARGEABLE HOURS _____

MILEAGE _____

Job Name _____

Job Location_____

Contractor _____

Client _____

Description of technical and/or engineering field operations including field test data*, locations (show direction of north), elevations, and other information:

_____

_____

_____

_____

_____

_____

_____

_____

TERRACON states that the above tests and/or field engineering services have been performed and the results are reported herein. This report, however, does not relieve the contractor of the responsibility to comply with the plans and specifications.

*Indicate when the field test data is estimated, pending final laboratory test results.

Attested to: _____

Position: _____

Company: _____

TERRACON
By: _____

FORM 113 - 6/85

E.2405
CLEANING – GENERAL

LAST REVIEW OR REVISION: June 2010

OBJECTIVE AND APPLICATION

To prepare the equipment for field activities in a manner that minimizes the potential for obtaining biased or erroneous data due to contaminant transfer. Cleaning is performed as a quality assurance measure and a safety precaution. It minimizes cross-contamination between samples and also helps to maintain a clean working environment. This procedure provides general guidelines and should be used in conjunction with more specific procedures applicable to the cleaning method used.

EQUIPMENT

- As determined by the project manager
- Expendable supplies:
  - Disposable chemical-resistant gloves
  - Garbage bags
  - Aluminum foil or plastic
  - Laboratory glassware detergent such as Alconox or Trisodium Phosphate (TSP)
  - Containers for collection of waste liquids, if necessary
  - Dilute acid, methanol, ethanol, isopropyl alcohol or other cleaning fluid
- Source of potable water without chemicals that would interfere or be identified in chemical analysis of samples. The project manager may require laboratory testing of cleaning water as a background for evaluating chemical analyses.

PROCEDURES

Cleaning procedures will vary considerably based on the equipment, type of contaminant, type of sample and detection levels. Initial cleaning should take place at the site prior to demobilizing. This will minimize the spread of contamination. The extent of on-site cleaning will vary based on specific conditions; however, an attempt should be made to decontaminate as thoroughly as possible on site. The more care one applies on keeping the equipment clean, the less energy will be required on cleaning.

All field equipment must be prepared at the laboratory/office prior to use. This will include additional cleaning, inspection, and maintenance.

Equipment such as hand trowels, bailers, mixing bowls, hand augers, etc., should be cleaned and wrapped in aluminum foil (with shiny side out) or plastic, as appropriate, prior to mobilization.

Sampling and monitoring equipment is normally cleaned by washing and rinsing with liquids such as a soap or detergent solution, potable tap water, deionized water (DI), isopropyl alcohol, methanol, or a dilute acid.

The extent and type of contaminant will determine the degree of cleaning. If the level of contamination cannot be readily determined, cleaning should be based on the assumption that the equipment is highly contaminated.

Waste products produced by the cleaning procedures such as waste liquids, solids, gloves, used Chem-wipe® cleaning pads, etc., should be collected, stored in USDOT-approved 55-gallon drums on-site and disposed based on the nature of the contaminant. Specific details for the handling of these wastes should be addressed by the project manager.

E.2410
CLEANING – MANUAL WASHING

LAST REVIEW OR REVISION: June 2010

OBJECTIVE AND APPLICATION

To prepare the equipment for field activities in a manner that minimizes the potential for obtaining biased or erroneous data due to contaminant transfer between sampling locations. Cleaning is performed as a quality assurance measure and a safety precaution. It minimizes cross-contaminants between samples and also helps to maintain a clean working environment.

EQUIPMENT

- As determined by the project manager
- Expendable supplies:
  - Disposable chemical-resistant gloves
  - Chem-wipe® cleaning pads
  - Garbage bags
  - Laboratory glassware detergent such as Alconox or Trisodium Phosphate (TSP)
  - Containers for collection of waste liquids, if necessary
  - Dilute acid, methanol, isopropyl alcohol, ethanol or other cleaning fluid
- Wash rack facility
- Cleaning containers with brushes (plastic, steel or stainless steel buckets)
- Aluminum foil or plastic
- Source of potable water without chemicals that would interfere or be identified in chemical analysis of samples. The project manager may require laboratory testing of cleaning water as a background for evaluating chemical analyses.

PROCEDURES

Cleaning procedures will vary considerably based on the equipment, type of contaminant, type of sample and detection levels. Initial cleaning should take place at the site prior to demobilizing. This will minimize the spread of contamination. The extent of on-site cleaning will vary based on

specific conditions; however, an attempt should be made to decontaminate as thoroughly as possible on site. The more care one applies on keeping the equipment clean, the less energy will be required on cleaning.

All field equipment must be prepared at the laboratory/office prior to use. This will include additional cleaning, inspection, and maintenance.

Equipment such as hand trowels, bailers, mixing bowls, hand augers, etc., should be cleaned and wrapped in aluminum foil (with shiny side out) or plastic, as appropriate, prior to mobilization.

Sampling and monitoring equipment is normally cleaned by washing and rinsing with liquids such as a soap or detergent solution, potable tap water, deionized water (DI), methanol, isopropyl alcohol or a dilute acid.

The extent and type of contaminant will determine the degree of cleaning. If the level of contamination cannot be readily determined, cleaning should be based on the assumption that the equipment is highly contaminated.

Listed below is a cleaning procedure which may be employed for field equipment such as a water level indicator at a monitoring well which contains dissolved petroleum hydrocarbons. If different or more elaborate procedures are required, they should be specified by the project manager during the project initiation meeting.

- Remove gross contamination from the equipment using a Chem-wipe® cleaning pad or brush.
- Wash with a soap or detergent solution
- Rinse with D.I. water
- Rinse with methanol or isopropyl alcohol (if method requires) and repeat rinse with D.I. water
- Repeat the entire procedure or any part of the procedure as necessary.

Waste products produced by the cleaning procedures such as waste liquids, solids, gloves, used Chem-wipe® cleaning pads, etc., should be collected and disposed of based on the nature of the contaminant. Specific details for the handling of these wastes should be addressed by the project manager.

E.2420
CLEANING – HIGH-PRESSURE, HOT-WATER WASHING

Last Review or Revision: June 2010

Objective

To prepare the equipment for field activities in a manner which minimizes the potential for obtaining biased or erroneous data due to contaminant transfer. Decontamination is performed as a quality assurance measure and a safety precaution. It minimizes cross-contaminants between samples and also helps to maintain a clean working environment.

Equipment

- As determined by the project manager
- High pressure hot/cold water washing device or steam cleaner
- Expendable supplies:
- Disposable chemical-resistant gloves
- Chem-wipes
- Garbage bags
- Detergent (Alconox or TSP)
- Containers for collections of waste liquids, if necessary D.I. water
- Dilute acid, methanol, ethanol or other cleaning fluid
- Wash rack or other approved decontamination fluid collection system
- Cleaning containers with brushes (plastic, steel or stainless steel buckets)
- Aluminum foil or plastic, as appropriate
- Safety monitoring devices as specified in the safety plan.

Procedures

Decontamination procedures will vary considerably based on the equipment, type of contaminant, type of sample and detection levels. Initial decontamination should take place at the site prior to demobilizing. This will minimize the spread of contamination. The extent of on-site decontamination will vary based on specific conditions; however, an attempt should be made to decontaminate as thoroughly as possible on site. The more care one applies on keeping the equipment clean, the less energy will be required on decontamination.

All field equipment must be prepared at the laboratory/office prior to use. This will include additional decontamination, inspection, and maintenance.

Equipment such as hand trowels, bailers, mixing bowls, hand augers, etc., should be cleaned and wrapped in aluminum foil (with shiny side out) or plastic, as appropriate, prior to mobilization.

Decontamination of larger objects, such as the working end of the drill rig or the downhole tools is accomplished using a high pressure wash.

Sampling and monitoring equipment is normally cleaned by washing and rinsing with liquids such a soap or detergent solutions, tap water, D.I. water, methanol, or a dilute acid.

The extent and type of contaminant will determine the degree of decontamination. If the level of contamination cannot be readily determined, cleaning should be based on the assumption that the equipment is highly contaminated.

Listed below is a decontamination procedure which may be employed for field equipment such as a water level indicator at a monitoring well which contains dissolved petroleum hydrocarbons. If different or more elaborate procedures are required, they should be specified by the project manager during the project initiation meeting.

- Remove gross contamination from the equipment using a chem-wipe or brush.
- Wash with a soap or detergent solution
- Rinse with D.I. water
- Rinse with methanol or other alternate cleaning agent (if method requires)
- Rinse with D.I. water
- Repeat the entire procedure or any part of the procedure as necessary.

Waste products produced by the decontamination procedures such as waste liquids, solids, gloves, chem-wipes, etc., should be collected, stored in USDOT-approved 55-gallon drums on the site, and disposed based on the nature of the contaminant. Specific details for the handling of these wastes should be addressed by the project manager.

E.3000
BULK SAMPLING OF SUSPECT ASBSETOS-CONTAINING MATERIAL (ACM)

Last Review or Revision: June 2010

I. PURPOSE

The purpose of this standard operating procedure (SOP) is to provide information on the hazards of asbestos and procedures to follow to sample suspect materials for laboratory analysis. The following guidelines contained in this document apply to Terracon personnel who engage in bulk sampling of suspect ACM and are designed to provide standardization with respect to sample collection. This procedure should ensure that potential asbestos-containing material samples are collected in a manner which allows for accurate analysis of the material and that sampling personnel are protected against potential asbestos fiber releases through controlled sampling techniques or appropriate personal protective equipment.

The objective of bulk sampling building materials and components suspected to contain asbestos is to characterize the items that contain asbestos in quantities equal to or greater than 1% or other contaent limit as specified by local or state guidelines. By characterizing the locations and quantities of asbestos-containing materials (ACM), exposure hazards can be greatly reduced.

II. BACKGROUND AND REFERENCE

Asbestos has been a common component used in several building materials because of its strength enhancing and fire resisting properties. However, asbestos has been recognized as a human carcinogen and respiratory hazard. Due to its health hazards, building inspections and asbestos bulk sampling is requested for schools and many public or commercial properties prior to building renovation or demolition activities. Therefore, identifying, locating and quantifying materials containing asbestos is essential in the effort to prevent worker exposure to asbestos and prevent environmental contamination.

As a consequence of inhalation of asbestos fibers, a body of federal and state regulations has been developed. Federal regulations pertaining to asbestos are included in AHERA (Asbestos Hazard Emergency Response Act) US EPA 40 CFR 763, Subparts E, F; NESHAP (National Emissions Standards for Hazardous Air Pollutants (EPA 40 CFR 61); OSHA Asbestos Standards (29 CFR 1910.1001 and 29 CFR 1926.1101), and ASHARA (Asbestos School Hazard Abatement Reauthorization Act). Many states and local authorities have additional requirements including state-specific licensing and certification.

Terracon will comply with applicable federal, state and local regulations when conducting asbestos-related services.

III. EQUIPMENT

The minimum equipment necessary to conduct bulk sampling of suspect materials, in addition to the personal protective equipment outlined below in the Health and Safety Section, is listed below.

- Utility Knife, Chisel, Hammer, Screwdriver, Coring Tool
- Duct Tape
- Sample Containers (preferably ziplock-style clear plastic bags)
- Sample Labels and Indelible Marker
- Spray Atomizer containing Detergent Amended Water, Paper Towels/Wet Wipes
- Spray Adhesive
- Roof Patch Kit (if necessary)
- Measuring Wheel
- Camera
- Flashlight
- Field ACM Sample Log

IV. CERTIFICATION

Individuals conducting asbestos sampling must have the certifications listed below. Copies of these certifications and licenses should be taken to the site during the sampling event.

- United States Environmental Protection Agency Building Inspector training (and refresher training, if applicable)
- Asbestos Inspector State-license for the state of the project location (where necessary)

In addition, Terracon requires company-based training courses and hands-on experience of employees prior to commencing asbestos-related field services. Each employee must also receive respirator training, be medically monitored and successfully pass a fit-test utilizing issued respirator(s).

V. HEALTH AND SAFETY

Asbestos has been recognized to cause asbestosis, cancer of the lungs and digestive tract and mesothelioma. Asbestosis is a lung disorder characterized by a diffuse interstitial (between cell) fibrosis. The onset of asbestosis probably depends upon the asbestos dust

concentration, the morphology of the fiber and length of exposure. Cigarette smoking is strongly implicated as a co-carcinogenic among asbestos workers.

Under the OSHA asbestos standards, the employer has an obligation to protect employees against exposure to asbestos fibers in excess of 0.1 fibers per cubic centimeter of air (0.1f/cc). Personnel engaged in asbestos-related activities (including building inspections) must be trained, medically cleared and fit-tested for respiratory protection. Therefore, enrollment in a medical surveillance program in compliance with the OSHA asbestos and respiratory protection standards is mandatory. Terracon employees are not permitted to engage in asbestos-related activities unless they are enrolled in the Terracon medical surveillance program and have been medically cleared for respirator use by a physician.

The following safety and health protocols apply to Terracon personnel who engage in asbestos-related services. The guidelines contained in this document are based upon potential health hazards from exposure to asbestos fibers and physical hazards which may be encountered on survey project sites. Field activities will be performed in accordance with the procedures outlined in this document and applicable federal/state health and safety regulations.

Terracon personnel will use professional judgment during sample collection to prevent exposure to other building occupants. If unauthorized personnel attempt to enter a sampling area which could reasonably pose a fiber release hazard, the inspector will curtail bulk asbestos sample collection activity and request that the individual(s) leave the work area. If unauthorized personnel refuse to leave the work area, immediately contact the Project Safety Officer and/or a client representative. Sample collection activities should recommence only after unauthorized personnel have left the work area.

In the event that minor amounts of suspect asbestos containing materials such as thermal system insulation, sprayed-on or trowled-on surfacing materials, ceiling texture, etc. are released during the course of sampling, sampling team members will immediately evacuate the area and don Level C personal protective equipment. The area of potential ACM release will then be approached and suspect materials will be thoroughly wetted with amended water, slowly and deliberately swept to a centralized pile, re-wetted, and containerized in heavy mil asbestos disposal bags. Affected surfaces will then be re-wetted and swabbed with clean cloths or paper towels. Used wipes will be disposed of as asbestos-containing waste.

In the event that large quantities of potential ACM is released during sample collection activities, personnel will immediately evacuate the area and notify the Project Safety Officer and the client representative. The Project Safety Officer will request that the area be sealed until a properly attired response team can be mobilized to the area with a high efficiency particulate air filter (HEPA) vacuum and other equipment necessitated by site conditions.

If suspect materials are in deteriorated condition and fiber release appears likely, or if sampling must be conducted overhead and/or above drop ceilings, personnel will upgrade to Level C personal protective equipment as itemized above. Level C personal protective

equipment should be donned before moving drop ceiling panels, attic access panels, etc. where friable fireproofing or thermal system insulation are known to be present.

The indicated personal protective equipment shall be mobilized to asbestos sampling project sites on each day of sample collection and utilized, if necessary:

- Tyvek (standard) protective coveralls
- Half face or full face air purifying respirator equipped with HEPA (P-100) cartridges
- Impermeable gloves (nitrile or latex).
- Tyvek boot covers or washable outer footwear

Additional Health and Safety protocols such as those established by the owner/operator of the project site and Terracon's company policy regarding ladder safety, confined space entry and electrical hazards shall be followed.

VI. SAMPLING HAZARDS

a. Elevated Surfaces

Asbestos building inspections may include roofing materials and ceiling spaces containing suspect ACM. Appropriate ladders or other suitable devices (e.g., manlifts) will be used for gaining access to elevated sampling locations. Ladders will be inspected prior to use. Spreaders will be fully extended on all step ladders and firmly positioned prior to use. Where footing is uncertain, a sample team member will hold or otherwise secure ladders while in use by another sample team member. Personnel must always face ladders during both ascent and descent. Extension ladders will not be positioned more than one-quarter of their working length from buildings, walls, etc. (4:1 pitch). Sample team personnel will not walk on steeply pitched roof surfaces and will not walk on low pitched roofing surfaces while wet. Remain on designated roof walkways wherever present. Terracon personnel will visually inspect roofs prior to beginning sample collection activities and will avoid all areas which appear to be structurally unsound.

b. Confined Space Entry

Terracon asbestos inspectors will not enter any pit, shaft, tunnel, etc. which has limited means of egress, the potential for an oxygen deficient or toxic atmosphere or which was not designed for human occupancy without first developing a written safety plan which includes a confined space entry permit and procedures. Readily accessible spaces such as pipe tunnels in which personnel may stand can be entered to a distance where continuous visual and verbal communication can be maintained with another sample team member.

Adequate portable lighting must be utilized during sample collection in tunnels and similar spaces. No Terracon or sample team member may attempt to walk through a pipe tunnel,

etc. beyond the sight of a stand-by team member unless written confined space entry procedures have been prepared for the project.

c. Electrical Contact Hazards

Personnel will remain cognizant of the location and condition of electrical wiring during the collection of bulk asbestos samples. A visual assessment of each work space will be made prior to sample collection and electrical contact hazards will be evaluated. Unguarded junction boxes, exposed wiring, knife switches, etc. will be avoided during the collection of bulk ACM samples, and coring tools will not be used in near proximity to electrical switches or receptacles.

VII. PROCEDURES FOR BULK SAMPLING OF SUSPECT ACM

The primary purpose of this section is to identify the methods and techniques of controlled sampling, sampling site control and use of appropriate personal protective equipment to protect Terracon personnel and members of the general public from exposure to asbestos fibers during sampling activities. Adherence to these procedures should enhance personnel safety during sample collection activities and aid in the suitability of samples for analysis. Field activities will be performed in accordance with the procedures outlined in this document and applicable federal/state health and safety regulations.

Protocols for inspection and bulk sampling are defined in AHERA regulations. These are applicable for any type of survey; for example, a school, an area prior to renovation, a building prior to demolition and inspections undertaken to rebut the OSHA presumption that certain materials contain asbestos.

An accredited Building Inspector must perform the inspection. A summary of AHERA sampling protocols is as follows:

1. Visually inspect the building interior and/or exterior and identify locations of suspect ACM. Identify homogenous areas of friable and non-friable suspect ACM. Document locations, condition, classification and estimated quantities of each suspect material. It is recommended to depict locations of materials on a building diagram and take photographs of sampled materials.

2. Touch each suspect ACM to determine its friablity.

3. Collect representative samples of suspect ACM. Terracon recommends a minimum of three (3) samples of each material be collected from each homogeneous area. However, specific materials may require additional samples such as surfacing material and insulation

as described below. Judgment should be used on the need for and quantity of additional sample collection.

> *Surfacing materials*: Collect, in a statistically random manner, at least 3 bulk samples from each homogenous area of 1,000 sq. ft. or less, at least 5 bulk samples from each homogenous area that is greater than 1,000 sq. ft. but less than or equal to 5,000 sq. ft., and at least 7 bulk samples of each homogenous area larger than 5,000 sq. ft.
>
> *Thermal System Insulation (TSI)*: Collect, in a randomly distributed manner, at least three bulk samples from each homogeneous area of TSI; collect at least one bulk sample from each homogeneous area of patched TSI if the patched section is less than 6 linear or square feet; collect bulk samples from each insulated mechanical system where cement or plaster is used on tees, elbows, etc. in a manner sufficient to assess whether the material is ACM.

If fiber release appears likely, wet methods will be employed in the collection of suspect ACM samples. Water amended with a minimum of 10% commercially available window cleaning solution or other suitable surfactant should be used to moisten materials prior to sampling. Bulk asbestos samples will not be collected over the heads of, or in near proximity to, non-project personnel. Respiratory protection is not required when sampling non-friable suspect materials or materials below the breathing zone which are adequately wetted with amended water.

4. Bulk ACM samples should be immediately placed in sample containers and sealed while the materials are wet. If collecting samples of friable ACM or normally non-friable materials which are in deteriorated condition, precautions must be taken to prevent the release of fibers to the work area. Precautions include aggressively wetting the surface or potentially isolating the material (e.g. glove bagging) prior to disturbance.

5. Reusable sampling equipment will be gently rinsed with amended water. Dry the equipment with paper towels to be disposed of as contaminated materials.

6. The following decontamination sequence should be used following sample collection activities requiring Level C personal protective equipment:

- Remove coveralls slowly turning the outside inward.
- Place in heavy mil asbestos disposal bag.
- Remove gloves and shoe covers (if utilized)
- Remove respirator and carefully dispose of respirator cartridges in asbestos disposal bag.
- Securely seal protective clothing and any potentially contaminated disposable sampling equipment in heavy mil asbestos disposal bags.
- Do not smoke or eat with soiled hands.

- Wash hands, face and forearms thoroughly before eating, drinking smoking or using toilet facilities.
- Shower thoroughly as soon as possible upon leaving the project site.

7. Bulk sample analysis for asbestos content is performed by polarized light microscopy (PLM). The analytical testing procedure is based on U.S. Environmental Protection Agency (EPA) methods and National Voluntary Laboratory Accreditation Program (NVLAP) requirements. Terracon will use NVLAP accredited and appropriately licensed laboratories for analysis of asbestos bulk samples. Samples will be controlled with the analytical laboratory through chain of custody documentation.

E.4010
(Formerly E.590)

AIRBORNE LEAD AND PARTICULATE MATTER MONITORING SAMPLE COLLECTION

Last Revision/Review: March 2014
Reviewer / Office: DEK/Corporate

Objective and Application

Indoor air sampling requires the participation / review of a Terracon industrial hygienist (IH) in selecting methods and scoping work. Engaging an IH is encouraged for any airborne contaminants. For direction to local or regional assistance, contact the Chair of the Industrial Hygiene Practice Resource Group on the Terracon Environmental Services Webpage. Click here if viewing electronically.

The following procedure is for collection of samples for measurement of total airborne particulate matter and airborne lead particulate. The methods will provide representative samples for laboratory analysis using NIOSH Method 7300.

Equipment

The following equipment and supplies will be needed for this testing:

- Air monitoring cassettes containing mixed cellulose ester filters with a 0.8 µm pore size pre-weighed and numbered by the laboratory.
- Rotometer or other flowmeter accurate to the 0.1 L/min. Flowmeters used for calibration of air sample pumps will be calibrated against a primary standard on a quarterly basis.
- Air monitoring pump (battery operated or ac powered depending on application) capable of provided a 1 to 4 L/min flow rate through the sample filter.
- Vinyl tubing to connect pump to cassette.
- Cassette stand or other means to fix cassette in place as appropriate to testing location.
- Chain of Custody.

Procedures

Select a location for sample that is subject to full ambient air flow but not subject to vibration that could dislodge particulates from the surface of the filter. A location protected from precipitation should be selected, if available. Excessive moisture will interfere with sample analysis and could effect the flow rate.

Label cassette and record laboratory identification number on chain of custody. Assemble sampling pump, tubing and stand in sample collection location. The base of the cassette should be a press fit into the interior of the tubing. The joint between the tubing and cassette may be reinforced with tape if site conditions make this necessary. Cassette must be tilted downward at a 45º angle from horizontal. Cassette and pump should be placed so that the sample does not have to be moved after sample calibration.

A short section of vinyl tubing should be used to connect the flowmeter to the inlet port of the cassette. An adapter fitting may be needed to connect the tubing to the cassette. If a rotometer is used for flow calibration, the instrument must be held upright for accurate readings. Turn on the pump and measure the flow rate. Using the flow control on the pump, adjust the flow to the desired reading between 1.0 and 4.0 L/min. Record the sampling start time and beginning flow rate.

After completion of the sample collection, inspect the pump and cassette for any problems that may affect the sample validity (wet filter, stand blown over, etc.) and record any problems noted. Measure the flow rate using the procedure described above. The average of the two flow rates will be used by the laboratory to calculate the sample volume. Turn off the pump and cap the inlet and outlet ports on the filter cassette. Record the sampling completion time and ending flow rate.

Documentation

In addition to chain of custody documentation, the following must be provided to the laboratory performing sample analysis:

- Average flow rate (average of beginning and ending readings)
- Sample duration
- Filter number
- Requested analytical method

The following additional information must be collected for Terracon's project files:

- Sample date
- Sample times
- Sample location
- Activities performed by during the sampling
- Wind orientation (upwind, downwind, etc.)
- Weather conditions

Attached or Referenced Supporting Information

- Industrial Hygiene Technical Manual – Chapter II: Standard Methods for Sampling Air Contaminants

- NIOSH Method 7300 – Elements by ICP

TERRACON CONSULTANTS, INC.

ASBESTOS
PHASE CONTRAST MICROSCOPY (PCM)
QUALITY ASSURANCE
PROGRAM MANUAL

September 2001

(Reviewed and/or Updated) - November 2002, November 2003, December 2004, July 2005, March 2006, November 2007, October 2008, September 2009, May 2010, May 2011, June 2012, August 2014, December 2015

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DESCRIPTION OF QA PROGRAM

The objective of the Quality Assurance Program described in this manual is to assure the reliability of the fiber counting data produced by Terracon Consultants, Inc. (Terracon) technicians (analysts). Adhering to the procedures described in this manual will assure consistency and accuracy of Terracon fiber counting analyses.

TERRACON QUALITY MANUAL MAINTENANCE AND UPDATE PROCEDURES

This Quality Assurance (QA) manual shall be updated whenever necessary. Whenever NIOSH, state or Terracon policy and procedures dealing with air sampling or analysis changes, this manual will reflect these changes.

A copy of this manual will be with each reader at the job site.

This manual will be reviewed and/or updated by the QA Coordinator and the Laboratory Director annually, or whenever necessary to address required items.

QA Coordinator	Laboratory Director	Date
Russell Harrings	Russell Harrings	12/14/2015

ORGANIZATION AND RESPONSIBILITY

- It is the responsibility of each analyst to follow the procedures in this QA manual and to record all QA parameters on the required forms.
- It is the responsibility of the QA Coordinator to assemble the analyst QA parameters, document and resolve problems, and to assist analysts where needed.
- It is the responsibility of the Laboratory Director to insure that all data leaving Terracon is of the utmost quality.

QUALITY ASSURANCE OBJECTIVES AND POLICIES

The objective of the QA Program described in this manual is to assure the reliability of the fiber counting data produced by Terracon technicians (analysts). The technician (analyst) will adhere to the procedures laid out in this manual.

TERRACON PERSONNEL QUALIFICATIONS AND TRAINING

Initial Training: Each analyst must have completed a NIOSH 582 course or equivalent. Each sample collector must have completed an approved training course, current annual refresher training, and be licensed/certified to perform air monitoring by the respect state where the project is being performed, where required.

Apprentice Training: Where possible, the newly trained analyst will read samples which have already been analyzed by a qualified analyst. The performance of the newly trained analyst will be reviewed by the QA Coordinator and approval given for the new analyst to begin analyzing field samples only after proof of competency has been established.

Maintenance of Proficiency: Each analyst will participate in the analysis of reference, round robin and AIHA IHPAT and/or AAT/AAR samples. Each analyst will independently read each set of samples and record his/her results. The QA Coordinator will review the results and resolve any discrepancies.

SAMPLING PROCEDURES / MATERIALS

Collect the required air sample using a calibrated pump and a 25 mm mixed cellulose ester filter that is plain, white, and 0.45 to 0.8 µm pour size, with a back-up pad. The standard filter for most Phase Contrast Microscopy (PCM) sampling and analysis will be 0.8 µm pour size. This filter is contained in an electrically conductive filter holder cassette having a 50 mm extension cowling.

CHAIN-OF-CUSTODY / SAMPLE RECEIVING PROCEDURES

- The Asbestos Air Sampling Log is the Chain-of-Custody (CoC) for all air fiber samples collected and counted by the same Terracon individual. Each sample shall be assigned an individual sample number and the air monitor shall be responsible for ensuring the samples are placed in the laboratory archive storage area following completion of the project.

- Air fiber samples shipped in or mailed to Terracon will be delivered to the laboratory supervisor, who checks the shipment condition and signs the accompanying CoC. The laboratory supervisor shall be responsible for the samples through the analysis and storage.

- The laboratory supervisor will complete a CoC for all filter samples received without a CoC.

- Any samples received in damaged condition or without individual identifying numbers shall be rejected. The Client will be contacted and the samples will be held until it is determined how the Client would like to proceed. Damaged samples will be returned and an explanation of the observed damage will be given to the Client.

- Samples shall be retained for a minimum of 90 days, unless other arrangements have been made. Disposal of the samples will be by a method approved by the applicable Federal, State and local regulations.

- All fiber samples received at Terracon that are not associated with a Terracon project number will be assigned a project or invoice number.

REAGENTS AND STANDARDS

Reagents:

- Acetone (HPLC grade)
- Triacetin (glycerol triacelate)
- Clear nail polish

Standards:

- HSE/HSL phase-shift test slide (Mark III, Band 4 or Band 5)
- Telescope, Ocular Phase-Ring Centering (Centering Telescope)
- Walter-Beckett Graticule, (100 µm field of view) Type G-22
- Stage Micrometer

EQUIPMENT CALIBRATION / ALIGNMENT

Daily or prior to use:

1. Clean all optical surfaces.

2. Remove the right ocular and insert the centering telescope.

3. Unscrew the top portion of the centering telescope until the phase annulus ring (bright circle) comes into focus.

4. Center the phase annulus ring inside the phase ring (dark circle) using the centering screws.

5. Remove the centering telescope and replace the ocular.

Weekly or prior to each field use after transportation:

1. Follow steps 1-5 above.

2. Place the HSE/NPL phase-shift test slide on the microscope stage and focus on the lines.

   Band 4 Slide: The analyst must fully see line set 4, partially see line set 5, but not see line sets 6 or 7.

Band 5 Slide: The analyst must fully see line set 5, partially see line set 6, but not see line set 7

A microscope which does not pass this test may not be used for fiber counting analysis.

ANALYTICAL METHODS

NIOSH method 7400, with latest revision (Currently Issue 2, 15 August 1994).

Sample preparation:

1. Remove the tape or band holding together the base and extension cowl. Very carefully separate the base from the extension cowling.

2. With a rocking motion, cut a triangular wedge from the filter using the scalpel. This wedge should be approximately 25% (one-fourth) of the filter. Transfer this wedge to a clean glass slide using forceps.

3. Using the hot block (acetone vaporizer), clear the filter wedge with acetone vapor, usually 3 to 5 seconds using 1 ml of acetone.

4. Immediately (less than 30 seconds) place 1 to 2 small drops of Triacetin on the filter wedge.

5. Lower a clean cover slip gently onto the filter wedge at a slight angle to reduce the possibility of forming air bubbles. If air bubbles form under the cover slip, add a small amount of Triacetin to the edge of the cover slip to displace the air.

6. To aid clearing of the slide, warm the slide on a warming plate or on the acetone vaporizer.

Fiber Counting (A Rules):

1. Start counting from one end of the wedge and progress along a radial line to the other end. Select fields randomly.

2. Continually scan over a range of focal planes with the fine focus during each graticule field count. A minimum counting time of 5 to15 seconds per field is appropriate.

3. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

4. Count only fibers which have a length-to-width ratio equal to or greater than 3:1.

5. Count all the fibers in at least 20 fields. Continue counting until either 100 fibers are counted or 100 fields have been viewed, whichever occurs first.

6. Fibers lying entirely within the boundary of the graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the field shall receive a count of 1/2. Do not count any fiber that crosses the graticule boundary more than once.

7. Count bundles of fibers as one fiber unless individual fibers can be clearly identified and each individual fiber is clearly not connected to another counted fiber.

8. When an agglomerate (mass of material) covers more than 25% of the graticule field, reject the field and select another.

9. Do not count at edges where filter was cut. Move in at least 1 mm from the edge.

DATA REDUCTION AND REPORTING

Calculations:

1. Calculate the estimated Airborne Fiber Concentration (AC) on the filter sample using the following formula:

$$AFC = \frac{(\text{Fibers/Fields - Blank}) \times (385\ mm^2)}{(1000\ cc/L)(0.00785 mm^2)(\text{Volume})}$$

or, since 385 mm^2, 1000 cc/L and 0.00785 mm^2 do not change, then use:

$$AFC\ (\text{fibers/cc}) = \frac{\text{Fibers/(Field - Blank)} \times (49.04)}{\text{Volume}}$$

2. If the fibers counted are less than the Limit of Detection (LOD) of 7 fibers/mm^2 (5.5 fibers/100 fields), then use 0.055 fibers/field in your calculation of AFC. Report the results as less than < X.XXX f/cc.

Reporting:

1. Input the collected data into the “Analytical Results of Daily Air Sampling” form or similar form.

3. Post copy of log where required (i.e., clean room, project log board), and forward to Project Manager for forwarding to Client in the proper format.

QUALITY CONTROL PROCEDURES

1. Reference Slides: A library of permanently mounted reference slides will be maintained for use by each analyst. The reference slide library will contain slides which are loaded minimally, to the three ranges outlined in the current version of the NIOSH 7400 method (5-20 fibers/100 fields, 20-50 fibers/100 fields and >50 fibers/100 fields).The reference slide library will also contain slides from previous AIHA-AAT testing rounds. The reference slides obtained from field projects will have been analyzed by blind repeat counts a minimum of 20 times by intra-lab and/or inter-lab analysts. An Excel program has been established to generate the UCL and LCL or CV for the reference slides.

   Prior to the analysis of project (field) air samples each day, the analyst will analyze a randomly selected reference slide from the reference slide library. The result of the reference slide analysis shall fall within the documented control limits established for that slide before fiber count analysis may be conducted on field samples that day. Analysts will analyze reference slides from each loading range over time.

   a. Count one of the reference slides in your calibration/QA kit.

   b. Record the data in the QA log book.

   c. These values will be used to calculate the individual S_r for different fiber ranges.

   d. A S_r or coefficient of variation (CV) of 0.45 will be used until enough readings on the reference slides have been completed to calculate the individual analyst's S_r (CV).

2. Field Blanks: Prepare and analyze a minimum of one field blank and one lab blank for each daily (8-10 hour) work shift, along with the field samples.

3. Blind Recounts:

   a. Perform blind recounts on 10% of filter samples analyzed (excluding blanks). When feasible, the filter samples to be recounted by the original field analyst will be relabeled by a person other than the original field analyst, so that "blind" reanalysis may be conducted.

   b. Record these recounts, along with the original count, in the QA log book.

   c. Use the following test to determine whether a pair of counts by the

same counter on the same filter should be rejected because of possible bias. Discard the sample if the absolute value of the difference between the square roots of the two counts (in fiber/mm^2) exceeds 2.77 * (A) * S_r * 0.5, where A = the average of the square roots of the two fiber counts (in fiber/ mm^2). In mathematical terms:

<u>Method 1</u>

The recount fails if the following is true:

$$\left| \sqrt{(f/mm^2_A} - \sqrt{(f/mm^2_B)} \right| > 2.77 * S_r * [\sqrt{(f/mm^2_A} + \sqrt{(f/mm^2_B)}] / 4$$

Where A is the original count and B is the recount.

<u>Method 2</u>

Or another way:

Difference of Square Roots (DS) = $\left| \sqrt{(f/mm^2_A} - \sqrt{(f/mm^2_B)} \right|$

Test Value (TV) = $2.77 * S_r * [\sqrt{(f/mm^2_A} + \sqrt{(f/mm^2_B)}] / 4$

Where A is the original count and B is the recount.

The recount fails if DS > TV.

d. If a pair of counts is rejected by this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

4. Laboratory / Analyst Accreditation:

a. All analysts must participate in the AIHA IHPAT and/or AAT program.

b. Turn in results to the QA Coordinator.

5. Round Robin Samples: Round Robins will be conducted on a semi-annual basis with a minimum of 2 other labs. Sets of permanently mounted slides will be exchanged between the participating labs for field analysts to “blindly” analyze. UCL and LCL have been established for the slides being exchanged. The results of the Round Robin analyses will be evaluated statistically. If there is an analytical discrepancy concerning a Round Robin sample or samples, a recount will be conducted in order to rectify the discrepancy. Corrective action will be taken whenever Round Robin analytical results fall outside acceptable limits. Round Robin slides will be analyzed by the same procedures as used for field samples.

a. All analysts should participate in the Round Robin program as required by AIHA and the NIOSH Method 7400.

b. Turn in results to the QA Coordinator.

PERFORMANCE AUDITS AND CORRECTIVE ACTION

Corrective action will be taken whenever quality control data, IHPAT performance results, AAT performance results or Round Robin results are outside the acceptance limits. No analytical data will be reported until the cause of the discrepancy has been determined and corrected, or until it has been demonstrated that the cause was a random event and no longer affects data. The QA Coordinator will document and maintain records of all events deemed out of compliance, the determined cause(s) and corrective actions taken.

1. The QA Coordinator will review all individual results on IHPAT, AAT, Round Robin and recommended samples.

2. When adverse trends develop in an individual analyst, corrective action will be taken.

   a. Microscope and analyst calibration techniques will be checked.

   b. Side-by-side counting with another analyst to re-calibrate his/her technique.

3. Terracon's procedure for handling Client quality-related complaints shall be to respond immediately and take whatever corrective measures are deemed appropriate. Any questionable data shall be reviewed by the QA Coordinator and/or Laboratory Supervisor and appropriate equipment recalibration, reanalysis or resampling will be conducted to resolve any issues not resolved by QA review. The QA Coordinator will document and maintain records of Client quality-related complaints, the determined cause(s) and any corrective actions taken.

QUALITY ASSURANCE REPORTS

1. Analysts will submit their QA log books to the QA Coordinator quarterly.

2. The QA Coordinator will review the log books, looking for trends, errors, omissions, etc., and develop corrective actions where needed.

3. The QA Coordinator will consolidate the results from blanks, replicate analyses, IHPAT analyses, AAT analyses, inter-laboratory analyses, deficiency corrections, precision for each microscopist and other pertinent

information into a report for the Laboratory Director.

DOCUMENTATION AND RECORD KEEPING

1. Most fiber counting at Terracon is associated with a field project. The air sampling data is incorporated into the project close-out report, required copies are sent to the Client and a copy is kept on file at Terracon.

   a. The Client report will include Terracon and Client identification, report date, sample identification, analytical method reference, sample analytical results and sample quantification limit (limit of detection=LOD).

2. Walk-in samples are logged into our Sample Analysis Log Book. After samples have been analyzed and data typed, copies of results are sent to the Client and a copy is kept on file at Terracon.

3. Normal project files are kept for seven years. Health and Safety files are kept for thirty years.

SAMPLE RETENTION AND DISPOSAL

1. Sample Retention:

   a. Once the filter has been mounted on a slide and analyzed, the slide will be disposed of unless it has been randomly selected for QA/QC analysis. The randomly selected slides will be retained in the analyst's QC slide box. The selected slides will be retained until QA/QC procedures have been completed.

   b. Air sample cassettes from each project will be retained in a labeled box in the laboratory archive storage area for a minimum of 90 days.

2. Disposal:

   a. Air sample cassettes will be disposed of as asbestos waste through arrangements made with a local abatement contractor.

   b. Slides will be disposed of with project waste after being read unless they are selected for QA/QC purposes. QA/QC slides will be disposed of with the cassettes once re-analysis has been completed.

HOUSEKEEPING AND ENVIRONMENTAL REQUIREMENTS FOR REMOTE (FIELD) SITES

A location will be selected which provides shelter from the elements, has available electricity and is relatively dust free. The analyst will utilize an appropriate work surface or a portable table and chair to establish a work space suitable for sample mounting and analysis. The work surface will be dusted prior to starting work and all sample mounting shall be conducted on slide racks or sheets of clean paper or laboratory wipes. Any waste generated shall be disposed of properly and paperwork/required documents shall be organized in a job file or expanding folder. A “no smoking” sign may be displayed and traffic in the work area shall be kept to a minimum. An ABC type fire extinguisher may be located in close proximity to the work area. The work area shall not be used for purposes other than sample mounting and analysis. Tools and supplies necessary for slide mounting and fiber counting shall be stored in the mounting kit except when in use.

Sample mounting and analysis shall not be conducted in dusty environments or in other situations where sample confidence is low. Samples shall be transported to the office or other controlled environment if the jobsite environment is not suitable.

STANDARD OPERATING PROCEDURE (OCTOBER 1, 1998) PCM FIBER COUNTING

1. PURPOSE: The purpose of this Standard Operating Procedure (SOP) is to provide guidance and procedures for the counting of airborne fibers.

2. APPLICABILITY: NIOSH Method 7400, Issue 2, 15 August 1994, gives an index of airborne fibers. Phase Contrast Microscopy (PCM) will not differentiate between asbestos and other fibers.

3. PREPARATION: Several actions will significantly reduce the difficulty and uncertainty of fiber counting while ensuring compliance with NIOSH 7400. (Read NIOSH Method 7400)

   a. Check all air sampling worksheets for the required air sampling data.

   b. Mount sample using Acetone Vapor-Triacetin technique.

   c. At least daily, utilize the centering telescope to align phase-shifting element and annular diagram. Record dates of microscope calibration along with dates of service and cleaning.

   d. View HSE/HSL test slide periodically for each analyst/microscope (weekly when possible, and each time microscope is moved to a new job location).

   e. Adjust light source for even illumination across the field of view. Adjust

and focus eyepieces for your eyes. Focus on particulate to be examined.

f. Using the A rules, start counting from the tip of the filter and progress along a radial line to the outer edge. Shift up or down on the filter and continue in the reverse direction. When counting a graticule field, continuously scan a range of focal planes. Report total fiber counts.

g. Log the result (fibers/fields) and calculate the fiber concentration (fibers/cc) on the daily log (NOTE: ensure that field blank analysis results are considered when calculating fiber concentrations). Deliver forms to project file and for typing as required.

h. Fiber counts of less than 5.5 fibers/100 fields will be reported as:

< X.XXX f/cc = 2.7 / Volume

4. QUALITY CONTROL:

a. An in-section fiber counting proficiency evaluation program will be used as the primary method for periodically checking sample reader's fiber counting proficiency.

b. Blind recounts will be performed by the same analyst on 10% of all air samples analyzed. Samples will be retained by the analyst in a QC slide box.

c. If the same analyst is reanalyzing his/her own samples - remedial action will be taken if the difference between the two counts exceeds the limits established in above "Quality Control Procedures".

d. If a different analyst is reanalyzing the samples - remedial action will be taken if the second reading is 213% above or 49% below the first count, (EXAMPLE: first count is 0.16 f/cc, then 213% above would be 0.16 + (2.13 x 0.16) = 0.5 f/cc; 49% below would be 0.16 - (0.49 x 0.16) = 0.08 f/cc].

e. When recounts are not within prescribed limits; multiple analyst, side by-side sample counting will be conducted to determine the acceptable sample result.

f. Each analyst will read the IHPAT, AAT and round robin samples (as appropriate) independently and submit their results to the AIHA for AAT samples or the laboratory manager for IHPAT and round robins. When the laboratory receives the results from AIHA, each analyst's count will be compared to the IHPAT and AAT results.

g. Each analyst shall analyze at least 1 reference slide daily, when sample analysis is performed, and record the results in the microscope book.

ANNUAL INTERNAL SYSTEMS REVIEW/AUDIT

The QA Coordinator and the Laboratory Director will conduct and document an annual internal systems review/audit. The purpose of the review/audit is to verify that all actions adhere to the approved quality system and its QA requirements. Any deficiencies noted in the review/audit will be addressed through corrective action. The attached Annual Review/Audit Checklist will be utilized to document the review/audit and any noted deficiencies.

PAT PROGRAMS
AIHA PROFICIENCY ANALYTICAL TESTING PROGRAMS

3141 Fairview Park Drive, Suite 777, Fall Church, VA 22042 USA
main 1+ 703-846-0757 *fax* 1+ 703-207-8558
email info.patllc@aiha.org *web* www.aihapat.org

Report Issue Date: 11/15/2016

Russell Harrings
Terracon Consultants, Inc.
2020 Starita Road
Suite E
Charlotte, NC 28206

Participant ID# 102892

Dear Russell Harrings,

Please find your organization's Industrial Hygiene Proficiency Analytical Testing results for **IHPAT Round 207**. It is the participant's responsibility to thoroughly review results and to immediately contact the AIHA Proficiency Analytical Testing Programs in writing, if any errors are found in your report.

The proficiency demonstrated by the results of this IHPAT round is valid until the results of the retest round are available on January 16, 2017, if the participant chooses to enroll, or until February 15, 2017 when the next IHPAT report will be available. Unacceptable performance may be improved by correctly analyzing a set of retest samples. If you require a retest for the round, you may order one by completing the Retest Order Form available online at www.aihapat.org. The completed form and payment must be received by November 29, 2016. Refer to the PAT Programs Schedule located at www.aihapat.org for important retest round dates.

Please handle, store and analyze your PAT samples in the same manner as routine client samples. To submit results, visit the Proficiency Analytical Testing (PAT) page and click on the PAT Data Entry Portal: www.aihapat.org**. Always print and save the confirmation page** after submitting data via the PAT Data Entry Portal.

Participants shall not describe their proficiency status in a manner that implies accreditation, certification or variations thereof. PAT results pertain only to the participant organization at the location listed on this results report. AIHA PAT Programs makes every effort to ensure that individual participant results are kept confidential and are not made public. Round results are only released to the participant and those entities requiring this information for accreditation, regulatory and contract purposes. New participants are made aware of the arrangement in advance of participation and consent is sought prior to the release of records for participants. PAT reports may not be reproduced or distributed unless copied in its entirety.

Any enrolled participant that is unable to participate in a PT round must request an "Excused Absence" in order to not receive outliers and an unacceptable performance rating. This written request must be received before the PT round closes. Please note that an "Excused Absence" will not be granted for more than two consecutive rounds.

IHPAT Round 208 sample kits will be mailed to participants around January 1, 2017. An email will be sent out upon shipment of the samples. If you do not receive samples within fifteen (15) days after the ship date please contact the AIHA PAT Programs. Y our organization's data will be due by 11:59pm ET on February 1, 2017. The analytes for **IHPAT Round 208** are:

- **Metals –** cadmium (CAD), chromium (CHR), lead (LEA)
- **Silica –** coal mine dust/talc
- **Asbestos –** amosite
- **Organics –** chloroform (CFM), 1-2-dichloroethane (DCE), trichloroethylene (TCE)
- **Diffusive –** benzene (BNZ), o-xylene (OXY), toluene (TOL)

Samples are generated, characterized, packaged, and shipped by SRI International, Menlo Park, CA 94025 under contract with AIHA Proficiency Analytical Testing Programs. Unless otherwise noted, sample homogeneity and stability criteria were satisfied for all samples.

I encourage you to contact me with any feedback, questions or if you wish to contest your results at aoler@aiha.org.

Sincerely,

Angela Oler

Angela Oler, ASQ CQA
Director of Operations, AIHA PAT Programs, LLC

Industrial Hygiene Proficiency Analytical Testing Results

This document contains three sub-reports relating to IHPAT Round 207. The first report contains your organization's results listed per contaminant, per sample. The second report contains your current and 2 previous test round performance respectively (where applicable), and the final report contains summary results for all participants for IHPAT Round 207.

Testing Results for IHPAT Round 207

This part of the report contains your organization's results listed per contaminant, per sample.

Contaminant	Units	#	Result	Ref. Value	Lower Limit	Upper Limit	z-Score	Rating
Asbestos / Fibers (ASB)	f/mm2	1	179	314	154	531	-2.4	A
	f/mm2	2	368	516	253	871	-1.6	A
	f/mm2	3	330	408	200	690	-1.0	A
	f/mm2	4	88	79	39	133	0.6	A

Statistical Analysis Interpretation Note:
Reference value is the mean of the reference group.
Lower limit = reference value - 3 standard deviations; Upper limit = reference value + 3 standard deviations
z-Score = (reported result - reference value)/standard deviation. Note: z-Scores are used to predict trends and to indicate how far a particular score is away from the mean.
A – Acceptable* Analysis; U - Unacceptable Analysis
Fiber data are positively skewed therefore transformations are used to obtain approximately normal distributions.
Both the assigned values and acceptance limits are based on consensus of the reference group. *The acceptability of reported results is based on upper and lower acceptance limits. This is why a reported result may appear unacceptable according to z-Score, but be identified as acceptable.
Any non-participation or non-reporting of PAT data will result in unacceptable results (see PAT Programs Participation Policies, Section 2.1.6.2.).

Overall Performance Summary Concluding with 207

The following table contains your organization's current and 2 previous test rounds performance respectively (where applicable). For more information in regard to the determination of proficiency, please visit: www.aihapat.org.

Sample	Round	Round Score	Round Performance	Proficiency Status -Three Round Score
Asbestos	205	4/4	Pass	
	206	4/4	Pass	
	207	4/4	Pass	P

Interpretation Note:
The denominators represent the total number of samples analyzed.
The numerators represent the number of acceptable results.
Pass: Round Score ≥ 75% Fail: Round Score < 75%
P – Proficient; NP – Non-proficient; I – Indeterminate (not enough rounds to determine proficiency)
A participant is rated proficient for the applicable IHPAT analyte group if the participant has a passing score for the applicable IHPAT analyte group in two (2) of the last three (3) consecutive PT rounds. A participant is rated non-proficient for the applicable PT analyte group if the participant has failing scores for the associated PT analyte group in two (2) of the last three (3) consecutive PT rounds.
The following items are available in the Industrial Hygiene Scheme Plan:
Procedures used to statistically analyze the data, establish any assigned value and standard deviation for proficiency assessment, or other criteria for evaluation; details of the metrological traceability and measurement uncertainty of any assigned value; information about design and implementation of PT scheme. Industrial Hygiene Scheme Plan is available at http://www.aihapat.org/documents-policies-fees/Pages/default.aspx.
Measurement uncertainty of any assigned value is also available on the respective certificate of analysis for the round.
Technical Comment: No remarkable observations.

Performance of all Participants for IHPAT Round 207

The following table contains aggregate results for all participants IHPAT Round 207.

Contaminant	#	Ref. Value	Ref. Std. Dev.**	RSD (%)	Uncertainty Measurement	Total Participants	Total Acceptable	Low*	High*
Cadmium (CAD)	1	0.01621	0.00065	4.0	0.000083	141	130	9	2
	2	0.01003	0.00040	4.0	0.000051	141	130	6	5
	3	0.00301	0.00012	4.0	0.000015	141	123	11	7
	4	0.00704	0.00031	4.4	0.000039	141	133	6	2
Lead (LEA)	1	0.1532	0.0061	4.0	0.000779	142	133	6	3
	2	0.0559	0.0022	4.0	0.000284	142	136	2	4
	3	0.0354	0.0014	4.0	0.000180	142	137	3	2
	4	0.1068	0.0043	4.0	0.000542	142	137	2	3
Nickel (NKL)	1	0.0467	0.0021	4.6	0.000271	140	136	3	1
	2	0.1864	0.0075	4.0	0.000947	140	136	2	2
	3	0.1039	0.0042	4.0	0.000528	140	134	4	2
	4	0.0623	0.0028	4.5	0.000353	140	139	0	1
Silica (SIL)	1	0.0517	0.0074	14.4	0.001360	53	50	1	2
	2	0.1705	0.0214	12.5	0.003898	53	51	2	0
	3	0.0711	0.0096	13.4	0.001745	53	50	3	0
	4	0.1329	0.0175	13.2	0.003199	53	51	1	1
Asbestos / Fibers (ASB)	1	314	63	20.0	7.507218	721	611	88	22
	2	516	103	20.0	12.322942	721	605	76	40
	3	408	82	20.0	9.762619	721	607	71	43
	4	79	16	20.0	1.885801	721	662	8	51
n-Butyl Acetate (BAC)	1	0.6953	0.0497	7.1	0.007404	99	97	1	1
	2	0.4149	0.0370	8.9	0.005514	99	94	4	1
	3	0.4699	0.0395	8.4	0.005893	99	96	1	2
	4	0.2348	0.0210	8.9	0.003130	99	96	1	2
Ethyl Acetate (EAC)	1	0.2556	0.0128	5.0	0.001914	99	94	2	3
	2	0.8928	0.0528	5.9	0.007872	99	95	1	3
	3	0.0977	0.0060	6.1	0.000894	99	93	1	5
	4	0.3719	0.0232	6.2	0.003464	99	96	2	1
2-Propanol (IPA)	1	0.7648	0.1006	13.2	0.014998	100	96	3	1
	2	0.5997	0.0692	11.5	0.010316	100	94	3	3
	3	0.6119	0.0789	12.9	0.011759	100	97	2	1
	4	0.1746	0.0265	15.2	0.003955	100	95	2	3

Note: **The reference group standard deviation is used but is limited to no less than 4% relative standard deviation or no greater than 20% relative standard deviation.
***Low** - number of participant results that are less than the Lower Limit; ***High** - number of participant results that are greater than the Upper Limit.
Reference group/participant data sets for individual methods are not separated out during statistical analysis. Methods used by participants produce comparable data based upon the proficiency samples provided. Methods represented by fewer than eight participant data points are not assessed for comparability.
Additional technical comments or recommendations, when available, shall be shared with participants via the web and participants shall be notified via email.

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health
and Environmental Control

REGULATION 61-86.1
STANDARDS OF PERFORMANCE FOR ASBESTOS PROJECTS

Effective May 27, 2011

Bureau of Air Quality
SC Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201
(803) 898-4123

Statutory Authority
Sections 44-1-140, 48-1-30, and 44-87-10 *et seq.*
of the 1976 South Carolina Code of Laws, as amended.

DISCLAIMER
This copy of the regulation is provided by the DHEC for the convenience of the public. Every effort has been made to ensure its accuracy and completeness; however, it is not the official text. DHEC reserves the right to withdraw or correct this text if deviations from the official text as published in the *State Register* are found.

SOUTH CAROLINA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

REGULATION 61-86.1
STANDARDS OF PERFORMANCE FOR ASBESTOS PROJECTS

(Statutory Authority: Sections 44-1-140; 48-1-30; 44-87-10 *et seq.*
of the 1976 South Carolina Code of Laws, as Amended)

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SOUTH CAROLINA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

REGULATION 61-86.1
STANDARDS OF PERFORMANCE FOR ASBESTOS PROJECTS

(Statutory Authority: Sections 44-1-140; 48-1-30; 44-87-10 *et seq.*
of the 1976 South Carolina Code of Laws, as Amended)

SECTION I. - DEFINITIONS.

1. "Abatement" - Procedures to control fiber release from regulated asbestos-containing materials. This includes removal, enclosure, encapsulation, repair, and any associated preparation, clean up and disposal activities having the potential to disturb regulated asbestos-containing material.

2. "Adequately wet" - To sufficiently mix or penetrate with liquid to prevent the potential release of particulates. The absence of visible emissions is not sufficient evidence of being adequately wet.

3. "Aggressive clearance sampling" - A method of sampling which uses electric fan(s), electric leaf blower(s), and other devices to simulate vigorous activity in the abated area while air samples are being collected.

4. "AHERA" - Regulations developed pursuant to the Asbestos Hazard Emergency Response Act, 40 CFR Part 763, Asbestos Containing Materials in Schools (October 30, 1987).

5. "AIHA" - American Industrial Hygiene Association.

6. "Airlock" - A chamber which permits entrance and exit with minimum air movement between a contaminated area and an uncontaminated area, consisting of two doorways protected by two overlapping polyethylene sheets and separated by a sufficient distance such that one passes through one doorway into the chamber, allowing the doorway sheeting to overlap and close off the opening before proceeding through the second doorway. The airlock maintains a pressure differential between the contaminated and uncontaminated areas, thereby minimizing flow-through contamination further.

7. "Air sampler - A person licensed by the Department to implement air-monitoring plans and analysis schemes during abatement.

8. "Air sampling" - A method such as NIOSH 7400 for PCM, the OSHA Reference Method, 40 CFR 763 Appendix A for TEM, or an equivalent method accepted by the Department used to determine the fiber content of a known volume of air during a specified period of time.

9. "Amended water" - Water to which a surfactant (for example, a non-sudsing detergent) has been added.

10. "Area air sampling" - Any form of air sampling whereby the sampling device is placed at a stationary location either inside or outside the regulated work area.

11. "Asbestos" - The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite (amosite), anthophyllite, and actinolite-tremolite.

12. "Asbestos abatement entity" - Any individual, partnership, firm, association, corporation, sole

proprietorship or other business concern, as well as an employee or member of any governmental, religious, or social organization that is involved in asbestos abatement.

13. “Asbestos containing material (ACM)” - Material containing asbestos of any type, either alone or mixed with other materials, in an amount greater than one percent (1%) as determined by using the method specified in 40 CFR Part 763, Appendix A, Subpart F, Section 1, as amended, or an accepted equivalent. (NOTE: “Appendix A to Subpart F” has been redesignated as, and shall hereinafter be referred to as, “Appendix E to Subpart E” - 60 FR 31917, June 19, 1995.)

14.“Asbestos containing waste materials” - As applied to demolition and renovation operations, this term includes regulated asbestos-containing waste materials and materials contaminated with asbestos, including disposable equipment and clothing.

15. “Asbestos project” - Any activity associated with abatement including inspection, design, air monitoring, in-place management, encapsulation, enclosure, renovation, repair, removal, any disturbance of regulated asbestos containing materials (RACM), and demolition of a facility.

16. “Asbestos project design” - A written or graphic plan prepared by an accredited project designer specifying how an asbestos abatement project will be performed that includes, but is not limited to, scope of work and technical specifications.

17. “Asbestos training course” - A Department-approved initial or refresher course in any discipline listed herein (for example, workers, supervisors, management planners, etc.) that meets the requirements of this regulation and is acceptable for licensing purposes.

18. “Asbestos training course instructor” - A Department-approved individual who will teach work practice topics, non-work practice topics, and/or hands-on topics in any Department-approved initial and/or refresher training course and who meets the qualifications of this regulation.

19. “Asbestos training course provider” - The person, sole proprietorship, public corporation, or incorporated entity that meets the qualifications of this regulation to provide instruction in any of the work practice topics or disciplines, non-work practice topics, and/or hands-on topics in any Department-approved initial and/or refresher training course.
20. “ASHARA” - Regulations developed pursuant to 40 CFR Part 763, Subpart E, Appendix C Model Accreditation Plan, Asbestos School Hazard Abatement Reauthorization Act (November 28, 1992).

21. “Authorized visitor” - The facility owner/operator, or any representative of a regulatory or other agency having jurisdiction over the project. This is limited to government project inspectors, police, paramedics, fire-safety personnel, nuclear plant operators, and insurance loss prevention safety auditors, or other personnel as approved on a case-by-case basis by the Department.

22. “Background monitoring” - Area sampling performed prior to abatement to obtain an index of existing airborne fiber levels under typical activity.

23. “Building inspection” - An activity undertaken at a facility by a Department-licensed asbestos building inspector to determine the presence and location of regulated and non-regulated ACM, and to assess the condition of materials identified as ACM. This includes visual or physical examination and bulk sample collection.

24. “Building inspector” - A person licensed by the Department to examine a facility for the presence of ACM, to identify and assess the condition of the material, and to collect bulk samples.

25. “Category I nonfriable asbestos containing material (ACM)” - Nonfriable asbestos or nonfriable asbestos-containing packing, gaskets, and resilient floor covering; and asphalt roofing products containing greater than one percent (1%) asbestos as determined using the method specified in 40 CFR Part 763, Appendix E, Subpart E, or an accepted equivalent.

26. “Category II nonfriable ACM” - Any material that cannot, when dry, be crumbled, pulverized, or reduced to powder by the forces expected to act upon it in the course of demolition or renovation operations, excluding Category I nonfriable ACM and containing greater than one percent (1%) asbestos as determined using the methods specified in 40 CFR Part 763, Appendix E, Subpart E, or an accepted equivalent.

27. “Clean room” - An uncontaminated area or room that is part of the decontamination enclosure system and that has provisions for storage of street clothing and protective equipment.

28. “Clearance monitoring” - Area air sampling performed using Department accepted aggressive clearance sampling techniques to determine the airborne concentrations of residual fibers upon conclusion of asbestos abatement.

29. “Commercial labor provider” - Any individual, partnership, corporation, or other business concern that is not engaged in an asbestos project but does provide temporary workers or supervisors to the owner/operator of the project.

30. “Contractor” - Any individual, partnership, corporation or other business concern that performs asbestos abatement but is not a permanent employee of the facility owner.

31. “Control measure” - Use of amended water, negative pressure differential equipment, encapsulant, high efficiency particulate air filtration device, glove-bag or other state-of-the-art equipment designed to prevent fiber release into the air.

32. “Critical barrier” - At minimum, two independent layers of 6-mil plastic sheeting applied to any opening into a work area in a manner that creates a leak-tight seal within the work area to isolate vents, windows, doors, switches, outlets, and any other cavity or opening to the contaminated work area.

33. “Cut” - To penetrate with a sharp-edged instrument. This includes sawing, but may not include shearing, slicing, or punching.

34. “Decontamination enclosure system” - An enclosed area adjacent and connected to the regulated work area consisting of an equipment room, shower area, and clean room, each separated by airlocks, that is used for the decontamination of employees, materials, and equipment that are contaminated with asbestos.

35. “Demolition” - Wrecking or taking out any load-supporting structural member of a facility together with any related handling operations, the burning of any facility, or moving of a structure.

36. “Department” - The South Carolina Department of Health and Environmental Control’s Asbestos Section.

37. “Electrical generating facility” - Any establishment primarily engaged in the generation, transmission and/or distribution of electrical energy for sale.

38. “Emergency operation” - A renovation or demolition operation that was not planned but results from a sudden, unexpected event that, if not immediately attended to, will present an imminent safety or public

health hazard, will cause equipment damage, or will impose an unreasonable financial burden. This term specifically excludes routine equipment maintenance.

39. “Encapsulation” - A form of abatement involving the treatment of regulated asbestos-containing material (RACM) with a liquid that covers the surface with a protective coating (bridging) or embeds fibers in an adhesive matrix (penetrating) to prevent the release of asbestos fibers.

40. “Enclosure” - A form of abatement involving placement of a leak-tight, impermeable, permanent barrier to prevent access to regulated asbestos-containing material and to prevent the release of asbestos fibers.

41. “EPA” - United States Environmental Protection Agency.

42. “Equipment room” - A contaminated area or room that is part of the decontamination enclosure system and that has provisions for the storage of contaminated clothing and equipment.

43. “Examination date” - The date printed on the Departmental Asbestos Abatement License that indicates the date of successful completion of an examination administered upon completion of an asbestos training course.

44. “F/cc” - Fibers per cubic centimeter.

45. “Facility” - 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 bridge; 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 requirement is included in this definition, regardless of its current use or function.

46. “Facility component” - Any part of a facility including equipment.

47. “Friable” - Refers to ACM, which may, when dry, be crumbled, pulverized, or reduced to powder by the forces expected to act upon it in the course of demolition or renovation operations. This also refers to previously non-friable ACM after such material becomes damaged to the extent that when dry, can be or has been crumbled, pulverized, or reduced to powder.

48. “Friable asbestos containing material” - Any material that, when dry, can be or has been crumbled, pulverized, or reduced to powder and contains greater than one percent (1%) asbestos as determined using the method specified in 40 CFR Part 763, Appendix E, Subpart E, as amended, or an accepted equivalent.

49. “Goose neck” - Process for sealing the outer bag by twisting the opening of the bag, folding twisted portion of bag over, and creating a loop. Adequately secure the opening of the bag to the base of the twist, using duct tape.

50. “Glovebag” - A sealed compartment with attached inner gloves used for the handling of asbestos-containing materials. Information on glovebag installation, equipment and supplies, and work practices is contained in the Occupational Safety and Health Administration’s (OSHA’s) final rules on occupational exposure to asbestos, 29 CFR 1926.1101 (August 10, 1994), as amended, and any subsequent amendments or editions.

51. “Grind” - To reduce to powder or small fragments. Grinding includes mechanical chipping or drilling.

52. “HEPA filter” - A high efficiency particulate air filter that will capture particles with an aerodynamic diameter of 0.3 micrometers with a minimum efficiency of 99.97 percent.

53. “Homogeneous area” - Area of surfacing material, thermal system insulation material, or a miscellaneous material that is uniform in color or texture.

54. “HVAC” - Heating, ventilation, and air conditioning.

55. “Industrial manufacturing facility” - Any establishment whose Standard Industrial Classification code falls within Major Groups 20 through 39, excluding any office space that is part of such an establishment.

56. “In poor condition” - Refers to any ACM where the binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material.

57. “Installation” - Any building or structure or any group of buildings or structures at a single demolition or renovation site that are under the control of a single owner or operator (or of owners or operators under common control).

58. “Issue date” - The date a license is issued by the Department.

59. “Leak-tight” - Dust, solids, or liquids cannot escape or spill out.

60. “License” - A document issued by the Department that allows an asbestos abatement contractor, building inspector, project designer, management planner, air sampler, supervisor, worker, or other to engage in asbestos projects.

61. “Long-term, in-house contractor” - A contractor having a long-term, often multi-year, contractual arrangement with an industrial manufacturing or electrical generating facility to provide construction and maintenance services, including asbestos abatement. The employees of a designated long-term, in-house contractor shall be covered under the group license of the assigned facility.

62. “Management planner” - A person licensed in accordance with the requirements of this regulation who interprets inspection reports, conducts hazard assessments of asbestos-containing materials, determines appropriate response actions, develops a schedule for implementing response actions, and prepares written management plans.

63. “Manometer” - Instrument for the measurement of gas pressure whose units are represented in inches of water column.

64. “Minor project” - A project where 25 or fewer square or linear feet of regulated asbestos-containing material (RACM) are removed, or where 10 or fewer cubic feet of RACM off a facility component are cleaned up.

65. “Movable object” - A structure within the work area that can be moved (e.g., chair, desk, etc.).

66. “Negative pressure differential equipment” - A portable exhaust system equipped with a HEPA filter.

67. “NESHAP” - National Emission Standards for Hazardous Air Pollutants, 40 CFR 61, Subpart M, February 3, 1994, as amended, and any subsequent amendments or editions.

68. “NESHAP project” - An asbestos project which involves at least 160 square feet or 260 linear feet of regulated asbestos containing material (RACM), or 35 or more cubic feet of RACM off a facility component such that the area or length could not be measured prior to abatement. If several contemporaneous projects in the same area within the same building being performed by the same contractor are smaller than 160 square or 260 linear feet individually but add up to that amount, then the combination of the smaller projects shall be considered one NESHAP project.

69. “NIOSH” - National Institute for Occupational Safety and Health.

70. “Non-industrial facility”- Any public, private, institutional or governmental entity that does not meet the definition of an electrical generating or industrial manufacturing facility as defined in this regulation.

71. “Operation and maintenance (O&M) activity” - The disturbance of regulated asbestos-containing material only when required in the performance of an emergency or routine maintenance activity that is not intended solely as asbestos abatement. In no event shall the amount of ACM disturbed exceed that which can be contained in one glovebag or 6-mil polyethylene bag that shall not exceed 60 inches in length and width.

72. “O&M worker” - An individual licensed under a facility group license to perform an operation and maintenance activity at that facility.

73. “OSHA” - Occupational Safety and Health Administration.

74. “Owner/operator” - Any person or contractor who owns, leases, operates, controls, or supervises a facility being demolished or renovated, or any person who operates, controls, or supervises the demolition or renovation operation, or both.

75. “Owner’s representative” - A licensed supervisor, management planner, project designer, or air sampler designated by the facility owner to manage the asbestos project, and who serves to ensure that abatement work is completed according to specification and in compliance with all relevant statutes and regulations.

76. “Personal air sampling” - A method used to obtain an index of an employee’s exposure to airborne fibers. Samples are collected outside the respirator in the worker’s breathing zone.

77. “Planned renovation operations” - A renovation operation, or a number of such operations, in which some RACM will be disturbed, removed, or stripped within a given period of time and that can be predicted. Individual non-scheduled operations are included if a number of such operations can be predicted to occur during a given period of time based on operating experience.

78. “Project designer” - A person licensed in accordance with the requirements of this regulation who is directly responsible for planning all phases of an asbestos abatement project design from project site preparation through complete disassembly of all abatement area barriers.

79. “Reciprocity” - A written agreement between another state and South Carolina to use the same or equivalent auditing criteria when evaluating training course materials, course presentations, and instructor qualifications.

80. “Regulated area” - An area established by the owner/operator of an asbestos project to demarcate areas where asbestos abatement activities are conducted; any adjoining area where debris and waste from such asbestos work is stored; and any work area within which airborne concentrations of asbestos exceed,

or there is a reasonable possibility they may exceed, the permissible exposure limit.

81. “Regulated asbestos-containing material (RACM)” - (a) Friable asbestos-containing 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, drilling, or abrading; or (d) Category II nonfriable ACM that is likely to become 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 subject to this regulation.

82. “Removal” - Taking out RACM or facility components that contain or are covered with RACM from any facility.

83. “Renovation” - 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.

84. “Repair” - Returning damaged asbestos-containing material to an undamaged condition or to an intact state so as to prevent fiber release.

85. “Resilient floor covering” - Asbestos-containing floor tile, including asphalt and vinyl floor tile, and sheet vinyl floor covering containing greater than one percent (1%) asbestos as determined using polarized light microscopy according to the method specified in 40 CFR Part 763, Appendix E, Subpart E, Polarized Light Microscopy, or an accepted equivalent.

86. “Shower room” - A room located between the clean room and the equipment room in the decontamination enclosure system containing a shower with hot and cold or warm running water controllable at the tap.

87. “Small project” - A project where more than 25 but fewer than 160 square feet or more than 25 but fewer than 260 linear feet of RACM are to be abated, or where more than 10 but fewer than 35 cubic feet of RACM off a facility component are to be cleaned up.

88. “Start date” - The date printed on the Departmental-issued asbestos abatement project license, which indicates when asbestos renovation or demolition operations, including any abatement activity having the potential to disturb RACM, will begin.

89. “Strip” - To remove RACM from any part of a facility or facility component.

90. “Structural member” - Any load-supporting member of a facility, such as beams and load-supporting walls; or any non-load-supporting member, such as ceilings and non-load-supporting walls.

91. “Structures per square millimeter” - Reporting measure for Transmission Electron Microscopy (TEM) Analysis. TEM clearance requires fewer than 70 structures per square millimeter ($70s/mm^2$).

92. “Supervisor” - A person licensed by the Department and designated as the contractor’s representative to provide direct on-site supervision and guidance to workers engaged in abatement of RACM.

93. “Surfactant” - A chemical wetting agent added to water to improve penetration, such as a non-sudsing detergent.

94. “Temporary storage license” - A license issued by the Department that authorizes storage of asbestos waste from small and minor projects at a secure location deemed acceptable by the Department.

95. “Variance” - Written Departmental approval for the use of alternative work practices at an asbestos project.

96. “Visible emissions” - Any emissions that are visually detectable without the aid of instruments that originate from RACM or asbestos-containing waste material or a regulated work area.

97. “Waste generator” - Any owner/operator of an asbestos project covered by this regulation whose act or process produces asbestos-containing waste material.

98. “Waste shipment record” - The shipping document, required to be originated, prepared, and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

99. “Wet cleaning” - The process of removing asbestos contamination from facility surfaces and objects by using cloths, mops, or other cleaning tools that have been dampened with amended water.

100. “Work area” - Designated rooms, spaces, or areas in which asbestos abatement activities are to be undertaken, or that may be contaminated as a result of such abatement activities.

101. “Worker” - A person licensed by the Department to perform asbestos abatement under the direct guidance of an accredited and licensed supervisor.

102. “Working day” - Monday through Friday, including holidays that fall on any of the days Monday through Friday.

SECTION II. - APPLICABILITY

A. The requirements of this regulation shall apply to: any owner/operator, building inspector, management planner, project designer, contractor, asbestos abatement entity, air sampler, commercial labor provider, supervisor, worker, non-industrial facility owner and/or operator, or demolition contractor involved in the inspection, in-place management, design, removal, encapsulation, enclosure, renovation, repair, demolition activity, or any other disturbance of RACM; and any asbestos training course provider or asbestos training course instructor who conducts mandatory asbestos training courses.

B. There are no size limits for abatement projects involving RACM for which the applicable requirements of this regulation shall not apply unless otherwise specified.

C. An owner/operator may request that the Department determine whether a project is an asbestos project subject to the requirements of this regulation.

D. Asbestos projects occurring at a private residential structure of four units or fewer may be exempt from the requirements of this regulation unless:

1. Performed by a person or persons holding an asbestos abatement license.

2. Performed as part of a larger commercial or public project, such as, but not limited to, highway construction; development of a shopping mall, industrial facility, other private development; or urban renewal, etc.

3. The project involves multiple structures within a compact area (“city block”) under the ownership and/or control of a single owner and/or operator. Examples would be a municipality clearing a block of houses for urban renewal purposes or SCDOT clearing a row of houses for a highway-right-of-way

project.

4. The structure meets the definition of an installation.

5. The residential structure is being burned for fire training.

E. If asbestos projects occur at separate buildings (different school buildings, for example) then each separate building shall be considered a separate project.

SECTION III. - ASBESTOS LICENSE FEE SCHEDULE.

A. Applicability.

1. The requirements of this Section shall apply to: any owner/operator, asbestos abatement entity, building inspector, management planner, project designer, contractor, asbestos abatement entity, air sampler, commercial labor provider, supervisor, worker, non-industrial facility owner and/or operator, demolition contractor involved in the inspection, in-place management, design, removal, renovation, encapsulation, enclosure, repair, clean-up, demolition activity, or any other disturbance of RACM; and any asbestos training course provider or asbestos training course instructor who conducts mandatory asbestos training courses.

2. Acceptable methods of payment shall be by check or money order made payable to SCDHEC, by credit card (VISA, MasterCard, or Discover), or cash.

3. Each separate building at a multi-building site shall be considered a separate asbestos project, and fees will be assessed for each.

B. Personnel Licensing Fees.

1. No application will be processed unless accompanied by the required fee.

2. Departmental receipt and deposit of fees submitted with an application shall in no way indicate approval of the application or guarantee the issuance of a license.

3. Fees shall not be refunded if a license application is denied per Section IV.F.

4. Fees for any duplicate original license shall be $10.00.

5. Fee schedule: Individual license fees are assessed on a per person per discipline basis.

a. Contractor - $100.00

b. Building Inspector - $100.00

c. Air Sampler - $100.00

d. Supervisor (Any type) - $50.00

e. Worker (Any type) - $10.00

6. Facility Operation & Maintenance (O&M) Worker Group License Fee Schedule:

a. The minimum fee for an O&M Worker Group License is $25.00 and the maximum is $500.00.

b. Fee Schedule:

(1) Up to 10 people - $25.00 minimum fee

(2) 11 to 20 people - $2.50 per person

(3) 21 to 50 people - $5.00 per person

(4) 51 to 90 people - $7.50 per person

(5) 91 or more persons - $500.00 minimum fee

C. Renovation Project Fees.

1. The Department shall collect project license fees based on all RACM being removed and ACM rendered regulated by use of destructive removal techniques such as chipping, grinding, sawing, abrading, drilling, or extensive breaking.

2. Abatement project fees for regulated asbestos-containing materials (RACM) are calculated at 10 cents per linear, square, or cubic foot, with a minimum fee of $25.00 and a maximum fee of $1,000.00.

3. The Department shall not issue an abatement project license for a renovation or demolition until all requested information has been submitted and reviewed and all applicable fees have been paid.

4. Fees shall not be refunded for projects for which the Department has issued an asbestos project license.

5. An abatement project license that has been issued shall automatically become invalid if an instrument of payment is returned for insufficient funds.

D. Demolition Project Fees.

1. The Department shall charge a fee of $50.00 to issue a project license for demolition projects.

2. A project license is required for every facility to be demolished, including any facility in which the required building survey indicates there is no ACM present.

3. The Department shall not issue a project license for a demolition until all requested information has been submitted and reviewed, and all applicable fees have been paid.

4. Fees shall not be refunded for projects for which the Department has issued a project license.

5. A project license that has been issued shall automatically become invalid if an instrument of payment is returned for insufficient funds, and the licensee shall be subject to enforcement action for operation without a valid license.

SECTION IV. - PERSONNEL LICENSING REQUIREMENTS.

A. Applicability.

1. No person or contractor shall engage in any asbestos project or abatement involving RACM, or ACM rendered regulated by removal techniques or methods, unless licensed to do so by the Department.

2. Every contractor, supervisor, worker, air sampler, project designer, building inspector, or management planner who engages in any asbestos project shall have a current and valid license specific to the duties performed under the license.

3. When a person or contractor engaged in an asbestos project performs duties in more than one discipline, a separate license shall be obtained specific for each discipline. However, a management planner may perform the duties of a building inspector, and a supervisor may perform the duties of a worker without having to obtain separate licenses.

4. A license in any discipline shall only be utilized in accordance with the conditions and provisions contained in the license.

5. When an individual or a company for hire plans to remove RACM, a Department-issued asbestos contractor license must be obtained prior to performing abatement.

B. Training Documentation.

Acceptable documentation of training shall be:

1. An original certificate issued by a Department-approved training course provider and that meets the requirements specified in this regulation; or

2. A valid, original license or accreditation (photocopies or telephone facsimile transmissions shall not be accepted) issued by a state with which the Department has a reciprocal arrangement; or

3. A letter verifying successful completion of training, which includes the name, last four digits of Social Security number, unique certificate number, test score, and printed name and signature of the course instructor and which is sent directly to the Department from the training provider.

C. License Application.

1. Each applicant seeking an asbestos personnel license in any discipline shall:

a. Successfully complete a Department-approved initial training course specific to the discipline and, at the conclusion of the course, pass an examination with a score of 70 percent or above;

b. Submit a completed application to the Department in a format designated by the Department;

c. Submit a color passport style photo or have a photo taken by the Department. Digital photos should be at least one mega pixel in resolution. Still photos should be a minimum of 2” x 2” and a maximum of 3” x 5”.

2. The application must state the type of license for which the application is being made and must include all of the following information:

a. Supervisor License:

(1) Applicant’s name, Social Security number, mailing address, telephone number, and, when

applicable, company affiliation; and

(2) Documentation of successful completion of an initial asbestos abatement five-day supervisor training course and all subsequent eight-hour refresher training courses, if applicable.

b. AHERA Worker License:

(1) Applicant's name, Social Security number, mailing address, telephone number, and, when applicable, company affiliation; and

(2) Documentation of successful completion of an initial asbestos abatement four-day worker training course and all subsequent eight-hour refresher training courses, if applicable.

c. Air Sampler License:

(1) Applicant's name, Social Security number, mailing address, telephone number, and, when applicable, company affiliation;

(2) Documentation of successful completion of an initial asbestos abatement five-day supervisor training course; and

(3) Documentation of successful completion of NIOSH 582 course or equivalent, or documentation that the applicant is a Certified Industrial Hygienist.

d. Project Designer License:

(1) Applicant's name, Social Security number, mailing address, telephone number, and, when applicable, company affiliation; and

(2) Documentation of successful completion of an initial three-day asbestos abatement project designer training course and all subsequent eight-hour refresher training courses.

e. Building Inspector License:

(1) Applicant's name, Social Security number, mailing address, telephone number, and, when applicable, company affiliation; and

(2) Documentation of successful completion of an initial three-day asbestos building inspector training course and all subsequent four-hour refresher training courses, if applicable.

f. Management Planner License:

(1) Applicant's name, Social Security number, mailing address, telephone number, and, when applicable, company affiliation; and

(2) Documentation of successful completion of an initial three-day asbestos building inspector training course and all subsequent four-hour refresher training courses, if applicable; and

(3) Documentation of successful completion of an initial two-day asbestos management planners' training course and all subsequent four-hour refresher training courses, if applicable.

g. Contractor's License:

(1) Company name, mailing address, street address, telephone number, name, and title of a responsible company official, registered agent with the South Carolina Secretary of State's office, and the Federal Employer Identification Number (FEIN); and

(2) The name and license number of a company employee who is currently licensed as a supervisor in affiliation with that company pursuant to this regulation, or an application completed as required herein for a supervisor's license for a company employee.

h. Non-Industrial Facility O&M Group License (this license is facility-affiliated only):

(1) The facility representative shall, on company letterhead, submit the name, Social Security number, and type of training received for each individual to be covered under the facility license; and

(2) Documentation shall be submitted in the form of an original initial and/or refresher asbestos training certificate that is discipline-specific for the duties to be performed by each individual covered under the facility license.

D. Continuing Education.

1. After successful completion of an approved initial training course, an applicant seeking a license in any discipline except that of Contractor shall thereafter successfully complete a Department-approved initial or refresher training course specific to the discipline and, at the conclusion of each course, shall pass an examination with a score of 70 percent or above.

2. If more than 12 months but fewer than 24 months have elapsed since completing an initial or refresher training course, an applicant shall successfully complete either a refresher training course or an initial training course.

3. If more than 24 months have elapsed since successfully completing an initial or refresher training course, an applicant shall complete an initial training course.

4. The Department may require additional initial or refresher training specific to the requirements of this regulation or to air sampling strategies.

E. Action on an Application.

1. Within 15 calendar days after receiving an application, the Department will acknowledge receipt of the application and notify the applicant of any deficiency in the application. Within 30 calendar days after receiving a completed application, including all additional information requested, the Department will issue a license or deny the application.

2. The Department reserves the right to request documentation to verify an applicant's previous training or accreditation in any discipline prior to issuing a license.

3. The Department reserves the right to request documentation, including Social Security numbers, to verify an applicant's identity prior to issuing a license.

F. Denial.

1. The Department shall deny an application if it determines that the applicant has not demonstrated the ability to comply with applicable requirements, procedures, and standards established by:

a. The Department as per South Carolina Regulation 61-86.1;

b. Chapter 87 of the 1976 South Carolina Code of Laws, as amended;

c. The U. S. Environmental Protection Agency as per:

(1) National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 61, Subpart M, as amended, and any subsequent amendments and editions; and

(2) Asbestos-Containing Materials in Schools, 40 CFR Part 763, Subpart E, as amended, and any subsequent amendments and editions; and

d. Occupational Safety and Health Administration in 29 CFR Part 1926.1101 and 1910.1001, as amended, and any subsequent amendments and editions.

2. The Department shall deny a license to any applicant who has failed to comply with the requirements of a properly issued consent, administrative, or judicial order initiated by the Department.

3. The Department shall deny a license to any applicant if it determines that any information or documentation, including a Social Security number, required by this regulation is fraudulent or has been altered or falsified.

4. The Department shall deny a license to any applicant who fails to remit applicable fees.

5. The Department shall deny a license to any applicant who submits fraudulent or falsified information or documents.

6. The Department will not return fees submitted with any invalid or falsified training and/or identification documents submitted for the purposes of licensing.

7. The Department shall send notification of the denial of an application by certified mail, unless the individual is present when the application is evaluated, in which case the Department will inform the applicant in person of the denial.

8. Reapplication after denial. An application denied per this Section shall be resubmitted as follows:

a. For failure to comply with the requirements of a properly issued consent, administrative, or judicial order initiated by the Department, the application shall not be considered until the applicant complies with said order.

b. For altered or falsified documents**,** including but not limited to, training certificates, Social Security cards or numbers, and photo IDs, the application shall not be considered by the Department prior to 180 days after receipt of such documents and will only be considered thereafter with proper proof of the applicant having successfully completed an initial course in the discipline in which licensure is sought.

c. For failure to remit applicable fees, the application shall not be considered until all applicable fees have been received.

9. The applicant may request a hearing pursuant to the provisions of this regulation.

G. Conditions and Generic Alternatives.

In granting a license, the Department may impose reasonable terms and conditions to ensure continuous compliance with the requirements of this regulation.

H. Duration of Licenses.

1. A license shall automatically become invalid if an instrument of payment is returned for insufficient funds.

2. A Contractor's license shall expire one year from the issue date, unless the Department suspends or revokes the license at an earlier date. A Contractor's license shall be considered invalid unless at least one company employee maintains a current, company-affiliated supervisor's license pursuant to this regulation.

3. All other licenses shall expire one year from the examination date printed on the license, which is based on the most recent acceptable training certificate submitted with the application, unless the Department suspends or revokes the license at an earlier date.

4. No license shall be extended beyond its expiration date.

SECTION V. - ASBESTOS PROJECTS/GENERAL INFORMATION.

A. Applicability.

The requirements of this Section shall apply to the owner/operator, building inspector, management planner, project designer, air sampler, supervisor, worker, non-industrial facility owner/operator, or demolition contractor of any asbestos project involving the disturbance of RACM or ACM.

B. General Requirements.

1. A person licensed as an asbestos project designer shall prepare the written design for each abatement renovation project involving the removal of greater than 3,000 square, 1,500 linear or 656 cubic feet of RACM in a facility. However, all projects must be designed in accordance with 40 CFR 763.90(g) (*Federal Register*, Volume 52, Number 210, Friday, October 30, 1987), as amended, and any subsequent amendments and editions, and this regulation.

2. The asbestos project design must address:

a. Preparation of each asbestos-related work area;

b. Establishment of each containment;

c. Establishment of each decontamination unit and procedures for use;

d. Evaluation and selection of various fiber release control options;

e. Establishment, maintenance, and monitoring of negative air pressure within each containment;

f. RACM enclosure, removal, encapsulation, or repair work practices;

g. Visual inspection procedures for each asbestos abatement containment area;

h. Clean-up and final clearance procedures;

i. Air monitoring, including analysis, documentation, and any other required record keeping;

j. Respiratory protection and personal protective equipment requirements;

k. Procedures for on-site storage, handling, and disposal of ACM and project waste; and

l. Procedures for maintaining personnel licenses and training certificates on-site.

3. An owner/operator shall obtain an asbestos project license from the Department prior to beginning any NESHAP, small, minor, or demolition asbestos project subject to this regulation unless reporting quarterly as specified herein or in the case of an emergency removal.

4. When air monitoring is required by this regulation, the facility owner shall utilize a person licensed as an air sampler and ensure that all air monitoring is performed.

5. When any negative pressure enclosure or contained work area is required for any sized asbestos abatement project or demolition project, the following requirements shall apply:

a. There shall be sufficient negative pressure differential equipment to ensure at least four air changes per hour;

b. A minimum of -0.02 column inches of water pressure differential, relative to outside pressure, shall be maintained as verified and recorded by a manometer;

c. The manometer record of daily readings (to be taken four times during every eight-hour work shift by a licensed air sampler independent from the contractor) verifying the negative pressure shall be maintained at the job site for Department review for the duration of the project;

d. The inlet sensor of the manometer shall be located at the farthest point from any source of make-up air;

e. The manometer must be calibrated prior to the start of each work shift;

f. Negative pressure shall be maintained until final clearance has been achieved; and

g. Air movement shall be directed away from employees performing asbestos work within the enclosure/containment and toward a HEPA filtration or other collection device.

6. The owner/operator shall notify the Department by telephone and follow up in writing as soon as possible, but not later than, the following working day when a project has been canceled.

7. The disposal requirements of this regulation shall be applicable to all asbestos-containing and asbestos-contaminated materials for any abatement activity.

8. The owner/operator shall ensure that contaminated water is filtered through a five-micron or smaller filter and discharged to a sanitary sewer system. No contaminated or filtered water shall be allowed to leak or drain outside of the work area.

C. Other Requirements at the Project Sites.

1. Every asbestos abatement entity performing abatement work shall have at the project site a legible, clear copy of a valid current initial or refresher training certificate issued by an approved training provider.

2. Every asbestos abatement entity performing abatement work shall have a clear, legible copy of a valid Department-issued personnel license at the project site.

3. For the duration of an abatement project, the asbestos owner/operator shall ensure that:

a. Each worker and supervisor employed at the abatement project site meets the applicable training and licensing requirements of this regulation.

b. At all times while abatement (including preparation, removal, and cleanup) of RACM is being performed at NESHAP and small projects, at least one licensed supervisor remains inside of each contained work area supervising the work. During abatement at regulated roofing projects, the supervisor shall be in the immediate work area supervising the work.

c. A means is available at all times during abatement at NESHAP and small abatement projects for Department inspectors or other authorized visitors to communicate with persons within the immediate contained work area in order to gain access.

d. For the duration of the asbestos project, a daily log containing the name and signature of every individual entering the negative pressure enclosure/regulated area shall be maintained on site.

e. The contained work area is secured at all times to prevent access of unauthorized visitors or unprotected persons.

f. Legible copies of Department letters of approval for alternative work practices are at the project site and available for inspection for the duration of abatement.

4. The contractor shall not proceed with abatement unless the air sampler fulfills all specified air monitoring requirements.

5. Commercial labor providers shall ensure that each worker or supervisor has completed appropriate training as specified in this regulation.

D. Alternative Work Practices for Any Sized Asbestos Project.

1. The Department may, on a case-by-case basis, approve and issue a variance for an alternative procedure for control of emissions from an asbestos abatement project, provided the owner/operator submits a written description of the alternative procedure to the Department prior to beginning work and demonstrates to the satisfaction of the Department that compliance with the prescribed procedures will not be practical or feasible, and that the proposed alternative procedures provide equivalent protection from asbestos exposure.

2. The owner/operator shall keep a copy of the Department's written approval at the work site and make it available for review by Department personnel upon request.

E. Emergency Operation.

1. For an emergency operation, the owner/operator must notify the Department by telephone (outside of normal business hours, an electronically recorded verbal notification is acceptable for approval to execute the emergency operation) and must submit a project notification/application as early as possible before, but not later than, the working day following the emergency operation. The notification/application may be transmitted via facsimile.

2. The facility owner shall notify the Department in writing of 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, public safety or health threat, equipment damage or would impose an unreasonable financial burden. The owner shall submit this information with the project notification/application.

SECTION VI. - ASBESTOS BUILDING INSPECTION REQUIREMENTS.

A. Applicability.

1. Prior to beginning a renovation or demolition operation at any facility, the facility owner and/or owner's representative shall ensure that an asbestos building inspection is performed to identify the presence of ACM.

2. The asbestos building inspection shall include the facility or part of the facility affected by the renovation or demolition operation.

3. The facility owner and/or owner's representative shall ensure the asbestos building inspection is completed by a person licensed as an asbestos building inspector or management planner.

4. When materials that will be disturbed by the renovation or demolition operation are assumed to be asbestos without the use of laboratory bulk sample results, the provisions of Section VI.A.3 of this regulation does not apply.

5. In a multi-unit building, each separate room in each part of the building or areas affected by the renovation or demolition operation shall be inspected to confirm and quantify ACM homogeneous areas for sampling purposes.

6. To be acceptable, a building inspection shall have been performed no earlier than three years prior to the renovation or demolition, or, if more than three years have elapsed since the most recent inspection, the previous inspection shall be confirmed and verified by a person licensed as a building inspector.

7. The Department will not accept an asbestos building inspection or written report for any structure from an employee of an abatement company also involved in the removal of asbestos-containing materials from that structure, unless the licensed inspector is an employee of an entity regulated under Section XX of this regulation.

8. An asbestos building inspector shall not participate in the analysis of the bulk samples he or she has collected.

B. Asbestos Inspection.

The building inspector or management planner shall:

1. Visually inspect the areas that may be affected by the renovation or demolition operation to identify the locations of all suspected ACM. For a pre-demolition inspection, destructive sampling techniques shall be utilized;

2. Touch all suspected ACM to determine condition, friability, and whether ACM is a regulated material in areas that may be affected by the renovation or demolition operation;

3. Identify all homogeneous areas of suspected ACM in areas that may be affected by the renovation or demolition operation;

4. In areas that may be affected by the renovation or demolition operation, assume that some or all of the homogeneous areas are ACM, and/or for each homogeneous area that is not assumed to be ACM, collect and submit bulk samples for analysis in compliance with this Section;

5. Material Safety Data Sheets (MSDS), statements from the manufacturer, and architecture signoff will not be accepted as proof that a building product contains no asbestos, except in cases where the owner can verify the direct correlation of the building product to the MSDS, statements from the manufacturer, and/or architecture signoff documents. The Department reserves the right to reject documentation that it deems unacceptable.

C. Asbestos Inspection Report Contents.

1. Prior to each demolition operation and upon request for renovations, the Department shall be provided with a complete, legible copy of the asbestos building inspection report.

2. The inspection report shall include:

a. A title page denoting:

(1) The client's name, company, address, and telephone number, and the name and exact location of the facility inspected;

(2) The date the inspection was performed;

(3) The date the inspection report was written; and

(4) The printed name and telephone number of the inspector(s), and his or her affiliated company name, address, and telephone number.

b. A cover letter to the building owner or owner's representative that describes the purpose of the inspection; a general synopsis of the inspection and results; and the name, title, and signature of the inspector(s) and report writer, if different.

c. A detailed narrative of the physical description of the building or part of the building affected by the renovation or demolition operation that includes:

(1) The square footage of the building or part of the building affected by the renovation or

demolition operation;

(2) The building materials used in the construction of the exterior, roof, interior, and basement or crawlspace of the building affected by the demolition or affected by the renovation materials operation; and

(3) An estimated or exact quantity (square or linear feet) for all suspect materials whether sampled for or assumed to be asbestos that may be affected by the renovation or demolition operation;

(4) Also include a description of non-suspect materials excluding: glass, metals, kiln brick, cement, fiberglass, concrete, pressed wood, cinder block, and rubber.

d. An executive summary that details:

(1) The type of suspect ACM (e.g., TSI, floor tile, mastic), total square or linear footage, and the total number of samples collected for each separate homogenous area affected by the renovation or demolition operation;

(2) The date of the inspection, type, condition, quantity, sample results, and exact location of ACM positively identified or assumed to be ACM in the part of the building affected by the renovation or demolition operation; and

(3) A list of the homogeneous areas identified are:

(a) Surfacing material that includes, but is not limited to, joint compound; plaster; and painted, troweled on, or spray-applied textured material;

(b) Thermal system insulation (TSI) that includes, but is not limited to, pipe and boiler insulation; or

(c) Miscellaneous material that includes, but is not limited to, flooring, roofing, mastics, gaskets, cementitious materials, caulkings, ceiling tiles, fire doors, wall boards, and flexible duct connections;

(4) Whether the material is accessible for the building or part of the building affected by the renovation or demolition operation; and

(5) The material's potential for disturbance for the building or part of the building affected by the renovation or demolition operation.

e. For renovation and demolition operations, the inspector’s determination that ACM is friable or non-friable.

f. Except when suspect ACM materials are assumed to be asbestos, include a complete, clear, legible copy of all laboratory bulk sample results.

g. Clear, legible drawings and/or photographs to clarify the scope of the renovation or demolition operation. Illustrate the exact location of each sample collected. For facilities that involve a trade secret or confidential component or an affected area process, a request for a variance may be submitted.

h. The printed name and signature of each accredited inspector who collected the samples, and a

clear legible copy of his or her Department issued asbestos building inspector or management planner license.

D. Sampling.

1. A licensed asbestos inspector shall collect, in a statistically random manner, a minimum of three bulk samples from each homogeneous area of any surfacing that is not assumed to be ACM, and shall collect the samples as follows:

a. At least three bulk samples shall be collected from each homogeneous area that is 1,000 or fewer square feet (sf) or linear feet (Lf) in size.

b. At least five bulk samples shall be collected from each homogeneous area that is greater than 1,000 but fewer than or equal to 5,000 sf or Lf.

c. At least seven bulk samples shall be collected from each homogeneous area that is greater than 5,000 sf or Lf.

2. A licensed asbestos inspector shall collect, in a statistically random manner, at least three bulk samples from each homogeneous area of TSI and any miscellaneous material that is not assumed to be ACM. In accordance with ASTM E2356, and any subsequent amendments and editions, negative results for non-friable organically bound materials such as flooring and roofing shall be verified with at least one TEM analysis.

3. Each owner/operator shall have all bulk samples collected per this regulation analyzed for asbestos using laboratories accredited by the National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), or an equivalent standard as approved by the Department.

4. Bulk samples shall be analyzed for asbestos content by polarized light microscopy (PLM) using the "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" found in Appendix E to subpart E of 40 CFR 763, the "Method for the Determination of Asbestos in Bulk Building Materials" (EPA/600/R-93/116), ASTM E2356, or other method(s) deemed acceptable by the Department on a case-by-case basis.

5. A homogeneous area is not considered to contain ACM only if the results of all samples required to be collected from the area show asbestos in amounts of one percent (1%) or less.

6. 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 one percent (1%).

SECTION VII. - STANDARDS FOR AIR SAMPLERS.

A. Applicability.

This Section shall apply to each owner, owner's representative and/or air sampler engaged in an asbestos project where air sampling is required.

B. General Requirements.

1. Area air sampling shall be performed by a licensed air sampler.

2. Abatement air sampling data collected by a licensed air sampler under contract with or employed by the asbestos contractor performing the abatement will not be acceptable to the Department.

3. Air sampling shall be conducted using collection media, procedures, and analytical methods in accordance with NIOSH Method 7400 when Phase Contrast Microscopy (PCM) is used, and with *Electron Microscope Measurement of Airborne Asbestos Concentrations* [EPA Report 600/2-77-178 (1978) and EPA Contract No. 68-02-3266 (1984)] when Transmission Electron Microscopy (TEM) is used.

4. Any alternative procedure for clearance sampling shall require prior written approval from the Department. The written request must provide a detailed description of the alternative procedure and an explanation of how it will provide an equivalent level of protection to facility occupants.

5. The air sampler shall:

a. Ensure that all air sampling pumps are accurately calibrated prior to operation by utilizing a rotometer that has been calibrated within the past six months using a primary standard, such as a bubble burette or a dry calibrator. Calibration data shall be maintained at the project site for the duration of abatement.

b. Ensure that all air sampling pumps are operating properly and that the filtered sampling cassettes are securely attached to the pumps for the duration of sampling.

c. Maintain current background, daily, and clearance air monitoring data at the project site, and make the data available for review by Department personnel and other authorized visitors upon request.

d. Ensure that there are always at least four sampling pumps operating properly for the duration of any asbestos project requiring daily area air monitoring.

e. Collect area air samples for a minimum of two and one half hours for each four-hour work period during preparation, removal, and clean-up activities at NESHAP projects.

f. Maintain a log for the duration of an asbestos project describing daily activities.

g. Follow the procedures specified in NIOSH 7400 or an equivalent method acceptable to the Department when conducting clearance air monitoring.

h. Submit a written copy of the sampling procedures and clearance air monitoring results to the facility owner within five working days following the completion of the project and to the Department upon request.

C. Background Monitoring.

1. The air sampler shall collect a minimum of five air samples at a NESHAP abatement project prior to the start of abatement activities in order to obtain an index of background airborne fiber concentrations.

2. Samples shall be taken both inside and outside the work area to establish existing ambient air levels under normal activity conditions.

3. The air sampler shall document any variations and justifications for the variations, and shall maintain a written copy of the sampling variation(s) at the project site for the duration of the abatement, and shall provide the information to the Department upon request.

4. No background air sampling is required at small, minor, and O&M abatement projects.

5. Background sampling, when required, may be analyzed using PCM methods.

D. Daily Monitoring.

1. Once abatement activities begin at a NESHAP abatement project, the air sampler shall conduct representative daily area sampling in the following areas:

a. In the equipment room of the decontamination enclosure systems;

b. At the entrance to the clean room of each decontamination enclosure system;

c. Outside the work area in uncontaminated areas of the facility;

d. Where the negative pressure differential equipment exhausts, at a distance no greater than five to eight feet from the air flow when feasible. When multiple machines are in operation, the air sampler may rotate the sampling; however, all exhausts must be monitored daily; and

e. The total volume of air collected for daily area air sampling shall be in accordance with 40 CFR Part 763 and/or NIOSH 7400 and any subsequent revisions for analytical methodology.

2. The air sampler shall document any variations and justifications for the variations, and shall maintain a written copy of the sampling variation at the project site for the duration of the abatement and provide the information to the Department upon request.

3. Daily air sampling, when required, may be analyzed using PCM methods.

E. Clearance Monitoring.

1. Where clearance air monitoring is required by this regulation, the clearance standard for any NESHAP abatement project shall be: by Phase Contrast Microscopy less than or equal to 0.01 f/cc; or by Transmission Electron Microscopy (TEM). The clearance standard is less than or equal to 70 s/mm^2 using the Mandatory TEM Method described in 40 CFR 763, Appendix A of Subpart E, as amended, and any subsequent amendments and editions. The Z test with a value of Z less than or equal to 1.65 for a Z test carried out as described in 40 CFR 763, Appendix A of Subpart E, as amended, and any subsequent amendments and editions, shall be allowed for clearance purposes only with prior Department approval.

2. The total volume of air collected for clearance air sampling shall be in accordance with 40 CFR Part 763 and/or NIOSH 7400 and any subsequent revisions for analytical methodology.

3. A licensed air sampler shall conduct, at a minimum, PCM clearance air monitoring at the completion of each NESHAP project. Projects exceeding the project design threshold (3,000 sf, 1,500 Lf, and 656 cubic feet of RACM) will require TEM clearance air monitoring.

4. When conducting clearance air monitoring, the air sampler shall follow the procedures specified in *Measuring Airborne Asbestos Following An Abatement Action*, EPA Report 600/4-85-049 (1985), which

is hereby incorporated by reference, or an equivalent method acceptable to the Department. Procedures shall be summarized and submitted to the facility owner. The air sampler shall report the clearance air monitoring results in writing to the facility owner within five working days following completion of the project and to the Department upon request.

5. Sampling shall not begin until wet cleaning has been completed and no visible pools of water or condensation remain. Sufficient time shall be allowed for all surfaces to dry. The sampling zone shall be representative of the building occupants' breathing zone.

6. Sampling shall not begin until the air sampler has performed a visual inspection and authorizes final clearance air monitoring.

7. Sampling shall be conducted only after all interior wall, ceiling, and floor polyethylene sheeting has been removed. Critical barriers and the five-stage decontamination enclosure system shall remain in place until the abated area has passed final clearance.

8. For projects subject to 40 CFR Part 763, AHERA, as amended, and any subsequent amendments or editions, conduct clearance air monitoring after abatement in areas to be reoccupied (including interior spaces, porticos, and covered exterior walkways) and abatement on exterior portions of mechanical systems used to condition interior spaces. For projects equal to or greater than 160 sf, 260 Lf or 35 cubic feet, TEM clearance air monitoring is required.

9. At least one licensed asbestos project supervisor shall remain at an asbestos project site for the duration of the final clearance visual inspection and clearance air sample collection process.

SECTION VIII. - DISPOSAL REQUIREMENTS.

A. Applicability.

This Section shall apply to each owner/operator engaged in a renovation abatement project.

B. General Requirements.

1. Each owner/operator engaged in a renovation abatement project subject to this Section shall ensure that:

a. Each container (bag, drum, wrapped component, etc.) is labeled so that labels have the appearance of or are designed in accordance with OSHA 29 CFR 1926.1101 (August 10, 1994), as amended, and any subsequent amendments and editions, and EPA 40 CFR 61.150 (November 20, 1990), as amended, and any subsequent amendments and editions.

b. All asbestos waste bags and/or containers shall be properly labeled prior to being placed into the waste transport vehicle.

c. Waste generator labels are:

(1) Written legibly and in indelible ink; and

(2) Displayed in a prominent location on the outer most bag or container.

d. Asbestos waste is disposed of at a landfill approved or permitted to accept asbestos waste.

e. Asbestos waste is not stored at a location other than the facility site without prior written approval from the Department.

f. Stored asbestos waste is maintained in a secured, locked location where access is controlled.

g. Asbestos waste is transported and disposed of in a manner that will not permit the release of asbestos fibers into the air (e.g., enclosed or retrofitted covered vehicle).

h. Asbestos waste is transported in accordance with the following procedures:

(1) The cargo area of the transport vehicle shall be free of debris and be lined with at least one layer of 6-mil polyethylene sheeting.

(a) Floor sheeting shall be installed first and shall extend up the side walls at least 12 inches and shall be taped securely into place.

(b) Wall sheeting shall overlap by at least six inches and be taped into place.

(c) Ceiling sheeting shall extend down the sides of the walls at least six inches and be taped into place.

(2) If asbestos waste is transported exclusively in leak-tight clean drums, or other leak-tight, rigid containers approved by the US Department of Transportation as appropriate shipping containers for asbestos waste, then polyethylene sheeting is not required.

(3) Drums, bags, wrapped components, and other leak-tight containers that have been removed from the work area shall be labeled in accordance with 1.a. of this Section prior to being loaded into an appropriate vehicle for transportation.

(4) Any debris or residue observed on containers or surfaces outside of the work area resulting from abatement activities shall immediately be cleaned using wet methods and a vacuum equipped with a HEPA filter.

(5) Containers shall be carefully placed, not thrown, into the truck cargo area. Drums shall be placed on a level surface in the cargo area and packed tightly or blocked and braced to prevent shifting and tipping. Large structural components shall be secured to prevent shifting.

(6) Asbestos waste that is removed from a facility site shall be transported directly to an approved landfill unless it is stored in the location designated in a temporary storage license issued to the owner/operator by the Department.

(7) Metal dumpsters or containers in which asbestos waste is temporarily stored at the abatement site shall be lined with 6-mil polyethylene sheeting to prevent contamination and shall have doors or tops. The doors and tops shall be closed and locked except during loading or unloading of asbestos waste.

(8) Metal dumpsters or containers used for waste storage shall be labeled in accordance with OSHA 29 CFR 1926.1101, August 10, 1994, as amended, and any subsequent amendments and editions.

(9) Bags shall be free of splits, rips, and tears, and shall be carefully placed, not thrown, into the transport vehicle.

(10) Any equipment, materials, or supplies stored in the waste transport vehicle shall be isolated from the asbestos waste by a leak-tight barrier. All containers and wrappings shall be free of asbestos contamination.

(11) Non-asbestos waste shall not be placed in waste containers or bags labeled as asbestos waste.

(12) The vehicle used to transport asbestos wastes shall be labeled in accordance with 40 CFR 61.149(d)(1)(i), (ii), and (iii), as amended, and any subsequent amendments and editions.

2. The owner/operator shall dispose of asbestos waste in accordance with the following procedures:

a. Upon reaching the landfill, vehicles shall approach the dump location as closely as possible to unload asbestos waste.

b. Bags, drums, and wrapped components shall be inspected when unloaded at the disposal site. Material in damaged containers shall be rewrapped or repacked in empty drums or bags.

c. Waste containers shall be placed on the ground at the disposal site, not dropped or thrown out.

d. Unloading of metal dumpsters or containers by tipping or tilting is permitted without re-inspecting individual bags or drums, provided there are no visible emissions.

e. Following the removal of all containerized waste, polyethylene sheeting shall be removed and discarded in bags or drums along with contaminated cleaning materials and protective clothing.

f. After asbestos waste has been unloaded, the truck cargo area, including the floor, walls, and ceiling, shall be decontaminated using wet methods or a vacuum equipped with a HEPA filter until no visible residues remain.

g. A copy of a completed waste shipment record with signature of the landfill operator shall be submitted to the Department by the asbestos contractor within 45 working days of completion of removal.

h. A waste shipment record shall be used and shall include the asbestos project license number; names of the facility owner, contractor and disposal site; the estimated quantity of asbestos waste; and the type and number of containers used. Each time the material changes custody, the record shall be signed by the person(s) receiving the waste. If a separate hauler is used, the hauler's name, address, telephone number, and the driver's signature shall also appear on the record.

i. The owner/operator shall ensure that asbestos-containing or asbestos-contaminated waste materials are not burned or recycled.

j. Commercial rental vehicles shall not be used to transport any asbestos, asbestos-containing, or asbestos-contaminated waste. This prohibition does not apply to tractors but does apply to cargo compartment areas used to store and/or transport asbestos waste. Rental vehicles do not include leased vehicles.

C. Temporary Asbestos Storage Containment Area Site.

1. Prior written approval must be obtained from the Department before a site other than an asbestos

abatement project site can be used for the storage of regulated asbestos-containing waste from small, minor, or O&M asbestos projects. NESHAP asbestos project waste must be deposited into an approved landfill and may not be stored.

2. Written authorization shall also be obtained from the facility owner or his representative prior to transporting regulated asbestos-containing waste from the facility site of generation (verification of the property owner's authorization must be sent directly to the Department by the facility owner).

3. In order to have a site permitted as a Temporary Asbestos Storage Containment Area, the operator must demonstrate that adequate precautions have been and will continue to be taken to ensure that the waste is properly maintained for the duration of its storage.

4. An operator must submit an application requesting a license for a Temporary Asbestos Storage Containment Area to the Department for review at least 45 working days in advance. The Department will acknowledge receipt of the application and notify the applicant of any deficiency in the application.

5. Within 45 working days after receiving a completed application, including additional information requested, the Department will issue a license or deny issuance of the license.

6. The Department reserves the right to inspect the proposed Temporary Asbestos Storage Containment Area prior to granting final approval.

7. Approval of the Temporary Asbestos Storage Containment Area will be valid for one year from the date of issuance unless the authorization is revoked or suspended by the Department at an earlier date.

8. The Department may revoke or suspend a license based on falsification of or known omission of information from an application for this license, omission or improper use of work practices, improper disposal of ACM, and/or spread of asbestos waste beyond the containment area.

9. In order to renew a storage license, the operator of a Temporary Asbestos Storage Containment Area must resubmit an application for off-site storage of regulated asbestos-containing waste to the Department at least 45 working days prior to the expiration of the existing permit. Previous approval of a site as a Temporary Asbestos Storage Containment Area does not guarantee re-issuance or continuance of a storage license.

SECTION IX. - EXEMPTION FROM WETTING FOR ANY SIZED PROJECT.

A. General Provisions.

In renovation operations, wetting is not required if:

1. The owner/operator has obtained prior written approval from the Department based on a written application that wetting to comply with this Section would unavoidably damage equipment or present a safety hazard; and

2. The owner/operator uses one or more of the following emission control methods:

a. A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of asbestos materials. The system must exhibit no visible emissions to the outside air or must be designed and operated in accordance with the requirements in EPA Regulation 40 CFR 61.152, as amended, and any subsequent amendments and

editions;

b. A glovebag system designed and operated in accordance with the requirements of OSHA regulation 29 CFR 1926.1101, as amended, and any subsequent amendments and editions;

c. Leak-tight wrapping to contain all RACM prior to dismantlement;

3. In renovation operations where wetting would result in equipment damage or a safety hazard and the methods allowed in this Section cannot be used, an owner or operator may use another method after obtaining written approval from the Department based on its determination that the alternative method is equivalent to wetting. The owner/operator shall keep a copy of the Department's written approval at the work site and make it available for review by Department personnel upon request.

B. Temperature Constraints.

When the temperature at the point of wetting is below 0° C (32° F):

1. During periods when wetting operations are suspended due to freezing temperatures, the owner/operator must record the temperature in the area containing the asbestos-coated or covered facility components at the beginning, middle, and end of each workday and keep daily temperature records. A copy of these records must be maintained at the project site and made available for inspection by Department personnel upon request. The facility owner must maintain these temperature records for two years from the date the project is completed and shall provide a legible copy of the data to the Department upon request.

2. The owner/operator may request to use an alternative work practice by submitting to the Department a written description of control measures to be used that will afford the same level of protection as wetting. A legible copy of the Department's approval letter must be available at the project site for the duration of the asbestos project and shall be made available for review by Department personnel upon request.

3. The owner/operator shall remove facility components containing, coated with, or covered with RACM as units or in sections and shall secure the units or sections leak-tight in 6-mil or thicker polyethylene sheeting.

SECTION X. - NESHAP PROJECTS.

A. Applicability.

The notification/application, work practice, air sampling, clean-up and disposal requirements of this Section shall apply to each owner/operator of a renovation asbestos project, where the combined amount of RACM to be stripped, removed, dislodged, cut, drilled, or similarly disturbed includes at least 260 linear feet on pipes, or 160 square feet on other facility components, or 35 cubic feet off of facility components where the area or length could not be measured prior to abatement.

B. Notification/Application.

1. Each owner/operator of a renovation or demolition operation to which this Section applies shall:

a. Provide the Department with written notification/application at least ten complete working days prior to any renovation or demolition operation, and pay all applicable project fees. Acceptable delivery

of the notification and fee payment is by U.S. Postal Service or commercial delivery service, by hand, or by other methods deemed acceptable by the Department.

b. Update/revise the notification/application and pay appropriate fees as required when any previously-notified information changes, including but not limited to, when the amount of asbestos affected increases or decreases more than five percent (5%), when the project start or completion date changes, when the disposal site changes, and/or the project has been cancelled. The owner/operator shall notify the Department by telephone and follow up in writing as soon as possible before, but not later than, the following working day.

c. Prior to each demolition operation, and upon request for renovations, provide the Department with a complete legible copy of the asbestos building inspection report.

d. Begin abatement on the start date contained in the Department-issued asbestos project license.

e. Project designs shall be submitted at the Department's request.

2. When the asbestos stripping or removal operation or demolition operation covered by this Section will begin on a date earlier than the previously-notified start date, the owner/operator shall provide the Department with written notification/application of the new start date at least ten working days before asbestos stripping or removal work will begin. The Department may waive this requirement on a case-by-case basis, although the owner/operator shall provide all required information in writing prior to commencing any abatement activities.

3. The owner/operator of an asbestos stripping or removal operation covered by this Section shall:

a. Notify the Department of the new start date by telephone as soon as possible before, but not later than, the original start date, when the renovation will begin after the date contained in the initial notification/application and in the asbestos project license issued by the Department.

b. Provide the Department with an updated written notice of the new start date as soon as possible before, but not later than, the original start date. Acceptable delivery of the updated notice is by the U.S. Postal Service or commercial delivery service, by hand, or by other methods deemed acceptable by the Department.

c. Provide the Department with an updated written notice of the new completion date as soon as possible before, but not later than, one working day following the completion of the project when the asbestos stripping or removal operation covered by this Section will end on a date earlier than contained in the initial notification and in the asbestos project license issued by the Department. Acceptable delivery of the updated notice is by the U.S. Postal Service or commercial delivery service, by hand, or by other methods deemed acceptable by the Department.

d. Provide the Department with written notification/application of the new completion date as soon as possible before, but not later than, the original completion date when the asbestos stripping or removal operation covered by this Section will end on a date later than contained in the initial notification/application and in the asbestos project license issued by the Department. Acceptable delivery of the updated notice is by the U.S. Postal Service or commercial delivery service, by hand, or by other methods deemed acceptable by the Department.

4. The written notification /application shall include:

a. Indication whether the notification/application is an original, revision, or cancellation;

b. Name, address, and telephone number of the owner/operator;

c. Type of operation: demolition or renovation;

d. Description of the facility or affected part of the facility, including the square footage, number of floors, age, and prior, present, and intended use of the facility;

e. Description of the procedures and analytical methods used to detect the presence of ACM (regulated and non-regulated), date of inspection, and name, address, telephone number, and license number of the building inspector;

f. An estimate of the approximate amount of RACM and Category II nonfriable ACM to be removed from the facility in terms of length of pipe in linear feet; surface area in square feet on other facility components, or volume in cubic feet, if already off facility components;

g. 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;

h. Scheduled starting and completion dates of asbestos renovation or demolition;

i. Description of planned renovation or demolition work to be performed, emission control measure(s) to be employed, and a description of the affected facility or facility components;

j. Description of the engineering controls and procedures to be used to comply with the work practice requirements of this regulation;

k. Name and location of the waste disposal site where the regulated asbestos-containing waste material will be deposited. Regulated asbestos-containing waste must be deposited into a landfill approved or permitted to accept asbestos waste;

l. Description of procedures to be followed in the event that unexpected RACM is found or Category I or II nonfriable ACM becomes regulated;

m. Name, address, and telephone number of the waste transporter; and

n. Printed name and signature of the asbestos owner/operator submitting the notification, and date signed.

5. A complete notification/application shall contain all of the above information and shall be reported on a form similar to the one found in 40 CFR Part 61, Subpart M, as amended, and any subsequent amendments and editions.

C. Work Practice Requirements.

1. Preparation.

a. Prior to beginning removal, each owner/operator engaged in a renovation project subject to this Section shall:

(1) Define the work area using barrier tape and danger signs in accordance with the following or OSHA 29 CFR 1926.1101, as amended, and any subsequent amendments and editions, if more stringent:

(a) Warning signs and tape that clearly separate the regulated area shall be provided and displayed at each location where a regulated area is required to be established by this Section. Signs shall be posted at a distance from the regulated area such that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(b) The warning signs required by this Section shall bear the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

(2) Shut down, lock, and tag out all HVAC equipment in or passing through the work area. Seal each intake and exhaust opening and any seam in system components with two sheets of 6-mil polyethylene sheeting and tape.

(3) Detach and wet clean removable electrical, heating, and ventilating equipment and other items which may be connected to asbestos surfaces.

(4) Remove existing filters from the HVAC system and dispose of as asbestos-contaminated waste.

(5) Seal each opening between the work area and uncontaminated areas including windows, doorways, elevator openings, corridor entrances, drains, ducts, electrical outlets, grills, grates, diffusers, and skylights with a critical barrier consisting of at least two independent sheets of 6-mil or thicker polyethylene sheeting secured in place. These critical barriers must be maintained leak-tight for the duration of asbestos abatement.

(6) Thoroughly clean and remove all movable objects from the work area.

(7) Thoroughly clean, then cover and secure each non-movable object in the work area with at least one sheet of 4-mil or thicker polyethylene sheeting.

(8) Use polyethylene sheeting to isolate contaminated from uncontaminated areas, and ensure the sheeting is attached securely in place and properly maintained at all times.

(9) Prevent contamination of carpet with ACM, or dispose of the carpet as asbestos-contaminated waste.

(10) Cover floors not being abated with at least two layers of 6-mil or thicker polyethylene sheeting. Floor sheeting shall be installed first and shall extend at least 12 inches up the walls and be taped into place. No seams shall be located at wall/floor joints. Spray-applied polyethylene coating shall not be used.

(11) Cover walls and ceilings not being abated with at least one sheet of 4-mil or thicker

polyethylene sheeting. Wall sheeting shall be installed to minimize joints and shall extend at least six inches beyond wall/floor joint and be taped into place. Ceiling sheeting shall extend at least 12 inches down the wall and be sized and taped into place. No seams shall be located at wall/ceiling or wall/wall joints.

(12) Construct a decontamination enclosure system adjoining the contained work area. The decontamination enclosure shall be built in a manner that will prevent track-out of RACM, and shall consist of: a clean room equipped with appropriate storage containers and adequate space for changing clothing; an air lock; a shower room containing hot and cold or warm running water controllable at the tap; and an equipment room suitable for storage of tools and equipment.

(13) Construct a clear viewing port measuring at least 24 inches by 24 inches in an external wall of the contained work area to allow unobstructed observation of abatement activities in the work area.

(14) Operate negative pressure differential equipment with HEPA filtration continuously from the time that barrier construction is completed through the time that acceptable final clearance air monitoring results are obtained.

(15) Utilize a manometer to measure negative pressure differential and operate it in accordance with the General Requirement Section of this regulation.

2. Removal.

Each owner/operator engaged in a renovation asbestos project subject to this Section shall ensure that:

a. Prior to removal, all RACM is thoroughly wet through to the substrate using amended water.

b. All RACM that has been stripped or removed in sections or units shall be:

(1) Thoroughly wet during stripping or removal and shall remain wet until disposed of in accordance with this regulation and 40 CFR 61.150, as amended, and any subsequent amendments and editions;

(2) Carefully lowered to the ground or floor, not dropped or thrown; and

(3) When removed or stripped at an elevation greater than 50 feet above ground level, transported to the ground via leak-tight chutes or containers.

c. At no time shall an owner/operator allow RACM to accumulate or become dry.

d. Structural components are thoroughly wet prior to wrapping in polyethylene sheeting for disposal.

e. For facility components such as reactor vessels, large tanks, and steam generators (but not beams, which must be stripped), ACM is not required to be stripped if the following requirements are met:

(1) The component is removed, transported, stored, disposed of, or reused without disturbing or damaging any of the ACM;

(2) The component is encased in leak-tight wrappings; and

(3) The leak-tight wrapping is labeled in accordance with EPA Regulation 40 CFR 61.149(d)(1)(i),(ii),and(iii), as amended, and any subsequent amendments and editions, during all loading, unloading, and storage operations.

f. When double polyethylene bags of at least 6-mil thickness are used for waste, bags shall be leak-tight. Excess air shall be removed from bags prior to sealing using a vacuum equipped with a HEPA filtration system in accordance with OSHA regulation 29 CFR 1926.1101, as amended, and any subsequent amendments and editions.

g. ACM from within the work area is not permitted outside of the work area except in sealed leak-tight containers.

h. Any person exiting or any equipment or machinery being removed from the contaminated work area shall be thoroughly decontaminated. If equipment or machinery is not or cannot be thoroughly decontaminated, it shall be sealed in leak-tight containers. No visible residue shall appear on the outside surface of the container.

3. Cleanup.

a. Each owner/operator engaged in a renovation abatement project subject to this Section shall ensure that:

(1) Following abatement, a visual inspection of the abated substrate is performed.

(2) A coating of a compatible encapsulating agent is applied to porous surfaces that have been stripped and cleaned of ACM. The encapsulant must be allowed to thoroughly dry prior to additional cleaning or final air clearance.

(3) The air sampler or the owner’s representative inspects the abated area prior to final clearance. If there is any evidence of contamination, the asbestos contractor shall perform additional wet cleaning and HEPA vacuuming.

(4) All polyethylene sheeting, except for critical barriers and the decontamination enclosure system, is removed and disposed of as asbestos-contaminated waste.

(5) With only the critical barriers and decontamination enclosure system left in place, the entire work area, including any duct work, is wet-cleaned and HEPA vacuumed until no visible residue remains.

(6) Areas exceeding clearance standards are re-cleaned by the contractor using wet methods and HEPA vacuuming. Re-cleaning, drying, and retesting shall be repeated until the satisfactory clearance standard is achieved.

(7) Following satisfactory clearance of the work area, remaining polyethylene critical barriers and decontamination enclosure systems are removed and disposed of as asbestos-contaminated waste.

(8) Portable decontamination trailers are cleaned and polyethylene sheeting disposed of as contaminated waste.

b. Re-establishment of the work area shall only occur following completion of clean-up procedures and after clearance air monitoring has been performed and documented to the satisfaction of the air sampler or of the facility owner or his representative.

c. Replacement materials shall only be installed following completion of abatement. This does not include outdoor projects subject to this regulation.

4. Disposal.

The disposal requirements of the Disposal Section of this regulation shall apply.

D. Air Sampling and Analysis Procedures.

The background, daily, and clearance air monitoring requirements of the Air Sampling Section of this regulation shall apply.

SECTION XI. - SMALL PROJECTS.

A. Applicability.

The notification/application, work practice, air sampling, clean-up, and disposal requirements of this Section shall apply to each abatement project where the combined amount of RACM to be stripped, removed, dislodged, cut, drilled, or similarly disturbed is more than 25 but fewer than 260 linear feet on pipes, or more than 25 but fewer than 160 square feet on other facility components, or more than ten but fewer than 35 cubic feet of RACM off of facility components such that area or length could not be measured prior to abatement.

B. Notification/Application.

In a facility being renovated subject to this Section, the owner/operator shall provide the Department with written notification prior to any abatement and pay all applicable fees as follows:

1. Deliver the notification/application by U.S. Postal Service or commercial delivery service, facsimile transmission, by hand or by other methods deemed acceptable by the Department.

2. Postmark or deliver the notice at least four working days before asbestos stripping or removal work or any other activity begins that would break up, dislodge, or similarly disturb RACM.

3. Update/revise the notification/application and pay appropriate fees as required, when any previously-notified information changes, including but not limited to: when the amount of asbestos affected increases or decreases more than ten percent (10%), when the project start or completion date changes, and/or when the disposal site changes, and/or the project has been cancelled. The owner/operator shall notify the Department by telephone and follow up in writing as soon as possible before, but not later than, the following working day. When the amount of asbestos affected changes such that the total quantity being abated qualifies as a NESHAP project, prior approval must be granted by the Department for work to proceed.

4. The Department may waive the four working days prior notice requirement on a case-by-case basis.

C. Air Sampling and Analysis Procedures.

The facility owner shall ensure that air sampling is performed in accordance with applicable requirements of the Air Sampling Section of this regulation.

D. Work Practice and Clean-up Requirements.

1. An owner/operator engaged in a small asbestos abatement project shall:

a. Construct critical barriers to prevent the potential release of asbestos fibers from within the work area;

b. Prevent contamination of carpet with ACM, or dispose of the carpet as asbestos-contaminated waste;

c. Thoroughly wet all RACM prior to removal and keep it wet until disposal;

d. Prevent track-out and leakage of RACM onto uncontaminated surfaces;

e. Use HEPA vacuum equipment and wet-cleaning techniques to clean up the work area following abatement until there is no visible residue;

f. Ensure that ACM from within the work area is not permitted outside of the work area except in sealed, leak-tight containers;

g. Ensure that any person exiting or any equipment or machinery being removed from the contaminated work area is thoroughly decontaminated. If equipment or machinery is not thoroughly decontaminated, it shall be sealed in leak-tight containers. No visible residue shall appear on the outside surface of the container; and

h. Ensure porous surfaces that have been stripped or cleaned of RACM are encapsulated to secure any residual fibers that may be present. The encapsulant used must be compatible with subsequent coverings.

2. Disposal.

The owner/operator shall comply with the requirements of the Disposal Section of this regulation.

SECTION XII. - MINOR PROJECTS.

A. Applicability.

The notification, work practice, clean-up, and disposal requirements of this Section shall apply to each abatement project where the combined amount of RACM to be stripped, removed, dislodged, cut, drilled, or similarly disturbed is equal to or fewer than 25 linear feet on pipes, or is equal to or fewer than 25 square feet on other facility components, or is equal to or fewer than 10 cubic feet of RACM off facility components where the area or the length or area could not be measured prior to abatement.

B. Notification/Application.

In a facility being abated subject to this Section:

1. The owner/operator shall provide the Department with a written application at least two working days prior to any abatement and pay all applicable fees as follows:

a. Acceptable delivery of the notification shall be by U.S. Postal Service, commercial delivery

service, facsimile transmission, by hand or by other methods deemed acceptable by the Department.

b. Update/revise the notification/application and pay appropriate fees as required when any previously-notified information changes, including but not limited to: when the amount of asbestos affected increases or decreases more than ten percent (10%), when the project start or completion date changes, and/or when the disposal site changes, and/or the project has been cancelled; or

c. The owner/operator shall notify the Department by telephone and follow up in writing as soon as possible before, but not later than, the following working day. When the amount of asbestos affected changes such that the total quantity being abated qualifies as a small or NESHAP project, prior approval must be granted by the Department for work to proceed.

2. Facility employees who do not meet the definition of a contractor as defined by this regulation, or a contractor who has obtained a temporary storage license may maintain a log of all minor abatements performed during a quarter, report them to the Department within 30 calendar days after the end of the quarter, and pay applicable project fees. The log shall include, but is not limited to: the name and address of the facility being abated, amount and type of ACM removed, date(s) of removal, names of individuals who performed the abatement, exact location for temporary storage of asbestos wastes, and the name of the landfill used for disposal.

C. Air Sampling and Analysis Procedures.

The facility owner shall ensure that air sampling is performed in accordance with applicable requirements of the Air Sampling Section of this regulation.

D. Work Practice and Clean-up Requirements.

1. An owner/operator engaged in a minor asbestos abatement project shall:

a. Construct critical barriers to contain asbestos fibers released within the work area;

b. Wet all RACM prior to removal and during containerization for disposal in an approved landfill;

c. Prevent track-out and leakage of RACM onto uncontaminated surfaces;

d. Use HEPA vacuum equipment and wet-cleaning techniques to clean up the work area following abatement until there is no visible residue;

e. Ensure that ACM from within the work area is not permitted outside of the work area except in sealed leak-tight containers;

f. Ensure that any person exiting or any equipment or machinery being removed from the contaminated work area is thoroughly decontaminated. If equipment or machinery is not thoroughly decontaminated, it shall be sealed in a leak-tight container. No visible residue shall appear on the outside surface of the container;

g. Ensure porous surfaces, that have been stripped or cleaned of RACM are encapsulated to secure any residual fibers that may be present. The encapsulant used must be compatible with subsequent coverings;

h. Containerize waste in appropriately labeled impermeable containers (6-mil polyethylene

sheeting, bags, and/or fiber or metal drums), and store in an area that is secured and locked; and

i. Transport asbestos waste in a manner that does not release fibers into the air and dispose of at a landfill permitted to accept asbestos waste.

2. Disposal.

The owner/operator shall comply with the requirements of the Disposal Section of this regulation.

SECTION XIII. - OPERATION AND MAINTENANCE ACTIVITIES.

A. Applicability.

1. The notification/application, work practice, clean-up, and disposal requirements of this Section shall apply to the non-industrial facility owner/operator and the O&M personnel covered under the facility's group license.

2. Workers are limited to an activity in which the amount of RACM disturbed does not exceed that which can be contained in one glovebag or one 6-mil polyethylene bag measuring no greater than 60 inches in length and width.

B. Notification/Application.

In a facility being abated that is subject to this Section:

1. The non-industrial facility owner/operator shall provide the Department with written notification/application and pay all applicable fees as follows:

a. Acceptable delivery of the notification shall be by U.S. Postal Service, commercial delivery service, facsimile transmission, by hand or by other methods deemed acceptable by the Department.

b. Update the notification when any previously-notified information changes.

c. Notify the Department by telephone and follow up in writing as soon as possible, but not later than, the original start date when a project for which notification was made has been canceled.

2. Alternately, facility employees who do not meet the definition of a contractor as defined by this regulation may maintain a log of all O&M activities performed during a quarter, report them to the Department within 30 calendar days of the end of the quarter, and pay applicable project fees. The log shall include, but is not limited to: the name and address of the facility being abated, amount and type of ACM removed, date(s) of removal, names of individuals who performed the abatement, exact location for temporary storage of asbestos wastes, and the name of the landfill used for disposal.

C. Air Sampling and Analysis Procedures.

The facility owner shall ensure that sampling is performed in accordance with applicable requirements of the Air Sampling Section of this regulation.

D. Work Practice and Clean-Up Requirements.

1. An owner/operator engaged in an operation and maintenance activity shall:

a. Construct critical barriers to prevent the potential release of asbestos fibers from within the work area;

b. Wet all RACM prior to removal and during containerization for disposal at an approved landfill;

c. Prevent track-out and leakage of RACM onto uncontaminated surfaces;

d. Use HEPA vacuum equipment and wet-cleaning techniques to clean up the work area following abatement until there is no visible residue;

e. Ensure that ACM from within the work area is not permitted outside of the work area except in sealed leak-tight containers;

f. Containerize wetted waste in appropriately labeled impermeable containers (6-mil polyethylene sheeting, bags, and/or fiber or metal drums) and store in an area that is secured and locked;

g. Transport asbestos waste in a manner that does not release fibers into the air, and dispose of at a landfill permitted to accept asbestos waste.

2. Each owner/operator engaged in an O&M glovebag operation shall:

a. Ensure that the glovebag procedure is being performed only by persons who have received training in the method and are licensed as workers or supervisors in accordance with the requirements of this regulation;

b. Ensure that the glovebag is constructed and utilized in accordance with the glovebag requirements of this regulation and OSHA 29 CFR 1926.1101, as amended, and any subsequent amendments and editions;

c. Isolate the work area to prevent access by unprotected persons;

d. Display danger signs in accordance with OSHA 29 CFR 1926.1101, as amended, and any subsequent amendments and editions, at all approaches to any asbestos abatement area;

e. Remove all polyethylene sheeting, tape, glovebags and other equipment, and inspect the area for visible residue following abatement;

f. Wet-clean the area using amended water and a HEPA vacuum after surfaces have been allowed to dry. The sequence of wet cleaning and vacuuming shall be repeated until no visible residue is observed in the work area; and

g. Ensure that porous surfaces that have been stripped or cleaned of RACM are encapsulated to secure any residual fibers that may be present. The encapsulant used must be compatible with subsequent coverings.

E. Disposal.

The owner/operator shall comply with the requirements of the Disposal Section of this regulation.

SECTION XIV. - GLOVEBAG TECHNIQUE.

A. Applicability.

1. The requirements of this Section shall apply to the owner/operator of any NESHAP, small, minor, or O&M abatement project when glovebag operations are implemented.

2. The owner/operator shall ensure that asbestos-containing waste from glovebag operations is wet at all times during abatement, storage, and transportation and is deposited in a landfill approved or permitted to accept asbestos waste.

B. Glovebag Operations.

Glovebag systems may be used to remove ACM from straight runs of piping, elbows, and other connections when performed in compliance with the provisions of this Section and OSHA 29 CFR 1926.1101, as amended, and any subsequent amendments and editions.

1. The owner/operator shall ensure that the glovebag is constructed and utilized in accordance with the following requirements:

a. The work area is isolated to prevent access by unprotected persons.

b. Danger signs are displayed at all approaches to any asbestos abatement area in accordance with OSHA 29 CFR 1926.1101, as amended, and any subsequent amendments and editions.

c. The glovebag procedure is performed only by persons who have received training in the method and are licensed as workers or supervisors in accordance with the requirements of this regulation.

d. At least two persons shall perform glovebag removal operations.

e. Each glovebag shall be made of 6-mil thick plastic and shall be seamless at the bottom.

f. Each glovebag used on elbows and other connections must be designed for that purpose and used without modifications.

g. Each glovebag shall be installed so that it completely covers the circumference of pipe or other structures where the work is to be performed.

h. Each glovebag shall be smoke-tested for leaks and any leaks sealed prior to use.

i. A glovebag shall be used only once and may not be slid or moved.

j. Each glovebag shall not be used on surfaces whose temperature exceeds 150 degrees Fahrenheit.

k. Prior to disposal, each glovebag shall be collapsed by removing air within it using a HEPA vacuum.

l. Before beginning the operation, loose and friable material adjacent to the glovebag or glovebox operation shall be wrapped and sealed in at least two layers of 6-mil polyethylene.

m. Where a system uses an attached waste bag, such bag shall be connected to the collection bag

using a hose or other material that shall withstand the pressure of ACM waste and water without losing its integrity.

n. A sliding valve or other device shall separate the waste bag from the hose to ensure no exposure when the waste bag is disconnected.

C. Negative Pressure Glovebag Systems.

1. Negative pressure glovebag systems shall be used to remove ACM from piping.

2. In addition to the requirements for glovebag systems in Section B above, negative pressure glovebag systems shall have a HEPA vacuum attached to the glovebag/box to prevent collapse during removal.

3. A HEPA vacuum shall be used to prevent collapse of the bag during removal and shall run continually until completion of operation, at which time the pipe shall be encapsulated, and the bag and ACM shall be isolated prior to removal of the bag from the pipe.

D. Negative Pressure Glovebox Systems.

Negative pressure gloveboxes may be used to remove ACM from pipe runs when the following work practices are utilized:

1. Gloveboxes shall be constructed with rigid sides and made from metal or other material that can withstand the weight of the ACM and water used during removal.

2. A negative pressure generator shall be used to create negative pressure in the system.

3. An air filtration unit shall be attached to the box.

4. The box shall be fitted with gloved apertures:

a. An aperture at the base of the box shall serve as a bagging outlet for waste ACM and water.

b. A back-up generator shall be present on site.

c. Waste bags shall consist of 6-mil or thicker plastic and be double-bagged before they are filled.

5. At least two persons shall perform the removal.

6. The box shall be smoke-tested for leaks and any leaks sealed prior to use.

7. Loose or damaged ACM adjacent to the box shall be wrapped and sealed in at least two layers of 6-mil or thicker plastic prior to the job or otherwise made intact prior to the job.

8. A HEPA filtration system shall be used to maintain pressure barrier in the box.

E. Air Sampling and Analysis Procedures.

1. Background and daily area monitoring shall be performed for all NESHAP glovebag/glovebox projects. Personnel air sampling in the worker’s breathing zone may be used to satisfy the requirement for

daily area monitoring.

2. Non-aggressive Phase Contrast Microscopy (PCM) clearance air monitoring shall, at a minimum, be required for NESHAP and small glovebag or glovebox projects.

3. If personnel fiber counts exceed the PCM clearance standard of 0.01 fibers per cubic centimeter, aggressive clearance air monitoring shall be performed.

F. Glovebag/Glovebox Work Practices.

1. Use of the glovebag shall be terminated, cleanup procedures contained in this Section shall be implemented, and clearance by TEM analysis performed if the owner/operator:

a. Fails to keep RACM in the glovebag/glovebox;

b. Fails to keep RACM adequately wet;

c. Disturbs or dislodges RACM outside of the glovebag/glovebox; and/or

d. Experiences glovebag failure, including any breach in the glovebag/glovebox.

2. Glovebag/Glovebox Clean-up. Following removal, the owner/operator shall ensure that:

a. Porous surfaces that have been stripped or cleaned of RACM are encapsulated to secure any residual fibers that may be present prior to removing the glovebag or glovebox from the abated pipe. The encapsulant used must be compatible with subsequent coverings.

b. All polyethylene sheeting, tape, glovebags or gloveboxes and other equipment must be removed and the area inspected for visible residue.

c. Wet-cleaning using amended water is performed, followed by HEPA vacuuming after surfaces have been allowed to dry. The sequence of wet cleaning and vacuuming shall be repeated until no visible residue is observed in the work area.

d. When required, final TEM air clearance shall be performed following visual clearance.

G. Disposal.

All applicable disposal requirements of this regulation shall apply.

SECTION XV. - NON-FRIABLE PROJECTS.

A. Applicability.

The requirements of this Section shall apply to the owner/operator of any renovation at any facility where the ACM being removed remains non-friable.

B. Notification/Application.

1. Each owner/operator shall:

a. Contact the landfill to ensure acceptance of non-friable ACM waste;

b. Provide the Department with a written application and obtain a Department-issued abatement license for the project four (4) working days prior to beginning abatement for NESHAP sized projects of 160 sf or 260 Lf. The license shall be maintained at the project site for the duration of the project;

c. For all other projects, provide a written application prior to disposal;

d. Facilities and those in possession of a temporary asbestos storage containment area license may notify the Department quarterly;

e. Prior to disposing of a non-regulated residential structure, provide a written application to the Department;

f. Applications must also be submitted for projects where waste will be disposed of out-of-state;

g. Provide the following information in the written application:

(1) Name, address, and telephone number of property/facility owner;

(2) Street address of the property or facility where removal will occur;

(3) Amount of non-friable ACM to be abated;

(4) Description of material (for example, cement-like tiles, asphaltic shingles, cementitious siding, roof flashing); and

(5) Name, address, telephone number, contact person, and location (county, city, state) of the landfill that the owner/operator has contacted for disposal of ACM waste;

h. The written disposal license issued by the Department must accompany the non-friable ACM waste to the landfill.

C. Work Practices.

1. The owner/operator shall prevent dust from being released during the removal of non-friable ACM to prevent exposure.

2. Category I and Category II ACM that will be or has been subjected to grinding, sanding, cutting, chipping, drilling, or abrading shall be considered regulated ACM, and the owner/operator shall comply with all applicable requirements of this regulation.

3. Category I and Category II ACM that will not be or has not been subjected to grinding, sanding, cutting, chipping, drilling, or abrading shall be considered non-regulated ACM, and the owner/operator shall comply with all applicable requirements of OSHA 29 CFR 1926.1101, as amended, and any subsequent amendments or editions.

4. The owner/operator shall ensure that ACM and asbestos-contaminated waste is not intentionally burned or recycled.

D. Disposal.

1. Transport and disposal shall occur in a manner that will not permit the release of asbestos fibers into the air.

2. Disposal shall occur at a landfill permitted or approved to accept asbestos waste.

3. All containers shall be labeled with the following warning:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

4. The owner/operator shall:

a. Obtain a waste shipment record or other shipment manifest at the landfill to document disposal of all asbestos waste;

b. Ensure that a waste shipment record or other shipment manifest is signed by the landfill operator; and

c. Submit a copy of the waste shipment record or other shipment manifest to the Department within 30 working days after abatement completion.

SECTION XVI. - STANDARDS FOR DEMOLITIONS.

A. Applicability.

The requirements of this Section shall apply to the owner/operator of a facility to be demolished.

B. Notification/Application.

1. Each owner/operator of a demolition to which this Section applies shall:

a. Submit to the Department a written DHEC demolition application at least ten working days in advance of the proposed demolition start date.

b. Delivery of the application shall be by U.S. Postal Service, commercial delivery service, by hand or by other methods deemed acceptable by the Department.

c. Acceptable methods of payment shall be by check or money order made payable to SCDHEC, credit card (VISA, MasterCard, or Discover), and cash.

d. Submit a written demolition project license application for each separate facility that includes all information required on the application form.

e. Submit a complete, legible copy of the building inspection report, which must be less than three

years old, for each facility to be demolished.

2. Obtain an asbestos demolition license for any facility, regardless of whether the required building inspection indicates the presence of ACM.

3. When a demolition will begin on a date earlier than the previously-notified start date, the facility owner/operator shall provide the Department with a written notification of the new start date at least ten working days prior to the previously-notified demolition start date.

4. The owner/operator of a demolition operation covered by this section shall:

a. Notify the Department by telephone no later than the original start date when the demolition will begin on a date later than the previously-notified start date.

b. Provide the Department with a revised written application of the new start date no later than the previously-notified start date.

c. Provide the Department with a revised written notification/application immediately when any information pertaining to the demolition project changes, including but not limited to, the start and/or completion date, the demolition contractor, or the landfill.

5. Any facilities being demolished under order of a State or local government agency because the facility is structurally unsound, in imminent danger of collapse, and is a threat to public health or safety may be exempt from the ten-working day notification requirement. However, the owner/operator shall submit a complete demolition license application and written justification documents to the Department for approval prior to commencing the demolition activities.

a. The application shall include all of the following information:

(1) Indication whether the notification is an original, revision, or cancellation;

(2) Name, address, and telephone number of the owner/operator;

(3) Indication that demolition is the type of operation;

(4) Description of the facility or affected part of the facility, including the square footage, number of floors, age, and prior, present, and intended use of the facility;

(5) Description of the procedures and analytical methods used to detect the presence of ACM (regulated and nonregulated), date of inspection, and name, address, telephone number, and license number of the building inspector;

(6) 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;

(7) Scheduled starting and completion dates of asbestos renovation or demolition;

(8) Description of planned demolition work to be performed, emission control measure(s) to be employed, and a description of the affected facility or facility components;

(9) Description of the engineering controls and procedures to be used to comply with the work

practice requirements of this regulation;

(10) Name and location of the waste disposal site where the regulated asbestos-containing waste material will be deposited. Regulated asbestos-containing waste must be deposited into a landfill approved or permitted to accept asbestos waste;

(11) Description of procedures to be followed in the event that unexpected RACM is found;

(12) Name, address, and telephone number of the waste transporter; and

(13) Printed name and signature of the owner/operator submitting the notification and the date signed.

b. The owner/operator shall submit to the Department a clear, legible copy of the signed order that contains all of the following information along with the completed demolition project application:

(1) The name, title, and authority of the State or local government representative who ordered the demolition;

(2) The date that the order was issued; and

(3) The date on which the demolition was ordered to begin.

C. Removal of ACM prior to Demolition.

1. Any demolition of a structure or portion of a structure that contains structural members or components composed of or covered by ACM shall be preceded by removal of all such materials.

2. All ACM, with the exception of those material referenced in Paragraph E. of this Section, shall be removed in accordance with work practice requirements for applicable NESHAP, small, or minor projects prior to demolition.

D. Air Sampling Procedures.

Air monitoring is not required during a demolition except when necessary due to an extenuating circumstance and/or required by the Department.

E. Exemptions from Removal of ACM prior to Demolition.

The following categories of asbestos-containing materials may be left in place during demolition:

1. ACM on a facility component that is encased in concrete or other similarly hard material and is adequately wet whenever exposed during demolition.

2. RACM that was not accessible for testing and was, therefore, not discovered until after demolition began and, as a result of the demolition, cannot be safely removed. If not removed for safety reasons, all exposed RACM and any asbestos-contaminated debris must be treated as regulated asbestos-containing waste material.

3. Category I and Category II nonfriable mastic, glue, and adhesive ACM that is not friable or in poor condition, and where the probability is low that the materials will become crumbled, pulverized, or

reduced to powder during demolition operations.

F. Disposal of Demolition Debris.

1. Waste that does not contain asbestos may be disposed of as construction debris at a landfill approved or permitted to accept such waste.

2. The owner/operator shall comply with the requirements of the Disposal Section of this regulation and shall ensure that asbestos-containing or asbestos-contaminated waste materials are not burned or recycled.

G. Project License Fees.

1. A project license is required for every facility that is to be demolished, including those that have been destroyed by fire or those whose required building survey indicates there is no ACM present.

2. The Department shall not issue a project license for a demolition until all requested information has been submitted and reviewed and all applicable fees have been paid.

3. Fees shall not be refunded for projects for which the Department has issued a project license.

4. A project license that has been issued shall automatically become invalid if an instrument of payment is returned for insufficient funds, in which case the licensee shall be subject to enforcement action for operation without a valid license.

SECTION XVII. - OUTDOOR PROJECTS.

A. Applicability.

The notification, work practice, clean-up, and disposal requirements of this Section shall apply to each owner/operator of any regulated O&M or minor, small or NESHAP outdoor renovation.

B. Notification/Application.

1. NESHAP Project.

a. Each owner/operator of a renovation or demolition operation to which this Section applies shall:

(1) Provide the Department with written notification/application at least ten working days prior to any renovation or demolition and pay all applicable project fees. Acceptable delivery of the notification and fee payment is by U.S. Postal Service or commercial delivery service, by hand, or by other methods deemed acceptable by the Department.

(2) Update the notification/application and pay appropriate fees as necessary when any previously-notified information changes, including but not limited to, when the amount of asbestos affected changes, when the project start or completion date changes, or when the disposal site changes.

(3) Provide the Department with a legible copy of the building inspection report upon request.

(4) Begin abatement on the start date contained in the Department-issued asbestos project license.

b. When the asbestos stripping or removal operation covered by this Section will begin on a date earlier than the previously-notified start date, the owner/operator shall provide the Department with written notification of the new start date at least ten working days before asbestos stripping or removal work will begin.

c. When the asbestos stripping or removal operation covered by this Section will begin after the date contained in the initial notification and in the asbestos project license issued by the Department, the owner/operator must:

(1) Notify the Department of the new start date by telephone as soon as possible before, but not later than, the original start date; and

(2) Provide the Department with an updated written notice of the new start date as soon as possible before, but not later than, the original start date. Acceptable delivery of the updated notice is by the U.S. Postal Service or commercial delivery service, by hand, or by other methods deemed acceptable by the Department.

d. The written notification/application shall include:

(1) Indication whether the notification is an original, revision, or cancellation;

(2) Name, address, and telephone number of the owner/operator;

(3) Type of operation: demolition or renovation;

(4) Description of the facility or affected part of the facility, including the square footage, number of floors, age, and prior, present, and intended use of the facility;

(5) Description of the procedures and analytical methods used to detect the presence of ACM (regulated and non-regulated), date of inspection, and name, address, telephone number, and license number of the building inspector;

(6) An estimate of the approximate amount of RACM and Category II nonfriable ACM to be removed from the facility in terms of length of pipe in linear feet, in terms of surface area for other facility components in square feet, or in terms of volume if already off of facility components in cubic feet;

(7) 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;

(8) Scheduled starting and completion dates of asbestos renovation or demolition.

(9) Description of planned renovation or demolition work to be performed, emission control measure(s) to be employed, and a description of the affected facility or facility components;

(10) Description of the engineering controls and procedures to be used to comply with the work practice requirements of this regulation;

(11) Name and location of the waste disposal site where the regulated asbestos-containing waste material will be deposited. Regulated asbestos-containing waste must be deposited into a landfill approved or permitted to accept asbestos waste;

(12) Name, address, and telephone number of the waste transporter; and

(13) Printed name and signature of the asbestos owner/operator submitting the notification and date signed.

e. A complete notification/application shall contain all of the above information and shall be reported on a form similar to the one found in 40 CFR Part 61, Subpart M, as amended, and any subsequent amendments and editions.

2. Small Project.

In a facility being renovated subject to this Section, the owner/operator shall provide the Department with at least a five calendar day advance written notification of intent to renovate and pay applicable fees as follows:

a. Acceptable delivery of the notification/application shall be by U.S. Postal Service, commercial delivery service, by hand, facsimile transmission, or by other methods deemed acceptable by the Department.

b. Postmark or deliver the notice before asbestos stripping or removal work or any other activity begins that would break up, dislodge, or similarly disturb RACM.

c. Update the notification/application when any previously-notified information changes and pay additional project fees as necessary.

d. The Department may waive the five calendar-day notice on a case-by-case basis.

3. Minor or O&M Projects.

In a facility being abated subject to this Section:

a. The owner/operator shall provide the Department with written notification/application prior to any abatement and pay all applicable fees as follows:

(1) Acceptable delivery of the notification/application shall be by U.S. Postal Service, commercial delivery service, facsimile transmission, by hand or by other methods deemed acceptable by the Department.

(2) Update the notification/application when any previously-notified information changes.

(3) Notify the Department by telephone and follow up in writing as soon as possible, but not later than, the original start date when a project for which notification was made has been canceled; or

b. Facility employees who do not meet the definition of a contractor as defined by this regulation or a contractor who has obtained a temporary storage license may maintain a log of all minor abatements performed during a quarter, report them to the Department within 30 calendar days of the end of the quarter, and pay applicable project fees. The log shall include, but is not limited to: the name and address of the facility being abated, amount and type of ACM removed, date(s) of removal, names of individuals who performed the abatement, exact location for temporary storage of asbestos wastes, and the name of the landfill used for disposal.

C. Air Sampling and Analysis Procedures.

1. For projects subject to 40 CFR Part 763, AHERA, as amended, and any subsequent amendments or editions, the facility owner shall ensure that a licensed air sampler performs clearance air monitoring after abatement in areas to be reoccupied, including porticos and covered exterior walkways, and abatement on exterior portions of mechanical systems used to condition interior spaces.

2. Air monitoring is not required for Outdoor Projects that are not subject to EPA 40 CFR Part 763, AHERA regulation.

D. Work Practice Requirements.

1. Preparation.

The owner/operator shall minimize, to the extent reasonable and necessary, the exposure to persons downwind of the project.

2. Removal.

a. Wet removal methods shall be used.

b. There shall be no release of visible emissions during preparation, removal, or cleanup.

3. Clean-up.

a. Following removal, the owner/operator shall ensure that:

(1) The abated area is thoroughly cleaned using wet methods and amended water and surfaces have been allowed to dry.

(2) Once dry, the abated area is vacuumed using a vacuum equipped with HEPA cartridges or filters.

(3) The sequence of wet cleaning and vacuuming is repeated until no visible residue can be observed.

b. The facility owner shall ensure that the work area is inspected for any remaining visible residue. Evidence of contamination will necessitate additional cleaning by the contractor.

c. For porous surfaces that have been stripped or cleaned of RACM, the owner/operator shall ensure that a coat of encapsulant is applied to the abated surface to secure any residual fibers that may be present. The encapsulant chosen must be compatible with subsequent coverings.

E. Disposal.

The disposal requirements of the Disposal Section of this regulation shall apply to outdoor projects.

SECTION XVIII. - ENCAPSULATION AND ENCLOSURE.

A. Applicability.

1. The notification/application, air sampling, work practice, clean-up, and disposal requirements of this Section shall apply to each owner/operator engaged in an encapsulation or enclosure operation where mechanical sprayers will be utilized and the potential to disturb RACM will involve amounts greater than 160 square or 260 linear feet of surfacing materials or thermal system insulation.

2. Surfaces that have been previously coated or treated with an encapsulant and that are not in poor condition are exempt from the requirements of this Section.

B. Notification/Application.

1. In a facility with RACM being encapsulated, the owner/operator shall:

a. Provide the Department with written notification/application at least ten complete working days prior to beginning any encapsulation activities.

b. Notify the Department as soon as possible by telephone and follow-up in writing when any previously-notified information changes or when a previously-notified project has been canceled.

2. Acceptable delivery of notification/application shall be by U. S. Postal Service, commercial delivery service or facsimile transmission, by hand, or by other methods deemed acceptable by the Department.

C. Air Sampling and Analysis Procedures.

1. Background Monitoring.

a. Background ambient air sampling shall be required.

b. At least five air samples shall be collected prior to the start of abatement activities in order to obtain an index of background airborne fiber concentrations.

c. Representative samples should be taken both inside and outside the work area within the facility to establish existing ambient air levels under normal activity conditions.

d. The air sampler shall document any variations and justifications for the variances, and shall provide the information to the Department upon request.

2. Clearance.

The owner/operator shall ensure that non-aggressive TEM clearance air monitoring is conducted prior to re-occupancy of any area that has been encapsulated.

D. Work Practice Requirements.

1. Preparation.

a. The owner/operator of an encapsulation or enclosure operation shall:

(1) Define the work area using barrier tape and danger signs in accordance with OSHA 29 CFR 1926.1101, as amended, and any subsequent amendments and editions.

(2) Shut down, lock, and tag out all HVAC equipment in or passing through the work area.

(3) Remove existing filters and dispose of as asbestos-containing waste.

(4) Securely seal all intake and exhaust openings and any seams in system components with 6-mil or thicker polyethylene sheeting and tape.

(5) Securely seal each opening between the work area and uncontaminated areas, including but not limited to windows, doorways, elevator openings, corridor entrances, drains, ducts, electrical outlets, grills, grates, diffusers, and skylights, with a critical barrier consisting of at least one sheet of 6-mil or thicker polyethylene sheeting and tape.

(6) Thoroughly clean and remove all movable objects from the work area.

(7) Thoroughly clean, then cover and secure all non-movable objects in the work area with at least one layer of 4-mil or thicker polyethylene sheeting.

(8) Cover and secure all surfaces not being encapsulated or enclosed with at least one layer of 4-mil polyethylene sheeting for walls or ceilings and 6-mil polyethylene sheeting for floors.

2. Encapsulation/Enclosure Procedures.

a. During any encapsulation of RACM, the owner/operator shall ensure that:

(1) The encapsulant chosen for use is compatible with the substrate to which it will be applied and is appropriate for the application intended.

(2) When airless sprayers are utilized, nozzle pressure shall be adjusted between 400 and 1,500 pounds per square inch (psi).

(3) Loose, damaged, or fallen RACM is cleaned immediately using wet methods and HEPA vacuuming.

(4) RACM is not tracked from the work area onto uncontaminated surfaces.

(5) Once all encapsulated surfaces have completely dried, each surface is wet wiped or HEPA vacuumed.

b. During any enclosure of RACM, the owner/operator shall ensure that:

(1) The enclosure is constructed air-tight so as to prevent the escape of airborne asbestos fibers.

(2) Loose, damaged, or fallen RACM is cleaned immediately using wet methods and HEPA vacuuming and is properly packaged for disposal.

(3) RACM is not tracked from the work area onto uncontaminated surfaces.

(4) Wet methods and HEPA vacuums are used to clean any fallen RACM immediately.

3. Disposal.

The requirements of the Disposal Section of this regulation shall apply.

SECTION XIX. - REQUIREMENTS FOR TRAINING COURSES, INSTRUCTORS, AND TRAINING PROVIDERS.

A. Asbestos Training Course Licenses.

1. An asbestos training course provider who intends to present asbestos training courses within the State shall submit an application for approval, for each initial or refresher training course discipline to be taught, that contains all information necessary to verify qualifications as required by the regulation.

2. An asbestos training course provider must have a separate Department-issued license for each different initial or refresher training course discipline.

3. Licenses for asbestos training course providers will be restricted to courses approved by the Department in accordance with the requirements of this regulation.

4. Each asbestos course license is valid for one year from date of issue, regardless of the number of times the course is taught during the year.

5. Each individual seeking to teach or instruct any portion of any mandatory asbestos training course, regardless of discipline, must submit an instructor application that contains all information necessary to verify qualifications as required by this Section and be approved by the Department.

6. When an asbestos training course instructor seeks to conduct mandatory asbestos training courses in more than one discipline, the instructor must be approved for each separate discipline by the Department.

7. Upon initial approval and licensing of an asbestos training course, the Department will audit and assess the training course provider an initial audit fee prescribed in this regulation.

8. Upon renewal of a training course license, the training course provider will be assessed the annual license renewal fee prescribed in this regulation.

9. An asbestos training course must be approved and currently licensed by the Department on the date that it is taught to be acceptable as a basis for documentation that the person receiving the course certificate has completed the requisite training for asbestos accreditation in any specific work practice topic or discipline.

B. Personnel Licensing Requirements.

In order for an initial or refresher training course in any discipline to be acceptable as a basis for personnel licensing pursuant to this regulation, the course must be licensed and instructor(s) must be approved by the Department.

C. Department Approval.

To qualify for Department approval, an initial or refresher training course in any discipline shall meet the following requirements:

1. Course Content.

a. Each course shall:

(1) Correspond only to a single discipline; and

(2) Provide coverage of specific topics, including instruction in the requirements of this regulation as requested by the Department, and satisfy the requirements of:

(a) The AHERA Model Contractor Accreditation Plan, 40 CFR 763, Subpart E, Appendix C (Federal Register, Volume 59, Number 23, Thursday, February 3, 1994), as amended, and any subsequent amendments and editions, and this regulation; and

(b) The 16-hour Operation and Maintenance Worker Course as specified in this Section.

b. Initial training courses for all supervisors and workers shall include hands-on glovebag training with smoke testing of the glovebag seal in accordance with OSHA 29 CFR 1926.1101(g)(5)(ii), as amended, and any subsequent amendments and editions.

c. Supervisor and worker refresher course hands-on training shall be required and shall include instructor demonstrations; video applications; and written illustrations or representations or other methods designed to communicate work practice procedures to the student. Students are not required to handle equipment or to participate in simulated abatement activities.

2. Course Presentation.

a. An initial worker or O&M worker training course may be conducted by a single qualified instructor if the instructor meets the minimum requirements of this Section.

b. Initial training courses in all disciplines (except worker) shall be taught by at least two Department-approved instructors.

3. Duration of Training.

a. A training course shall not include more than eight hours of training during a single 24-hour period.

b. One day of training equals no less than six and one-half hours of actual classroom or hands-on activities.

c. The total number of hours required for any initial training course shall be completed within a period not to exceed 14 calendar days.

4. Effectiveness of Training.

a. Instructors shall be evaluated by Department-conducted on-site audits or by audits conducted by representatives from states with whom the Department has established reciprocity.

b. Training providers shall conduct courses in a physical environment conducive to learning (such as a classroom).

c. The maximum enrollment of an initial asbestos course shall be 40 participating students.

d. There shall be no more than ten students per instructor during all hands-on portions of initial training.

5. Foreign-Language Instruction.

a. Worker course instructors and students shall be fluent in the language in which the course is being taught.

(1) An English-speaking instructor shall not use an interpreter to instruct foreign-language trainees.

(2) Training courses in all disciplines (except worker) shall be conducted only in English.

b. The training provider shall provide trainees with course materials accurately translated into the language in which the course is being conducted.

6. Testing.

a. At the conclusion of each initial or refresher course, the training provider shall administer an examination in written or oral form to any trainee seeking to obtain a license to perform asbestos-related activities. Oral examinations are allowed to be administered only to individuals seeking training in the worker category.

b. The training provider shall administer an examination designed to test the trainees' familiarity with those issues relevant to the safe and proper performance of asbestos projects.

c. The training provider shall construct the course examination from a pool of validated questions and shall prepare a new examination for each course presentation.

d. A trainee who fails to pass an initial examination by not achieving a minimum score of 70 on a 100-point scale may be retested once. Upon failing to pass an examination on the second attempt, the trainee shall retake the entire training course before being allowed to retest for that discipline.

e. The Department may approve alternative testing it deems appropriate.

7. Certificates.

a. The training course provider shall issue a unique numbered certificate to each student who successfully completes the training course and passes the examination.

b. Each numbered certificate shall include the following information:

(1) Name and last four digits of the Social Security number of the trainee;

(2) Unambiguous course title indicating the discipline and specifying whether the training is an initial or refresher course;

(3) A unique certificate number;

(4) Inclusive dates of training course;

(5) Examination date;

(6) A statement indicating that the person whose name appears on the certificate has completed the training course and successfully passed an examination;

(7) For courses covered under 40 CFR Part 763, Subpart E, Appendix C, as amended, and any subsequent amendments and editions, a certificate expiration date that is one year after the date the course was completed and the applicable examination passed;

(8) The name, address, and telephone number of the training provider;

(9) The printed name and signature of the principal instructor;

(10) Training course location; and

(11) A statement that the person receiving the certificate has completed the requisite training for asbestos accreditation under Title II of Section 206 of the Toxic Substances Control Act (15 U.S.C.A. Section 2646), with the exception of O&M certificates.

8. Notifications and Reporting.

a. A training provider who intends to present a training course within the state shall notify the Department in writing at least ten calendar days prior to the first day of the course. The written notification must include the following information:

(1) Training provider name, address, telephone number, and contact person;

(2) Training course title;

(3) Inclusive dates of course and applicable exam;

(4) Daily start and completion times;

(5) Location and detailed directions to course facility;

(6) Language in which the course is taught;

(7) Names of the instructors; and

(8) A copy of the training course agenda. (If the agenda is identical to one previously submitted to the Department, an additional copy is not required.)

b. Within seven days of conclusion of a training course presented within the State, the training provider shall submit the following information to the Department:

(1) Name of the course indicating whether initial or refresher;

(2) Inclusive dates of the course and examination;

(3) Names of all course instructors and topics taught;

(4) The course location;

(5) The name and Social Security number of every trainee, including names of those who did not successfully pass or otherwise complete the course;

(6) The unique certificate numbers of every trainee who completed the course and passed the examination; and

(7) Name, address, and telephone number of the training provider.

c. Out-of-state training providers shall submit any information specified in this Section to the Department upon request.

d. Failure to submit a written course notification or course roster in the timeframe prescribed by this Section may result in the rejection of the course and certificates for licensure by the Department.

9. Record Keeping.

a. The person, sole proprietorship, public corporation, or incorporated entity operating as a training provider shall retain copies of records related to asbestos training approved pursuant to this regulation for three years or for a period of time as defined in Title II, Section 206 of the Toxic Substances Control Act of the United States (15 U.S.C.A. Section 2646), as amended.

b. In the event that ownership of the sole proprietorship, public corporation, or incorporated entity operating as a training provider is transferred to a different owner, all records maintained during the previous three years shall be transferred and maintained by the new owner.

c. Records that must be maintained shall include those defined in Title II, Section 206 of the Toxic Substances Control Act of the United States (15 U.S.C.A. Section 2646), as amended, and in all cases shall include the following:

(1) Course curriculum materials;

(2) Examinations and scores of all persons who have taken examinations;

(3) Instructor applications and resumes;

(4) Training course approval applications;

(5) Rosters of individuals taking training courses;

(6) Copies of training course notifications; and

(7) Copies of all correspondence with federal and/or state accreditation agencies regarding instructor and training course approvals, disapprovals, suspensions, or audits.

D. Operation and Maintenance (O&M) Worker Course.

1. An initial O&M training course shall be at least 16 hours in length and shall provide, at a

minimum, information on all of the following topics:

a. The physical characteristics of asbestos, including fiber size, aerodynamic characteristics, and physical appearance.

b. The health hazards of asbestos, including the nature of asbestos-related diseases, routes of exposure, dose-response relationships, synergism between cigarette smoking and asbestos exposure, latency period of diseases, and health basis for the standards.

c. Typical locations, uses, and types of ACM; and recognition of damage, deterioration, and delamination of ACM.

d. Employee personal protective equipment, including the types and characteristics of respirators; limitations of respirators; proper selection, inspection, donning use, maintenance and storage procedures for respirators; methods for field testing of the face-piece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit test 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.

e. Air monitoring procedures and requirements included under OSHA 29 CFR 1926.1101, as amended, and any subsequent amendments and editions, including a description of equipment and methods, reasons for air monitoring, types of samples, and current standards with proposed changes.

f. Description of the proper methods of handling RACM to include state-of-the-art work practices for asbestos O&M activities including: purpose, proper construction, and maintenance of barriers; posting of warning signs; electrical and ventilation system lockout/tagout; proper working techniques for minimizing fiber release; use of wet methods and surfactants; use of HEPA vacuums; and proper cleanup and disposal procedures. Work practice requirements as they apply to removal, encapsulation, enclosure, and repair shall be discussed individually.

2. A yearly review course shall be one day in length and shall review the health hazards associated with exposure to asbestos; the locations, uses, types, and condition of ACM; hands-on activities; updated information on state-of-the-art procedures and equipment; and regulatory changes and interpretations. Actual instruction time shall be a minimum of six and one-half hours. The Department may request coverage of specific topics.

3. The requirements of this Section pertaining to course presentation, effectiveness of training, foreign-language instruction, testing, certificates, notification and reporting, record keeping, qualifications for instructors, course approval, and periodic audits shall apply to O&M courses.

E. Qualifications for Instructors of Non-Work Practice Topics.

1. Applicants seeking approval to teach segments of asbestos training courses other than work practice or hands-on exercises shall be actively working in the field of expertise for which he or she is conducting training.

2. The following documentation is required for instructors of non-work practice topics:

a. A copy of a high school, General Education Development (GED), or college/university diploma;

b. A copy of all professional licenses relevant to the subject matter being taught; and

c. The name, address, and telephone number of the applicant's current employer.

F. Initial and Refresher Course Instructor Qualifications.

The Department reserves the right to reject instructor training and/or experience that it deems unacceptable for qualification.

1. Worker Discipline.

a. Previous Training.
The applicant shall meet current EPA and Department accreditation requirements for supervisors.

b. Education/Asbestos Work Experience.

The applicant shall meet at least one of the following education/asbestos work experience combinations:

(1) If the applicant does not possess either a GED or high school diploma, the applicant shall:

(a) Have at least 360 instructional hours as an instructor in an EPA-approved worker course; and

(b) Have at least 1,440 hours experience in a worker or supervisory capacity of contained work areas.

(2) If the applicant possesses either a high school or GED diploma, the applicant shall:

(a) Have at least 960 hours of documented experience in a worker, supervisory, or consulting capacity of contained work areas; or

(b) Have at least 240 documented hours as an instructor in an asbestos worker or supervisor course.

(c) The applicant may substitute 240 documented hours of occupational safety, health, and environmental instructional hours taught in courses required to meet federal or State regulations for the instructional hours required in Paragraph F.1.b.(2)(b) of this Section.

(3) If the applicant possesses at least an associate degree from a regionally-accredited college/university, the applicant shall:

(a) Have at least 480 hours of documented experience in a worker, supervisory, or consulting capacity of contained work areas; or

(b) Have at least 120 documented hours as an instructor in an asbestos worker or supervisor course.

(c) The applicant may substitute 120 documented hours of occupational safety, health, and environmental instruction taught in courses required to meet federal or State regulations for the instructional hours required in Paragraph F.1.b.(3)(b) of this Section.

2. Supervisor Discipline.

a. Previous Training.

The applicant shall meet current EPA accreditation requirements for supervisors.

b. Education Asbestos Work Experience.

The applicant shall meet at least one of the following education/asbestos work experience combinations:

(1) If the applicant does not possess either a high school or GED diploma, the applicant shall:

(a) Have at least 360 documented hours as an instructor in an EPA-approved supervisor course; and

(b) Have at least 1,440 hours of documented experience in a supervisory capacity of contained work areas.

(2) If the applicant possesses either a high school or GED diploma, the applicant shall:

(a) Have at least 960 hours of documented experience in a supervisory capacity of contained work areas; or

(b) Have at least 240 documented hours as an instructor in an asbestos worker or supervisor course.

(c) The applicant may substitute 240 documented hours of occupational safety, health, and environmental instruction taught in courses required to meet federal or State regulations for the instructional hours required in Paragraph F.2.b.(2)(b) of this Section.

(3) If the applicant possesses at least an associate degree from a regionally-accredited college/university, the applicant shall:

(a) Have at least 480 hours experience in a worker, supervisory, or consulting capacity of contained work areas; or

(b) Have at least 120 instructional hours as an instructor in an asbestos worker or supervisor course.

(c) The applicant may substitute 120 hours of occupational safety, health, and environmental instructional hours taught in courses required to meet federal and State regulations for the instructional hours required in Paragraph F.2.B.(3)(b) of this Section.

3. Management Planner Discipline.

a. Previous Training.

The applicant shall meet current EPA accreditation requirements for management planners.

b. Education/Asbestos Work Experience.

The applicant shall meet at least one of the following education/asbestos work experience combinations:

(1) If the applicant possesses either a high school or GED diploma, the applicant shall:

(a) Have documented management planning experience showing at least 25 management plans written in the last three years, or documented experience as the project manager for at least 25 asbestos projects in the last three years, or a combination of management plans and projects managed; or

(b) Have at least 48 documented hours as an instructor in an EPA-approved management planner course.

(c) The applicant may substitute 48 documented hours of occupational safety, health, and environmental instruction taught in courses required to meet federal or State regulations for the instructional hours required in Paragraph F.3.b.(1)(b) of this Section.

(2) If the applicant possesses at least an associate degree from a regionally-accredited college/university, the applicant shall:

(a) Have documented management planning experience showing at least 12 management plans written in the last three years, or documented experience as the project manager for at least 12 asbestos projects in the last three years, or a combination of management plans and projects managed; or

(b) Have at least 32 documented hours as an instructor in an EPA-approved management planner course.

(c) The applicant may substitute 32 documented hours of occupational safety, health, and environmental instruction taught in courses required to meet federal or State regulations for the instructional hours required in Paragraph F.3.b.(2)(b) of this Section.

4. Building Inspector Discipline.

a. Previous Training.

The applicant shall meet current EPA accreditation requirements for asbestos building inspectors.

b. Education/Asbestos Work Experience.

The applicants shall meet at least one of the following education/asbestos work experience combinations:

(1) If the applicant possesses either a high school or GED diploma, the applicant shall:

(a) Have documented experience including asbestos inspections in at least one million square feet of building space in the last three years; or

(b) Have at least 60 documented hours as an instructor in an EPA-approved building inspector course.

(c) The applicant may substitute 60 documented hours of occupational safety, health, and environmental instruction taught in courses required to meet federal or State regulations for the

instructional hours required in Paragraph F.4.b.(1)(b) of this Section.

(2) If the applicant possesses at least an associate degree from a regionally-accredited college/university, the applicant shall:

(a) Have documented experience including asbestos inspections in at least 500,000 square feet of building space in the last three years; or

(b) Have at least 40 documented hours as an instructor in an EPA-approved building inspector course.

(c) The applicant may substitute 40 documented hours of occupational safety, health, and environmental instruction taught in courses required to meet federal or State regulations for the instructional hours required in Paragraph F.4.b.(2)(b) of this Section.

5. Project Designer Discipline.

a. Previous Training.

The applicant shall meet current EPA accreditation requirements for asbestos project designers.

b. Education/Asbestos Work Experience.

The applicants shall meet at least one of the following education/asbestos work experience combinations:

(1) If the applicant possesses either a high school or GED diploma, the applicant shall:

(a) Have documented asbestos project design experience including the design of at least 12 asbestos projects in the last three years; or

(b) Have at least 30 documented hours as an instructor in an EPA-approved asbestos project designer course.

(c) The applicant may substitute completion of 30 documented hours of occupational safety, health, and environmental instruction taught in courses required to meet federal or State regulations for the instructional hours required in Paragraph F.5.b.(1)(b) of this Section.

(2) If the applicant possesses at least an associate degree from a regionally-accredited college/university, the applicant shall:

(a) Have documented asbestos project design experience including the design of at least six asbestos projects in the last three years; or

(b) Have at least 20 documented hours as an instructor in an EPA-approved asbestos project designer course.

(c) The applicant may substitute 20 documented hours of occupational safety, health, and environmental instruction taught in courses required to meet federal or State regulations for the instructional hours required in Paragraph F.5.b.(2)(b) of this Section.

G. Documentation of Instructor Qualifications.

1. Applicants seeking approval to teach work-practice or hands-on topics or to act as a sole instructor shall submit documentation of training, education, and work experience as required herein.

2. Documentation of Training.

a. The applicant shall submit a copy of initial and subsequent refresher certificates of training from courses approved by the EPA or by an EPA-accredited state, and provide for each course the title, dates of instruction, names of instructors, name, address, and telephone number of the training provider.

b. Instructors shall take refresher training from a training provider not affiliated with the instructor for at least one discipline every year. Instructors teaching multiple disciplines shall alternate among the different disciplines taught.

3. Documentation of Education.

The applicant shall submit a copy of high school, GED, or college or university diploma or the name and address of the conferring institution.

4. Documentation of Asbestos Work Experience.

a. An applicant for instructor of worker or supervisor training courses shall submit a detailed description of job duties and responsibilities as an asbestos worker, foreman, supervisor, or consultant, including all of the following:

(1) Inclusive dates of employment;

(2) The name of the employer;

(3) Types of ACM removed;

(4) Number of workers supervised;

(5) Name, address, and telephone number of each different employer; and

(6) Name of immediate supervisor at each different employer.

b. An applicant for instructor of building inspector, management planner, or project designer training courses shall include all relevant information concerning experience completing inspections, management plans, or project designs, including all of the following:

(1) Size and location of buildings inspected;

(2) Descriptions of management plans, projects managed, or projects designed;

(3) Name, address, and telephone numbers of building owners;

(4) Name, address, and telephone numbers of all employers; and

(5) Inclusive dates of employment.

c. Documentation of Instructor Experience.

The applicant shall submit a detailed description of instructor experience, including all of the following:

(1) Name of training courses taught;

(2) Topics taught for each course;

(3) Inclusive dates of each training course;

(4) Total hours taught for each training course; and

(5) Name, address, and telephone number of each training organization with which experience is claimed.

H. Work Practice Topics.

Instructors shall meet the qualifications for instructors listed in Section XIX.F. above in order to teach the following asbestos Work Practice Topics:

1. O&M Worker and Worker Refresher:

   a. State-of-the-Art Work Practices.

   b. Hands-on Exercises (initial course only).

2. Worker and Worker Refresher:

   a. State-of-the-Art Work Practices.

   b. Hands-on Exercises (initial course only).

3. Supervisor and Supervisor Refresher:

   a. State-of-the-Art Work Practices.

   b. Techniques for Asbestos Abatement Activities.

   c. Hands-on Exercises (initial course only).

4. Management Planner and Management Planner Refresher:

   a. Evaluation/Interpretation of Survey Results.

   b. Hazard Assessment.

   c. Developing an Operation~~s~~ and Maintenance (O&M) Plan.

   d. Record Keeping for the Management Planner.

   e. Assembling and Submitting the Management Plan.

5. Building Inspector and Building Inspector Refresher:

a. Pre-inspection Planning and Review of Previous Inspection Records.

b. Inspecting for Friable and Non-friable Asbestos Containing Materials (ACM).

c. Assessing the Condition of Friable ACM.

d. Bulk Sampling/Documentation of Asbestos in Schools.

e. Record Keeping and Writing Inspection~~s~~ Reports.

f. Field Trip.

6. Project Designer and Asbestos Project Designer Refresher:

a. Safety System Design Specifications.

b. Designing Abatement Solutions.

c. Budgeting/Cost Estimation.

d. Writing Abatement Specifications.

e. Preparing Abatement Drawings.

f. Occupied Buildings.

g. Field Trip.

I. Course Approval.

1. The Department may base approval of an initial or refresher training course in any discipline in whole or in part on the provider's compliance with the requirements of Section XIX.C., the accuracy and applicability of the materials submitted pursuant to this Section, observation by a Department representative of an actual presentation of the course, or approval from the EPA, an EPA-accredited state, or a state having reciprocity with the Department.

2. The training provider shall submit all of the following information to the Department not less than 30 days prior to the initial presentation of the course within the State:

a. Course sponsor's name, address, and telephone number;

b. The course curriculum;

c. Length of training in days;

d. Description of amount and type of hands-on training;

e. Topics covered in the course;

f. A copy of all course materials, including student manuals, student handouts, instructor notebooks, lecture outlines, etc;

g. A detailed statement regarding the length, format, and development of examinations, and copies of actual examinations;

h. A description of procedures used to administer examinations and to ensure their security;

i. Instructor names, documentation of qualifications (including resumes), and the subject areas that each instructor will teach;

j. Description and samples of numbered certificates that will be issued to students who successfully complete the course, and a statement regarding the manner in which certificate numbers are generated; and

k. Other applicable information requested by the Department.

3. The provider of any training course presented in the State shall allow Department representatives to attend, monitor, and evaluate the course without charge and without advance notice.

4. The provider of any training course approved by the Department shall notify the Department within ten days of any changes in course topics, materials, and instructors. The training provider shall provide notification in writing and shall submit appropriate documentation for Department approval.

5. The Department reserves the right to require additional training as appropriate, including training specific to this regulation, air sampling strategies, or roofing projects.

6. The Department shall withdraw approval of a training course if it determines that:

a. The course no longer meets the requirements of this regulation or the EPA Model Accreditation Plan.

b. Approval from the EPA, an EPA-accredited state, or a state with whom the Department has reciprocity has been withdrawn.

J. Periodic Audits.

1. The Department may conduct unannounced audits of any training course to ensure compliance with all requirements of this regulation.

2. All in-State training providers shall maintain the approval status of their training courses by submitting to periodic on-site audits by the Department. Such audits may be unannounced. In-State training courses that have been audited by a state having a written reciprocal agreement with the Department regarding periodic audits may be exempted from the periodic audit rule.

3. The Department shall conduct periodic audits for the purpose of verifying that:

a. The training course complies with all requirements of this regulation;

b. The training course content has been updated and is current with state-of-the-art methods and technology available in the asbestos abatement and management industry;

c. The training course meets instructor qualifications and performance standards, training course administration standards, hands-on training standards, and instructor-to-student and workstation-to-student ratios as established by the Department;

d. The training course sponsor has maintained training-related records as required in Paragraph C.9. of this Section; and

e. Previously-approved curriculum materials and instructors are subject to the training course standards as defined by the Department.

4. All training course sponsors shall allow, at no charge, representatives from the Department to attend all or any part of any training course for the purpose of conducting periodic audits. Training course sponsors shall not restrict access to any part of a training course for which the Department is conducting an on-site audit. As part of the audit process, training course sponsors shall make records that are required by this regulation available to the Department upon request.

5. As a result of a periodic on-site audit of any training course previously approved by the Department, the Department may revoke or suspend its approval; or, for training courses that have been approved by other federal or state approval agencies, the Department may refuse to accept certificates of training if any of the following deficiencies are noted during the audit:

a. The course is not in compliance with this regulation;

b. The training provider misrepresents the extent of the training course's approval; or

c. The Department finds evidence of falsification of any records required by this regulation.

6. The Department shall not recognize a certificate of training issued by any in-State training course that has had its acceptance suspended or revoked as a result of an on-site audit until a subsequent audit shows that the cause of suspension or revocation has been corrected.

7. The Department shall not recognize a certificate of training issued by any training course that has had its approval, acceptance, or certification revoked by any other state or federal approval agency until the approval has been reinstated by the revoking agency.

K. Training Course Fee Schedule.

1. Initial approval for each training course license - $350.00 per day per course.

2. Annual license renewal for Department-approved training courses - $200.00 per course.

3. Each course license is valid for an entire year, regardless of the number of times the course is taught during the year.

4. Fees shall not be refunded if a training course is denied a license per this regulation.

5. Failure to pay annual training course license renewal fees may, after a hearing in accordance with the provisions of this regulation, result in the course license being revoked.

SECTION XX. - INDUSTRIAL MANUFACTURING AND ELECTRICAL GENERATING FACILITIES.

A. Applicability.

1. In lieu of requirements described in other sections of this regulation except as specified herein, the requirements of this Section shall apply to the owner of an industrial manufacturing or electrical generating facility that has obtained a group license for facility employees or employees of the designated long-term in-house contractor.

2. Unless otherwise specified herein, the applicable requirements of this regulation shall apply to any asbestos project involving RACM, regardless of the size of the project.

3. No person shall engage in any asbestos project or abatement involving RACM unless licensed to do so by the Department.

4. Industries that choose not to obtain a facility group license or who hire companies or individuals not covered under the facility group license shall satisfy all applicable requirements described in other sections of this regulation, except for with regard to the frequency with which building inspections are required, as outlined in Section XX, J of this regulation.

B. Training.

Employees of industrial manufacturing or electrical generating facilities and of such facilities' long-term in-house contractors who perform asbestos abatement projects shall satisfy the training requirements as specified below:

1. Employees who perform OSHA-designated Class I and II work not subject to OSHA's exceptions shall receive training consistent in length and curriculum with 40 CFR Part 763, Subpart E, Appendix C, as amended, and any subsequent amendments and editions. Employees who perform OSHA-designated Class III work not subject to OSHA's exceptions shall receive training consistent in length and curriculum with 40 CFR 763.92(a)(2).

2. All training conducted for the purpose of satisfying B.1 of this Section shall be conducted by a person who meets the applicable instructor qualifications of the Training Section of this regulation.

C. License Application.

1. Each person covered under a facility group license shall successfully complete a Department-approved initial or refresher training course specific to the discipline, and at the conclusion of the course, shall successfully pass an examination, when applicable, with a score of 70 percent or above.

2. Each facility seeking a group license shall submit a completed application to the Department in a format designated by the Department. The application must state the type of license for which the application is being made and must include the following information:

a. Name, mailing address, and street address of the industrial manufacturing or electrical generating facility;

b. Name, title, and telephone number of a responsible company official;

c. Name of the designated long-term in-house contractor, when applicable; and

d. Name, Social Security number, discipline, training provider or approved instructor, and, when applicable, examination date of most recent training certificate for each person to be included under the license.

e. An owner shall notify the Department quarterly of any change in facility name, contact person, mailing address, street address, telephone number, long-term in-house contractor, and/or personnel covered by the group license.

3. Acceptable documentation of training may be requested by the Department and shall include:

a. An original certificate issued by the training course provider that meets the requirements specified in this regulation; or

b. A valid, original license or accreditation issued by a state that has a reciprocal arrangement with the Department (photocopies or telephone facsimile copies shall not be accepted); or

c. A letter verifying successful completion of training that is sent directly to the Department from the approved training instructor.

4. Duration of a License.

a. A license shall automatically become invalid if an instrument of payment is returned for insufficient funds.

b. A group license shall expire one year from the process date, unless the Department suspends or revokes the license at an earlier date. No person covered by a group license shall engage in any asbestos project after one year from the examination date printed on his or her most recent training certificate regardless of the expiration date of the group license.

D. Continuing Education

1. After successful completion of an approved initial training course, each employee to be covered under a group license shall thereafter successfully complete a Department-approved initial or refresher training course specific to the discipline, and, at the conclusion of each course shall pass an examination with a score of 70 percent or above where applicable.

2. If more than 12 months but fewer than 24 months have elapsed since completing an initial or refresher training course, an applicant shall successfully complete either a refresher training course or an initial training course.

3. If more than 24 months have elapsed since successfully completing an initial or refresher training course, an applicant shall complete another initial training course.

E. Fees.

1. No application will be processed unless accompanied by the required fee.

2. Departmental receipt and deposit of fees submitted with an application shall in no way indicate

approval of the application or guarantee the Department's issuance of a license.

3. Fees shall not be refunded if a license is denied.

F. Group License Fee Schedule.

The fee for a group license shall be as follows:

1. Up to 10 people - $ 25.00 minimum fee

2. 11 to 20 people - $ 2.50 per person

3. 21 to 50 people - $ 5.00 per person

4. 51 to 90 people - $ 7.50 per person

5. 91 persons or more - $ 500.00 maximum fee

6. The minimum fee for a group license is $25.00 and the maximum is $500.00.

G. Project Fees.

1. The Department shall collect project license fees for all RACM being removed and for previously non-regulated ACM rendered regulated by use of destructive removal techniques such as chipping, grinding, sawing, abrading, drilling, or extensive breaking.

2. Abatement project fees for RACM are calculated at 10 cents per linear, cubic, or square foot, with a minimum fee of $25.00 and a maximum fee of $1,000.00.

3. The Department will not issue an abatement project license for a renovation or demolition until all requested information has been submitted and reviewed and all applicable fees have been paid.

4. Fees will not be refunded on projects for which the Department has issued an asbestos project license.

5. An abatement project license that has been issued shall automatically become invalid if an instrument of payment is returned for insufficient funds.

H. Action on an Application.

Within 15 calendar days after receiving an application, the Department will acknowledge receipt of the application and notify the applicant of any deficiency in the application. Within 30 calendar days after receiving a completed application, including all additional information requested, the Department will issue a license or deny issuance of the application.

I. Conditions and Generic Alternatives.

In granting a license, the Department may impose reasonable terms and conditions to ensure continuous compliance with the requirements of this regulation.

J. Asbestos Project General Information.

1. Prior to beginning a renovation or demolition operation at a facility, the owner/operator shall ensure that a building inspection is performed to identify the presence, location, and estimated quantity of ACM that may be disturbed by the work activity. The building inspection shall be performed by a person licensed as a building inspector or management planner.

2. The building inspector or management planner shall comply with the Building Inspection Section of this regulation.

3. To be acceptable, a building inspection shall have been performed no earlier than five years prior to the renovation or demolition, or, if more than five years have elapsed since the most recent inspection, the previous inspection shall be confirmed and verified by a person licensed as a building inspector.

K. Notification.

1. For NESHAP renovation projects, refer to the NESHAP Project Section of this regulation.

2. For demolitions, refer to the Demolition Section of this regulation.

3. For small, minor, and O&M renovation projects, either:

a. Provide the Department with written notification/application prior to any abatement and pay all applicable fees.

(1) Deliver the notification by U.S. Postal Service or commercial delivery service, facsimile transmission, by hand or by other methods deemed acceptable by the Department.

(2) Postmark or deliver the notice at least four working days for small projects before commencing asbestos stripping or removal work or any other activity begins that would break up, dislodge, or similarly disturb RACM. For minor and O&M projects, postmark or deliver the notice prior to commencing abatement activities.

(3) Update the notification when any previously-notified information changes and pay additional project fees as necessary.

(4) Notify the Department by telephone and follow up in writing as soon as possible, but not later than, the originally notified start date when a project for which notification was sent has been canceled.

(5) The Department may waive the five-calendar-day prior notice requirement on a case-by-case basis.

b. Maintain a log of all small, minor, or O&M projects performed during a quarter, report them to the Department within 30 calendar days of the end of the quarter, and pay applicable project fees. The log shall include but is not limited to: the name and address of the facility being abated, amount and type of ACM removed, date(s) of the removal, names of individuals who performed the abatement, the temporary waste storage location, and the name of the landfill used for disposal.

4. The owner/operator shall notify the Department by telephone and follow up in writing as soon as possible before, but not later than, the notified start date when a project has been canceled.

5. A licensed asbestos project designer shall prepare and implement the written design for each abatement renovation project involving the removal of greater than 3,000 square, 1,500 linear, or 656 cubic feet of RACM in a facility to be reoccupied. However, all projects shall be designed in accordance with the requirements of 40 CFR 763.90(g), as amended, and any subsequent amendments and editions, and this regulation.

6. The disposal requirements of this regulation shall be applicable to asbestos-containing and asbestos-contaminated materials for any abatement activity.

L. Emergency Operation Documentation.

1. For an emergency operation, the owner/operator shall submit project notification as early as possible before, but not later than, the working day following the emergency operation.

2. The facility owner shall notify the Department in writing of 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, public safety or health threat, equipment damage, or would impose an unreasonable financial burden. The owner shall submit this information with the project notification as required in this Section.

M. Work Practices.

1. NESHAP projects performed at an industrial manufacturing or electrical generating facility by individuals covered under the facility's group license shall satisfy the work practice requirements of 40 CFR 61.145, as amended, and any subsequent amendments and editions, and shall ensure that: wet removal methods are used; no visible emissions are released to the outside air; and all asbestos waste is sealed in leak-tight containers and disposed of at a landfill permitted to accept asbestos waste.

2. Any small or minor asbestos project or any O&M activity performed at an industrial manufacturing or electrical generating facility shall be subject to the work practice requirements of the Small Project, Minor Project, or O&M Project Sections whenever feasible. When such work practice requirements are not feasible or when alternate Federal OSHA and EPA work practice standards are used, the owner/operator shall perform work in such a way to provide assurance of RACM containment.

3. The use of glovebags must be in accordance with the requirements of OSHA 29 CFR 1926.1101.

4. The owner/operator shall ensure that contaminated water is filtered through a five micron or smaller filter and discharged to a sanitary sewer system. No contaminated or filtered water shall be allowed to leak or drain outside of the work area.

5. The Department may, on a case-by-case basis, approve alternative procedures for work practices, control of emissions from an asbestos abatement project, or air monitoring, provided the owner/operator submits a written description of the alternative procedure to the Department prior to beginning work and demonstrates to the satisfaction of the Department that compliance with the prescribed procedures will not be practical or feasible and that the proposed alternative procedures provide equivalent protection from asbestos exposure.

6. Legible copies of Departmental letters of approval for alternative work practices shall be kept at the project site and available for inspection for the duration of abatement.

N. Exemption from Wetting for Any Sized Project.

The requirements of the Exemption From Wetting Section of this regulation shall apply.

O. Disposal.

The requirements of the Disposal Section of this regulation shall apply except as follows:

1. In lieu of locking metal dumpster doors and tops, the dumpster containing asbestos waste may be kept in a secured area to which access is controlled.
2. Asbestos waste may be kept at the site until a sufficient quantity has accumulated for a full shipment. In this instance, the facility owner shall submit a copy of a completed waste shipment record or other shipping manifest to the Department within 45 working days of shipment of the waste.

P. Requirements for Training Courses and Training Instructors.

In order for initial or refresher training subject to the requirements of 40 CFR Part 763 to be acceptable as a basis for licensing pursuant to this Section, the course curriculum and instructors must meet the applicable curriculum criteria in the Training Section of this regulation and be approved by the Department.

Q. The requirements of the Reprimands, Suspensions, and Revocation Section of this regulation shall apply.

R. The requirements of the Contested Cases Section of this regulation shall apply.

S. The requirements of the Records Section of this regulation shall apply.

T. The requirements of the Other Requirements Section of this regulation shall apply.

SECTION XXI. - REPRIMANDS, SUSPENSIONS AND REVOCATION.

The Department may reprimand any licensee or revoke or suspend any license based upon violation of any requirement stated herein. Reasons for reprimand, suspension, or revocation may include, but are not limited to, falsification or known omission of any written submittal required as part of this regulation, submission of fraudulent information or documentation, omission or improper use of work practices, improper disposal of ACM, or spread of asbestos emissions beyond the containment area.

SECTION XXII. - CONTESTED CASES.

A. A Department decision involving the issuance, denial, renewal, suspension, or revocation of a permit or license may be appealed by an affected person with standing pursuant to applicable law, including S.C. Code Title 44, Chapter 1 and Title 1, Chapter 23.

B. Any person to whom an order or civil penalty is issued may appeal it pursuant to applicable law, including S.C. Code Title 44, Chapter 1 and Title 1, Chapter 23.

SECTION XXIII. - RECORDS.

Each licensed asbestos owner/operator shall retain, for at least three years after their issuance, all records required herein unless otherwise stated. These records shall be made available to the Department for review upon request.

SECTION XXIV. - OTHER REQUIREMENTS.

A. The requirements of this regulation shall in no way be construed to relieve the owner/operator from compliance with other regulatory requirements or contractual agreements that may be more restrictive.

B. The Department reserves the right to assess additional fees for licensing, training course auditing, and abatement activities, should enabling legislation be enacted.

SECTION XXV. - SEVERABILITY CLAUSE.

The provisions of Sections I through XXV of this regulation must be construed as separate provisions. If a provision is judged to be invalid in a court of law of this State, the court's decree shall apply only to the provision and action specified and shall have no effect on any other provision unless stated in the court's decree. The invalidity does not affect other provisions or applications of the Section which may be given effect without invalid provision or application and pursuant to this requirement, the provisions of these Sections are severable.

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Vol. 32, Issue No. 6, (Doc. No. 3162), June 27, 2008;
Vol. 35, Issue No. 5, (Doc. No. 4130), May 27, 2011.

APPENDIX C
EMSL Analytical, Inc. QMS Manual - Asbestos
EMSL Laboratory Accreditation Documentation

The attached document contains privileged and confidential information, and is solely for reference by the sender's intended recipient(s). Any unauthorized review, use and dissemination of this document is strictly prohibited.

EMSL Analytical, Inc. Management

Uncontrolled Copy

MODULE A

Asbestos Analysis

POLARIZED LIGHT MICROSCOPY

PHASE CONTRAST MICROSCOPY

TRANSMISSION ELECTRON MICROSCOPY

Module A – Asbestos – PLM, PCM and TEM

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Module A – Asbestos – PCM, PLM and TEM

A.1.0 Scope

This module defines the policies and procedures specific for laboratories performing analysis for asbestos samples under AIHA-LAP, A2LA, NVLAP, CALA or State Accreditation requirements or for laboratories conducting this analysis without accreditation. The requirements documented in this module are supplemental to the policies and procedures documented in the main section of the Quality Management System (QMS) Manual. This Module maintains the same format as the main QMS Manual for easy reference of additional requirements.

REVISION HISTORY

Previous revision histories are available from the QA Department on request.

Revision	Date	Changes
18	11/14/15	Removed Rev. 14 revision history. Added reference to CALA.
17	11/31/14	No Changes.
16	5/30/13	References to QAM changed to QMS.
15	9/16/11	No Changes.
14	7/1/11	Modified scope to differentiate between GMP and non-GMP requirements.

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A.2.0 Normative References

- AIHA-LAP, LLC – Accreditation Policy Modules – May 2015
- ISO/IEC 17025:2005
- TNI Standards – July 1, 2009
- NIST Handbook 150:2006
- NIST Handbook 150-3:2006
- NIST Handbook 150-13:2006
- A2LA General Requirements: Accreditation of 17025 Laboratories (R101), Feb. 2015

REVISION HISTORY

Previous revision histories are available from the QA Department on request.

Revision	Date	Changes
18	11/14/15	Removed Rev. 14 revision histories. Updated AIHA and A2LA references.
17	10/31/14	Changed TNI to 2009. Updated reference to current AIHA-LAP standard. Added A2LA General Requirements.
16	5/30/13	Updated 150-3 to 2009.
15	9/16/11	Updated reference to new AIHA-LAP standard.

A.3.0 Terms and Definitions

See QMS Manual, Appendix A – Glossary. This section reserved for use.

REVISION HISTORY

Previous revision histories are available from the QA Department on request.

Revision	Date	Changes
18	11/14/15	Removed revision histories for Revision 14.
17	10/31/14	No changes.
16	5/30/13	References to QAM changed to QMS.
15	9/16/11	Added reference to Appendix A.

A.4.0 Management Requirements

A.4.1 Organization

A.4.1.1 NVLAP Sub-Facilities

A.4.1.1.1 Relationship with Main Facility

Following the NVLAP requirements, sub-facilities are to be supported by the main facility. The EMSL main facility includes the corporate Quality Assurance Department, vice president/asbestos division, national asbestos manager, as well as the corporate laboratory facility. The Quality Assurance Department, vice president, national manager and regional managers provide support to the sub-facilities including:

- Developing, implementing and maintaining quality assurance procedures and policies
- Standardizing reporting policies and standard operating procedures
- Implementing and enforcing the quality control program
- Providing monthly review of quality control data (including calibrations, re-analysis data, standards, contamination data, etc.)
- Completing annual reports to upper management on laboratory quality activities
- Providing technical direction and support
- Distribution of proficiency testing samples
- Selection of supplies and equipment

A.4.1.1.2 Sub-Facility Internal Audits

The internal audit procedures for the sub-facility follow those policies written in the EMSL Internal Audit SOP.

A.4.1.1.3 Sub-Facility Proficiency Testing

Regional managers and or the national asbestos manager ensure that the NVLAP sub-facilities receive and analyze NVLAP proficiency testing rounds.

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All active analysts participate in the testing, when possible, following the requirements of the NVLAP program.

The national asbestos manager later forwards a copy of the scored results to the sub-facilities. If necessary, the laboratory manager initiates corrective action procedures. A copy of these results is maintained at the sub-facility and is made available for analysts to review.

Results of the proficiency analysis of the sub-facility laboratories are not submitted to NVLAP.

A.4.2 Management System
No additional requirements. See § 4.2 of QMS Manual.

A.4.3 Document Control
No additional requirements. See § 4.3 of QMS Manual.

A.4.4 Review of Requests, Tenders and Contracts
No additional requirements. See § 4.4 of QMS Manual.

A.4.5 Subcontracting of Tests and Calibrations
Laboratories that choose to subcontract any sample analysis to an outside laboratory shall ensure that the subcontract laboratory maintains the same relevant accreditations as that of the contracting laboratory. The qualifications of EMSL laboratories are maintained on the *EMSL Subcontracting Qualifications Record* available on E-link. Use of non-EMSL subcontract laboratories must be approved by the National Director for Asbestos.

Note: EMSL laboratories are considered independent facilities following NVLAP and AIHA-LAP policy, therefore, subcontracting policies apply. See *EMSL Subcontracting SOP* and § 4.5 of QMS Manual for additional detail.

A.4.6 Purchasing Services and Supplies
Supplies including microscope slides, sample preparation tools, acetone, triacetin, copper specimen grids, filters, acids and dispersion oils are to be ordered through the corporate purchasing department. This allows for company-wide control and standardization of consumable supplies.

A.4.7 Service to the Customer
No additional requirements. See § 4.7 of QMS Manual.

A.4.8 Complaints
No additional requirements. See § 4.8 of QMS Manual.

A.4.9 Control of Nonconforming Testing
No additional requirements. See § 4.9 of QMS Manual.

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A.4.10 Improvement

No additional requirements. See § 4.10 of QMS Manual.

A.4.11 Corrective Action

No additional requirements. See § 4.11 of QMS Manual.

A.4.12 Preventive Action

No additional requirements. See § 4.12 of QMS Manual.

A.4.13 Control of Records

No additional requirements. See § 4.13 of QMS Manual.

A.4.14 Internal Audits

No additional requirements. See § 4.14 of QMS Manual.

A.4.15 Management Reviews

No additional requirements. See § 4.15 of QMS Manual.

REVISION HISTORY

Previous revision histories are available from the QA Department on request.

Revision	Date	Changes
18	11/14/15	Removed revision histories of Rev. 14
17	10/31/14	A.4.1.1.3 – Added National Asbestos Manager.
16	5/30/13	References to QAM changed to QMS. "Client" changed to "Customer" to align with 17025. A.4.1.1.1 – Added reference to Regional Manager. A.4.1.1.3 – Changed responsibility for Sub-Facility PT to Regional Managers.
15	9/16/11	Removed reference to NVLAP sub-facilities from NOTE to clarify requirements for subcontracting.

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A.5.0 Technical Requirements

A.5.1 General

No additional requirements. See § 5.0 of QMS Manual.

A.5.2 Personnel

A.5.2.1 Additional PCM Training and Qualification Requirements

New analysts must complete the EMSL 'on the job' training program in asbestos PCM analysis in order to perform such analysis independently. EMSL also offers a more formal course – *Sampling and Analysis of Airborne Asbestos Dust.* The contents of this course have been evaluated by AIHA and found to meet their requirements as a substitute for the NIOSH 582 course. This course is provided following specific policies as described below.

<u>A.5.2.1.1</u> <u>Training Program – PCM</u>

The laboratory manager or designee (i.e., sr. analyst) is responsible for ensuring all PCM analysts receive proper training. The lab manager will draw on the candidate's previous training, if any. The candidate will receive sufficient in-house training following EMSL's PCM Training Checklist to demonstrate proficiency and understanding in all related topics to the laboratory manager's satisfaction. This training program must include:

<u>Theoretical</u>

Trainees must read and understand the methods, procedures and policies related to the analysis. These include:

- NIOSH 7400 Method
- EMSL standard operating procedure for the analysis of fibers via PCM analysis
- Quality Management System (QMS) Manual

<u>Demonstration</u>

Working with the trainer, trainees must perform all steps involved with preparation and analysis. The hands-on tasks must include:

- Preparation of the sample
- Calibration of the microscope
- Analysis of sample
- Calculation of result

<u>Skills</u>

An analyst-in-training must demonstrate proficiency in a number of ways. These include:

- Demonstration of accurate inter-analyst QC analysis on 95% of 50 real-time samples (see QC program for acceptance criteria - use QC report for PCM analysis)

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- Generation of personal relative standard deviations (S_r) by the completion of 120 analyses on laboratory reference slides (20 analyses per slide, 40 analyses per range)
- Demonstration of accurate analysis on 80% of 10 past proficiency samples and success in generating data within the acceptable range as established by the agency(ies) statistical analysis

Records pertaining to the analyst's training including the PCM training checklist, individual training records, bench sheets, etc., are maintained in the analyst's individual training binder. When all areas are signed off the candidate may perform analysis. A DOC is issued from the corporate QA Department.

A.5.2.1.2 Training Course: *Sampling and Analysis of Airborne Asbestos Dust – A NIOSH 582 Equivalent*

This course is provided at the discretion of corporate management, which may be based on regulatory requirements, project or customer's specific need, or general quality requisites.

Topics to be covered include:

- Introduction to asbestos and the asbestos industry
- Regulatory agencies/standards and compliance
- Sampling (including types of cassettes, pumps, calibrations, strategies, safety)
- PCM Microscopy (including optics, scope, alignment, calibration, maintenance)
- NIOSH Method 7400 (overview, history, calculations, etc.)
- Sample receiving, handling and preparation
- Sample analysis and reporting
- Quality control (incl. intro to statistics, ISO 17025 and counting statistics, proficiency programs)
- Hands-on with PCM scope alignments/calibrations and fiber counting
- Filter analysis practical and written exam

A.5.2.1.3 Qualifications Checklist – PCM

Training is documented with a qualifications checklist. This checklist is completed by the trainer, then dated and initialed by both trainer and trainee. The checklist includes a general section and method specific section.

A.5.2.1.4 Qualifying an Analyst – PCM

All analysts must complete the training program (even if they have previously completed a NIOSH 582 equivalent training course).

Training checklists are maintained, recording all tasks that are completed. Demonstration of Capability (DOC) certifications are issued by the Quality Assurance Department once the training checklists are complete. Analysts are

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qualified to perform independent analysis when all requirements of the training checklist and the probationary periods (if applicable) are met.

A.5.2.1.5 Ongoing Training – PCM

Analyst performance and qualifications are reviewed annually. Laboratories accredited by the AIHA-LLP must review analyst performance every 6 months. Recertification is complete when analysts have demonstrated continuing capability as discussed in the general section of this manual.

Also, if there are any updates to methodology or regulatory requirements, these are introduced at laboratory meetings or training sessions. During this meeting, the laboratory manager may review certain topics in PCM such as practical aspects of analyzing difficult samples, etc.

A record of this and other training will be documented on EMSL's Training Record forms and kept on file.

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A.5.2.2 TEM Training and Qualification Requirements

New analysts must complete the EMSL training program in TEM asbestos analysis in order to perform the analysis independently. Training includes:

- Understanding of asbestos regulations/aspects of the industry
- TEM theory, operation and calibration, including all support equipment
- Method review (AHERA, NIOSH 7402, etc.)
- Proficiency analysis
- Quality control re-analysis
- Completion of a TEM asbestos portfolio demonstrating morphology, chemistry (EDXA) and diffraction (SAED)

In all cases, previous training and experience is factored into this program. Completion of each phase of training is defined by the ability to demonstrate skills and knowledge to the satisfaction of the lab manager and QA manager. Each approved task is checked off on the analyst training log checklist. These training logs must be maintained even for those who have received prior training unless equivalent training records are transferred with the analyst.

A.5.2.2.1 TEM Theory

The lab manager or national asbestos management will draw on the candidate's previous training, if any. If not, the candidate will receive sufficient in-house training to demonstrate proficiency in these topics. Included are theories underlining selected area electron diffraction, energy dispersive X-ray analysis, crystallography and TEM operation, and calibration.

A.5.2.2.2 Hands-on Practices – TEM

When the candidate has received sufficient training to analyze samples, he/she will work in the laboratory alongside an experienced analyst. The candidate in training will be deemed proficient when at least 95% of 20 inter-analyst real-

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time QC analyses are accepted using the criteria established by the QC program. In addition, for AIHA-LAP accredited labs the 20 day probation period must also be met (See A.5.2.4.3.)

A.5.2.2.3 Proficiency Analysis – TEM
Additionally, the trainee must perform analysis on one round of past proficiency samples and succeed in generating data within the acceptable range as established by the agency(ies) statistical analysis.

A.5.2.2.4 Qualifications Checklist – TEM
Training is documented with a qualifications checklist. This checklist is completed by the trainer. The checklist is separated into a general section and the method specific training.

A.5.2.2.5 Qualifying an Analyst – TEM
All analysts must have completed the entire TEM training program.

Training checklists, training records, analytical bench sheets, etc., are maintained to document each step of the training process. Demonstration of Capability (DOC) certifications are issued by the Quality Assurance Department once the training checklists are complete. Analysts are qualified to perform independent analysis when all requirements of the training checklist and the probationary periods are met.

A.5.2.2.6 Ongoing Training – TEM
Analyst performance and qualifications are reviewed annually. Laboratories accredited by the AIHA-LLP must review analyst performance every 6 months. Recertification is complete when analysts have demonstrated continuing capability as discussed in the general section of this manual.

Also, if there are any updates to methodology or regulatory requirements, these are introduced at laboratory meetings or training sessions. During this meeting, the laboratory manager may review certain topics in TEM such as practical aspects of analyzing difficult samples, etc.

A record of this and other training will be documented on EMSL's Training Record forms and kept on file.

A.5.2.3 PLM Training and Qualification Requirements

Analysts must complete the EMSL training program in PLM asbestos analysis in order to perform analysis independently. The level of training may be adjusted according to the candidate's work experience, academic background and prior training. Training consists of four phases:

1) Theory and operation of polarized light microscopy technique and asbestos identification (understanding of method and standard operating procedures)

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2) Practical application of microscopy and analysis of samples
3) Proficiency analysis
4) Quality control

A.5.2.3.1 Theory – PLM

A basic understanding of the asbestos industry, microscopy and the crystallography of asbestos is the preliminary part of the training program. Areas covered include:

- Health effects/regulatory issues of asbestos
- Crystallography
- The polarized light microscope

A.5.2.3.2 Practical Factors – PLM

The trainee will work with an experienced analyst on polarized light microscopy techniques, sample preparation methods, the identification and quantitation of asbestos and non- asbestos materials found in bulk samples.

The trainee will analyze at least 50 field samples with an acceptable performance of accurate analysis on 94% of 50 real time samples (using the PLM QC program to determine acceptability).

A.5.2.3.3 Proficiency Analysis – PLM

Demonstration of accurate analysis on 80% of 10 past proficiency samples and succeeding in generating data within the acceptable range established by the PT providers' statistical analysis.

A.5.2.3.4 Qualifications Checklist – PLM

Training is documented with a qualifications checklist. This checklist is completed by the trainer. The checklist is separated into a general section and the method specific training.

A.5.2.3.5 Qualifying an Analyst – PLM

All analysts must have completed the PLM training program.

Training checklists are maintained, recording all tasks that are completed. Demonstration of Capability (DOC) certifications are issued by the QA Department once the training checklists are complete. Analysts are qualified to perform independent analysis when all requirements of the training checklist and are met. In AIHA accredited laboratories, the 20 day probationary period requirement shall also be met (See Mod. A § A.5.2.4.3).

A.5.2.3.6 Ongoing Training – PLM

Analyst performance and qualifications are reviewed annually. Laboratories accredited by the AIHA-LLP must review analyst performance every six (6) months. Recertification is complete when analysts have demonstrated continuing capability as discussed in the general section of this manual.

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Also, if there are any updates to methodology or regulatory requirements, these are introduced at laboratory meetings or training sessions. During this meeting, the laboratory manager may review certain topics in PLM such as practical aspects of analyzing difficult samples, etc.

A record of this and other training will be documented on EMSL's Training Record forms and kept on file.

A.5.2.4 Additional Personnel Requirements for Accredited Laboratories

Summarized below are additional personnel requirements as established by AIHA-LAP and NYS ELAP. In addition, please see **Attachment 2** at the end of this Module for additional personnel education and experience requirements by other accrediting authorities.

A.5.2.4.1 AIHA-LAP - Technical Manager

- Employee of laboratory with authority to provide day to day supervision of technical operations with responsibility for ensuring that accredited analysis are performed by qualified, trained personnel that are adequately supervised
- Bachelor's degree in an applicable physical or biological science (inorganic chemistry, environmental sciences, etc.)
- Present onsite at least 20 hours a week or 50% of operating hours (whichever is less) to address technical issues
- Three (3) years of non-academic analytical experience, of which at least two (2) years shall be in industrial hygiene analysis relevant to scope of AIHA-LAP accreditation
- A relevant post-graduate degree (MS or PhD) shall be considered equivalent to one (1) year of work experience. Academic experience and post-graduate degrees may not be substituted for the two (2) years industrial hygiene experience.

A.5.2.4.2 AIHA-LAP –Quality Manager

- BS degree in an applicable basic or applied science AND one (1) year non-academic analytical experience or quality control experience appropriate to the analysis performed
- OR, in lieu of a BS, four (4) years of non-academic analytical or quality control experience
- Documented training in statistics or laboratory quality assurance/quality control

Note: Appropriate documentation of training in statistics or laboratory quality assurance/quality control shall include at least one of the following: 1) college level course in statistics; 2) continuing education in laboratory quality assurance/quality control (e.g., AIHA-LAP or equivalent course); or 3) relevant

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experience – documented examples of the level of quality assurance/quality control used in applicable work experience.

A.5.2.4.3 AIHA-LAP – Analysts for Accredited tests

- Minimum of twenty (20) business days of hands-on experience conducting analyses in an industrial hygiene laboratory before initiation of independent work on customer samples. Until this time all analyses must be reviewed by the laboratory manager or senior analyst.
- For PCM analysts: Successful completion of the EMSL or other NIOSH 582 equivalent course.
  Note: EMSL's 582 course has been reviewed by AIHA and found to be equivalent with the NIOSH course.
- Demonstrated ability to produce reliable results through accurate analysis of certified reference materials (CRMs), proficiency testing samples, or in-house quality control samples. This demonstration shall be done at a minimum of every six (6) months and documented.

A.5.2.4.4 NVLAP – TEM Technical Supervisor

The TEM technical supervisor(s) shall be qualified to conduct AEM studies, apply AEM to crystalline materials and shall be proficient in the field of asbestos analysis including procedures for sample handling, preparation, analysis, storage, disposal, and contamination monitoring.

A.5.2.4.5 NYS ELAP – Technical Director – PLM

- Associate's Degree or two (2) years equivalent college study
- Specialized course in PLM analysis
- One (1) year experience under the supervision of an experienced analyst

A.5.2.4.6 NYS ELAP – Technical Director – PCM

- Associate's Degree or two (2) years equivalent college study
- Formal course work in PCM analysis
- One (1) year experience under the supervision of an experienced analyst

A.5.2.4.7 NYS ELAP – Technical Director – TEM

- Bachelor's Degree
- Specialized course in TEM analysis
- One (1) year experience under supervision of an experienced analyst

A.5.3 Accommodation and Environmental Conditions

A.5.3.1 Laboratory Conditions

A.5.3.1.1 Temperature

The rooms where analysis is performed should be held at normal temperature ranges. Reagents used in the analysis (refractive index oils, triacetin, etc.) shall

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not be kept in below freezing temperatures. Temperatures are recorded at the time of analysis when analyzing PLM samples due to the effect temperature has on the RI oils. Temperatures are recorded on the worksheet.

A.5.3.1.2 Lighting

Direct sunlight should be avoided when using the optical microscopes. Room lighting shall be provided which provides comfortable reading/writing conditions for the analysts. TEM analysis is performed in darkened conditions to provide ease while viewing the fluorescent screen.

A.5.3.1.3 Ventilation

Room ventilation must be provided so as to provide safe and comfortable conditions for the analyst.

A.5.3.1.4 Location

Air samples (PCM and TEM analysis) are not prepared in the same room where bulk sample preparation is performed.

A.5.3.2 Contamination

A.5.3.2.1 Contamination Management

In addition to the procedures and policies discussed in the main section of this manual, specific steps to avoid contamination in the asbestos laboratory include:

- Bulk sample containers are opened and samples examined using the stereo microscope only in the hood.
- Only small numbers of active samples are kept near the hood. The sample containers are kept closed at all times. Inactive samples are stored in a suitable, out of the way area.
- Target containers - samples, mounting reagents, microscope slides, and cover glasses are opened one at a time as practical.
- Prepared slides are stored in a protected manner.
- Prepared TEM samples are stored in an indexed grid box.
- Surfaces are frequently wiped clean with moistened wipes.

A.5.3.2.2 Ambient Air Monitoring

On a quarterly schedule, air monitoring is performed in the laboratory. Ambient air samples shall be collected from each work area as well as other common areas such as Log In.

Sampling and analysis is performed according to the following requirements:

- Collection on 0.45 micron MCE filters (at least 1200 liters collected at no greater than 10 lpm)
- Collection during normal working hours to best monitor worker exposure
- Analysis is performed via TEM AHERA protocol.
- The action level is considered exceeded if any asbestos is detected.

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If any asbestos is detected, a PCM analysis is performed (to coincide the data with health and safety (OSHA) limits) and the event is documented on a corrective action (CAR) form. The area is cleaned and additional samples are collected and analyzed by TEM AHERA to ensure the area is free of contamination. Cleaning and sampling is to continue until the sample results are negative for asbestos. Additional monitoring in addition to the regular quarterly samples may be needed to ensure corrective actions were effective.

A.5.3.2.3 Resolution of Contamination in Lab Blanks

If analyses of the blank samples indicate the possibility of contamination, the customer sample analysis is immediately halted. The area and tools are cleaned and another blank sample prepared and analyzed. If this second sample shows contamination, a complete investigation is conducted to determine the contamination source (acetone, triacetin, dispersion oils, preparation containers, etc.). A detailed flow chart for resolution of PLM and TEM contamination can be found in the appropriate SOPs.

A.5.4 Test and Methods and Method Validation

A.5.4.1 List of Asbestos Specific SOPs

The scopes of accreditation differ between branch labs. Accreditations and scopes are found in the EMSL websites – qualifications.

A.5.4.2 Estimation of Uncertainty of Measurement

EMSL has established and applies procedures for the determination and reporting of uncertainty to customers. These procedures are summarized in the "Uncertainty Worksheet – Asbestos" and detailed in EMSL's PLM SOP, NIOSH 7400 SOP, and TEM AHERA SOP.

A.5.4.3 Control of Data

A.5.4.3.1 Data Review

As documented in the main QMS Manual § 5.4.3, data review is performed continuously by the laboratory management for irregularities or questionable results. Criteria for judging a result questionable will include deviation from prior data from the same sample, from another sample collected within the same homogenous area, etc. Any questionable result will be rechecked with other quality control samples.

A.5.4.3.2 Data Recording for TEM

EMSL is in the process of converting all worksheets to direct entry into our iL@b LIMS system. There are very specific requirements for the recording of information for the TEM analysis. Data recording should be done in a manner conducive to good record keeping. If data cannot be entered directly into the iL@b LIMS system, data should be recorded using either black or blue indelible ink on an original analytical worksheet. Data should not be recorded in lab notebooks or scrap paper and then transposed to the analytical worksheet. If

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any correction on the data form needs to be made, it should be done using a dated and initialed single-line strikeout, and then the new data recorded next to the old data. The use of correction fluid is not permitted.

A.5.4.3.2.1 Sample Preparation Data

Sample preparation data is recorded on the internal chain of custody, the analytical worksheet, or directly into the LIMS system. The data recorded includes the following:

- Project identification number
- Sample identification number
- Customer identification
- Sample description
- Preparation date and analyst's ID
- Grid box identification
- Location of grid preparations in the grid box
- Effective filtration area and volume filtered (applicable for water, Chatfield, etc.)

Specific procedures for each sample type and criteria for acceptable final preparations can be found in the applicable Standard Operating Procedures for the method.

A.5.4.3.2.2 Structure/Fiber Identification & Sizing (where applicable)

The analytical worksheet or direct data entry system will contain at a minimum:

- SAED identification and negative number, if applicable
- EDXA spectra identification and printout or computer file ID, if applicable
- Structure's mineralogical identification (i.e., chrysotile, amphibole or non-asbestos)
- Structure classification (i.e., fiber, bundle, cluster, matrix)
- Structure size
- Quantitative totals of all structures / fibers identified as both asbestos and non-asbestos particles
- Analyst initials and date
- Sketch, if applicable

A.5.4.3.2.3 SAED Indexing

Images of SAED diffraction patterns are developed and measured to verify the pattern identity. Each analyst is required to have an on-screen identification accuracy of at least 80% as determined by indexing the negative. If any analyst falls below 80%, the analyst must not analyze customer samples until the laboratory manager has reviewed his/her data and determine the cause of the problems involved. Corrective actions will then be documented.

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Chrysotile:
Suspected chrysotile diffraction patterns are examined for a 5.3 Å layer-line (row) spacing and for the correct orientation and d-spacings. If results differ by more than 5% of accepted values, identification of chrysotile is suspect.

Amphibole:
Suspected amphibole patterns are examined for a 5.3 Å layer-line spacing (if the pattern is of random orientation) or for Zone-Axis measurements if a zone axis pattern was obtained. If results differ by more than 5% of accepted values, identification is suspect, particularly for amphiboles.

A.5.4.3.2.4 EDXA Spectra Evaluation
EDXA spectra can be evaluated either qualitatively, by comparing the sample spectra to spectra obtained from asbestos standards, or quantitatively, by calculating elemental concentrations using K-Factors obtained during EDXA calibration.

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A.5.5 Equipment

A.5.5.1 Equipment List
Each EMSL asbestos laboratory maintains a variety of equipment suitable to their size and workload. Specific equipment requirements can be found in the analytical SOPs. Each lab maintains an inventory of equipment onsite which provides specific of their particular equipment. This list is available for review upon request.

A.5.5.2 PCM Verification of Instrument Verifications

A.5.5.2.1 Stage Micrometer
See § 5.6 of main QMS Manual.

A.5.5.2.2 Microscope Alignments
Daily (Each analyst to perform daily or prior to analysis):
- Phase Ring Alignment - adjust to concentric
- Contamination control - clean microscope and work area

Weekly (Each analyst to perform weekly)
- HSE/NPL Test Slide – block 3 must be visible, 4-5 at least partially visible, 6-7 invisible
- Due to the current unavailability of HSE/NPL test slides, some labs use the HSE/UPO slides. These slides are available in different resolutions and acceptable line visibility is as follow:
  HSE/ULO Red - Lines 1- 3, must be visible, 4- 5 partially visible, lines 6-7 invisible
  HSE/ULO Green - Lines 1-4 visible, 5-6 partially visible, line 7 invisible

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Monthly

- Measurement of Walton-Beckett Graticule - diameter must be 100 µm

Note: For labs complying with the TNI (NELAC) Standard this must be checked and recalculated once per day by each analyst using the scope.

First time use (New, newly received or repaired microscope)

- Phase Ring Alignment - adjust to concentric
- Contamination control - clean microscope and work area
- HSE/NPL or HSE/UPO acceptability as listed above
- Walton Beckett Graticule -diameter must be 100 µm

A.5.5.2.3 Analyst Calibration

Daily (Each analyst, each day prior to performing PCM analysis):

- Standard reference slide (past proficiency test slide or other well characterized real world samples with targets and acceptance limits)

A.5.5.2.4 Hood Check

Quarterly, measure and record flow rate of PCM hoods with anenometer following the *EMSL Hood Maintenance and Calibration SOP* for acceptance criteria.

A.5.5.3 TEM Instrument Verifications

A.5.5.3.1 Alignment

Proper alignment of a transmission electron microscope is imperative in order to provide quality data. Each microscope will be checked for alignment daily, before first use, and thereafter during the day as the analyst deems necessary, or due to deteriorating conditions during analysis. If the microscope cannot be brought into alignment, the microscope should be serviced. The microscope is then realigned for use. Any service performed on the microscope is recorded in the equipment maintenance log.

A.5.5.3.2 Magnification

It is imperative to know accurate image magnifications for the sizing of asbestos both on the TEM phosphor screen and negative. In order to achieve this, the magnification will be calibrated monthly, both on phosphor screen and negative, using a carbon replica standard of 2,160 lines/mm at both 20,000 X and 10,000 X nominal magnifications. If the calibrated magnifications do not fall within acceptable limits of 2SD < 5% cumulative mean, the calibration should be checked for accuracy.

If the calculated magnification differs significantly from the target magnification and no other sources of error can be found (e.g., calculation errors, non-eucentricity), the microscope should be serviced and realigned, and magnification recalibrated.

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Magnifications will be charted over time to indicate any trends or problems. The variation of calibration data points, (defined as 2X the standard deviation of the past measurements to date) must be <5% of the mean. This data is tracked and managed in the EMSL QC program.

Any service is documented in the equipment maintenance log.

A.5.5.3.3 Verification of Measuring Aids

It is important to determine the exact size of the 0.5 and 5 micron measuring aids on the phosphor screen (either circles or two perpendicular lines depending on manufacturer). This is easily measured but requires a one-time procedure of removing the viewing glass and measuring directly on the phosphor screen with a fine ruler. Be careful not to scratch the phosphor coating. Armed with these measurements and the most current magnification calibration results, one can calculate their exact size at the magnification used for analysis. (These markings need to be recalibrated every time the phosphor screen is recoated.)

For asbestos in water analysis, additional calibration of 1.0 and 10 µm aids at 10,000x is also required.

A.5.5.3.4 Camera Constant

In order to index or measure selected area electron diffraction (SAED) patterns, an accurate camera constant must be obtained. For this purpose, the on screen and on negative camera constants will be calculated monthly (provided measurements have been stable over time - see below) using a gold-coated TEM grid. Camera constants shall not fall outside 2xSD<5% cumulative mean (the average calibrated camera constant to date). In the event the camera constant measurement indicates change outside these limits, sources of variability should be investigated and the calibration frequency should be increased to weekly for a period of four weeks.

If sources of error have been investigated but the measured result differs significantly from the target value, the microscope should be serviced and realigned and the camera constant recalculated. Any service is documented in the equipment maintenance log.

Camera constant calibrations will be charted over time to indicate any trends or problems. The variation of calibration data points, (defined as 2X the standard deviation of the past measurements to date) must be <5% of the mean. This data is tracked and managed in the EMSL QC program.

If sufficient data has been collected which indicates confidence in the stability of measurements, frequency of camera constant calibration can be adjusted to monthly. If values fall outside the acceptance range based on statistical evaluation, frequency is increased to weekly for approximately four weeks until

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stability of measurements is obtained again. Stability is determined by evaluating the data collected from weekly measurements over a period of 6 months (24 data points) and using the above mentioned criteria.

Note: For those instruments utilized for water calibration, frequency must be maintained at a weekly rate during the period of time analysis is performed.

A.5.5.3.5 Chrysotile Beam Dose

Low beam dose verifies the TEM can generate SAED diffraction patterns obtained from single chrysotile fibrils without damaging the fibril. Low beam dose must be demonstrated quarterly with 9 of 10 SAED patterns obtained from NIST traceable chrysotile fibrils. A fibril having a diameter greater than or equal to 1 µm in length must be visible for a minimum of 15 seconds. The electron micrograph of both the chrysotile fibril image and the SAED pattern obtained from that fibril must be maintained.

When proper dose levels are achieved, the parameters of the microscope settings are documented and known by each operator. These settings include:

- Condenser aperture
- Spot size
- Accelerated voltage
- Beam current

A.5.5.3.6 Spot Diameter

The beam size (at crossover) normally used for EDXA elemental analysis is calibrated quarterly to verify a spot diameter of less than 250 nm. An electron micrograph verifying this calibration must be recorded quarterly.

Diameter measurements will be charted over time to indicate any trends or problems. The variation of spot diameters, defined as 2X the standard deviation of the past measurements to date, must be <25% of the mean. This data is tracked and managed in the EMSL QC program.

A.5.5.3.7 Mapping Areas with Abnormal Spectra

The sections of the grid specimen holder, which may produce abnormal spectra, must be known to all analysts. Using a known standard reference material, such as NIST 2063a or 1866 Amosite, the areas producing abnormal spectra are recorded. This way determination can be made as to the regions that should be avoided in routine analysis.

A.5.5.3.8 EDXA Detector

The following lists the proper calibration and monitoring of performance for the EDXA detector.

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The TEM's Energy Dispersive X-Ray Analyzer (EDXA) is checked daily at the Al and Cu peak center line measuring, 1.48 keV and 8.04 keV respectively, within ±0.02 keV.

To assure low energy detection of the EDXA system, a resolvable Na kα peak must be measured using the NIST SRM 1866 crocidolite standard. These measurements must meet the criteria:

$I_B > 3(2I_B^b)^{1/2}$ where:
I_B = Integrated peak intensity, background subtracted
I_B^b = Integrated background intensity

Print a hard copy of the spectrum, sign, date, and file. It is strongly recommended to save spectrum on the hard drive. This must be done quarterly.

Using a single fibril of chrysotile from NIST SRM 1866, 1876a, or 1876b, the detector must be capable of clearly resolving the Mg and Si peaks. Hard copies of the spectrum are printed, signed, dated, and filed. This must be done quarterly.

The detector resolution is measured using a Mn source to verify the Mn kα peak has a resolution of less than or equal to 175 eV at full width half maximum. Resolution measurements are tracked over time to indicate any trends or problems. The value of the sum measurements and the variation (defined as 2X the standard deviation of the past measurements to date) must not exceed 180 eV. Print a hard copy of the spectrum, sign, date, and file. This must be done on a semi-annual basis.

For labs complying with the TNI (NELAC) standard, this frequency shall be quarterly.

Elemental K-Factors for Mg, Ca, and Fe relative to Si are calculated using NIST SRM 2063a or equivalent as a standard. The Mg to Fe ratio is also calculated using NIST SRM 2063a or equivalent as a standard. Elemental K-Factors for Na and Al to relative to Si are calculated from an Albite standard. These two sets of standards for K-Factor determination should be done at the same time (preferably the same day.) The following are some of the pass-fail criteria (see *Asbestos QC SOP* for complete listing):

Mg:Si – 1.0 - 2.0
Ca:Si – 1.0 - 1.75
Fe:Si – 1.0 - 2.0
Mg:Fe – 1.5 or less
Na:Si – 1.0 – 4.0
Al:Si – 1.0 – 1.75

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Print a hard copy of the spectrum, sign, date, and file. It is strongly recommended to save spectrum on the hard drive. This must be done on a semi-annual basis.

A.5.5.3.9 Plasma Asher

Although the AHERA method specifies 10% ashing, it allows for etching less than this amount if 10% generates a texture that negatively affects structure counting. EMSL has evaluated the ashing procedures, and found that in most cases 5% removal produces better preparations with lower fiber loss and better intact carbon films.

The low temperature plasma asher is calibrated quarterly to provide the calculated time needed to remove 5% of the collapsed mixed cellulose ester filter. This is performed gravimetrically and is charted against time.

Any service is documented in the equipment maintenance log.

A.5.5.3.10 Grid Opening Measurement

TEM 200 mesh locator grids are to be measured using light microscopy. Upon the receipt of each batch (10 vials of 100 grids), 2 grids per vial are removed and measured at the rate of 20 grid openings per grid for a total of 400 grid openings measured. A total of 2% of the grid lot is measured to determine the average grid opening area in mm^2.

Precision of the measuring system itself is tracked and documented.

See also *EMSL Grid Measurement SOP*.

A.5.5.3.11 Muffle Furnace

The high temperature muffle furnace is verified quarterly at three different temperatures in the temperature range of 450° to 520°C. A high temperature thermometer should be immersed in a sand bath for temperature readings. Actual temperature recorded should be within ± 5% of target temperature. Record date, target temperature, measured temperature and initials of technician. Any service performed is recorded in the equipment maintenance log.

A.5.5.3.12 Effective Filtration Area

An accurate result in any procedure requiring filtration depends upon an accurate measurement of the effective filter area (EFA). Prior to use on actual samples, the EFA of all filter funnel apparatus should be determined and documented. The EFA of disposable filter funnels needs to be documented using the “Effective Filtration Area Log” form at a rate of 2 per lot. This information should be stored in the laboratory files for future reference.

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A.5.5.3.13 Analytical Balance & Weights
See §§s 5.5.3 & 5.6.2 of main QMS Manual.

A.5.5.4 PLM Equipment Verifications

Verification procedures must be followed prior to the analysis of samples to ensure that results of analysis reflect true and accurate data. The following summarizes the type and frequency of calibration required. Details on the performance of these functions are found in the PLM SOP.

A.5.5.4.1 Microscope

Daily (Each analyst to perform daily, prior to analysis):

- Center stage or objective, and center and align condenser lens
- Align polars (full extinction)
- Crosshair alignment fixed in polarizer's privileged direction

A.5.5.4.2 Analyst

Daily

- Standard reference sample (may be actual sample material or pre-mounted slides from old proficiencies that are mounted in the proper RI medium that allow the recording of all the optical properties, including the refractive index of the asbestos fiber)
- Contamination check with fine grained, reagent grade salt

Monthly

- Check standard Amosite mount for proper dispersion color / wavelengths.

A.5.5.4.3 Verification of Balance
See § 5.5.3 of main QMS Manual.

A.5.5.4.4 RI Oil Calibration
RI oils are calibrated every time a new bottle is open. If the date of last calibration on the bottle is greater than three months, then the oil needs to be verified before use.

For NIOSH 9002 samples, RI Oils must be calibrated weekly or on next use.

See *EMSL RI Calibration SOP*.

A.5.5.4.5 Muffle Furnace Checks
Muffle furnace temperature are checked quarterly at three different temperatures in the temperature range of 450° to 520°C.

A.5.6 Measurement Traceability

The results of analytical measurements are traceable to recognized standards. These standards include:

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- SRM 1876b (or equivalent, i.e., NVLAP PT round)
- SRM 1867 or 1867a
- SRM 2063a
- SRM 1866 (a or b)
- Calibration using NIST certified or NIST traceable support equipment (thermometers, balance weights, stage micrometer, etc.)
- Consensus standards such as past proficiency testing samples

A.5.7 Sampling

For purposes of this manual, sampling is defined as the procedures involved with the splitting of samples for distribution to other laboratories and the preparation of samples for analysis (sub-sample preparation).

Samples are not split prior to shipment to another laboratory for regular customer analysis (as in sub-contracting). Where samples are shipped for quality control purposes, the originating laboratory may choose to retain a portion of the sample for internal quality control purposes. Care must be taken when splitting the sample to ensure the sample is split as evenly as possible. **Note***:* The splitting of samples for QC is optional and at the discretion of the laboratory manager.

Sub-sample preparation procedures are detailed in the *EMSL PLM SOP*.

A.5.8 Handling of Test and Calibration Items

A.5.8.1 Sample Acceptance Criteria: General

Whenever samples fail to meet sample acceptance criteria, the chain of custody and/or other project records shall be appropriately commented and the customer shall be contacted immediately. If the customer requests the analysis to continue, the laboratory shall ensure that all correspondence is clearly documented. Sample acceptance criteria include, but are not limited to, the lists included in the following sections.

A.5.8.2 Sample Acceptance Criteria: PCM

Samples accepted for PCM analysis must comply with a number of specific conditions. Examples of situations where samples might be judged unacceptable include:

- Bulk samples packaged with the PCM cassettes
- Cassettes packaged with Styrofoam 'peanuts'
- Tops missing from the cassette (or disassembled)
- Wet filter

See also *EMSL PCM NIOSH 7400 SOP* for additional criteria (if any).

A.5.8.3 Sample Acceptance Criteria: TEM

Samples accepted for TEM analysis must comply with a number of conditions. Samples are judged unacceptable under any of the following circumstances:

- Air cassettes submitted with bulk samples in the same package
- Air cassettes packaged with Styrofoam 'peanuts'
- Air cassettes submitted with missing tops (or disassembled)
- Air cassettes submitted with wet filters
- Water samples submitted with preservative added

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- Insufficient amount of sample submitted
- More than one non-layered sample in container ('Baggie')

See also *EMSL PLM SOP* for additional criteria (if any).

A.5.8.4 Sample Acceptance Criteria: PLM

Samples accepted for PLM analysis must comply with a number of conditions. Samples are judged unacceptable under any of the following circumstances:

- Insufficient amount of sample submitted
- Sample containers open
- Sample numbers on the COC don't match sample numbers on the sample, or are otherwise unidentifiable.
- Samples submitted in damaged sample containers
- Evidence of cross contamination

See also specific EMSL TEM SOPs for additional criteria (if any).

A.5.8.5 Sample Storage & Disposal

Sample Type	Standard Retention Time	Storage Conditions
Bulk and Air Asbestos	60 days	Stored in Ziplock bags; Air & Bulk not stored together
TEM Grids (AHERA)	3 Years	
TEM Grids (NYS NOBs)	3 Years	
Water grids filtrate of sample/ petri dishes may be stored also)	3 Years	Stored on filters used for prep in individual 50 mm Petri dishes
Microvac & wipe Petri dishes and grids	1 Year	Stored on filters used for prep in individual 50 mm Petri dishes

Following analysis, all bulk and air samples are placed in Ziplock bags and held for at least 60 days from the final report date, unless otherwise requested by the customer. TEM grids analyzed for AHERA compliance are held for three (3) years. Grids for microvac and wipes are held for only one (1) year. Samples containing $\geq$1% asbestos are discarded through a licensed hazardous waste removal company. A copy of the waste manifest is stored in the laboratory files.

Air samples shall not be stored with bulk samples, containers must be secure, and storage boxes should be placed in an area void of any possibility of damage.

After analysis is complete, the filtrate of water samples may optionally be stored on the filters used for preparation in individual 50 mm petri dishes. The prepared grids are stored in grid boxes assigned specifically to be stored for three (3) years.

The petri dishes and grids are stored for three (3) years from the date of the final report.

If requested, samples will be returned to the customer.

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A.5.9 Assuring the Quality of Test and Calibration Results

A.5.9.1 Monthly QC Data Report to Management

In addition to the Quarterly Report required by all departments, the asbestos quality control coordinator or quality assurance coordinator (or lab manager) shall compile a monthly report of quality control data by the 15th of each month for submission to the corporate QA Department.

The laboratory manager will prepare the monthly report highlighting the following:

- Summary of all QC activities
- Results of investigations of any QC outlier results
- Report of any problems, discrepancies encountered

A.5.9.2 Trend Analysis of QC Data – PLM, TEM, PCM

As discussed below, QC data for the Asbestos Department will be charted over time in order to evaluate analyst and laboratory performance. This data shall be reviewed by the laboratory's quality control and/or quality assurance coordinator or department manager. Statistically relevant trends should trigger an evaluation.

Examples of a significant trend include:

- Seven (7) consecutive data points on either side of the mean
- For any group of three (3) data points, two (2) data points outside the warning limits
- For any group of five (5) data points, four (4) data points outside the warning limits

Trend analysis shall be documented along with conclusions. If any actions are taken as a result, these may be documented as preventive actions. Trend evaluations shall be included in quality reports submitted to the laboratory manager and corporate Quality Assurance Department.

A.5.9.3 Selection of Quality Control Samples

The selection of samples for re-analysis is as random as possible while meeting the requirement that 30% of QC samples fall between 1%-10%. Original (first) results should not be known when the second analysis is performed.

Samples chosen are typically random, however, samples may be selectively chosen if there is a problematic or unique sample where a re-analysis may provide important information about that sample.

A.5.9.4 Single Analyst Laboratories

Laboratories that have a single analyst will be unable to perform in-house, inter-analyst QC analysis. Therefore the percentage of intra-analyst QC analysis as well as inter-lab QC analysis should be increased to maintain the overall 10% QC requirement.

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A.5.9.5 PCM Quality Control

The laboratory manager will determine how QC testing is implemented, either on a frequency basis (e.g., after the analyses of every ten samples), or a percentage of sample volume.

The Quality Assurance Department will inspect the results of QC testing on a regular basis and provide the necessary support and directives to the laboratory manager to ensure the QC program is properly executed.

The laboratory manager (or manager's designee) of each laboratory is responsible for implementing the day-to-day QC testing and ensuring the correct types of testing occur at the appropriate frequencies. The laboratory manager is also responsible for ensuring complete records of QC testing are maintained.

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A.5.9.5.1 Intra-Analyst – PCM

The original analyst re-analyzes the same sample. An attempt should be made to perform the analysis as 'blindly' as possible. Data is evaluated using the PCM QC program spreadsheet.

A.5.9.5.2 Reference Samples – PCM

Known standards are analyzed as if they were actual customer samples.

At the start of each day, the analyst will be given a standard reference slide at random for analysis. Results of this count are then compared to the standard reference value calculated by the proficiency program, which will determine whether the results are within accepted limits. Slides are rotated to ensure all slides are analyzed at approximately the same frequency over a period of time.

Note: The analyst may not analyze customer samples until she/he has counted a reference slide (i.e. past PAT sample). Results must be within acceptance criteria before analysis of customer samples can begin.

A.5.9.5.3 Statistical Analysis of PCM QC Data

Copies of data produced in intra-analyst testing will be submitted to the laboratory quality assurance or quality control coordinator or laboratory manager. The quality assurance or quality control coordinator or lab manager then carries out statistical analysis, using the EMSL monthly quality control report Excel spreadsheet. Procedures for this analysis, data collection, and data evaluation are described below. This program covers the QC requirements for airborne fiber counting. It addresses the requirements as defined in NIOSH Method 7400.

The principle objectives of the QC program are as follows:

- To determine analyst CV values over the ranges of fiber concentrations to assist in identifying random intra-analyst errors

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- To verify that results of analysis are precise within the 95% confidence level as measured using the determined analyst CV
- To verify that an analyst's results are accurate as measured against a general consensus result (past PAT samples and well characterized customer samples)

The program has three principle methods used to satisfy our objectives. These include:

1) Intra-analyst re-analysis of 10% of the samples
2) Routine re-analysis of Standard Reference slides
3) Inter-laboratory round robins

Data collected from the analysis of the same reference sample (from past PAT rounds) will be used to calculate analyst CV values, from all three (3) required ranges (5-20, >20-50, >50-100 fibers in 100 fields). The CV is updated as data is collected from daily reference slide analysis. Calculations are updated as 20 data points are collected.

The system will use these CV values to determine the acceptance of each set of sample replicates that are run daily. The system uses statistical calculations following those referenced in the NIOSH 7400 Method, Issue 2, dated August 1994, and is based on paired difference statistic. When a re-analysis does not agree with the original, all other samples in that set are to be re-analyzed. Test the new analysis with the original analysis for the entire batch and discard any failed data. Report results from those sample sets that fall within the control limits only.

A.5.9.5.3.1 Calculations

Standard Deviation:

A standard deviation is calculated for each set of data (minimum 20 data points/range) generated for each applicable range of fiber concentration using the formula:

$$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{n}}$$

Where: $\sigma =$ standard deviation

$x =$ Data point (f/mm^2)

$\bar{x} =$ Average of data points (f/mm^2)

$n =$ Number of data points

Coefficient of Variation (also referred to as relative standard deviation S_r)

With the standard deviation calculated,

$$CV = \frac{\sigma}{\bar{x}}$$

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Paired Difference Analysis (for pass / fail):
Each pair of replicate counts is compared using the paired difference quality test as follows:

$$\left|\sqrt{x_1} - \sqrt{x_2}\right| > 2.8 \times mean \times (.5 \times CV)$$

Where:

X_1 = Original fiber count (f/mm^2)
X_2 = Replicate (f/mm^2)
Mean = Average of the square roots of the two fiber counts (f/mm^2)
CV = Coefficient of variation (as established for each analyst, each fiber range)

Note: This calculation represents the rejection/ acceptance criteria for replicate data.

A.5.9.5.3.2 Control Charts
The replicate data is plotted on a control chart as a graphic tool designed to monitor the analyst's precision performance. It graphs the comparison with the difference of the square roots of the paired data with the acceptable limit calculated using the quality test explained above. The program normalizes these numbers to 1 and uses the following control limits.

- 1 = UCL (upper control limit) - 0.65 = UWL (upper warning limit)
- -1 = LCL (lower control limit) - 0.65 = LWL (lower warning limit)

Data is generated and charted to monitor and measure both individual analysts and overall laboratory performance. It measures trends in the analytical processes, which may affect the quality of data. These control charts contribute to the criteria for determining validity of the data, and monitors any bias that an analyst and/or laboratory may be experiencing.

A.5.9.6 TEM Quality Control
The following section describes the type and frequency of quality control analysis performed by the TEM laboratory. The frequency and type of quality control analyses are dictated by the analytical procedures and regulatory agencies.

Quality control data is tracked and managed in the EMSL quality control program.

The laboratory enters QC data into Excel worksheets, which then provides information including:

- Acceptance/rejection of replicate and duplicate data

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- Performance trends
- Upper and lower control limits
- Acceptance/rejection of calibration measurements
- Record of QC and calibration measurements and frequencies
- Contamination events
- Corrective actions
- Control charts

A.5.9.6.1 Standards Analysis

SRM 1876b or equivalent must be analyzed once each year per analyst.

The laboratory and analysts must obtain mean analytical results on SRM 1876b (or equivalent) so that trimmed mean values fall within 80% of the lower limit and 110% of the upper limit as published on the certificate.

Where the SRM 1876b is unavailable (as of the date of this revision of the QMS Manual, NIST has chosen to discontinue this SRM), EMSL will use NVLAP or New York State ELAP past proficiency testing samples as the reference standard. The results are evaluated using the criteria established by the PT provider.

Note2: Standard analysis of NIST 1876 or substitute is not applicable for TEM Bulk (NOB) samples; they have their own standards detailed in Section A.5.9.6.4.3.

A.5.9.6.2 AHERA, EPA Level I, II & III

A.5.9.6.2.1 Intra-Analyst Same Grid Opening Re-analysis

At least 2% (1/50 samples analyzed) of analyses are re-analyzed by the same analyst counting the same grid openings. QC samples are to be analyzed without prior knowledge of results where possible.

The measure of variance is calculated using the formula:

R = |(A-B)/((A+B)/2)|

Where:

R = the measure of variance for the analysis
A = the value of the first analysis in structures
B = the value of the second analysis in structures

Measures of variance (R) are recorded and plotted over time to determine trends and problems in analyses.

The Pass/Fail criteria for the QC analyses are as follows:

- < 5 structures = ± 1 structure
- 5-20 structures = ± 2 structures
- >20 structures = ± 3 structures

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A failure based on the above criteria will result in a verified analysis in order to determine the cause of the problem. A cumulative record of False Positives, False Negatives, and True Positives based on the verified analysis are kept for each analyst.

A.5.9.6.2.2 Inter-Analyst Same Grid Opening Re-analysis

At least 4% (1/25) of analyses are re-analyzed by a different analyst counting the same grid openings. (Single analyst labs must perform 1/10.) QC samples are to be analyzed without prior knowledge of results where possible.

The measure of variance is calculated using the formula

$$R = (A-B)/((A+B)/2)$$

Where:

R = the measure of variance for the analysis
A = the value of the first analysis in structures
B = the value of the second analysis in structures

Measures of variance (R) are recorded and plotted over time to determine trends and problems in analysis.

The Pass/Fail criteria for the QC analyses are as follows:

- < 5 structures = ± 1 structure
- 5-20 structures = ± 2 structures
- 20 structures = ± 3 structures

A failure based on the above criteria will result in a verified analysis in order to determine the cause of the problem. A cumulative record of False Positives, False Negatives, and True Positives based on the verified analysis are kept for each analyst.

A.5.9.6.2.3 Same Prep Different Grid Opening Analysis

Sample re-analysis of different grid openings is performed to monitor and evaluate the method in regard to loading deposition uniformity on the filter. Re-analyses are analyzed at a frequency of 1 in 100 samples; QC analyses should be split relatively evenly between intra-and inter-analyst analyses.

Poissonian statistics are applied to re-analysis data. QC samples are to be analyzed without prior knowledge of results where possible. The analysis is accepted when:

$$|(A-B)| \leq 1.5 \times ((A+B)/2)^{1/2}$$

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Where:

A = the value of the first analysis in structures
B = the value of the second analysis in structures

A.5.9.6.2.4 Sample Re-Preparations

Same sample re-preparations are performed to monitor any possible discrepancies that may occur in the implementation of the overall method. This includes sampling, preparation and analysis. Re-preparations are analyzed at a frequency of 1 in 100 samples and should be split relatively evenly between intra- and inter-analyst analyses.

Poissonian statistics are applied to re-preparation data. QC samples are to be analyzed without prior knowledge of results, where possible. The analysis is accepted when:

$$|(A-B)| \leq 2.0 \times ((A+B)/2)^{1/2}$$

Where:

A = the value of the first analysis in structures
B = the value of the second analysis in structures

A.5.9.6.2.5 Verified Analysis

At least 1/100-grid openings analyzed are re-analyzed by at least one other analyst using a verified analysis technique. Structures within a grid opening are either sketched or plotted and their locations are verified. 20% of the samples used for verified analysis must contain between 6-40 structures/grid opening (approximately 1,000 – 5,000 asbestos structures per mm^2), with the exception of verified analysis used to resolve discrepancies.

Analysts-in-training are required to perform a greater amount of verified analysis as seen fit by the laboratory manager and as dictated by the analyst's QC results.

A.5.9.6.2.6 Laboratory Blank Sample Analysis

Prep one blank per batch or 10% of the daily total (whichever is greater), and after cleaning or servicing the preparation area. Analyze 1 per 100 filter analyses for MCE (mixed cellulose ester) filters, and 1 per 25 filter analyses for PC (polycarbonate) filters. For those laboratories accredited by the NYS ELAP, analysis frequency is 5%. Store all prepared grids (even if not analyzed) and record blank data on appropriate forms. Blank QC analysis is made part of the overall 10% quality assurance analysis.

For labs complying with the TNI (NELAC) standard, lab blanks must be analyzed at a rate of 1 per 20 samples analyzed.

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Criteria for the maximum allowable contamination levels for laboratory blanks are:

MCE Filters:

- Cumulative average of < 5 structures/mm^2 , AND
- A single preparation level of < 15 structures/mm^2

PC Filters:

- Cumulative average of 18 structures/mm^2 , AND
- Any single preparation level of 53 structures/mm^2

A.5.9.6.3 ASTM Dust Microvac and Wipe Sample Analysis

Quality control for this method specifies 10% of total analyses (excluding blanks) and requires following the QC procedures as recommended by NVLAP/NIST and ASTM. The re-analysis must be performed on second grid preparations from the final filter.

A.5.9.6.3.1 Intra-Analyst Re-analysis

At least 3% of analyses are re-analyzed by the same analyst on different grid openings of different preparations. QC samples are to be analyzed without prior knowledge of results where possible.

The analysis is accepted when:

$$|(A-B)| \leq 1.5 \times ((A+B)/2)^{1/2}$$

Where:

A = the value of the first analysis in structures
B = the value of the second analysis in structures

For any failure of the above criteria, re-analysis is required in order to determine the cause of the problem.

A.5.9.6.3.2 Inter-Analyst Re-analysis

At least 7% of analyses are re-analyzed by a different analyst on different grid openings of different preparations. QC samples are to be analyzed without prior knowledge of results where possible.

The analysis is accepted when:

$$|(A-B)| \leq 2.0 \times ((A+B)/2)^{1/2}$$

Where:

A = the value of the first analysis in structures
B = the value of the second analysis in structures

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For any failure of the above criteria, re-analysis is required in order to determine the cause of the problem.

A.5.9.6.3.3 *Process Blanks*

One (1) process blank is prepped and analyzed along with each sample set.

A.5.9.6.4 TEM NOB (ELAP 198.4) & Chatfield VAT

A.5.9.6.4.1 *Intra-Analyst Re-analysis*

At least 2% of analyses are re-analyzed by the same analyst. QC samples are to be analyzed without prior knowledge of results where possible.

Measures of variance are calculated using the formula:

$$R = |(A-B)/((A+B)/2)|$$

Where:

R = the measure of variance for the analysis
A = the value of the first analysis in % asbestos
B = the value of the second analysis in % asbestos

Measures of variance are recorded and plotted over time to determine trends and problems in analyses.

The Pass/Fail criteria for the QC analyses are as follows:

- $R \leq 1$ – PASS
- $R > 1$ – FAIL
- Incorrect Asbestos ID – FAIL
- Asbestos missed during analysis (false negative) – FAIL
- Asbestos incorrectly identified to be present in a negative sample (false positive) – FAIL

A failure based on the above criteria will result in re-analysis to determine the cause of the problem. If this should fail to resolve the problem, the sample will be re-prepped (a complete gravimetric reduction) and again re-analyzed by the initial analyst.

R values are maintained and R control charts updated monthly along with results for and resolutions of failures.

A.5.9.6.4.2 *Inter-Analyst Re-analysis*

At least 7% of analyses are re-analyzed by a different analyst; the sample is re-prepped, including ashing and acid dissolution. QC samples are to be analyzed without prior knowledge of results, where possible.

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Measures of variance are calculated using the formula:

R = (A-B)/((A+B)/2)

Where:

R = the measure of variance for the analysis
A = the value of the first analysis in % asbestos
B = the value of the second analysis in % asbestos

R-values are recorded and plotted over time to determine trends and problems in analyses.

The Pass/Fail criteria for the QC analyses are as follows:

- R > 1 or R< -1 – FAIL
- Incorrect Asbestos ID – FAIL
- Asbestos missed during analysis (false negative) – FAIL
- Asbestos incorrectly identified to be present in a negative sample (false positive) – FAIL

A failure based on the above criteria will result in re-analysis to determine the cause of the discrepancy. If this should fail to resolve the problem, the sample will be re-prepped (complete gravimetric reduction) and again re-analyzed by the initial analyst.

R-values are maintained and R control charts updated monthly, along with reasons for and resolutions of failures.

A.5.9.6.4.3 Standard Analysis

At least 1% of analyses are prepared of reference standards or consensus standards. Results are charted to determine analyst as well as laboratory precision and accuracy.

A.5.9.6.4.4 Blank Analysis

At 5% (1/20) of sample volume, a known negative floor tile is prepped and analyzed for % weight recovery and contamination. Residue weights must be within 10% of the average recovery weight. If asbestos is detected, the source of contamination must be traced and problem resolved.

A.5.9.6.5 EPA 100.2

Quality control follows TNI guidelines:

- Total number of QA samples and blanks must be at least 10% of total sample workload.
- There are no inherent inter- or intra-analyst QC requirements, but good practice would include both.

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A.5.9.6.5.1 *Verified QC Analysis*

At least 5% of samples must be analyzed by the analysis of the same grid openings in a verified format, including sketches and verification of all discrepancies. Verified QC is evaluated by NISTIR 5351, and analysts must maintain at least ≥ 80% True Positives, ≤ 10% False Positives, and ≤ 20% False Negatives for cumulative verified analysis from analysis of verified samples and standards.

A.5.9.6.5.2 *Verified Standard Analysis*

Standard samples are analyzed at a rate of 1% of total analyses. Standard samples must be created from all six NIST (NIST 1866 & 1867) standard asbestos types, with final preparations containing 1-20 asbestos fibers (>10µm long) per grid opening.

Standards should be re-analyzed using verified analysis of the same grid openings, including sketches and verification of all discrepancies. Verified QC is evaluated by NISTIR 5351, and analysts must maintain at least ≥ 80% True Positives, ≤ 10% False Positives, and ≤ 20% False Negatives for cumulative verified analysis from analysis of verified samples and standards.

A.5.9.6.5.3 *Replicate QC*

At least 1% of samples should be re-analyzed by the analysis of different grid openings of the same preparation used for analysis.

The analysis is accepted when;

$$|(A-B)| \leq 1.5 \times ((A+B)/2)^{1/2}$$

Where:

A = the value of the first analysis in structures
B = the value of the second analysis in structures

For any failure of the above criteria, re-analysis is required in order to determine the cause of the problem.

Note: Definition for Replicate QC above is specific to water methodologies.

A.5.9.6.5.4 *Duplicate QC*

At least 1% of samples should be re-analyzed by re-preparing the sample by re-filtration, re-preparation, and re-analysis of the same volume aliquot as used for the original analysis.

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For the analysis of different preparations, the analysis is accepted when:

$$|(A-B)| \leq 2.0 \times ((A+B)/2)^{1/2}$$

Where:

A = the value of the first analysis in structures
B = the value of the second analysis in structures

For any failure of the above criteria, re-analysis is required in order to determine the cause of the problem.

Note: Definition for Duplicate QC above is specific to water methodologies.

A.5.9.6.5.5 Blanks

A process blank is filtered, prepared and analyzed before each batch of samples. The process blank must meet a contamination level of ≤ 0.01MFL for fibers > 10µm long.

A.5.9.7 PLM Quality Control

A.5.9.7.1 Intra-Analyst Re-analysis – PLM

A.5.9.7.1.1 Frequency

At least 2% of analyses are re-prepared and re-analyzed by the same analyst. A full analysis is performed (re-prepared, optical properties recorded, etc.).

A.5.9.7.1.2 Statistical Analysis

Measures of variance are calculated using the formula

$$R = |(A-B)/((A+B)/2)|$$

Where :

R = the measure of variance for the analysis
A = the value of the first analysis in %
B = the value of the second analysis in %

Measures of variance are recorded and plotted over time to determine trends and problems in analyses.

The Pass/Fail criteria for the QC analyses are as follows:

- $R \leq 1$ – PASS
- $R > 1$ – FAIL
- Incorrect Asbestos ID – FAIL
- Asbestos missed during analysis (false negative) – FAIL

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- Asbestos incorrectly identified to be present in a negative sample (False positive) – FAIL

For any failure of the above criteria, the cause of the failure is identified and corrected.

A.5.9.7.2 Inter-Analyst Re-analysis – PLM

A.5.9.7.2.1 Frequency

At least 7% of analyses are re-analyzed by a different analyst; the sample is re-prepped from the original sample.

A.5.9.7.2.2 Statistical Analysis

Measures of variance are calculated using the formula

R = (A-B)/((A+B)/2)

Where:

R = the measure of variance for the analysis
A = the value of the first analysis in %
B = the value of the second analysis in %

R-values are recorded and plotted over time to determine trends and problems in analyses.

The Pass/Fail criteria for the QC analyses are as follows:

- $-1 \leq R \leq 1$ – PASS
- R > 1 and R< -1 – FAIL
- Incorrect Asbestos ID – FAIL
- Asbestos missed during analysis (false negative) – FAIL
- Asbestos incorrectly identified to be present in a negative sample (False positive) –FAIL

For any failure of the above criteria, the cause of the failure is identified and corrected.

A.5.9.7.3 Reference Samples – PLM

A.5.9.7.3.1 Frequency

Past proficiencies and known standards made with SRM 1866 and 1867 are analyzed. These standards are used to both calibrate evaluate the performance of the analyst.

The standards are used to:

- Calibrate analyst visual estimation technique
- Verify the analyst's ability to correctly measure optical properties. Optical properties recorded must be within the acceptance criteria established by NIST.

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At least 1% of analyses are to be quantitative standards repeatedly submitted and quantified.

A.5.9.7.3.2 *Statistical Analysis*
Results are quantified and charted to determine analyst, as well as laboratory precision and accuracy, using the following formula for percent recovery.

%R = (A/F) x 100

Where:
%R = percent recovery
A = the analytical result
F = the formulated standard weight

A.5.9.7.4 EMSL PLM Consensus Program
In addition to the EMSL standard quality control program, a separate quality analysis program is used which provides for an additional check on analyst performance.

Following the sampling strategies documented in the AHERA regulations, sample batches are generally submitted to our laboratories in sets collected from homogenous areas. Samples are typically collected in sets of 2, 3, 5 or 7 depending on the total area sampled. These sets should contain samples of identical type.

Collection of samples in this way helps to minimize the chance for false negative results whether the source is from sampling error, non-homogeneity or lab error.

The homogeneous make up of these sets provides the lab with an opportunity to provide an extra layer of quality control. If the analysis of each homogenous group is split between two different analysts, a check on each analysis is achieved without any additional analytical effort.

See *EMSL PLM Consensus Analysis Program SOP* for additional information and procedure.

A.5.9.7.5 Blanks
For friable samples, at least one blank should be processed daily; this should entail the preparation of a known negative material to slide using all tools and oils to be used for analysis that day.

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For NOB samples, a known negative floor tile is prepped and analyzed for % weight recovery and contamination. Residue weights must be within 10% of the average recovery weight.

For Labs complying with the TNI (NELAC) Standard, a similar check is made with every 20 uses of a piece of homogenization equipment.

For all blanks, if asbestos is detected, the source of contamination must be traced and problem resolved.

A.5.9.8 Proficiency Testing

A.5.9.8.1 General

In addition to the policies and procedures mentioned in the general section of this manual, results are reported by each active analyst following the requirements of the proficiency testing (PT) program and must ensure:

- Analyses are not contracted out to another laboratory
- The laboratory keeps and uses proficiency testing materials as in-house instructional materials, unless otherwise directed.
- All analysts (full and part time) participate in proficiency testing rounds (all analysts need not participate in proficiency testing prior to returning the results to the PT provider, but all analysts shall participate without prior knowledge of the testing results at a later date, where applicable).
- Each analyst should analyze and record sample results independently as part of the lab's internal QC system.
- A single result is reported back to the PT provider by the laboratory, unless otherwise specified in the PT instructions.
- Procedures and calculations (if any) are documented as to how a single result is determined.
- Results from multiple analyses are not averaged.
- Test results are used for inter-analyst comparisons.
- Corrective actions are taken and documented for problems indicated by proficiency testing.
- Test results, when applicable, are used in determining accuracy and precision for each analyst.

A.5.9.8.2 PCM Proficiency Testing

EMSL laboratories will participate in proficiency testing programs, where accredited.

EMSL asbestos laboratories participate in the following programs at the discretion of the QA manager:

- AIHA-PAT Programs Industrial Hygiene Proficiency Analytical Testing program (IHPAT)
- Mandatory proficiency testing administered by state agencies as applicable

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- AIHA Registry Programs Asbestos Analyst Registry (AAR)

Proficiency samples from these programs are to be run as normal laboratory samples, except where agency policy dictates additional requirements.

A.5.9.8.3 TEM Proficiency Testing

EMSL TEM asbestos laboratories participate in the following programs:

- Mandatory proficiency testing administered by the NYS ELAP
- The mandatory testing administered by the NIST (National Institute for Standards and Technology) National Voluntary Laboratory Approval Program (NVLAP)

Proficiency samples are to be run as normal laboratory samples, except where agency policy dictates additional requirements.

All analysts, including those analyzing in a NVLAP sub-facility, participate in the analysis of the NVLAP proficiency samples.

A.5.9.8.4 PLM Proficiency Testing

EMSL PLM asbestos laboratories participate in the following programs:

- Mandatory proficiency testing administered by the NYS ELAP
- The mandatory testing administered by the NIST (National Institute for Standards and Technology) National Voluntary Laboratory Approval Program (NVLAP)

Proficiency samples are to be run as normal laboratory samples, except where agency policy dictates additional requirements.

All analysts, including those analyzing in a NVLAP sub-facility, participate in the analysis of the NVLAP proficiency samples.

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A.5.9.9 Round Robin Program

In addition to the intra-laboratory QC, laboratories participate in an inter-lab exchange among other EMSL laboratories and select laboratories outside of the EMSL network. The TEM, PLM and PCM programs are managed by the corporate Quality Assurance Department.

The EMSL asbestos Inter-laboratory program is documented in the *EMSL Inter-Laboratory Sample Exchange – Asbestos – SOP*.

The compiled results of the most recent inter-lab exchange shall remain posted in the laboratory for review by analysts.

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A.5.10 Reporting the Results

A.5.10.1 Reference to NVLAP Accreditation

A.5.10.1.1 Reports with NVLAP accredited and non-accredited data

Whenever a report contains data covered by NVLAP accreditation and data not covered by NVLAP accreditation, the report must prominently display the following statement at the beginning of the report: "This report contains data that are not covered by the NVLAP accreditation."

A.5.10.1.2 Use of NVLAP Logo

EMSL does not generally display the logos from accreditation agencies on the final report. Logos are commonly used on mailing envelopes and marketing materials. The NVLAP logo is displayed in compliance with the following procedures:

- Logo must be accompanied by the NVLAP Code and approved (by NVLAP) caption. The caption shall appear below and in close proximity to the logo.
- Logo must stand by itself and shall not be combined with any other logo, symbol or graphic.
- The aspect ratio shall be 1 to 2.25.
- The logo and caption shall be of a size that allows the caption to be easily read. The size of the caption shall not exceed the size of the logo itself.
- The logo shall appear in black, blue or other color approved by NVLAP and may be filled or unfilled. In the case of a filled logo, the same color shall be used for the outline and the fill.
- If the NVLAP term or logo is used in a contract or proposal, the term and logo is to be accompanied by a description of the laboratory's scope of accreditation and current accreditation status.

A.5.10.1.3 Use of NVLAP term

Whenever the term NVLAP is used to reference accredited status, it shall be accompanied by the NVLAP Lab Code. *For example: NVLAP Lab Code XXXXXX-X.*

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REVISION HISTORY

Previous revision histories are available from the QA Department on request.

Revision	Date	Changes
18	11/14/2015	Removed revision histories for Rev. 14. Removed reference to any mention of 'NVLAP no longer recognizes NYS ELAP samples as NIST traceable. These should no longer be used as a substitute for SRM 1876b.' Changed calibrations to verifications where appropriate. A.5.2.1.1: Clarified authorization for analysis using training checklist. DOC can follow. A.5.4: Removed reference to list of accredited methods and referred to website. All references to muffle furnace calibrations changed to 450, 485 and 520° temps. Attachment 1 – Added that if more than 100 samples are analyzed, must do an extra reference sample.

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17	10/31/2014	Section A.5.2.1.5 – Ongoing Training PCM. Analyst performance and qualifications are reviewed annually. Laboratories accredited by the AIHA-LLP must review analyst performance every 6 months. Recertification is complete when analysts have demonstrated continuing capability as discussed in the general section of this manual. Section A5.2.2.6 – Ongoing Training TEM. Analyst performance and qualifications are reviewed annually. Laboratories accredited by the AIHA-LLP must review analyst performance every 6 months. Recertification is complete when analysts have demonstrated continuing capability as discussed in the general section of this manual. Section A.5.2.3.6 – Ongoing Training PLM. Analyst performance and qualifications are reviewed annually. Laboratories accredited by the AIHA-LLP must review analyst performance every 6 months. Recertification is complete when analysts have demonstrated continuing capability as discussed in the general section of this manual Section A.5.9.6.2.6 – added 'For those laboratories accredited by the NYS ELAP, analysis frequency is 5%.'
16	5/30/13	References to QAM changed to QMS. "Client" changed to "Customer" to align with 17025. A.5.2.1 – Revised language on our course to clarify extent of AIHA endorsement. A.5.2.3.1 – Removed references to "chemistry" of asbestos in favor of crystallography. A.5.2.3.4 – Updated to remove requirement for probationary period for non-AIHA accredited labs. A.5.4.3.2.2 – Header change to include "Structure". A.5.5.2.1 – language removed in favor of reference back to main QAM A.5.5.2.2 – Acceptable range removed for W-B Graticule. Must measure 100 microns. A.5.5.2.4 – Removed acceptance criteria from Hood check and referred back to SOP. A.5.5.3.8 – Clarified NIST SRM 1866 A.5.5.3.13 - language removed in favor of reference back to main QAM A.5.5.4.1 – clarified requirement for condenser A.5.5.4.2 – Revised salt requirement from table salt to reagent grade salt. A.5.5.4.3 - language removed in favor of reference back to main QAM. A.5.6, A.5.9.6.1 – added note that NYS ELAP samples are no longer considered NIST traceable & added reference to 1867a. A.5.8.1 – New section but no new requirements. Moved from next section for clarity. A.5.8.2, A.5.8.3 – Added reference to SOP. A.5.8.4 – Added additional criteria and reference to SOP. A.5.9.3 – clarified "random" Attachments 1 & 2: Updated to reflect changes above where necessary.
15	9/16/11	A.5.2.1.1 – "On-the-Job" - Added reference to PCM Training Checklist. A.5.2.1.1 – "Skills" – Added requirement for generation of personal relative standard deviation to demonstration of proficiency. Clarified language on analyst training records. A.5.2.2.1 – Modified to allow national asbestos management to evaluate previous training. A.5.2.2.5 & 6– Clarified language. No new requirements. A.5.2.3.2 – Added the word "light." A.5.2.4.3 – Added note regarding status of EMSL's 582 course as AIHA approved. A.5.3.2.2 – Added requirement that common areas (e.g., log-in) shall also have ambient air monitoring. A.5.3.2.3 – Clarified that section applies to Lab blanks only. A.5.4.3.2.3 – Clarifies that if an analyst falls below 80% they cannot analyze customer samples until the lab manager has reviewed data and taken corrective action.

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		A.5.5.2.2 – Added reference to use of HSE/UPO slides when HSE/NPL slide is not available. A.5.5.2.2 - Walton-Beckett measurements in TNI/NELAC labs must be conducted daily by each analyst using the scope. A.5.5.2.2 – Clarified that first-time use refers to after microscope repair. A.5.5.3.8 – Added requirement that for TNI/NELAP labs, detector resolution must be measured quarterly instead of annually. A.5.5.3.8 - Added requirement that K-Factors for Na and Al from Albite shall be performed at the same time (same day). A.5.5.4.2 – Removed “refractive index” from Monthly requirements. A.5.6 – Added NVLAP PT rounds as an equivalent where SRM 1876b is not available. A.5.8.4 – Modified requirements for Water Grids to make retention of petri dishes optional. Retention of filtrate is still required even if grids are not kept. A.5.8.4 – Corrected definition of ACM for waste removal > 1% instead of >=1. A.5.9.6.2.6 – Added requirement that TNI/NELAP labs must analyze Lab blanks at rate of 1 per 20 samples analyzed. A.5.9.6.5.5 – Clarified blanks should be analyzed BEFORE each batch of samples. A.5.9.7.5 – New Section “Blanks” Revised Attachments to reflect TNI/NELAP frequency changes.

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Module A
Attachment 1: QC Frequencies

POLARIZED LIGHT MICROSCOPY
PHASE CONTRAST MICROSCOPY
TRANSMISSION ELECTRON MICROSCOPY

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PLM CALIBRATION FREQUENCIES

DAILY

PLM SCOPE ALIGNMENT
Record date, check off for rotation centering, condenser & objective alignment, axial illumination full extinction and crosshair alignment fixed in polarizer's privileged direction.

CONTAMINATION CHECK
Clean microscope and work area daily and all equipment after each use.
Prep and analyze a fine grained reagent grade salt sample as a check for asbestos contamination.

EACH DAY OF USE

ANALYTICAL BALANCE VERIFICATION
Analytical balance should be checked as per the *Balance Calibration Verification SOP*.

MONTHLY

AMOSITE DISPERSION COLORS
Check Amosite Standard for proper dispersion color wavelengths. Record DS color wavelengths, date and the analyst performing the calibration.

QUARTERLY

RI OILS
RI oil calibration to ± 0.004 using certified refractive index solids. Record date, nominal refractive index, measured refractive index, temperature and analyst's initials. All RI oils are calibrated when bottle is opened for first use. In addition, calibrate on next use if an oil has not been used in three (3) months.

MUFFLE FURNACE TEMPERATURE CHECK
Muffle furnace should be verified using three-point calibration covering 450, 485 and 520 degrees Celsius. Thermometer should be immersed in sand bath. Record date, target temperatures, measured temperatures, and analyst's initials.

AIR MONITORING
Ambient air samples should be collected (0.45 micron MCE cassettes, at least 1200 liters collected at not greater than 10 lpm) from each work area and analyzed by TEM using AHERA rules.

HOOD CALIBRATION
Measure and record flow rate of hoods with Anenometer as per the *EMSL Hood Maintenance and Calibration SOP*.

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ANNUALLY

THERMOMETERS

Thermometers used for measurement of ambient air temperature shall be verified annually as per § 5.6.2 of the main QMS Manual and the *EMSL Thermometer Calibration Verification SOP*.

ANALYTICAL BALANCE

The analytical balance shall be calibrated annually by an outside calibration firm accredited to ISO 17025.

WORKING WEIGHTS

Weights used for routine measurements in the lab shall be verified annually as per § 5.6.2 of the main QMS Manual and the *EMSL Working Weight Verification SOP*.

5 YEARS

REFERENCE WEIGHTS

Weights (used only for calibration of working weights) must be calibrated by an ISO 17025 accredited calibration service to NIST-traceable source every five (5) years as per § 5.6.2 of main QMS Manual.

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PLM FRIABLE QC ANALYSIS FREQUENCIES

STANDARD REFERENCE SAMPLE ANALYSIS (Daily)
One standard reference sample (known percentages) should be analyzed daily to determine precision and accuracy. Record date, analyst, type and percentage of asbestos present, as determined by calibrated visual estimation. A full analysis documented completely on a standard PLM bench sheet is required for each sample for each analyst.
In the event an analyst analyzes over 100 samples per day consistently, after the 100th sample, another reference sample must be analyzed for that day.

INTER-ANALYST RE-ANALYSIS (1/15 Friable Samples and 1/15 Non Friable Samples)
1/15 samples should be analyzed by different analyst (inter analyst) and R-values calculated R = {(A-B)/((A+B)/2)}. Analysis fails if R > 1 or < -1, misidentification of Asbestos occurs, or ACM vs. Non ACM. A full analysis documented completely on a standard PLM bench sheet is required for each sample for each analyst.

INTRA-ANALYST RE-ANALYSIS (1/50 Friable and 1/50 Non Friable Samples)
1/50 samples should be re-analyzed by the same analyst (intra-analyst) and R-values calculated R = {(A-B)/((A+B)/2)}. Analysis fails if R > 1 or < -1, misidentification of Asbestos occurs, or ACM vs. Non ACM. A full analysis documented completely on a standard PLM bench sheet is required for each sample for each analyst.

ROUND ROBIN (2 times/year)
All analysts should participate. Record dates of analysis, in-house analyst signatures, all results, and reasons for and resolution of disagreements.
A full analysis documented completely on a standard PLM bench sheet is required for each sample for each analyst.

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PLM NOB QC ANALYSIS FREQUENCIES

STANDARD REFERENCE SAMPLE (1/100 Samples)
At least 1 out of 100 samples shall be a verified quantitative standard that has been routinely resubmitted to determine analyst's precision and accuracy.

INTER-ANALYST RE-ANALYSIS (1/15 Non Friable Samples)
1/15 samples should be analyzed by different analyst (inter analyst) and R-values calculated R = {(A-B)/(A+B)/2}. Analysis fails if R > 1 or < -1, misidentification of Asbestos occurs, or ACM vs. Non ACM. A full analysis documented completely on a standard PLM bench sheet is required for each sample for each analyst.

INTRA-ANALYST RE-ANALYSIS (1/50 Non Friable Samples)
1/50 samples should be re-analyzed by the same analyst (intra-analyst) and R-values calculated R = {(A-B)/(A+B)/2}. Analysis fails if R > 1 or < -1, misidentification of Asbestos occurs, or ACM vs. Non ACM. A full analysis documented completely on a standard PLM bench sheet is required for each sample for each analyst.

NOB PREPARATION CHECK (1/20 NOB Samples)
A known negative floor tile is routinely re-submitted. These samples must go through the full preparation and analysis regimen and then be analyzed for asbestos contamination and residue recovery (% wt). NOB residue weights must be within 10% of the average recovery weight to be acceptable (PASS). If asbestos is detected, the source of contamination must be traced and problem resolved to prevent recurrence.

ROUND ROBIN (2 times/year)
All analysts should participate. Record dates of analysis, in-house analyst signatures, all results, and reasons for and resolution of disagreements.
A full analysis documented completely on a standard PLM bench sheet is required for each sample for each analyst.

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PCM CALIBRATION FREQUENCIES

DAILY

ALIGNMENT
Check alignment (phase rings) and illumination. Record date and analyst's initials.

CONTAMINATION CONTROL
Clean microscope and work area daily and all equipment after each use.

MICROSCOPE FIELD AREA MEASUREMENT (For TNI/NELAC labs)
Once per day, each analyst using the scope shall check the diameter of the Walton-Beckett Graticule. Measurement must equal 100 microns. Record diameter, PASS / FAIL, corrective action if necessary, date and the analyst's initials.

Other labs shall complete this Monthly.

WEEKLY

PHASE SHIFT DETECTION
The HSE / NPL Slide contains seven (7) blocks of grooves. Blocks 4 and 5 must be at least partially visible. Record the highest block visible, PASS / FAIL, corrective action if necessary, date and the analyst's initials.

For HSE/UPO Slides if used:

HSE/ULO Red - The microscope should be able to completely resolve the first 3 sets of lines (1-3); the next two sets of lines (4- 5) should be partially visible. The microscope should not be able to see the last two sets (6-7) of lines at all; they should be invisible.

HSE/ULO Green - The microscope should be able to completely resolve the first four (4) sets of lines (1-4); the next two sets of lines (5-6) should be partially visible. The microscope should not be able to see the last set (7) of lines at all; they should be invisible.

MONTHLY

MICROSCOPE FIELD AREA MEASUREMENT
Check the diameter of the Walton-Beckett Graticule. It must equal 100 microns. Record diameter, PASS / FAIL, corrective action if necessary, date and the analyst's initials.

For Labs complying w/ TNI (NELAC) Standard this should be increased to each time a different analyst uses the scope.

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MECHANICAL COUNTER
Mechanical counter accuracy is documented by counting to 100 while clicking the counter with each count. The clicker must read 100 on the 100th count. Record date, PASS/FAIL and analyst's initials.

QUARTERLY

AIR MONITORING
Ambient air samples should be collected from each work area. The samples should be collected on 0.45 micron MCE filters (at least 1200 liters collected at no greater than 10 lpm) and analyzed by TEM using AHERA rules.

HOOD CALIBRATION
Measure and record flow rate of PCM hoods with anemometer as per the *EMSL Hood Maintenance and Calibration SOP*. Record date, flow rate and the analyst's initials. See SOP for acceptance criteria.

PRIOR TO FIRST USE

STAGE MICROMETER
The stage micrometer in use at laboratory should be calibrated to ISO 17025 standards initially prior to first use, and if damaged as per § 5.6.2 of the main QMS Manual.

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PCM QC ANALYSIS FREQUENCIES

DAILY REFERENCE SLIDE
Each Analyst should analyze at least one Reference Slide daily (taken from low, medium and high fiber count pool randomly) in order to generate a CV for each analyst and for the lab. Record fiber counts and date for each analyst.

INTRA-ANALYST RE-ANALYSIS (1/10 Samples)
Perform blind intra-analyst recounts on 10% of filters counted. Record analyst, date, Reference #, Sample #, initial and QC fiber counts, density, PASS / FAIL, and comments / corrective actions.

ROUND ROBIN (2 times/year)
All analysts should participate. Record dates of analysis, in-house analyst signatures, all results, and reasons for and resolution of disagreements.
A full analysis documented completely on a standard PCM bench sheet is required for each sample for each analyst.
Samples are chosen from previously analyzed customer samples or past proficiency testing samples.

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TEM CALIBRATION FREQUENCIES

DAILY

Al, Cu CALIBRATION
Collect spectrum on Al, Cu grid. Peaks should be centered at 1.48 and 8.04 both to within ± 0.02 keV. If not, then calibration of the instrument is necessary. Record date, analyst and results. It is strongly recommended to save spectrum on the hard drive.

MICROSCOPE ALIGNMENT
Check off after each step. Record date and analyst's initials.

CONTAMINATION CONTROL
Clean work area and equipment after each sample.

SAED (as needed)
Indexing of diffraction patterns to verify a cumulative 80% accuracy rating for each analyst.

EACH DAY OF USE

ANALYTICAL BALANCE
Analytical balance should be checked in all applicable ranges as per § 5.5.3.1 of main QMS Manual and *EMSL Balance Calibration Verification SOP*. See SOP for acceptance criteria.

WEEKLY

CAMERA CONSTANT
Record camera length and camera constant as per the *TEM CAL Worksheet*. Produce negative, measurement results from photo and screen (+/- 5% change acceptable), and screen diameter that corresponds to 5.3 Angstroms.
Note: If sufficient data has been collected which indicates confidence in the stability of measurements, frequency of camera constant calibration can be adjusted to monthly.
Note: For those instruments utilized for water calibration, frequency must be maintained at a weekly rate during the period of time analysis is performed.

MONTHLY

MAGNIFICATION CALIBRATION
Calibration of screen and negative (± 5% change acceptable). Produce negative, calculations and results and conversion factors for the small and large circles on the phosphor screen.

QUARTERLY

BEAM DOSE
ED patterns of 9 out of 10 NIST SRM chrysotile fibrils (max. diameter 0.05 microns) must remain visible for 15 seconds. Record one fibril image and one photo of ED pattern.

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ASHER CALIBRATION
Determine ash time to etch 10% of collapsed filter. Chart ash time versus date.
Note: If during TEM analysis it is observed that a 10% ash results in over etching of the filter, the lab should switch to 5% as its target for calibration.

SPOT SIZE MEASUREMENT
Crossovers at spot size 3; take picture and record actual diameter.

Na SENSITIVITY
Resolvable (statistically significant) Na K alpha peaks from NIST SRM 1866 crocidolite. Produce calculations, dated and signed spectra AND photo of fibril. It is strongly recommended to save spectrum on the hard drive.

CHRYSOTILE FIBRIL SENSITIVITY
Check for resolvable Mg and Si peaks from single fibril from either NIST SRM 1866 or 1876b chrysotile. Produce dated and signed spectra. It is strongly recommended to save spectrum on the hard drive.

AIR MONITORING
Ambient air samples should be collected from each work area on 0.45 micron MCE filters and analyzed by TEM AHERA.

X-RAY DETECTOR RESOLUTION (For TNI/NELAP labs)
FWHM of Mn peak. Collect 2000 FS counts in the Mn peak (or more, but be consistent each time). Resolution must be <175 eV. Produce dated and signed spectra. It is strongly recommended to save spectrum on the hard drive.
Note: For other labs, this must be done semi-annually.

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SEMI - ANNUALLY

X-RAY DETECTOR RESOLUTION
FWHM of Mn peak. Collect 2000 FS counts in the Mn peak (or more, but be consistent each time). Resolution must be <175 eV. Produce dated and signed spectra. It is strongly recommended to save spectrum on the hard drive.
Note: For labs complying with the TNI (NELAC) Standard, this frequency must be quarterly.

K FACTORS:
USING SRM 2063 and Albite: Collect 10,000 integral or 2000 FS counts in the Si peak (or more, but be consistent each time). The various sensitivity factors must be calculated each with their own PASS/FAIL criteria. 10 runs. Produce dated & signed hard copy of spectrum. It is strongly recommended to save spectrum on the hard drive.

GRID OPENING AREA: Twenty grid opening areas from twenty grids (400 total) must be calculated for **each lot of 1,000** grids. Record date, lot number, analyst and average GSO.

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ANNUALLY

ANALYTICAL BALANCE

The analytical balance shall be calibrated by an external calibration service accredited to ISO 17025 annually as per § 5.5.3 of the main QMS Manual and *EMSL Balance Calibration Verification SOP*.

WORKING WEIGHTS

Weights used for routine measurements in the lab shall be verified annually as per § 5.6.2 of the main QMS Manual and the *EMSL Working Weight Verification SOP*.

5 YEARS

REFERENCE WEIGHTS

Weights (used only for calibration of working weights) must be calibrated by an ISO 17025 accredited calibration service to NIST-traceable source every 5 years as per § 5.6.2 of main QMS Manual.

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TEM AIR QC ANALYSIS FREQUENCIES

INTRA-ANALYST SAME GRID OPENING REANALYSES (1/50 Air Samples)
This re-analysis used to determine the analyst's precision. Calculate R values where R=[(A-B)/(A+B)/2]. Chart R values and PASS/FAIL results for each analyst and for lab in the following four ranges of asbestos structures only:

RANGE of MEAN of RECOUNT	PASS/FAIL CRITERIA
<5 Structures	±1 Structure
5-20 Structures	±2 Structures
>20 Structures	±3 Structures

Verified analysis is required to resolve failures. Record sample, grid(s) and grid opening(s) analyzed date(s) of analyses, analyst's signature, both results, R-value reasons for and resolutions of disagreements. A cumulative record of true positives, false positives, and false negatives is maintained for each analyst.

INTER-ANALYST SAME GRID OPENING REANALYSES (1/25 AIR Samples)
This re-analysis of the same grid openings is used to determine both the laboratory's overall precision and to detect bias of the various analysts. Calculate R values where R=[(A-B)/(A+B)/2]. Chart R values and PASS/FAIL results for each analyst and for lab in the following four ranges of asbestos structures only:

RANGE of MEAN of RECOUNT	PASS/FAIL CRITERIA
<5 Structures	±1 Structure
5-20 Structures	±2 Structures
>20 Structures	±3 Structures

For any failures, verified analysis is required. Record sample, grid(s) and grid openings) analyzed date(s) of analysis, signatures, both results, R-value, reason(s) for analysts and resolution(s) of disagreement(s). A cumulative record of true positives, false positive and false negatives is maintained for each analyst.

SAME GRID/DIFFERENT OPENING RE-ANALYSIS (1/100)
Inter-analyst analysis – 0.5 in 100 samples
Intra-analyst analysis – 0.5 in 100 samples

SAME SAMPLE REPREPARATIONS (1/100)
Inter-analyst analysis – 0.5 in 100 samples
Intra-analyst analysis – 0.5 in 100 samples

VERIFIED ANALYSES (1/100 Grid Openings Analyzed)
20% of the samples used must contain between 6-40 structures/grid opening (approximately 1,000-5,000 asbestos structures/mm^2. Previous customer samples, NYS ELAP proficiency samples, NVLAP proficiency samples and NIST SRM 1876b samples may be used). Record results from each analyst, date(s) of analysis, acceptability (within appropriate guidelines), reason(s) for

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and resolution(s) of disagreements, analyst's signature(s). A cumulative record of true positives, false positives and false negatives is maintained for each analyst. Maintain a separate record for NIST SRM 1876b or equivalent analysis.

INTER-LAB ROUND ROBIN ANALYSES (1/200 G.O.) (2 times/year)
Use asbestos samples that cover a range from less than 100 to more than 2,000 structures/sq. mm. This re-analysis of the same grid opening must be by VERIFIED ANALYSIS. Record sample, grid and grid opening identification, date(s) of analysis, in-house analyst's signature, all results reasons for and resolutions of disagreements. Analysts must attain an average accuracy of ≥ 80% True Positives, ≤ 20% False Negatives, and ≤10% False Positives to maintain verified status.

LABORATORY BLANK (AIR Samples)
Prep 1 blank per series or 10% of daily total; Analyze 1 per 100 filter analyses for MCE (mixed cellulose ester) filters, and 1 per 25 filter analyses for PC (polycarbonate) filters. For those laboratories accredited by the NYS ELAP, analysis frequency is 5%.

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TEM NOB QC ANALYSIS FREQUENCIES

INTRA ANALYST - NEW PREP (1/50 NOB Samples Re-analyzed by Same Analyst)
This re-analysis is used to determine the analyst's precision and check the laboratory's preparation technique. Calculate R-values for each pair. R= |(A-B)/[(A+B)/2]| Analysis fails if R >1, misidentification of Asbestos occurs, or ACM vs. Non ACM. Record sample, dates of analyses, analyst's initials, both results, R-values, causes and corrective actions for failures. R Control charts updated monthly for each analyst's precision. Also check recovery (% Wt) of both sample preparations. Re-prep weight must be within 10% of initial prep weight to pass. Failure requires a third prep be made (all steps checked by lab supervisor) to determine correct recovery. Record dates of all preparations, weights, technician initials, and reasons for and resolutions of failures.

INTER ANALYST - NEW PREP (1/15 NOB Samples Re-analyzed by Different Analyst)
This re-analysis is used to determine laboratory precision and to check the laboratory's preparation technique. Calculate R-values for each pair of analyses. R= (A-B)/[(A+B)/2]. Analysis fails if R >1 or < -1, misidentification of Asbestos occurs, of ACM vs. Non ACM. Record sample, dates of analysis, analyst's initials, both results, R-values, reasons for and resolutions for failures. R Control charts updated for each analyst's precision.

Also check residue recovery (% Wt) of both sample preparations. Re-prep weight must be within 10% of initial prep weight to pass. In case of failure, request a third prep be made (all steps checked by lab supervisor) to determine correct recovery. Record dates of all preparations, weights, technician initials, and reasons for and resolutions of failures.

INTER-LAB ANALYSIS (2 times/year) ROUND ROBIN
Samples analyzed for asbestos contents and residue recovery (% Wt). Record asbestos type(s), percentage(s), analyst(s), and dates of analyses. Track misclassifications (false positive, false negative) and misidentification of asbestos types and residue recovery (% Wt).

NOB PREPARATION CHECK (1/20 NOB Samples)
A known negative floor tile sample is prepped and analyzed for asbestos contamination and residue recovery (%Wt). These samples must go through the full preparation and analysis regimen. NOB residue weights must be within 10% of the average recovery weight to be acceptable (PASS). Track PASS/FAIL % monthly and cumulatively for each year. If asbestos is detected, the source of contamination must be traced and problem resolved to prevent recurrence.

STANDARD REFERENCE SAMPLE (1/100 Samples)
At least 1 out of 100 samples shall be a verified quantitative standard that has been routinely resubmitted to determine analyst's precision and accuracy.

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Module A
Attachment 2: Additional Qualification Requirements

Additional Qualification Requirements by Accrediting Authorities for ASBESTOS

Accred. Agency	Lab Manager		QA Manager		Analyst	
	Required Degree	Required Lab Exp	Required Degree	Required Lab Exp	Required Degree	Required Lab Exp
AIHA-LAP	**(Tech. Manager)** B.S. – applicable physical or biological science	**(Tech. Manager)** - 3 years of relevant non-academic analytical experience. A minimum of 2 years in IH within the Scope of Accreditation and 1 year from other lab analytical procedures. - M.S. or Ph.D. is equivalent to 1 year of work experience.	**(Quality Manager)** B.S. – applicable basic or applied science	**(Quality Manager)** 1 year of non-academic analytical or QC experience appropriate to types of analysis performed. Or in lieu of a degree – 4 years of non-academic analytical or QC experience. - Documented training in statistics or laboratory quality assurance/quality control.	**(Analyst)** B.S. in chemistry or related science **(Technician)** No degree is necessary	- Both Analysts and Technicians shall complete a training course (in-house is acceptable) for applicable analysis. - Both Analysts and Technicians need to demonstrate capability through SRMs, PT or QC samples. Re-certification every 6 months - Both Analysts and Technicians shall have 20 business days of hands-on experience before independent analysis on customer samples.
NYS ELAP TNI standard (July 2011)	**(Tech. Director) TEM** B.S. degree and specialized courses in use of instrument **PLM** A.S. degree and specialized courses in use of instrument or 2 years of equiv. college study or formal coursework **PCM** A.S. degree or 2 years of equiv. college study or formal coursework	**(Tech. Director) TEM** 1 year experience under supervision in use of instrument **PLM** 1 year experience under supervision in use of instrument **PCM** 1 year experience under supervision in use of instrument				
CA ELAP	**(Lab Director)** B.S. degree in applicable science	(**Lab Director)** 3 years experience M.S. substituted for 1 year of exp. Ph.D. substituted for 2 years of exp.	**(Principal Analyst)** B.S. – applicable basic or applied science	**(Principal Analyst)** 6 months experience in analysis. Completion of training course		

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Accred. Agency	Lab Manager		QA Manager		Analyst	
	Required Degree	Required Lab Exp	Required Degree	Required Lab Exp	Required Degree	Required Lab Exp
FL DOH TNI standard (July 2011)	**(Tech. Director) TEM** B.S. degree and specialized courses in use of instrument **PLM** A.S. degree and specialized courses in use of instrument or 2 years of equiv. college study or formal coursework **PCM** A.S. degree or 2 years of equiv. college study or formal coursework	**(Tech. Director) TEM** 1 year experience under supervision in use of instrument **PLM** 1 year experience under supervision in use of instrument **PCM** 1 year experience under supervision in use of instrument				
NJ DEP Louisiana LADEQ	**(Lab Manager)** B.S. degree or A.A. degree or No degree **(Lab Tech Director)** B.S. degree in science or 4 years equiv. experience	**(Lab Manager)** B.S. – 1 year experience A.A. – 3 years experience None – 5 years experience **(Lab Tech Director)** Minimum of 2 years in environmental analysis.	**(QA Officer)** B.S. degree or A.A. degree or No degree **(QA Manager)** B.S. degree in science or 4 years equiv. experience	**QA Officer)** B.S. – 1 year experience A.A. – 3 years experience None – 5 years experience **(QA Manager)** Minimum of 2 years in environmental analysis.	**(Operators)** B.S. degree or A.A. degree or No degree **(Supervisors)** B.S. degree or 4 years experience **(Instrument Operators)** H.S. diploma and completion of in-house training course	**(Operators)** B.S. – 1 year experience A.A. – 3 years experience None – 5 years experience **TEM** Completion of formal training course **(Supervisors)** Minimum of 1 year experience **(Instrument Operators)** 6 months experience and passing PT results.
Pennsylvania DEP TNI Standard (July 2011)	**(Lab Supervisor) TEM** B.S. degree and specialized courses in use of instrument **PLM** A.S. degree and specialized courses in use of instrument or 2 years of equiv. college study or formal coursework **PCM** A.S. degree or 2 years of equiv. college study or formal coursework	**(Lab Supervisor) TEM** 1 year experience under supervision in use of instrument **PLM** 1 year experience under supervision in use of instrument **PCM** 1 year experience under supervision in use of instrument				

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Accred. Agency	Lab Manager		QA Manager		Analyst	
	Required Degree	Required Lab Exp	Required Degree	Required Lab Exp	Required Degree	Required Lab Exp
Texas TCEQ TNI standard (July 2011)	**(Tech. Director) TEM** B.S. degree and specialized courses in use of instrument **PLM** A.S. degree and specialized courses in use of instrument or 2 years of equiv. college study or formal coursework **PCM** A.S. degree or 2 years of equiv. college study or formal coursework	**(Tech. Director) TEM** 1 year experience under supervision in use of instrument **PLM** 1 year experience under supervision in use of instrument **PCM** 1 year experience under supervision in use of instrument				

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APPENDIX D
Typical Field Forms

Terracon
72 Pointe Circle, Greenville, SC 29615
P [864] 292.2901 I F [864] 292.6361

Project:
Date:
Inspector:

Sample Number	Analysis Method	Sample Location	Sample Description	Homogeneous Area	Classification	Friable / Non-Friable	Current Condition	Potential for Disturbance	Estimated Quantity

Terracon

Fiber Count Worksheet

v498t.2.1 jfh

Client Name:

Client Location: **City / State:**

Project Name: **Collected By:**

Project Location: **City / State:**

Project No: **Sample Date:**

Sample Set No.:

Analytical Method: NIOSH 7400 Rev. 3, Issue 2 (8/15/94)

Microscope & I.D. No.: Olympus CX-21

Filter ECA: 385 mm2

Microscope Field Area: 0.00785 mm2

CV= coefficient of variation

Liedel-Busch CV:

Blank Lab No.	Blank Field No.	Fibers	Fields	Avg. of Field Blanks
			100	
			100	

Lab. Sample No.	Field Sample No.	Type	Location	Activity	Fibers	Fields	Sample Fld.- Blank Fld Avg.	Fibers / mm^2	Flow Rate (L/min) Pre-	Post	Ave	Sample Time (min) Start[24hr]	Stop[24hr]	Total	Vol. (L)	CV	LOQ (f/cc)	F/cc	Comments
Total Samples	Blind Count																		
		<<Enter Lab Sample Number Here																	

Microscope Adjustments:

- Phase Test
- Micrometer
- Focus on Samples
- Adjust Field Iris
- Adjust Phase Rings

Sample Type:

1	OSWA =	Outside Work Area
2	IWA =	Inside Work Area
3	P =	Personal
4	STEL =	Short Term Exposure Limit
5	HEPEX =	HEPA Exhaust
7	NA=PF =	Not Analyzed / Pump Failure
8	NA-OLF =	Not Analyzed / Overloaded Filter
9	NA-WDF =	Not Analyzed / Water Damaged Filter

Activity:

1	BKGD =	Background
2	REM =	Removal
3	CL =	Clearance
4	PA =	Post Abatement
5	GB =	Glovebag
6	B/O =	Bag Out
7	AMB =	Ambient
8	PREP =	Work Site Prep
9	CU =	Clean Up

Analyst: _____ Date:

Typed Name:

Reviewed By: Date:

Detection Limit: 7 fibers/mm^2

[1] Reanalyze All Samples

[24hr] Use 24 hour clock time (Military Time)

Project Notes

Project Name: _____

Job Location: _____

Project Number: _____

Date: _____

Abatement Contractor: _____

Supervisor: _____

Asbestos Permit Number: _____

Removal Location: _____

Time	Notes

If Applicable, Containment Pressure (time/reading): _____

Terracon Representative: _____

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number (*Lab Use Only*):

PHONE:
FAX:

Company Name :		**EMSL Customer ID:**	
Street:		**City:**	**State/Province:**
Zip/Postal Code:	**Country:**	**Telephone #:**	**Fax #:**
Report To (Name):		**Please Provide Results:** ☐ **Fax** ☐ **Email**	
Email Address:		**Purchase Order:**	
Project Name/Number:		**EMSL Project ID** (*Internal Use Only*):	
U.S. State Samples Taken:		**CT Samples:** ☐ **Commercial/Taxable** ☐ **Residential/Tax Exempt**	

EMSL-Bill to: ☐ Same ☐ Different - If Bill to is Different note instructions in Comments**
Third Party Billing requires written authorization from third party

Turnaround Time (TAT) Options* – Please Check

☐ **3 Hour**	☐ **6 Hour**	☐ **24 Hour**	☐ **48 Hour**	☐ **72 Hour**	☐ **96 Hour**	☐ **1 Week**	☐ **2 Week**

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air ☐ Check if samples are from NY
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☐ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NYS 198.8 SOF-V
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT (AHERA only)**
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2

Fibers >10µm ☐ Waste ☐ Drinking

All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM EPA 600/R-93/116 with milling prep (<1%)
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.25%)
- ☐ TEM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM Qualitative via Filtration Prep
- ☐ TEM Qualitative via Drop Mount Prep
- ☐ Cincinnati Method EPA 600/R-04/004 – PLM/TEM (BC only)

Other:
- ☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**

Filter Pore Size (Air Samples): ☐ **0.8µm** ☐ **0.45µm**

Samplers Name: **Samplers Signature:**

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled

Client Sample # (s): - **Total # of Samples:**

Relinquished (Client): **Date:** **Time:**

Received (Lab): **Date:** **Time:**

Comments/Special Instructions:

Controlled Document – Asbestos COC – R10 – 05/09/2016

Asbestos Chain of Custody

EMSL Order Number (*Lab Use Only*):

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

PHONE:
FAX:

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled

***Comments/Special Instructions:**

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