AHERA - THREE YEAR REINSPECTION



NAOMI BROOKS ES

600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA 22301

ECS PROJECT NO. 47:11652-E4-17

FOR: ALEXANDRIA CITY PUBLIC SCHOOLS

SEPTEMBER 8, 2025

September 8, 2025

Mr. Lee Conroy
Alexandria City Public Schools
1717 North Beauregard Street
Alexandria, Virginia 22311

ECS Project No. 47:11652-E4-17

Reference: AHERA - Three Year Reinspection, Naomi Brooks ES, 600 Russell Road, Alexandria, Virginia

Dear Mr. Conroy:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide Alexandria City Public Schools with the results of the above referenced AHERA - Three Year Reinspection performed at Naomi Brooks ES located at 600 Russell Road in Alexandria, Virginia.

Previous asbestos surveys of the school identified asbestos-containing materials. ECS performed a walk through of the school to observe present conditions. The following materials were observed to be damaged at the time of the site visit:

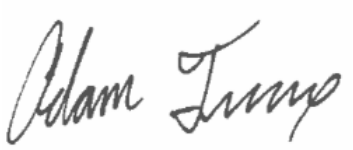
- **Glue Dots associated with 1' x 1' ceiling tiles, on plaster ceilings in Rooms 1, 3, 5, 7, 18, 19, 20, and 21 - were observed as damaged. It was reported however to ECS that these damaged ceiling tiles were removed and the problem was addressed over the summer by Waco inc.**

This report summarizes our observations, findings, and recommendations related to the work performed. The work described in this report was performed by ECS in general accordance with the Scope of Services described in ECS Proposal Number 47:39012-EP and the terms and conditions of the agreement authorizing those services.

ECS appreciates this opportunity to provide Alexandria City Public Schools with our services. If we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

ECS Mid-Atlantic, LLC



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1.0 SITE DESCRIPTION

The subject property consists of Naomi Brooks ES, formerly Matthew Maury Elementary School, a one-story brick school building located at 600 Russell Road in Alexandria, Virginia. The school was originally constructed in 1929 and has been improved with renovations since its original construction. Building finishes observed included concrete sub-floors, vinyl floor tiles, carpet, and/or ceramic tiles; the wall systems appeared to generally consist of concrete masonry unit (CMU) block walls, drywall wallboard, and/or ceramic wall tiles; and the ceiling systems appeared to generally consist of suspended drop ceilings with ceiling tiles and some plaster finishes.

Based on a review of historical documentation, the following materials were previously identified as asbestos-containing and have since been abated.

- Asbestos-containing Black Mastic associated with carpet near the East Main Entrance Area, Psychology Office and adjacent rooms in 2020. (ECS Project No. 1517-L)
- Asbestos-containing Floor Tile and associated Mastic from the first-floor hallway between classrooms 1-16 (ECS Project No. 47:11652-H), and the first-floor corridor in 2021. (ECS Project No. 47:11652-H1/H2)
- Asbestos-containing Floor Tile and associated Mastic from Classrooms 1, 2, 3, 5, and 7 in 2022. (ECS Project No. 47:11652-H3)

Note: Based on the age of the structure, it is likely that asbestos insulation on piping and ductwork is present and concealed behind solid walls/above solid ceilings. Floor tile and mastic is also assumed to be also present throughout the school, even in areas where it was reported abated (concealed under fixtures such as cabinets etc.).

2.0 PURPOSE

The purpose of this Asbestos Hazard Emergency Response Act (AHERA) three-year re-inspection of asbestos-containing materials was to assess previously identified asbestos-containing building materials (ACBMs) present on the subject property. The survey was performed on the interior areas of the subject building. This survey is intended to provide a supporting document for the AHERA management plan.

3.0 METHODOLOGY

ECS performed the authorized Scope of Services in general accordance with our proposal, standard industry practice(s) and methods specified by regulation(s) for the identification of Asbestos-Containing Materials (ACMs).

3.1 Asbestos Re-Inspection

The AHERA re-inspection survey was performed by Williams Sargent, a Virginia licensed asbestos inspector (license number 3303005062) who has received EPA-accredited training.

Before conducting the re-inspection, ECS reviewed existing inspection reports and then walked through areas where previously friable or non-friable ACBM were reported to be located, including assumed materials.

The scope of work for the re-inspection included the following items:

- Review the existing management plan to determine the areas requiring re-inspection.
- Visually reinspect and reassess the condition of known or assumed friable ACBM.
- Visually reinspect known or assumed non-friable ACBM and determine if it has become friable.
- Identify homogeneous areas that have changed conditions since previous re-inspections.
- Identify renovations or new materials that have been added to the building since the previous inspection.

At the request of the client, ECS did not sample additional materials during this inspection.

4.0 RESULTS

The following is a summary of laboratory results, findings and observations.

4.1 Asbestos-Containing Materials

An Asbestos-Containing Material (ACM) is defined as any material containing more than one percent (>1%) asbestos as determined using the method specified in Appendix E, Subpart E, 40 CFR Part 763, Section 1, PLM. Materials are categorized by the U.S. EPA in the following categories:

- Friable ACMs are defined as any ACM that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure.
- Non-friable ACMs are defined as any ACM that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
    - Category I non-friable ACM are listed as following: packings, gaskets, resilient floor coverings, and asphalt roofing products containing more than one percent (>1%) asbestos.
    - Category II non-friable ACM are listed as any material, excluding Category I non-friable ACM, containing more than one percent (>1%) asbestos.

Regulated Asbestos Containing Materials (RACM) are friable ACM or non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or has crumbled, been pulverized, or reduced to powder in the course of renovation and/or demolition operations.

A table of previously identified ACBM in the building is appended to this report. ECS notes the following ACMs were observed to be damaged during the site reconnaissance.

- **Glue Dots associated with 1' x 1' ceiling tiles, on plaster ceilings of Rooms 1, 3, 5, 7, 18, 19, 20, and 21 were observed as damaged.**

5.0 RECOMMENDATIONS AND REGULATORY REQUIREMENTS

Based on our understanding of the purpose of the AHERA - Three Year Reinspection, the results of laboratory analysis, and our findings and observations, ECS presents the following recommendations.

5.1 Asbestos-Containing Materials

ECS recommends the damaged Glue Dots associated with the 1' x 1' ceiling tiles observed in Rooms 1, 3, 5, 7, 18, 19, 20, and 21 be abated by a Virginia licensed asbestos abatement contractor. It is ECS's understanding that this material was abated over the summer by Waco inc. as part of other abatement work occurring at the school.

If ACMs are to be removed, it is recommended that an industrial hygienist monitor the project. This involves collecting air samples from within and outside abatement work areas to monitor the asbestos abatement contractor's work practices over the course of the project. Only after the industrial hygienist has determined the identified ACMs have been removed should final clearance air samples be collected.

For any future renovation project, a more in-depth survey should be performed for asbestos in the path of construction. Where asbestos is found, an asbestos abatement plan should be prepared by an accredited professional as outlined in AHERA prior to performing any asbestos removal work.

The results of this survey should be added to the school's AHERA management plan.

6.0 LIMITATIONS

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

Our recommendations are in part based on federal, state, and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies, any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

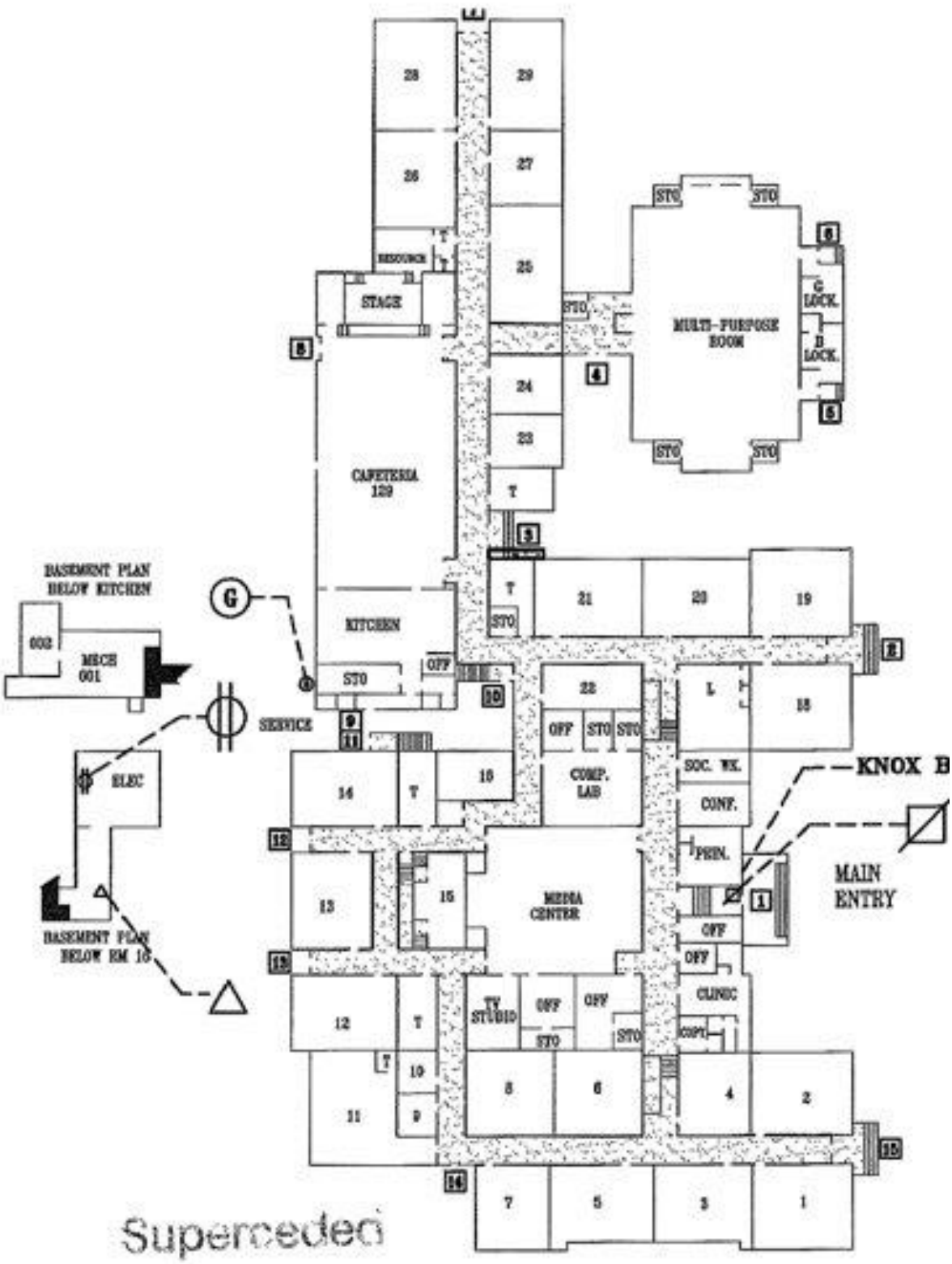
Appendix I: AHERA ACBM Tables

MATERIAL	LOCATION	FRIABILITY	CONDITION	COMMENTS	LAST INSPECTION DATE	RECOMMENDATION	SEMI-ANNUAL INSPECTION DATE	REMARKS
MATERIALS REPORTED AS ASBESTOS-CONTAINING MATERIALS ON PRIOR SURVEYS								
White 4" Pipe Insulation	Storage Room in Basement at Exit Door 11	F	Intact	Partially abated; assumed to be present in inaccessable areas.	27-Jun-25	Maintain in O & M Plan		Wrap: 40% Chrysotile Insulation: 15% Chrysotile, 15% Amosite
Brown 2" Pipe Insulation	Storage Room in Basement at Exit Door 11	F	Intact	Partially abated; assumed to be present in inaccessable areas.	27-Jun-25	Maintain in O & M Plan		30% Amosite
Blue TS-Mudded Elbows	Gym	F	Intact	Possibly Replaced	27-Jun-25	Verify Removal: Maintain in O & M Plan		Verify Status
Fire Doors	Hallways	NF	Intact	Observed in other areas	27-Jun-25	Maintain in O & M Plan		Verify Analytical Results
TSI-Mudded Elbows/Joints	Gym Storage Room	F	Removed	Observed in other areas	27-Jun-25	Maintain in O & M Plan		Verify Analytical Results
Glue Dots associated with 1' x 1' Ceiling Tile on Plaster Ceiling	Room 18, 19, & 20	NF	Damaged	Assumed in all classrooms; In Room 1, 3, 4, 7, 18, 19, 20, and 21 there was damaged plaster ceiling associated with this material	27-Jun-25	Maintain in O & M Plan		Verify Analytical Results
MATERIALS REPORTED AS ASBESTOS-CONTAINING MATERIALS ON PRIOR SURVEYS THAT WERE NOT IDENTIFIED/OBSERVED BY ECS ON JULY 27, 2025 SURVEY								
Vibration Damper	Gym AHU	NF	N/A	This material is reported as ACM; however it was not observed in this area	27-Jun-25	Maintain in O & M Plan		Sampling if encountered/uncovered
White Interior Window Glazing	Storage Room in Basement at Exit Door 11	NF	N/A	Reportedly replaced in 2025.	27-Jun-25	Remove from O & M Plan pending verification of removal		Verify Removal
White Mastic on Fiberglass Insulation and Duct	Crawlspace in Basement Storage Room	NF	N/A	Materials may be under existing partition walls, fixtures, cabinets, etc. throughout the building	27-Jun-25	Maintain in O & M Plan		Verify Analytical Results
9" x 9" Tan w/White Streaks Floor Tiles	Café Stage Storage	NF	N/A	Inaccessable at the time of the survey. Assumed to be present	27-Jun-25	Maintain in O & M Plan		Verify Analytical Results
9" x 9" Medium Green Floor Tiles and associated Mastic	Classroom 1-5, and 20	NF	N/A	Abated from Classrooms 1-5 during ECS Project No. 47:11652-H3. May be present in an accessible areas.	27-Jun-25	Maintain in O & M Plan		Verify Removal
Black floor Tiles	Classroom 1-5	NF	N/A	Abated from Classrooms 1-5 during ECS Project No. 47:11652-H3. May be present in an accessible areas.	27-Jun-25	Maintain in O & M Plan		Verify Removal
TSI-Mudded Elbows/Joints	Gym Storage Room	F	N/A	Inaccessable at the time of the survey. Assumed to be present	27-Jun-25	Maintain in O & M Plan		Verify Analytical Results
Brown Floor Tile and associated Black Mastic (bottom layer)	Multi-Purpose Room	NF	N/A	Materials may be under existing partition walls, fixtures, cabinets, etc. throughout the building	27-Jun-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Incandescent Light Fixture Insulation	Kitchen	NF	N/A	Inaccessable at the time of the survey. Assumed to be present	27-Jun-25	Maintain in O & M Plan		Verify Analytical Results
Black Tar Paper/Waterproofing	Basement Storage Room	NF	N/A	Assumed to be present in inaccessable areas	27-Jun-25	Maintain in O & M Plan		Verify Analytical Results
Black Mastic associated with Brown Floor Tile (under Blue Floor Tile)	Hallway at Girl's Restroom (Toilet Room)	NF	N/A	Assumed to be present in inaccessable areas	27-Jun-25	Maintain in O & M Plan		Mastic: 5% Chrysotile
Beige Interior Wood Door Caulk	Cafeteria	NF	N/A	Inaccessable at the time of the survey. Assumed to be present	27-Jun-25	Maintain in O & M Plan		3% Chrysotile
MATERIALS ASSUMED TO CONTAIN ASBESTOS								
Hardwood Underlayment and associated Mastic	Stage or Throughout the Building	NF	Intact	PACM until tested	27-Jun-25	Maintain in O & M Plan		Sampling if encountered/uncovered

Rubber Floor and associated Mastic	Gym and Gym AHU	NF	Intact	PACM until tested	28-Jun-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Advertisement Fiberboards and associated Mastic	Hallways	NF	Intact	PACM until tested	29-Jun-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Chalk Board and associated Mastic	All Classrooms	NF	Intact	PACM until tested	30-Jun-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Thermal System Insulation (TSI)	Throughout the Building	F	Intact	PACM until tested	1-Jul-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Pipe Flange Gaskets	Throughout the Building	Unknown	Intact	PACM until tested	2-Jul-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Electrical Panels: Transite Components	Mechanical Rooms	NF	Intact	PACM until tested	3-Jul-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Mirror Mastic	Bathrooms	NF	Intact	PACM until tested	4-Jul-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Interior Pipe Wrap associated with Water Fountains and Radiators	Throughout the Building	NF	Intact	PACM until tested	5-Jul-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Waterproofing Membranes/Mastics	Behind Interior Finishes, Exterior Veneer and/or Subgrade Walls, and Under Ceramic Flooring	NF	Intact	PACM until tested	6-Jul-25	Maintain in O & M Plan		Sampling if encountered/uncovered
Asphalt-Based Roofing Material and Caulks/Sealants	Roof	NF	Intact	PACM until tested	7-Jul-25	Maintain in O & M Plan		Sampling if encountered/uncovered

Notes: F = Friable; NF = Non-Friable; PACM = Presumed Asbestos Containing Material; O & M Plan = Operations and Maintenance Plan; NAD = No Asbestos Detected.

Appendix II: Floor Plan


BASEMENT PLAN
BELOW KITCHEN
002
MECH
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ELEC
BASEMENT PLAN
BELOW RM 16
SERVICE
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129
KITCHEN
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SOC. WK.
CONF.
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MEDIA
CENTER
TV
STUDIO
CLINIC
COPY
KNOX B
MAIN
ENTRY
Superceded

Appendix III: Site Photographs



1 - Brown Ceiling Glue Dots (Room 19)

Appendix IV: Certifications/ Licenses

DPOR License Lookup License Number 3303005062

License Details

Name	SARGENT, WILLIAM TAIGA
License Number	3303005062
License Description	Asbestos Inspector License
Rank	Asbestos Inspector
Address	ROCKVILLE, MD 20851
Initial Certification Date	2023-11-29
Expiration Date	2025-11-30

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DPOR License Lookup License Number 3304001722

License Details

Name	TRUAX, ADAM MICHAEL
License Number	3304001722
License Description	Asbestos Management Planner License
Rank	Asbestos Management Planner
Address	RANSON, WV 25438
Initial Certification Date	2023-03-30
Expiration Date	2026-03-31

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Appendix V: Previous Reports

AHERA ASBESTOS-CONTAINING MATERIALS SURVEY



NAOMI L. BROOKS ELEMENTARY SCHOOL

600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA 22301

ECS PROJECT NO. 47:11652-E2

FOR: ALEXANDRIA CITY PUBLIC SCHOOL (ACPS)

MARCH 24, 2022

March 24, 2022

Mr. John Contreras
Alexandria City Public School (ACPS)
1340 Braddock Place
Alexandria, Virginia 22314
john.contreras@acps.k12.va.us

ECS Project No. 47:11652-E2

Reference: AHERA Asbestos-Containing Materials Survey, Naomi L. Brooks Elementary School, 600 Russell Road, Alexandria, Virginia

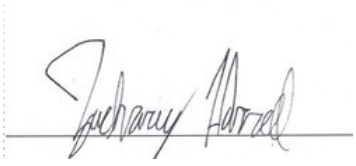
Dear Mr. Contreras:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide Alexandria City Public School (ACPS) with the results of the above referenced AHERA Asbestos-Containing Materials Survey performed at Naomi L. Brooks Elementary School located at 600 Russell Road in Alexandria, Virginia. This report summarizes our observations, analytical results, findings, and recommendations related to the work performed. The work described in this report was performed by ECS in general accordance with the Scope of Services described in ECS Proposal Number 47:16069-EP and the terms and conditions of the agreement authorizing those services.

ECS appreciates this opportunity to provide Alexandria City Public School (ACPS) with our services. If we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

ECS Mid-Atlantic, LLC



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EXECUTIVE SUMMARY

The subject property Naomi L. Brooks Elementary School is a 51,800 square foot, school building reportedly originally constructed in 1929.

The purpose of the survey was to determine if asbestos-containing building materials (ACBMs) present on the subject property. The survey was performed within interior areas of the school building excluding the roofs and exterior materials. This survey is intended to provide a supporting document for an Asbestos Hazard Emergency Response Act (AHERA) management plan.

Based on the laboratory analysis of the bulk samples collected during the survey, none of the sampled materials were reported to contain asbestos.

Based on a review of historical documentation the following materials were previously identified as asbestos-containing and ECS does not have records of them being abated.

- Vibration Cloth - Not observed during survey but may be located in inaccessible areas.
- Beige Interior Door Caulk- Observed to be present in the cafeteria, but may be in inaccessible or concealed (due to caulk re-application) in various areas throughout the building.
- Black Tar Paper/ Waterproofing in the Basement Storage Room- Not observed during survey but may be located in inaccessible areas.
- White Interior Window Glazing present in the Storage Room in the Basement at Exit Door 11- May be present on other older windows.
- Various applications of pipe insulations and sealants reported as ACM prior to this survey but were not observed; Likely material still present in concealed and inaccessible areas of the building throughout pipe and duct systems.

Based on a review of historical documentation the following materials were previously identified as asbestos-containing and have since been abated.

- Vinyl Floor Tiles and associated mastics- abated from the 1st floor corridor in 2022 (ECS PROJECT NO. 47:11652-H1/H2), floor tile and associated black mastic were abated from the first floor hallway between classrooms 1-16 in 2021 (ECS PROJECT NO. 47:11652-H) , and black floor mastic (underneath carpet) was abated near the East Main Entrance Area (Psychology Office and adjacent rooms) in 2020 (ECS PROJECT NO.47:1519-L).

Recommendations regarding the removal and disposal of the ACMs identified by ECS can be found in Section 5.0 of this report. The executive summary is an integral portion of this report, however, ECS recommends the report be read in its entirety.

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Appendix VII: Previous Reports

1.0 SITE DESCRIPTION

The subject property consists of Naomi L. Brooks Elementary School, a one-story brick school building located at 600 Russell Road in Alexandria, Virginia. The school was originally constructed in 1929 and has been improved with renovations since its original construction. Building finishes observed included concrete sub-floors, vinyl floor tiles, carpet, and/or ceramic tiles; the wall systems appeared to generally consist of concrete masonry unit (CMU) block walls, drywall wallboard, and/or ceramic wall tiles; and the ceiling systems appeared to generally consist of suspended drop ceilings with ceiling tiles and some plaster finishes.

2.0 PURPOSE

The purpose of this Asbestos Hazard Emergency Response Act (AHERA) re-inspection asbestos-containing materials survey was to determine if asbestos-containing building materials (ACBMs) are present on the subject property. The survey was performed within interior areas of the subject buildings. Exterior and roofing materials were not included in this survey. This survey is intended to provide a supporting document for an AHERA management plan.

The AHERA requires all public and private schools to survey school buildings and associated support school buildings for ACMs, and to prepare management plans for identified ACMs.

3.0 METHODOLOGY

ECS performed the authorized Scope of Services in general accordance with our proposal, standard industry practice(s) and methods specified by regulation(s) for the identification of Asbestos-Containing Materials (ACMs).

3.1 Asbestos-Containing Materials

The non-destructive asbestos survey was performed by an asbestos inspector who has received EPA accredited training and is licensed by the Commonwealth of Virginia. Samples of suspect ACMs were collected utilizing hand tools and placed into individual, labeled plastic bags. Unique bulk suspect ACM samples were submitted to Scientific Analytical Institute, Inc. (SAI) in Greensboro, North Carolina for analysis via Polarized Light Microscopy (PLM) in accordance with current EPA-600 methodology. Materials consisting of additional layers were analyzed separately. Scientific Analytical Institute, Inc. (SAI) is listed as an accredited laboratory by the National Voluntary Laboratory Accreditation Plan (NVLAP) managed by the National Institute of Standards and Technology (NIST) for bulk sample analysis by currently approved EPA methodology by PLM.

During the survey, ECS attempted to identify suspect ACMs in readily accessible areas. However, due to the destructive means required to identify some materials, certain areas were deemed inaccessible (i.e. behind walls or sub grade materials) and were not surveyed for suspect ACMs. Occupied classrooms, select inaccessible closets, and roofs. Unidentified suspect ACMs may be located in these and/or other inaccessible areas. It is important to note that due to the COVID-19 pandemic, extra precautions were taken in order to avoid contact with students and staff, increasing the number of areas deemed inaccessible.

Samples were collected in general accordance with EPA Standard 40 CFR 763 Subpart E, Asbestos Hazard Emergency Response Act (AHERA) and OSHA Standard 29 CFR 1926.1101 Inspection Protocol. Multiple samples of each unique material were submitted. Samples were analyzed using "Positive Stop" methodology. If one sample of a homogeneous material is reported to contain asbestos, the remaining samples of that material are not analyzed. EPA regulations stipulate that if one sample contains asbestos the entire quantity of that material contains asbestos, regardless of additional analysis.

4.0 RESULTS

The following is a summary of laboratory results, findings and observations.

4.1 Asbestos-Containing Materials

An Asbestos-Containing Material (ACM) is defined as any material containing more than one percent (>1%) asbestos as determined using the method specified in Appendix E, Subpart E, 40 CFR Part 763, Section 1, PLM. Materials are categorized by the U.S. EPA in the following categories:

- Friable ACMs are defined as any ACM that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure.
- Non-friable ACMs are defined as any ACM that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
    - Category I non-friable ACM are listed as following: packings, gaskets, resilient floor coverings, and asphalt roofing products containing more than one percent (>1%) asbestos.
    - Category II non-friable ACM are listed as any material, excluding Category I non-friable ACM, containing more than one percent (>1%) asbestos.

Regulated Asbestos Containing Materials (RACM) are friable ACM or non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or has crumbled, been pulverized, or reduced to powder in the course of renovation and/or demolition operations.

AHERA requires identified asbestos-containing building materials (ACBMs) to be categorized by a trained AHERA inspector into the following categories:

• (1) Damaged or significantly damaged thermal system insulation ACBM.
• (2) Damaged friable surfacing ACBM.
• (3) Significantly damaged friable surfacing ACBM.
• (4) Damaged or significantly damaged friable miscellaneous ACBM.
• (5) ACBM with potential for damage.
• (6) ACBM with potential for significant damage.
• (7) Any remaining friable ACBM or friable suspected ACBM.

Definitions for the above-referenced categories can be found in the Appendices.

Scientific Analytical Institute, Inc. (SAI) submitted a signed final laboratory report to ECS on February 3, 2022. None of the bulk samples submitted for analysis were reported to contain asbestos in detectable concentrations. A complete list of the sampled materials submitted for analysis and sample locations are located in the Appendix of this report. Additional details regarding the overall locations of the materials identified as asbestos-containing are provided further in the report. Photographs of collected samples reported as asbestos-containing are also located in the Appendix of this report.

In total, 22 bulk samples from homogeneous areas were submitted to the laboratory of which 30 layers were analyzed.

No asbestos was detected in the samples collected for this survey.

Summary of Previously Identified Asbestos-Containing Materials

Location	Material Description	Analytical Results	EPA Category	AHERA Category	Abatement History
Storage Room in Basement at Exit Door 11	White 4" Pipe Insulation and associated insulation wrap	Wrap – 40% Chrysotile Insulation – 15% Chrysotile 15% Amosite	Friable	(6) ACBM with potential for significant damage.	Not observed, assumed to have been abated. Material still present in inaccessible areas
Storage Room in Basement at Exit Door 11	Brown 2" Pipe Insulation	30% Amosite	Friable	(6) ACBM with potential for significant damage.	Not observed, assumed to have been abated. Material still present in inaccessible areas
Storage Room in Basement at Exit Door 11	White Interior Window Glazing	3% Chrysotile	Category II Non-Friable	Not applicable	Observed (Pictured)
Hallway at Girl Restroom (Toilet Room)	Brown Floor Tile and Black Mastic under Blue Floor Tile	Leveling – NAD Black Mastic – 5% Chrysotile	Category I Non-Friable	Not applicable	Not observed, assumed to have been abated.

Location	Material Description	Analytical Results	EPA Category	AHERA Category	Abatement History
Cafeteria	Beige Interior Wood Door Caulk	3% Chrysotile	Category II Non-Friable	Not applicable	Observed (Pictured)
Kitchen	Incandescent Light Fixture Insulation	Unknown	Friable	(6) ACBM with potential for significant damage.	Not observed, assumed to have been abated.
Basement Storage Room	Black Tar Paper/ Waterproofing	Unknown	Category II Non-Friable	Not applicable	Not observed, assumed to be concealed
Crawlspace in Basement Storage Room	White Mastic on Fiberglass Insulation and Duct	Unknown	Category II Non-Friable	Not applicable	Not observed, assumed to be present in concealed areas throughout the system.
Café Stage Storage	9" x 9" Tan w/ White Streaks Floor Tiles	Unknown	Category I Non-Friable	Not applicable	Observed in Custodial Storage (pictured). May be present but concealed in other areas
Classroom 1-5	Black Floor Tiles	Unknown	Category I Non-Friable	Not applicable	Not observed, maybe concealed under carpet application.
Classroom 1-5, & 20	9" x 9" Medium Green Floor Tiles and associated Mastic	Unknown	Category I Non-Friable	Not applicable	Not observed, maybe concealed under carpet application.

Location	Material Description	Analytical Results	EPA Category	AHERA Category	Abatement History
Gym	Blue TSI Mudded Elbows	Unknown	Friable	(6) ACBM with potential for significant damage.	Not observed, assumed to be present in concealed areas throughout the system.
Hallways	Fire Doors	Unknown	Category II Non-Friable	Not applicable	Observed
Gym Storage Room	TSI-Mudded Elbows/Joints	Unknown	Friable	(6) ACBM with potential for significant damage.	Inaccessible during survey, assumed to be present.
Room 18, 19, & 20	Glue Dots associated with 1' x 1' Ceiling Tile on Plaster Ceiling	Unknown	Category II Non-Friable	Not applicable	Inaccessible during survey, assumed to be present.
Multipurpose Room	Brown Floor Tile and Associated Black Mastic (Bottom Layer)	Floor Tile- 7% Chrysotile Mastic- 5% Chrysotile	Category I Non-Friable	Not applicable	Not observed, assumed to be abated or concealed.
Gym AHU	Vibration Damper	Unknown	Friable	(6) ACBM with potential for significant damage.	Not observed, assumed to be abated or concealed.

Location	Material Description	Analytical Results	EPA Category	AHERA Category	Abatement History

Notes:
1. Upon review of historical documentation, floor tiles and associated mastic were abated from the 1st floor corridor in 2022 (ECS PROJECT NO. 47:11652-H1/H2); Floor tile and associated black mastic were abated from the first floor hallway between classrooms 1-16 in 2021 (ECS PROJECT NO. 47:11652-H) , and black floor mastic (underneath carpet) was abated near the East Main Entrance Area (Psychology Office and adjacent rooms) in 2020 (ECS PROJECT NO.47:1519-L).
2. No additional description of the vinyl floor tiles abated was provided in historical documentation reviewed.
3. It is possible that the materials listed above maybe present concealed in others areas of the building.

Summary of Non Asbestos-Containing Materials Identified

Location	Material Description	Analytical Results
Materials Sampled in 2021 AHERA Survey		
Basement Storage- Near Exit door	Pink and Yellow foam HVAC Wall Packing	NAD
Gym- Boys bathroom	Red Electrical Pipe Wall Packing	NAD
Gym- Boys bathroom	Gray Sprinkler Pipe Wall Packing	NAD
Gym	4" Black Cove Base and associated Tan Mastic	Both NAD
Teachers lounge	Beige Sink Undercoat	NAD
Teachers lounge	2' x 4' White Pinhole and Large Fissure Ceiling Tile	NAD
Teachers lounge	2' x 4' White Pinhole and Medium Fissure Ceiling Tile	NAD
Teachers lounge	2' x 4' White Pinhole and Small Fissure Ceiling Tile	NAD
Conference Room	4" Gray Cove Base and associated Tan Mastic	Both NAD
Conference Room- Closet	1' x 1' Textured White Ceiling Tile and associated Brown Dot Mastic	Both NAD
Conference Room (observed throughout offices)	18" x 12" Gray Self-stick Vinyl Floor Tile	NAD

Location	Material Description	Analytical Results
Previously Sampled Materials		
Main Hallway	12" x 12" White Mottled Floor Tile & Yellow Mastic	Both NAD
Main Hallway	12" x 12" Magenta Mottled Floor Tile & Yellow Mastic	Both NAD
Lower Hallway	4" Blue Cove Base & Yellow Mastic	Both NAD
Storage/Sprinkler Room in Basement	Plaster Ceiling	NAD
Boiler Room	Black Ceiling Coat	NAD
Staff Work Room 22	Drywall	NAD
Staff Work Room 22	Joint Compound	NAD
Classrooms 9, 15, & 18	Yellow Carpet Mastic	NAD
Kitchen, Classrooms 3,19, 20, 22, & the Hallway between Classrooms 1-5	Plaster Wall/Ceiling	NAD
Cafeteria	Plaster Column	NAD
Classroom 20	Yellow Carpet Mastic and Leveling Compound	Both NAD
Hallway at Girl Restroom (Toilet Room)	Blue Floor Tile and Underlayer under 12" x 12" Floor Tile	Both NAD
Cafeteria (Walls and Columns)	Brown Glue Dot	NAD
Kitchen (behind Plaster Wall)	Black Waterproofing	NAD
Classrooms 1, 3, & Art Classroom 14	Gray Sink Undercoat	NAD
Multipurpose Room	Grey Floor Tile and Associated Yellow Mastic (middle layer)	Both NAD
Multipurpose Room	White Floor Tile and Associated Yellow Mastic (top layer)	Both NAD

Notes:
NAD = No Asbestos Detected
Due to the nondestructive means of this survey, newly applied and installed flooring components and air moving equipment components were not sampled to avoid voiding warranty or damage to said systems.
Locations reflect the area in which the material was sampled. These materials may be representative of and located in other homogenous areas throughout the school.

4.2 Suspect or Assumed Asbestos-Containing Materials

Due to the inaccessibility or the destructive means that asbestos sampling requires, additional suspect ACMs may remain within the building hidden behind inaccessible areas that include, but are not limited to, sub-grade walls, structural members, topping slabs, sub-grade sealants, flooring located below underlayments, areas behind exterior walls, pipe trenches, and subsurface utilities, etc. These areas were deemed inaccessible and were not assessed.

If these materials are discovered during construction activities, they should be presumed to contain asbestos and be treated as ACMs or be sampled immediately upon discovery and prior to disturbance for asbestos content by a certified asbestos inspector in accordance with 29 CFR 1926.1101.

Based upon our past experience in the identification of ACMs in similarly constructed buildings, the following additional suspect ACMs may also be located in inaccessible areas of the structure:

- **Boilers Components** in boilers (gasket, fire brick, etc.).
- **Wainscoting Ceiling** adherents.
- **Vermiculite Filler** associated with Concrete Masonry Unit (Blocks/Walls).
- **Duct Pin Mastic** associated with the HVAC Units.
- **Electrical Panels Asbestos Cement Components** in electrical systems.
- **Fire Door and associated Casing Insulation** in locations requiring a rated fire door and door casing.
- **Mastics or Cement Boards** associated with Baseboard Heaters/Radiator Components/Wall Mounted Fan Coil Units in and/or behind Radiators/Baseboards.
- **Mastics** behind/under mirrors and dry-erase/chalk boards.
- **Water Fountain Components** in water fountains (mastics, pipe cloth, etc).
- **Waterproofing Membrane/Mastics/Vapor Barriers/Sub-grade Pipe Conduit** within exterior wall cavities, behind interior finishes, exterior veneer and/or subgrade walls.
- **Thermal System Insulation (TSI)** on pipes within chases behind solid walls, within the inaccessible regions of crawl spaces, above the visible ductwork, or below subgrade.
- **Pipe Flange Gaskets** in heating and plumbing systems.
- **Air Handler Components** in the air handlers (interior components).
- **Freezer Components** and insulation.
- **Roofing Materials** including caulk, flashing, membranes .
- **Felt Paper and Leveling Compound** associated with hardwood floors.
- **Asbestos-Cement Pipe Conduit** encased in duct banks and/or below sub-grade.
- **Cement Boards** associated with kitchen or laboratory hoods, windows, or exterior panels.
- **Laboratory Bench Tops**
- **Terrazzo Stairs, Floors, Sinks, and Window Sills**
- **Exterior Soffit Materials**
- **Spray-On Fireproofing** above ceilings and behind walls.
- **Gym Flooring**

5.0 RECOMMENDATIONS AND REGULATORY REQUIREMENTS

Based on our understanding of the purpose of the AHERA Asbestos-Containing Materials Survey, the results of laboratory analysis, and our findings and observations, ECS presents the following recommendations.

5.1 Asbestos-Containing Materials

ECS recommends where a material type has been identified as asbestos-containing that other materials with similar color, texture, age and size throughout the building's interior and exterior be assumed to contain asbestos. Please refer to Section 4.1 for a complete list of building materials that were reported positive for asbestos and to Section 4.2 for materials that were assumed to contain asbestos.

If ACMs are to be removed, it is recommended that an industrial hygienist monitor the project. This involves collecting air samples from within and outside abatement work areas to monitor the asbestos abatement contractor's work practices over the course of the project. The industrial hygienist should evaluate if the asbestos abatement work is in accordance with project specifications, U.S. EPA regulation 40 CFR Part 61-National Emission Standards for Hazardous Air Pollutants Subpart M: National Emission Standard for Asbestos, and U.S. Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1926.1101 – Asbestos in Construction. The industrial hygienist should assess each work area to monitor the removal of ACMs. Only after the industrial hygienist has determined the identified ACMs have been removed should final clearance air samples be collected (if necessary).

Suspect ACMs not observed due to inaccessibility or not sampled due to the destructive means that sampling would require may also be encountered during construction activities. At the time of the survey, only limited destructive means were used to locate or sample suspect ACMs; therefore, additional suspect ACMs may remain within inaccessible areas that include, but are not limited to, sub-grade walls, structural members, topping slabs, exterior areas, sub-grade sealants, flooring located below underlayments, vapor barriers, pipe trenches and other subsurface utilities, etc. If additional suspect ACMs are uncovered which were not accessible during this survey, it is recommended that these materials either be assumed to contain asbestos or be sampled prior to disturbance upon discovery for asbestos content by an asbestos inspector in accordance with 29 CFR 1926.1101.

The results of this survey should be added to the school's management plan.

6.0 LIMITATIONS

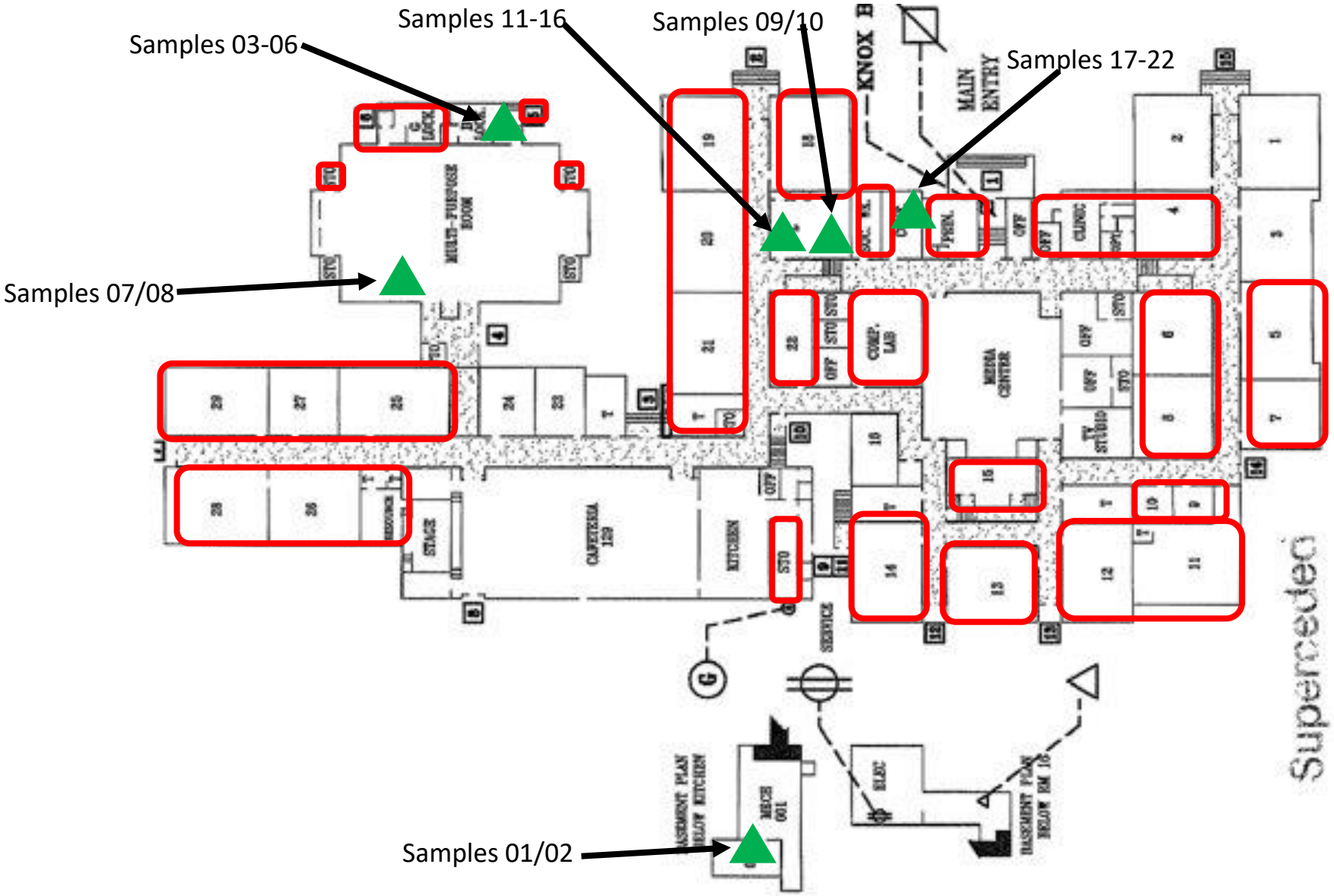
The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

During this study, samples were submitted for analysis at an accredited laboratory via polarized light microscopy. As with any similar survey of this nature, actual conditions exist only at the precise locations from which samples were collected. Certain inferences are based on the results of this sampling and related testing to form a professional opinion of conditions in areas beyond those from which the samples were collected. No warranty, expressed or implied, is made.

The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

Our recommendations are in part based on federal, state, and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies, any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

Appendix I: Figures



Inaccessible Areas (during time of survey)

Sample Locations

Naomi L. Brooks Elementary School
600 Russell Rd,
Alexandria, Virginia, 22301

Sample Location Sketch

Scale: NTS

Project No.
11652-E2

Site Visit:
12/13/21

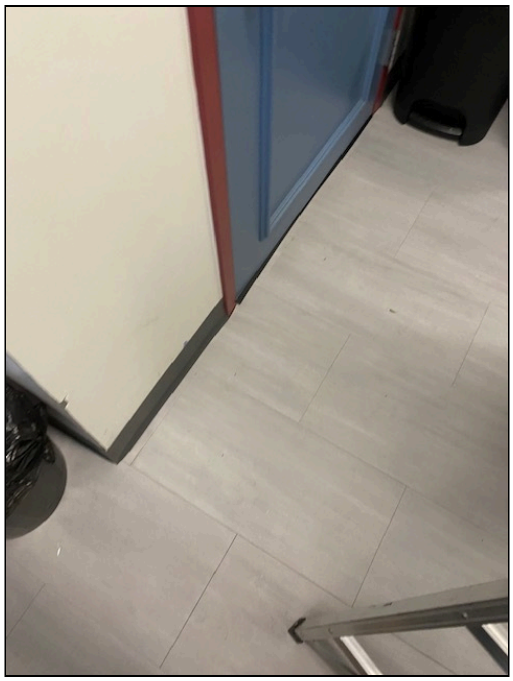
Appendix II: Asbestos Bulk Sample Results

SUSPECT ASBESTOS-CONTAINING MATERIALS BULK SAMPLING RESULTS

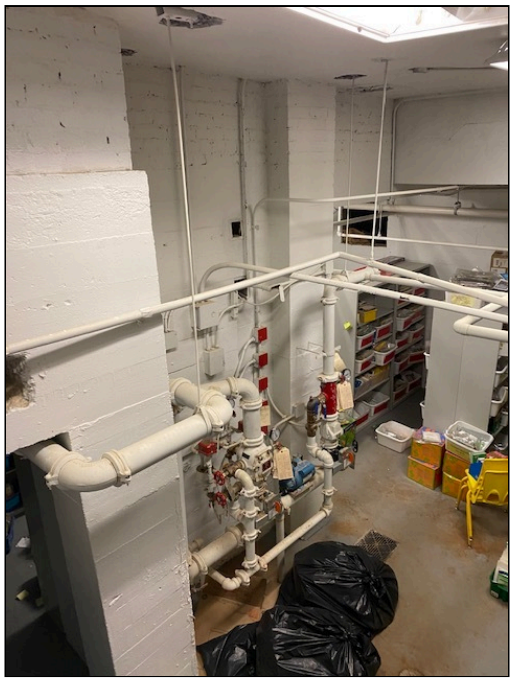
Sample #	Sampling Location	Material/Description	Analytical Results
1	sement Storage- Near Exit c	Pink and Yellow foam HVAC Wall Packing	NAD
2	sement Storage- Near Exit c	Pink and Yellow foam HVAC Wall Packing	NAD
3	Gym- Boys bathroom	Red Electrical Pipe Wall Packing	NAD
4	Gym- Boys bathroom	Red Electrical Pipe Wall Packing	NAD
5	Gym- Boys bathroom	Gray Sprinkler Pipe Wall Packing	NAD
6	Gym- Boys bathroom	Gray Sprinkler Pipe Wall Packing	NAD
7-A	Gym	4" Black Cove Base and associated Tan Mastic- Cove Base	NAD
7-B	Gym	4" Black Cove Base and associated Tan Mastic- Mastic	NAD
8-A	Gym	4" Black Cove Base and associated Tan Mastic- Cove Base	NAD
8-B	Gym	4" Black Cove Base and associated Tan Mastic- Mastic	NAD
9	Teachers Lounge	Beige Sink Undercoat	NAD
10	Teachers Lounge	Beige Sink Undercoat	NAD
11	Teachers Lounge	2' x 4' White Pinhole and Large Fissure Ceiling Tile	NAD
12	Teachers Lounge	2' x 4' White Pinhole and Large Fissure Ceiling Tile	NAD
13	Teachers Lounge	2' x 4' White Pinhole and Medium Fissure Ceiling Tile	NAD
14	Teachers Lounge	2' x 4' White Pinhole and Medium Fissure Ceiling Tile	NAD
15	Teachers Lounge	2' x 4' White Pinhole and Small Fissure Ceiling Tile	NAD
16	Teachers Lounge	2' x 4' White Pinhole and Small Fissure Ceiling Tile	NAD
17-A	Conference Room	4" Gray Cove Base and associated Tan Mastic- Cove Base	NAD
17-B	Conference Room	4" Gray Cove Base and associated Tan Mastic- Mastic	NAD
17-C	Conference Room	4" Gray Cove Base and associated Tan Mastic- Compound	NAD
18-A	Conference Room	4" Gray Cove Base and associated Tan Mastic- Cove Base	NAD
18-B	Conference Room	4" Gray Cove Base and associated Tan Mastic- Mastic	NAD
18-C	Conference Room	4" Gray Cove Base and associated Tan Mastic- Compound	NAD
19-A	Conference Room- Closet	L' Textured White Ceiling Tile and associated Brown Dot Mastic	NAD
19-B	Conference Room- Closet	Textured White Ceiling Tile and associated Brown Dot Mastic- I	NAD
20-A	Conference Room- Closet	L' Textured White Ceiling Tile and associated Brown Dot Mastic	NAD
20-B	Conference Room- Closet	Textured White Ceiling Tile and associated Brown Dot Mastic- I	NAD
21	e Room (observed through	18" x 12" Gray Self-stick Vinyl Floor Tile	NAD
22	e Room (observed through	18" x 12" Gray Self-stick Vinyl Floor Tile	NAD

Table Notes:
Bold = Asbestos-Containing Materials
N/A = Not Analyzed
None Detected = No Asbestos Detected

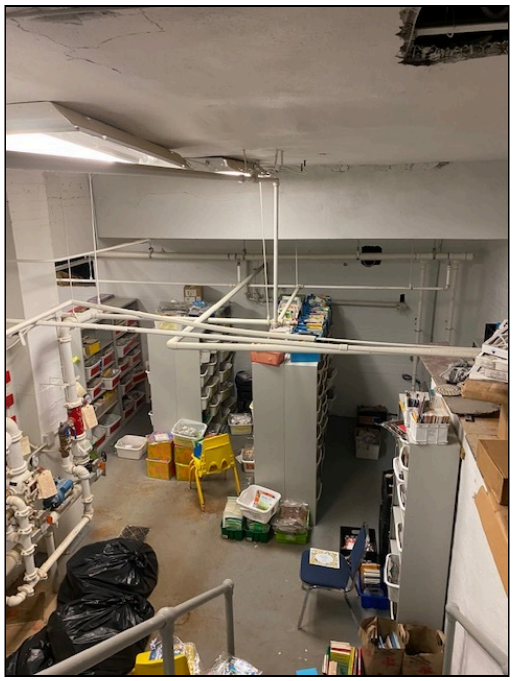
Appendix III: Site Photographs



1 - View of 18x12 Gray Self-stick Floor Tile Sample Location



2 - View of Basement Storage Room Water Pipes



3 - View of Basement Storage Room



4 - View of Beige Interior Wood Door Caulk (previously identified as ACM)



5 - View of Beige Sink Undercoat



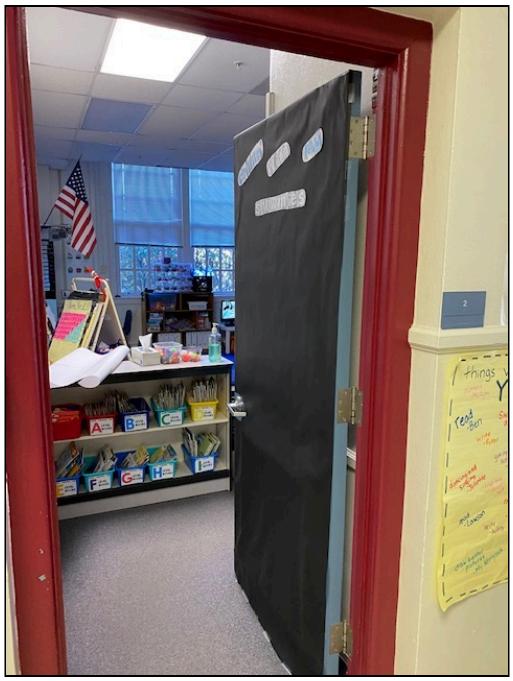
6 - View of Boiler Room Thermal System Insulation (TSI)



7 - View of Boiler Room



8 - View of Classroom 1



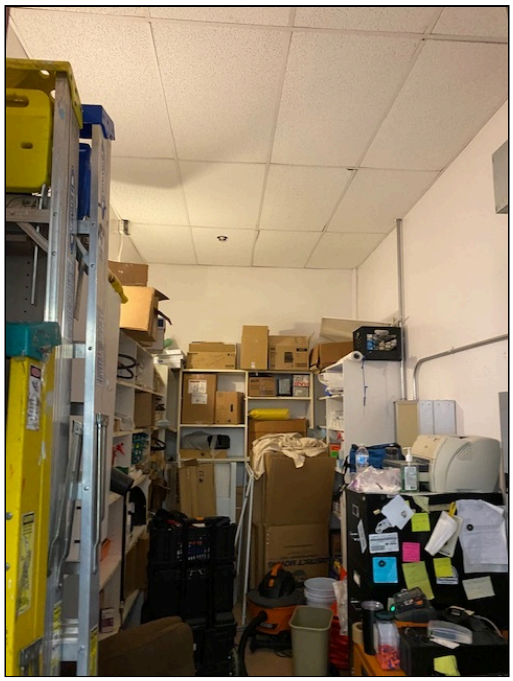
9 - View of Classroom 2



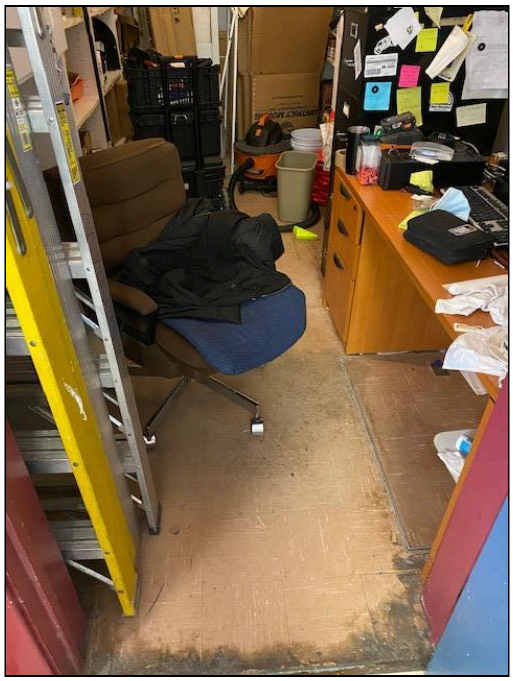
10 - View of Classroom 3



11 - View of Conference Room Closet 1' x 1' Ceiling Tile



12 - View of Custodial Office



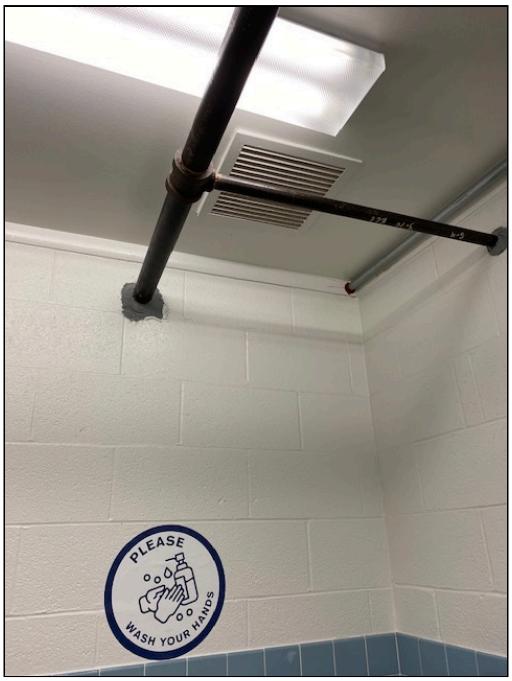
13 - View of Custodial Storage 9" x 9" Tan Floor Tile (previously identified as ACM)



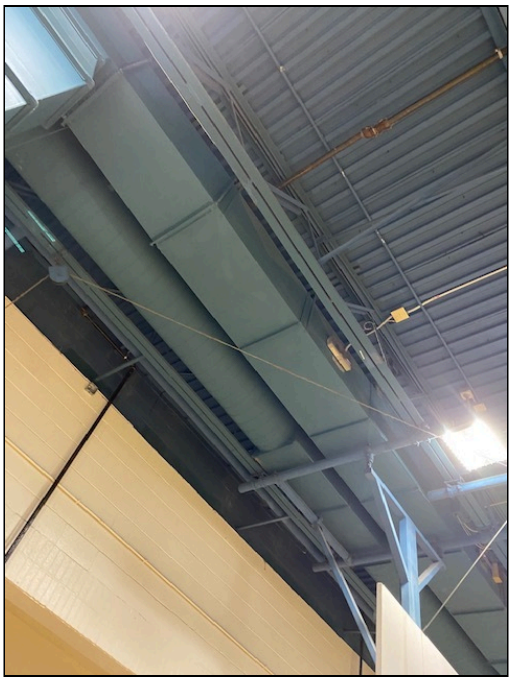
14 - View of Electric Room in Basement



15 - View of Front Entrance



16 - View of Gray and Red Pipe Packing in Gym bathroom



17 - View of Gym Ceiling HVAC System



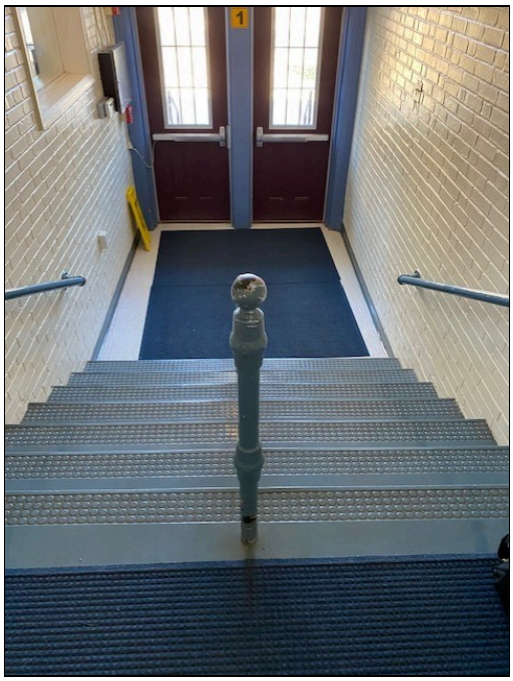
18 - View of Hallway Plaster Wall and Stripped floor



19 - View of Hallway with stripped Cove Base and Flooring



20 - View of HVAC Duct



21 - View of Main Entrance Stairs



22 - View of Main Foyer and Hallway Floor



23 - View of Main Foyer Ceiling



24 - View of Main Foyer Floor



25 - View of Media Center Carpeted



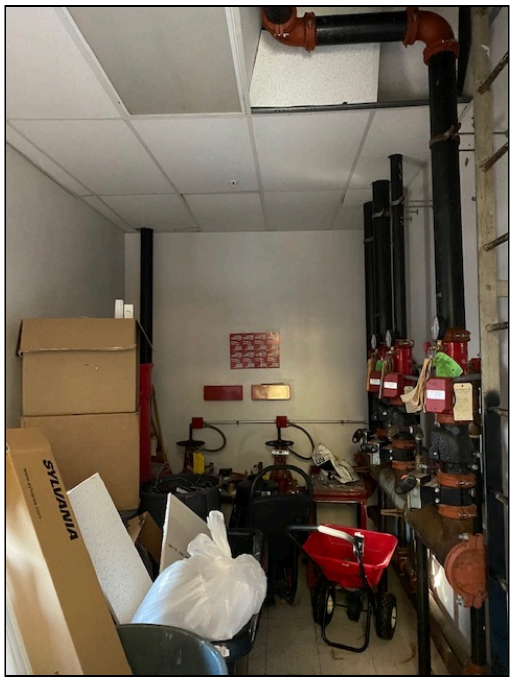
26 - View of White Interior Window Glazing (previously identified as ACM)



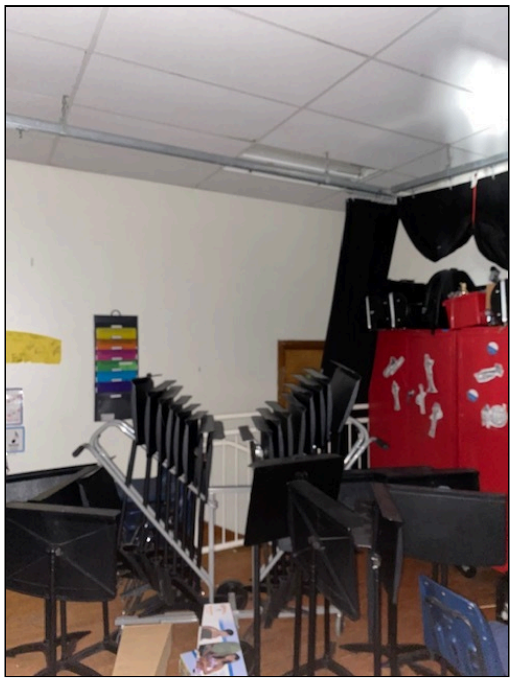
27 - View of Media Center



28 - View of Pink and Yellow Foam HVAC Pipe Packing Sample Location



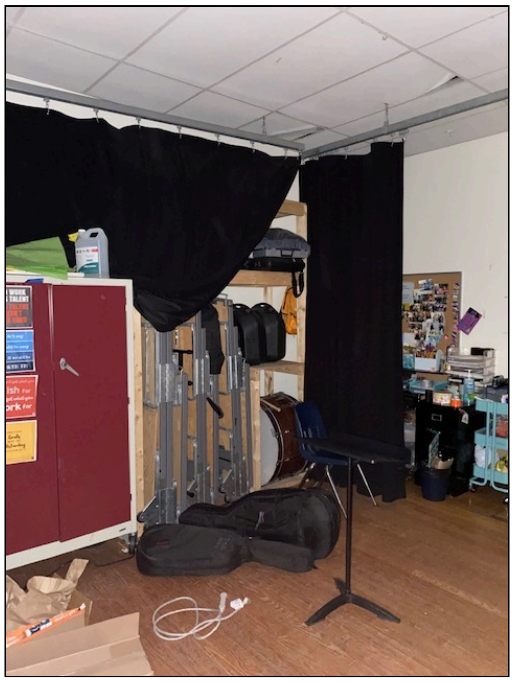
29 - View of Sprinkler Closet



30 - View of Stage 2



31 - View of Stage Curtain Tag



32 - View of Stage



33 - View of Stairs to Boiler Room



34 - View of Students Bathroom



35 - View of Teacher Work-Copy Room



36 - View of Three different types of Ceiling Tile utilized throughout

Appendix IV: Laboratory Report(s)

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 40 CFR, Part 763, Subpart E, App.E

NVLAP TESTING NVLAP LAB CODE 200664-0

AIHA ACCREDITED LABS.ORG Lab ID # 173190

Customer: ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151

Attn: Michael Hamill

Project: ACPS 11652-E2/ Naomi Brooks (12-13-21) AHERA Survey

Lab Order ID: 71984387
Analysis ID: 71984387_PLM
Date Received: 1/31/2022
Date Reported: 2/3/2022

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
1 *71984387PLM_1*	Pink and Yellow Foam HVAC Wall packing	None Detected		100% Other	Pink, Yellow Non Fibrous Heterogeneous Ashed, Crushed
2 *71984387PLM_2*	Pink and Yellow Foam HVAC Wall packing	None Detected		100% Other	Pink, Yellow Non Fibrous Heterogeneous Ashed, Crushed
3 *71984387PLM_3*	Red Electrical Pipe Wall Packing	None Detected	5% Fiber Glass	95% Other	Red Non Fibrous Homogeneous Ashed, Crushed
4 *71984387PLM_4*	Red Electrical Pipe Wall Packing	None Detected	5% Fiber Glass	95% Other	Red Non Fibrous Homogeneous Ashed, Crushed
5 *71984387PLM_5*	Gray Sprinkler Pipe Wall Packing	None Detected		100% Other	Gray Non Fibrous Homogeneous Ashed, Crushed
6 *71984387PLM_6*	Gray Sprinkler Pipe Wall Packing	None Detected		100% Other	Gray Non Fibrous Homogeneous Ashed, Crushed
7 - A *71984387PLM_7*	4" black covebase and associated tan mastic *covebase*	None Detected		100% Other	Black Non Fibrous Homogeneous Ashed, Crushed
7 - B *71984387PLM_23*	4" black covebase and associated tan mastic *mastic*	None Detected		100% Other	Tan Non Fibrous Homogeneous Dissolved, Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Katelyn Stewart (30)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 40 CFR, Part 763, Subpart E, App.E

NVLAP TESTING NVLAP LAB CODE 200664-0

AIHA ACCREDITED LABS.ORG Lab ID # 173190

Customer: ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151

Attn: Michael Hamill

Project: ACPS 11652-E2/ Naomi Brooks (12-13-21) AHERA Survey

Lab Order ID: 71984387
Analysis ID: 71984387_PLM
Date Received: 1/31/2022
Date Reported: 2/3/2022

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
8 - A *71984387PLM_8*	4" black covebase and associated tan mastic *covebase*	**None Detected**		**100% Other**	Black Non Fibrous Homogeneous Ashed, Crushed
8 - B *71984387PLM_24*	4" black covebase and associated tan mastic *mastic*	**None Detected**		**100% Other**	Tan Non Fibrous Homogeneous Dissolved, Crushed
9 *71984387PLM_9*	White/beige sink undercoat	**None Detected**	**20% Cellulose**	**80% Other**	White, Beige Non Fibrous Homogeneous Crushed
10 *71984387PLM_10*	White/beige sink undercoat	**None Detected**	**20% Cellulose**	**80% Other**	White, Beige Non Fibrous Homogeneous Crushed
11 *71984387PLM_11*	2'x4' white pinhole and large fissure ceiling tile	**None Detected**	**30% Cellulose** **30% Fiber Glass**	**20% Other** **20% Perlite**	White, Tan Fibrous Homogeneous Ashed, Crushed
12 *71984387PLM_12*	2'x4' white pinhole and large fissure ceiling tile	**None Detected**	**30% Cellulose** **30% Fiber Glass**	**20% Other** **20% Perlite**	White, Tan Fibrous Homogeneous Ashed, Crushed
13 *71984387PLM_13*	2'x4' white pinhole and medium fissure ceiling tile	**None Detected**	**30% Cellulose** **30% Fiber Glass**	**20% Other** **20% Perlite**	White, Tan Fibrous Homogeneous Ashed, Crushed
14 *71984387PLM_14*	2'x4' white pinhole and medium fissure ceiling tile	**None Detected**	**30% Cellulose** **30% Fiber Glass**	**20% Other** **20% Perlite**	White, Tan Fibrous Homogeneous Ashed, Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Katelyn Stewart (30)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 40 CFR, Part 763, Subpart E, App.E

NVLAP TESTING NVLAP LAB CODE 200664-0

AIHA ACCREDITED LABS.ORG Lab ID # 173190

Customer: ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151

Attn: Michael Hamill

Project: ACPS 11652-E2/ Naomi Brooks (12-13-21) AHERA Survey

Lab Order ID: 71984387
Analysis ID: 71984387_PLM
Date Received: 1/31/2022
Date Reported: 2/3/2022

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
15 *71984387PLM_15*	2'x4' white pinhole and small fissure ceiling tile	**None Detected**	**30% Cellulose** **30% Fiber Glass**	**20% Other** **20% Perlite**	White, Tan Fibrous Homogeneous Ashed, Crushed
16 *71984387PLM_16*	2'x4' white pinhole and small fissure ceiling tile	**None Detected**	**30% Cellulose** **30% Fiber Glass**	**20% Perlite** **20% Other**	White, Tan Fibrous Homogeneous Ashed, Crushed
17 - A *71984387PLM_17*	4" gray covebase and assoiated tan mastic *covebase*	**None Detected**		**100% Other**	Gray Non Fibrous Homogeneous Ashed, Crushed
17 - B *71984387PLM_25*	4" gray covebase and assoiated tan mastic *mastic*	**None Detected**		**100% Other**	Tan Non Fibrous Homogeneous Dissolved, Crushed
17 - C *71984387PLM_26*	4" gray covebase and assoiated tan mastic *compound*	**None Detected**		**100% Other**	White Non Fibrous Homogeneous Crushed
18 - A *71984387PLM_18*	4" gray covebase and assoiated tan mastic *covebase*	**None Detected**		**100% Other**	Gray Non Fibrous Homogeneous Ashed, Crushed
18 - B *71984387PLM_27*	4" gray covebase and assoiated tan mastic *mastic*	**None Detected**		**100% Other**	Tan Non Fibrous Homogeneous Dissolved, Crushed
18 - C *71984387PLM_28*	4" gray covebase and assoiated tan mastic *compound*	**None Detected**		**100% Other**	White Non Fibrous Homogeneous Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Katelyn Stewart (30)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 40 CFR, Part 763, Subpart E, App.E

NVLAP TESTING NVLAP LAB CODE 200664-0

INDUSTRIAL HYGIENE ISO/IEC 17025:2017 Accredited Laboratory AIHA LAP, LLC AIHAACCREDITEDLABS.ORG Lab ID # 173190

Customer: ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151

Attn: Michael Hamill

Project: ACPS 11652-E2/ Naomi Brooks (12-13-21) AHERA Survey

Lab Order ID: 71984387
Analysis ID: 71984387_PLM
Date Received: 1/31/2022
Date Reported: 2/3/2022

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
19 - A	1'x1' textured white ceiling tile and associated brown dot mastic	None Detected	80% Fiber Glass 5% Wollastonite	15% Other	White, Yellow Fibrous Homogeneous
71984387PLM_19	*ceiling tile*				Ashed, Crushed
19 - B	1'x1' textured white ceiling tile and associated brown dot mastic	None Detected	3% Other	97% Other	Brown Non Fibrous Homogeneous
71984387PLM_29	*mastic*				Dissolved, Crushed
20 - A	1'x1' textured white ceiling tile and associated brown dot mastic	None Detected	80% Fiber Glass 5% Wollastonite	15% Other	White, Yellow Fibrous Homogeneous
71984387PLM_20	*ceiling tile*				Ashed, Crushed
20 - B	1'x1' textured white ceiling tile and associated brown dot mastic	None Detected	3% Other	97% Other	Brown Non Fibrous Homogeneous
71984387PLM_30	*mastic*				Dissolved, Crushed
21	18"x12" gray self stick floor tile	None Detected		100% Other	Gray, Transparent Non Fibrous Homogeneous
71984387PLM_21					Ashed, Crushed
22	18"x12" gray self stick floor tile	None Detected		100% Other	Gray, Transparent Non Fibrous Homogeneous
71984387PLM_22					Ashed, Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Katelyn Stewart (30)

Analyst

Approved Signatory

71984387

Client:	ECS Mid-Atlantic, LLC	***Instructions:***
Contact:	Michael Hamill	*Use Column "B" for your contact info*
Address:	14026 Thunderbolt Place, Suite	
Phone:	(703)-471-8400	*To See an Example Click the bottom Example Tab.*
Fax:		
Email:	mhamill@ecslimited.com	***Enter samples between "<<" and ">>"***
Project:	ACPS 11652-E2/ Naomi Brooks (12	***Begin Samples with a "<< "above the first sample and end with a ">>" below the last sample.***
Client Notes:		*Only Enter your data on the first sheet "Sheet1"*
	Positive Stop	
P.O. #.		*Note: Data 1 and Data 2 are optional fields that do not show up on the official report, however they will be included in the electronic data returned to you to facilitate your reintegration of the report data.*
Date Submitted:	1/27/2022 0:00	
Analysis:	PLM EPA 600/R-93/116	
TurnAroundTime:	3 day TAT	

Scientific Analytical Institute

4604 Dundas Drive
Greensboro, NC 27407
Phone: 336.292.3888
Fax: 336.292.3313
Email: lab@sailab.com

Sample Number	Data 1	Sample Description	Data 2
<<			
1		Pink and Yellow Foam HVAC Wall packing	Basement Storage- Near Exit
2		Pink and Yellow Foam HVAC Wall packing	Basement Storage- Near Exit
3		Red Electrical Pipe Wall Packing	Gym Boys Bathroom
4		Red Electrical Pipe Wall Packing	Gym Boys Bathroom
5		Gray Sprinkler Pipe Wall Packing	Gym Boys Bathroom
6		Gray Sprinkler Pipe Wall Packing	Gym Boys Bathroom
7		4" black covebase and associated tan mastic	Gym
8		4" black covebase and associated tan mastic	Gym
9		White/beige sink undercoat	Teachers Lounge
10		White/beige sink undercoat	Teachers Lounge
11		2'x4' white pinhole and large fissure ceiling tile	Teachers Lounge
12		2'x4' white pinhole and large fissure ceiling tile	Teachers Lounge
13		2'x4' white pinhole and medium fissure ceiling tile	Teachers Lounge
14		2'x4' white pinhole and medium fissure ceiling tile	Teachers Lounge
15		2'x4' white pinhole and small fissure ceiling tile	Teachers Lounge
16		2'x4' white pinhole and small fissure ceiling tile	Teachers Lounge
17		4" gray covebase and assoiated tan mastic	Confrence Room
18		4" gray covebase and assoiated tan mastic	Confrence Room
19		1'x1' textured white ceiling tile and associated brown dot mastic	Confrence Room Closet
20		1'x1' textured white ceiling tile and associated brown dot mastic	Confrence Room Closet
21		18"x12" gray self stick floor tile	Confrence Room (observed thoughout main office)
22		18"x12" gray self stick floor tile	Confrence Room (observed thoughout main office)
>>			

B Gulley 1/31 10:30A

Accepted ☒

Rejected ☐

Relinquished By

Received By

Appendix V: Certifications/ Licenses

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation
9960 Mayland Drive, Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON
12-31-2022

NUMBER
3309002099

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS PROJECT MONITOR LICENSE

ZACHARY DAVID HARRELL
1927 N CAMERON ST
ARLINGTON, VA 22207

Mary Broz-Vaughan, Director

Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)

(DETACH HERE)

DPOR COMMONWEALTH of VIRGINIA
Department of Professional and Occupational Regulation

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS PROJECT MONITOR LICENSE
NUMBER: 3309002099 EXPIRES: 12-31-2022

ZACHARY DAVID HARRELL
1927 N CAMERON ST
ARLINGTON, VA 22207

(FOLD)

Status can be verified at http://www.dpor.virginia.gov

DPOR-PC (02/2017)

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation
9960 Mayland Drive, Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON
12-31-2022

NUMBER
3303004832

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS INSPECTOR LICENSE

ZACHARY DAVID HARRELL
1927 N CAMERON ST
ARLINGTON, VA 22207

DPOR

Mary Broz-Vaughan, Director

Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)

(DETACH HERE)

DPOR COMMONWEALTH of VIRGINIA
Department of Professional and Occupational Regulation

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS INSPECTOR LICENSE
NUMBER: 3303004832 EXPIRES: 12-31-2022

ZACHARY DAVID HARRELL
1927 N CAMERON ST
ARLINGTON, VA 22207

(FOLD)

Status can be verified at http://www.dpor.virginia.gov

DPOR-PC (02/2017)

Appendix VI: AHERA ACBM and Suspect ACBM Categories Document

AHERA ACBM and Suspect ACBM Categories

(1) Damaged or significantly damaged thermal system insulation ACM:

- (1) Means thermal system insulation ACM on pipes, boilers, tanks, ducts, and other thermal system insulation equipment where the insulation has lost its structural integrity, or its covering, in whole or in part, is crushed, water stained, gouged, punctured, missing, or not intact such that it is not able to contain fibers. Damage may be further illustrated by occasional punctures, gouges or other signs of physical injury to ACM; occasional water damage on the protective coverings/jackets; or exposed ACM ends or joints. Asbestos debris originating from the ACBM in question may also indicate damage.

(2) Damaged friable surfacing ACM:

- (2) Means friable surfacing ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or which has delaminated such that its bond to the substrate (adhesion) is inadequate, or which, for any other reason, lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

(3) Significantly damaged friable surfacing ACM:

- (3) Means damaged friable surfacing ACM in a functional space where the damage is extensive and severe.

(4) Damaged or significantly damaged friable miscellaneous ACM:

- (4) Means friable miscellaneous ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate or which for any other reason lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

(5) ACBM with potential for damage:

- (5) Means circumstances in which:

    - (1) Friable ACBM is in an area regularly used by building occupants, including maintenance personnel, in the course of their normal activities.

- (2) There are indications that there is a reasonable likelihood that the material or its covering will become damaged, deteriorated, or delaminated due to factors such as changes in building use, changes in operations and maintenance practices, changes in occupancy, or recurrent damage.

(6) ACBM with potential for significant damage:

- (6) Means circumstances in which:

  - (1) Friable ACBM is in an area regularly used by building occupants, including maintenance personnel, in the course of their normal activities.

  - (2) There are indications that there is a reasonable likelihood that the material or its covering will become significantly damaged, deteriorated, or delaminated due to factors such as changes in building use, changes in operations and maintenance practices, changes in occupancy, or recurrent damage.

  - (3) The material is subject to major or continuing disturbance, due to factors including, but not limited to, accessibility or, under certain circumstances, vibration or air erosion.

(7) Any remaining friable ACBM or friable suspected ACBM:

- (1) Means any remaining friable ACBM or friable Suspected ACBM in a building.

Appendix VII: Previous Reports

ASBESTOS ABATEMENT PROJECT MONITORING SUMMARY REPORT

NAOMI L BROOKS ELEMENTARY SCHOOL

600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA 22301

ECS PROJECT NO. 47:11652-H

FOR: ALEXANDRIA CITY PUBLIC SCHOOLS

AUGUST 13, 2021

August 13, 2021

Mr. John Finnigan
Alexandria City Public Schools
1340 Braddock Place
Alexandria, Virginia 22314
john.finnigan@acps.k12.va.us

ECS Project No. 47:11652-H

Reference: Asbestos Abatement Project Monitoring Summary Report, Naomi L Brooks Elementary School, 600 Russell Road, Alexandria, Virginia

Dear Mr. Finnigan:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide Alexandria City Public Schools with this summary report of the asbestos abatement work performed during the above-referenced project. ECS performed visual assessments, evaluations, and air monitoring and sampling during the removal of asbestos-containing materials (ACMs). This report includes a project description, a summary of the asbestos abatement activities observed by ECS, and a summary of the work conducted by ECS including laboratory results.

ECS appreciates this opportunity to provide Alexandria City Public Schools with our services. If we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

ECS Mid-Atlantic, LLC

John O'Neil
Staff Project Manager
joneil@ecslimited.com
703-471-8400

Michael Hamill, CIH
Environmental Senior Project Manager
MHamill@ecslimited.com
703-471-8400

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2.0 ECS SCOPE OF WORK 1

3.0 ASBESTOS ABATEMENT ACTIVITIES 1

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3.2 Daily Air Sampling 1

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Appendix I: Abatement Work Area Summary Sketch

Appendix II: Daily Field Reports with PCM Air Sample Results

1.0 PROJECT DESCRIPTION

The Naomi L Brooks Elementary School is a two-story school building with a basement located at 600 Russell Road in Alexandria, Virginia. The building is currently occupied and is used by Alexandria City Public Schools (ACPS) as a school.

The asbestos abatement work was performed by Waco, Inc., in general from August 3 through August 8, 2021.

2.0 ECS SCOPE OF WORK

ECS was tasked with performing visual assessments and evaluations, monitoring and air sampling during and after the removal of the identified asbestos-containing materials (ACMs) which are referenced below, within the subject building. The services were provided in general accordance with ECS proposal 47:19870-EP.

3.0 ASBESTOS ABATEMENT ACTIVITIES

3.1 Asbestos Removal

The abatement activities included the removal of the following asbestos-containing materials (ACMs) from the subject property:

- Floor tile and associated black mastic - first floor hallway between classrooms 1 - 16

No other materials or areas of the school building were included in this asbestos abatement. Please note that the above-referenced asbestos-containing materials (ACMs), other identified ACMs, and/or assumed ACMs are most likely present in other areas of the school building.

3.2 Daily Air Sampling

During the asbestos abatement, the ECS licensed project monitor collected and analyzed air samples using Phase Contrast Microscopy (PCM) in general accordance with applicable federal and Commonwealth of Virginia regulations. Samples were collected during the project outside the work areas to monitor airborne fiber concentrations. In general, the air sampling found the engineering controls (i.e., polyethylene sheeting, negative air pressure, High Efficiency Particulate Air (HEPA) filtration adequate to keep fiber concentrations on air samples collected outside the regulated work areas below the Commonwealth of Virginia PCM re-occupancy limit of <0.01 fibers per cubic centimeter (f/cc). Air sample results are included within the technicians' daily field notes.

3.3 ECS Observations

Asbestos abatement was performed by Waco, Inc. within regulated work areas. The regulated work areas within the subject building consisted of enclosures constructed of 6-mil polyethylene sheeting which were placed under negative pressure through the use of HEPA air filtration units. ECS observed the abatement contractor utilize wet methods to control the fiber concentrations within the work area.

ECS reviewed the asbestos credentials of the abatement workers. The credential documentation provided was reviewed and noted to be current.

ECS observed abatement workers utilizing personal protective equipment deemed necessary for asbestos abatement work by applicable OSHA and Virginia regulations (respirators, disposable protective clothing, eye protection, hard hats, gloves, etc.).

ECS observed the abatement contractor seal the asbestos waste in 6-mil waste bags prior to removal from the work area for disposal. ECS observed that the waste was collected by the abatement contractor in sealed shipping containers for transport to an EPA accredited landfill authorized to accept asbestos waste. ECS recommends that the property owner obtain a copy of the waste transport and disposal manifests from the abatement contractor, if not already provided.

4.0 FINAL CLEARANCE AIR SAMPLING

After Waco, Inc. had removed the specified asbestos-containing materials (ACMs) and related waste from the work area, ECS performed a final clearance visual assessment to survey the work area and evaluate if the ACMs had been removed and if dust and/or debris remained in the work area. Following the completion of the final clearance visual assessment, ECS reported the results to the client and Waco, Inc..

Final clearance air samples were collected from work areas in accordance with aggressive sampling protocol described in Unit III.B.7.d of 40 CFR 763 Subpart E Appendix A and analyzed via Transmission Electron Microscopy (TEM) in accordance with federal and Virginia regulations. The results of the TEM final clearance air samples collected from the work area were found to be below the Virginia re-occupancy limit of 70 structures per square millimeter (70 s/mm^2).

5.0 CLOSING

Copies of ECS's daily monitoring field reports are enclosed along with copies of laboratory reports. If we can be of further assistance to you, please do not hesitate to contact us at (703) 471-8400.

6.0 LIMITATIONS

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

Our recommendations are in part based on federal, state, and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies, any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

The client agrees to notify the appropriate local, state, or federal public agencies as required by law, or otherwise to disclose, in a timely manner, information that may be necessary to prevent any danger to public health, safety, or the environment.

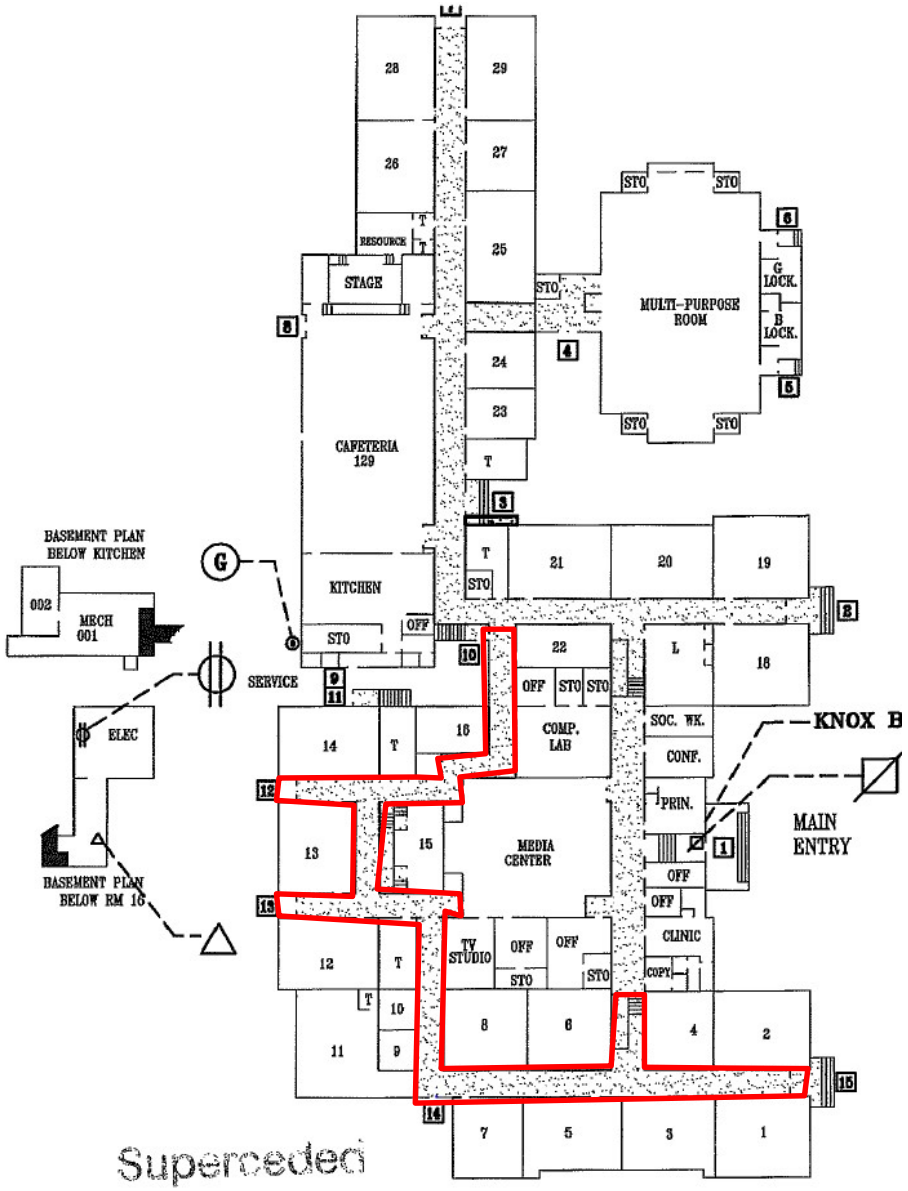
Appendix I: Abatement Work Area Summary Sketch

Legend

= Regulated Work Area

= Decontamination Unit

= Sample Location



Date	Project No.	SCALE			
08/13/21	47:11652-H	NTS		Abatement Work Area	Naomi Brooks Elementary School 600 Russell Road Alexandria, VA 22301

Appendix II: Daily Field Reports with PCM Air Sample Results

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

August 4, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: John Finnigan

RE: **ACPS Naomi L Brooks ES Abatement Monitoring**
ECS Job # **47:11652-H**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X Field Reports **X** For your use **X** As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - Norman Wiebusch
Waco, Inc - Chris Lanham

ENCL: Field Report # 1 8/3/2021

Michael P. Hamill, CIH
Environmental Senior Project Manager

John A. O'Neil
Environmental Staff Project Manager

Disclaimer

1. *This report (and any attachments) shall not be reproduced except in full without prior written approval of ECS.*
2. *The information in this report relates only to the activities performed on the report date.*
3. *Where appropriate, this report includes statements as to compliance with applicable project drawings, and specifications for the activities, performed on this report date.*
4. *Incomplete or non-conforming work will be reported for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project	**ACPS Naomi L Brooks ES Abatement Monitoring**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Project No.	**47:11652-H**
Report No.	**1**
Day & Date	**Tuesday 8/3/2021**
Weather	**75 °/ Cloudy**
On-Site Time	**2.00**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**2.00**
Re Obs Time	**0.00**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Times of	Arrival	Departure
Chargeable Items				**6:00A**	**7:00A**
				3:00P	**4:00P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The material to be removed today are floor tile and mastic from the first floor hallway (between classrooms 1 and 13). Photographs and a sketch for today's regulated work area are attached to this report.

Prior to starting the removal of the specified material, the abatement permit was reviewed. The permit was observed to be onsite, and the abatement contractor was notified the removal of the specified material could begin.

Prior to starting the removal of the specified material, the abatement contractor employees were asked to present their licenses for review. No workers were found to be without valid licenses.

FIRST FLOOR HALLWAY WORK AREA

At approximately 6:00 am, the abatement contractor requested a pre-abatement survey of the regulated work area. The Pre-Abatement Checklist was completed and is attached to this report.

Between 6:27 and 6:31 am, PCM air samples were started outside the work area. The sampling pumps were calibrated using a rotameter to 2.0 liters per minute.

The abatement contractor employees were observed using hand tools and ride-on floor scraper to remove floor tiles within the work area.

Between 3:40 and 3:42 pm, the sampling pumps were checked using a rotameter. The flow rate was 2.0 liters per minute. The PCM air samples were stopped and gathered from outside the work area.

By Catey Bourne 1302

GENERAL

The regulated work area was surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

ECS observed the abatement contractor placing the specified asbestos-containing materials in 6-mil polyethylene bags in barrels which were double-bagged and sealed in general accordance with applicable regulations. Waste bags were temporarily stored in the work area.

The undersigned prepared and analyzed the PCM air samples cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.

The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). OWA samples were reported below the level.

The sample results reflect the conditions where the air samples were collected at the time and dates of collection.

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 8/3/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
08032101CB	OWA- Outside decontamination unit	6:27 AM	3:40 PM	2.0	2.0	2.0	553	1106.0	7.0	100	0.003
08032102CB	OWA- Critical barrier by front desk	6:31 AM	3:42 PM	2.0	2.0	2.0	551	1102.0	4.0	100	0.002
08032103CB	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
08032104CB	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The US EPA and Commonwealth of Virginia PCM re-occupancy limit is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). OWA samples were reported below the re-occupancy limit.

ECS Technician: Catey Bourne **Date:** 8/3/2021

ECS Mid-Atlantic, LLC

Pre-Abatement Work Area Checklist

Project Number: 47:11652-H **Date:** 8/4/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: First Floor Hallway (Between Classrooms 1 - 13) - Floor Tile and Associated Mastic

	Work Area Location/Description	First Floor Hallway (Between
Administrative	Training Certificates/Licenses	Satisfactory
	Permits	Satisfactory
	EPA/State/Local Notification	Satisfactory
Work Area	Public Access Restricted	Satisfactory
	Warning Signs/Tape Posted	Satisfactory
Negative Air Filtration	Number of Units	5
	Pre-Filters In-Use/Available	Satisfactory
	Exhausted from Work Area	Satisfactory
	Pressure Differential Monometer Operating	Satisfactory
Equipment	HEPA Vacuum Available	Satisfactory
	Amended Water Sprayers	Satisfactory
Decontamination Enclosure	Clean Room	Satisfactory
	Shower Water Available	Satisfactory
	Waste Water Filtration In-Use	Satisfactory
	Disposable Towels	Satisfactory
	Soap	Satisfactory
	Equipment Room	Satisfactory
Personal Protective Equipment	Type of Respirator	Half Face APR
	Type of Filters Used	P100
	Disposable Protective Clothing	Satisfactory
	Work Area Acceptable	Yes

Notes:

ECS Technician: John A. O'Neil **Date:** 8/4/2021

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H **Date:** 8/4/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: First Floor Hallway (Between Classrooms 1 - 13) - Floor Tile and Associated Mastic

	Work Area Location/Description	First Floor Hallway (Between
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: John A. O'Neil **Date:** 8/4/2021

Attachments



View of 1st floor hallway during the pre-abatement walk-through (1)

Figure 1



View of 1st floor hallway during the pre-abatement walk-through (2)

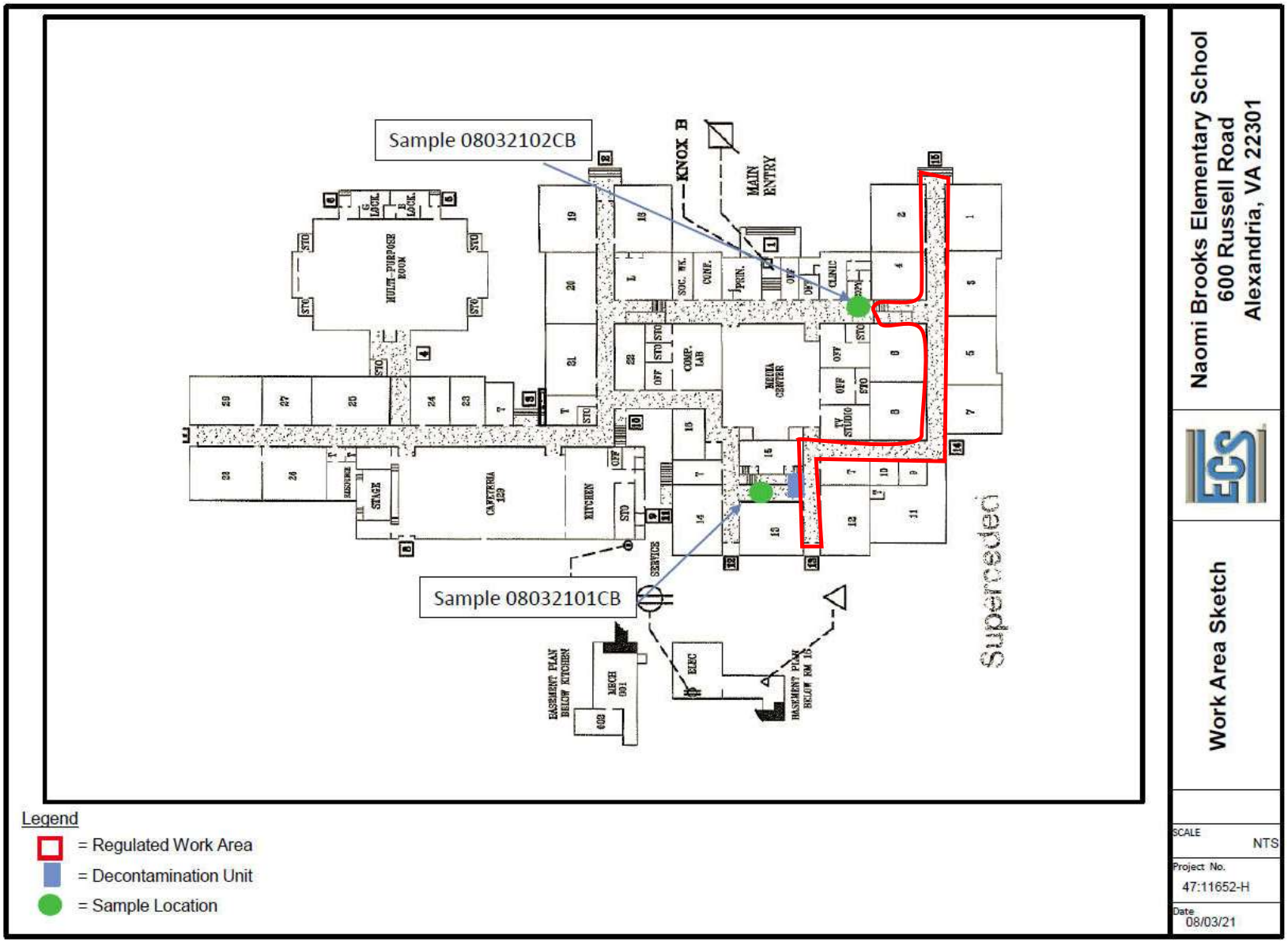
Figure 2

Attachments



View of 1st floor hallway micromanometer reading during the pre-abatement walk-through

Figure 3


Sample 08032102CB
Sample 08032101CB
KNOX B
MAIN ENTRY
MULTI-PURPOSE ROOM
CAFETERIA 129
KITCHEN
STAGE
COMP. LAB
MEDIA CENTER
TV STUDIO
CLINIC
SOC. WK.
CONF.
PRIN.
OFF
STO
SERVICE
ELEC
MECH 001
BASEMENT PLAN BELOW KITCHEN
BASEMENT PLAN BELOW RM 15
Superseded
Legend
= Regulated Work Area
= Decontamination Unit
= Sample Location
Naomi Brooks Elementary School
600 Russell Road
Alexandria, VA 22301
Work Area Sketch
SCALE
NTS
Project No.
47:11652-H
Date
08/03/21

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

August 6, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: John Finnigan

RE: **ACPS Naomi L Brooks ES Abatement Monitoring**
ECS Job # **47:11652-H**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X	Field Reports	**X**	For your use	**X**	As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - Norman Wiebusch
Waco, Inc - Chris Lanham

ENCL: Field Report # 2 8/4/2021

Michael P. Hamill, CIH
Environmental Senior Project Manager

John A. O'Neil
Environmental Staff Project Manager

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4. *Incomplete or non-conforming work will be reported for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project	**ACPS Naomi L Brooks ES Abatement Monitoring**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Project No.	**47:11652-H**
Report No.	**2**
Day & Date	**Wednesday 8/4/2021**
Weather	**81 °/ Sunny**
On-Site Time	**3.75**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**3.75**
Re Obs Time	**0.00**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Times of	Arrival	Departure
Chargeable Items				**6:00A**	**7:00A**
				9:00A	**10:30A**
				1:30P	**2:45P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The material to be removed today is floor tile and mastic from the first-floor hallway (between classrooms 1 and 16). Photographs and a sketch for today's regulated work area are attached to this report.

FIRST FLOOR HALLWAY WORK AREA

The abatement contractor expanded the original containment to include the hallway from room 9 to room 16 in the work area. The abatement contractor requested a pre-abatement survey of the expanded regulated work area. The Pre-Abatement Checklist was completed and is attached to this report.

Between 6:30 and 6:48 am, PCM air samples were started outside the work area. The sampling pumps were calibrated using a rotameter to 2.0 liters per minute.

The abatement contractor employees were observed using hand tools and a ride-on floor scraper to remove floor tiles within the work area.

Between 2:15 and 2:20 pm, the sampling pumps were checked using a rotameter. The flow rate was 2.0 liters per minute. The PCM air samples were stopped and gathered from outside the work area.

GENERAL

The regulated work area was surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

By Catey Bourne 1302

ECS observed the abatement contractor placing the specified asbestos-containing materials in 6-mil polyethylene bags and waste drums which were sealed in general accordance with the applicable regulations. Waste drums were temporarily stored within the work area.

The undersigned prepared and analyzed the PCM air sample cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.

The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results from outside the work area were reported to be less than 0.01 f/cc.

The sample results reflect the conditions where the air samples were collected at the time and dates of collection.

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 8/4/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
08042101CB	OWA- First Floor Hallway Work Area - Outside Decontamination Unit	6:30 AM	2:15 PM	2.0	2.0	2.0	465	930.0	3.0	100	0.002
08042102CB	OWA- First Floor Hallway Work Area - Outside Critical Barrier by Clinic	6:48 AM	2:20 PM	2.0	2.0	2.0	452	904.0	0.0	100	0.000
08042103CB	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
08042104CB	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0	NFD

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). OWA samples were reported below the level.

ECS Technician: Catey Bourne **Date:** 8/4/2021

ECS Mid-Atlantic, LLC

Pre-Abatement Work Area Checklist

Project Number: 47:11652-H **Date:** 8/4/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: First Floor Hallway (Classrooms 13-16) - Floor Tile and Mastic

	Work Area Location/Description	First Floor Hallway (Classrooms 13
Administrative	Training Certificates/Licenses	Satisfactory
	Permits	Satisfactory
	EPA/State/Local Notification	Satisfactory
Work Area	Public Access Restricted	Satisfactory
	Warning Signs/Tape Posted	Satisfactory
Negative Air Filtration	Number of Units	4
	Pre-Filters In-Use/Available	Satisfactory
	Exhausted from Work Area	Satisfactory
	Pressure Differential Monometer Operating	Satisfactory
Equipment	HEPA Vacuum Available	Satisfactory
	Amended Water Sprayers	Satisfactory
Decontamination Enclosure	Clean Room	Satisfactory
	Shower Water Available	Satisfactory
	Waste Water Filtration In-Use	Satisfactory
	Disposable Towels	Satisfactory
	Soap	Satisfactory
	Equipment Room	Satisfactory
Personal Protective Equipment	Type of Respirator	Half-Face
	Type of Filters Used	P100
	Disposable Protective Clothing	Satisfactory
	Work Area Acceptable	Yes

Notes:

ECS Technician: John A. O'Neil **Date:** 8/4/2021

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H **Date:** 8/4/2021

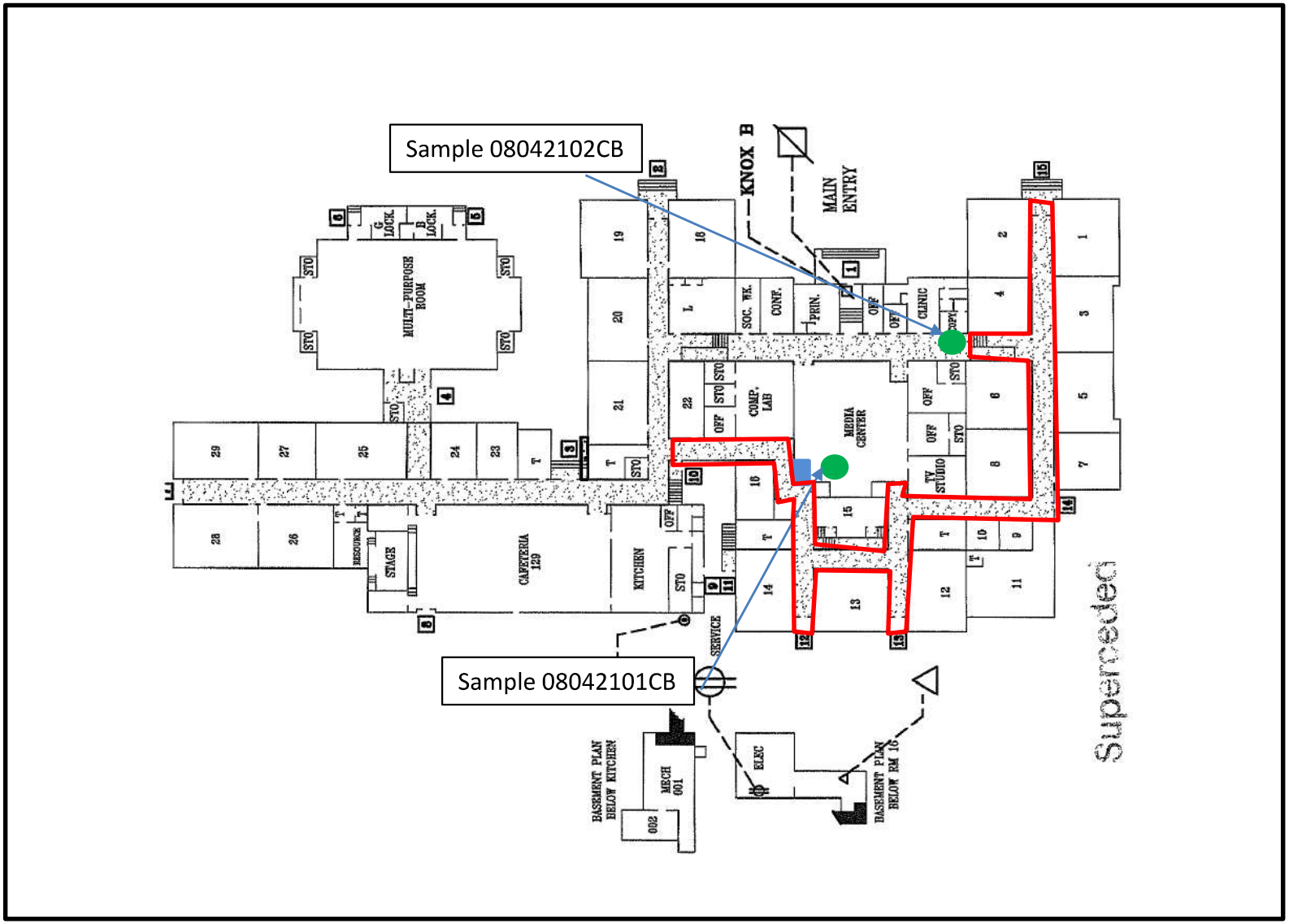
Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: First floor hallway work area between rooms 1 - 16 - Floor Tile and Black Mastic

	Work Area Location/Description	First floor hallway work area
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: John A. O'Neil **Date:** 8/4/2021



Legend

= Regulated Work Area

= Decontamination Unit

= Sample Location

Naomi Brooks Elementary School
600 Russell Road
Alexandria, VA 22301

Work Area Sketch

SCALE NTS

Project No. 47:11652-H

Date 08/04/21

Attachments



View of abatement activities in the first floor hallway work area (1)

Figure 1



View of abatement activities in the first floor hallway work area (2)

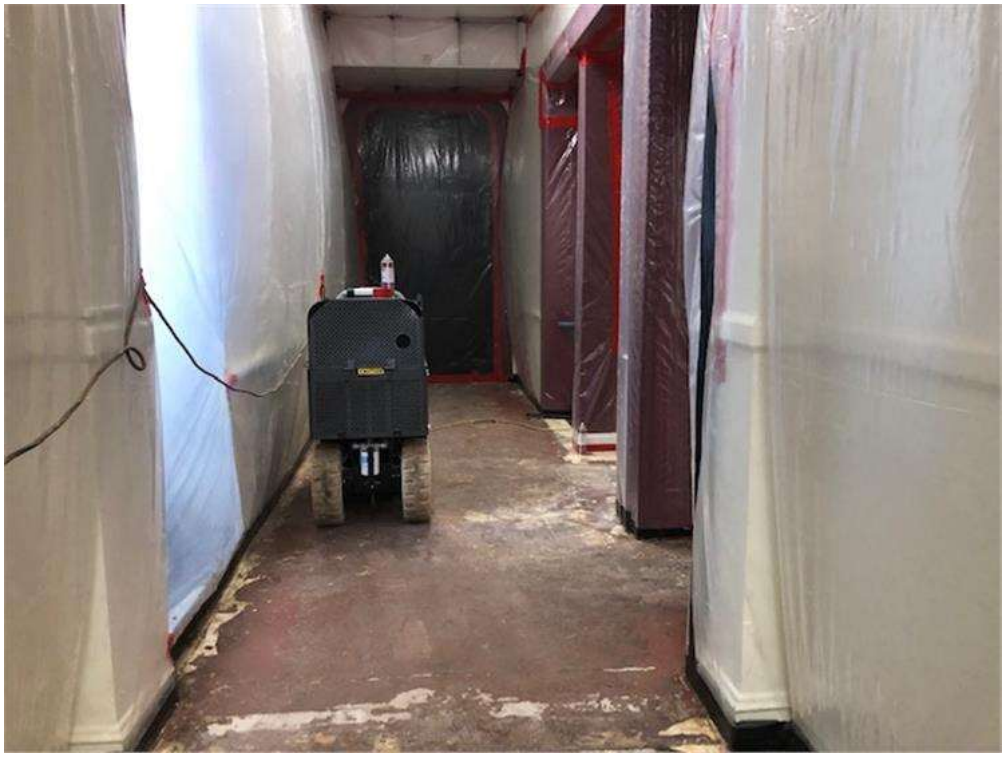
Figure 2

Attachments



View of abatement activities in the first floor hallway work area (3)

Figure 3



View of abatement activities in the first floor hallway work area (4)

Figure 4

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

August 10, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: John Finnigan

RE: **ACPS Naomi L Brooks ES Abatement Monitoring**
ECS Job # **47:11652-H**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X Field Reports **X** For your use **X** As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - Norman Wiebusch
Waco, Inc - Chris Lanham

ENCL: Field Report # 3 8/5/2021

Michael P. Hamill, CIH
Environmental Senior Project Manager

John A. O'Neil
Environmental Staff Project Manager

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14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project	**ACPS Naomi L Brooks ES Abatement Monitoring**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Project No.	**47:11652-H**
Report No.	**3**
Day & Date	**Thursday 8/5/2021**
Weather	**88 °/ Sunny**
On-Site Time	**2.00**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**2.00**
Re Obs Time	**0.00**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Times of	Arrival	Departure
Chargeable Items				**7:30A**	**8:30A**
				3:30P	**4:30P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The material to be removed today is floor tile and mastic from the first-floor hallway (between classrooms 1 and 16). Photographs and a sketch for today's regulated work area are attached to this report.

FIRST FLOOR HALLWAY WORK AREA

Between 7:30 and 7:32 am, PCM air samples were started outside the work area at the decontamination unit entry and the critical barrier in the stairwell. The sampling pumps were calibrated using a rotameter to 2.0 liters per minute.

Abatement workers were observed removing floor mastic using grinder machines with HEPA vacuum attachments. Water sprayers were utilized during abatement activities.

Between 3:47 and 3:49 pm, the sampling pumps were checked using a rotameter. The flow rate was 2.0 liters per minute. The PCM air samples were stopped and gathered from outside the work area.

GENERAL

The regulated work area was surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

ECS observed the abatement contractor placing the specified asbestos-containing materials in 6-mil polyethylene bags in barrels which were double-bagged and sealed in general accordance with applicable regulations. Waste bags/barrels were labeled and placed in a waste hauling container.

By JP Nuique 1825

The undersigned prepared and analyzed the PCM air samples cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.

The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results from outside the work area were reported to be less than 0.01 f/cc.

The sample results reflect the conditions where the air samples were collected at the time and dates of collection.

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 8/5/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
08052101GN	OWA,1st floor hallway work area at decontamination unit entry	7:30 AM	3:47 PM	2.0	2.0	2.0	497	994.0	3.0	100	0.001
08052102GN	OWA,1st floor hallway work area at critical barrier in the hallway	7:32 AM	3:49 PM	2.0	2.0	2.0	497	994.0	1.0	100	0.000
080521FB01GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
080521FB02GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results from outside the work area were reported to be less than 0.01 f/cc.

ECS Technician: JP Nuique **Date:** 8/5/2021

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H **Date:** 8/6/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: First floor Hallway work Area Between Rooms 1 - 16 - Floor Tile and Black Mastic

	Work Area Location/Description	First floor Hallway work Area
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: John A. O'Neil **Date:** 8/6/2021

Naomi Brooks Elementary School
600 Russell Road
Alexandria, VA 22301

ECS

Work Area Sketch

SCALE NTS

Project No. 47:11652-H

Date 08/05/21

Legend

= Regulated Work Area

= Decontamination Unit

= Sample Location

Transmittal Page 6/9

Attachments



View of abatement activities in the 1st floor hallway work area (1)

Figure 1



View of abatement activities in the 1st floor hallway work area (2)

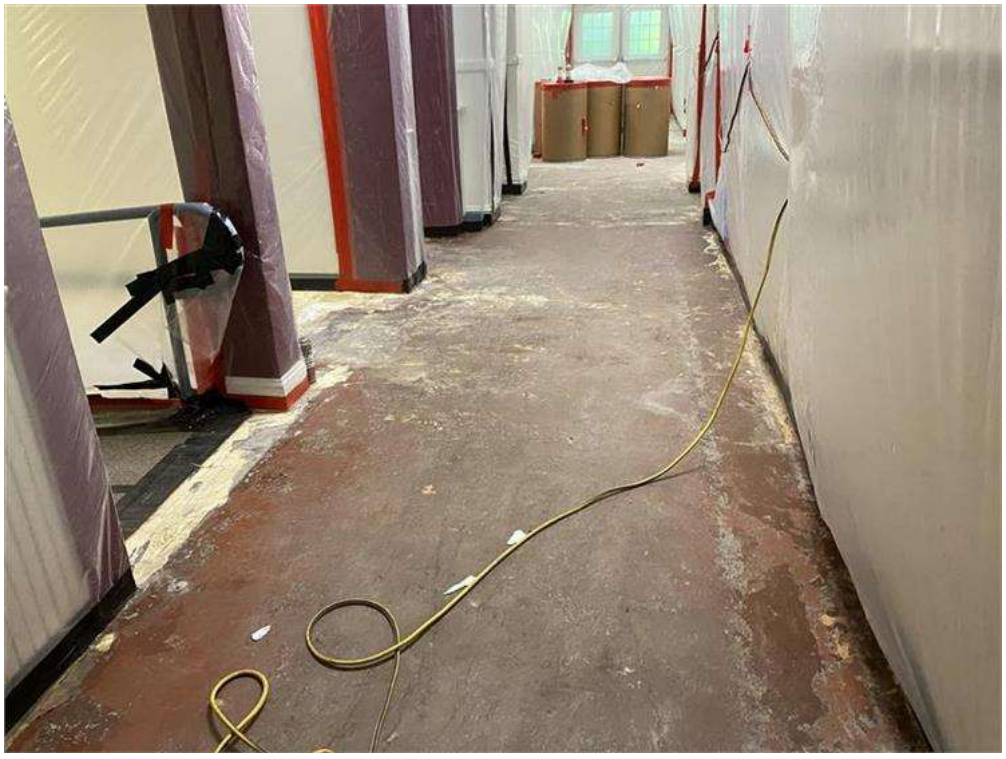
Figure 2

Attachments



View of abatement activities in the 1st floor hallway work area (3)

Figure 3



View of abatement activities in the 1st floor hallway work area (4)

Figure 4

Attachments



View of abatement activities in the 1st floor hallway work area (5)

Figure 5

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

August 10, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: John Finnigan

RE: **ACPS Naomi L Brooks ES Abatement Monitoring**
ECS Job # **47:11652-H**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X Field Reports **X** For your use **X** As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - Norman Wiebusch
Waco, Inc - Chris Lanham

ENCL: Field Report # 4 8/6/2021

Michael P. Hamill, CIH
Environmental Senior Project Manager

John A. O'Neil
Environmental Staff Project Manager

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ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project No.	**47:11652-H**
Report No.	**4**
Day & Date	**Friday 8/6/2021**
Weather	**88 °/ Sunny**
On-Site Time	**5.50**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**5.50**
Re Obs Time	**0.00**

Project	**ACPS Naomi L Brooks ES Abatement Monitoring**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Times of	Arrival	Departure
Chargeable Items				**8:00A**	**8:30A**
				11:30A	**4:30P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The material to be removed today is floor tile and mastic from the first-floor hallway (between classrooms 1 and 16). Photographs and a sketch for today's regulated work area are attached to this report.

FIRST FLOOR HALLWAY WORK AREA

Between 8:15 and 8:17 am, PCM air samples were started outside the work area at the decontamination unit entry and the critical barrier in the stairwell. The sampling pumps were calibrated using a rotameter to 2.0 liters per minute.

Abatement workers were observed removing floor mastic using grinder machines with HEPA vacuum attachments. Water sprayers were utilized during abatement activities.

Between 3:45 and 3:47 pm, the sampling pumps were checked using a rotameter. The flow rate was 2.0 liters per minute. The PCM air samples were stopped and gathered from outside the work area.

GENERAL

The regulated work area was surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

ECS observed the abatement contractor placing the specified asbestos-containing materials in 6-mil polyethylene bags in barrels which were double-bagged and sealed in general accordance with applicable regulations. Waste bags/barrels were labeled and placed in a waste hauling container.

By JP Nuique 1825

The undersigned prepared and analyzed the PCM air samples cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.

The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results from outside the work area were reported to be less than 0.01 f/cc.

The sample results reflect the conditions where the air samples were collected at the time and dates of collection.

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 8/6/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
08062101GN	OWA,1st floor hallway work area at decontamination unit entry	8:15 AM	3:45 PM	2.0	2.0	2.0	450	900.0	2.5	100	0.001
08062102GN	OWA,1st floor hallway work area at critical barrier in the hallway	8:17 AM	3:47 PM	2.0	2.0	2.0	450	900.0	1.0	100	0.001
080621FB02GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
080621FB02GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results from outside the work area were reported to be less than 0.01 f/cc.

ECS Technician: JP Nuique **Date:** 8/6/2021

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H **Date:** 8/7/2021

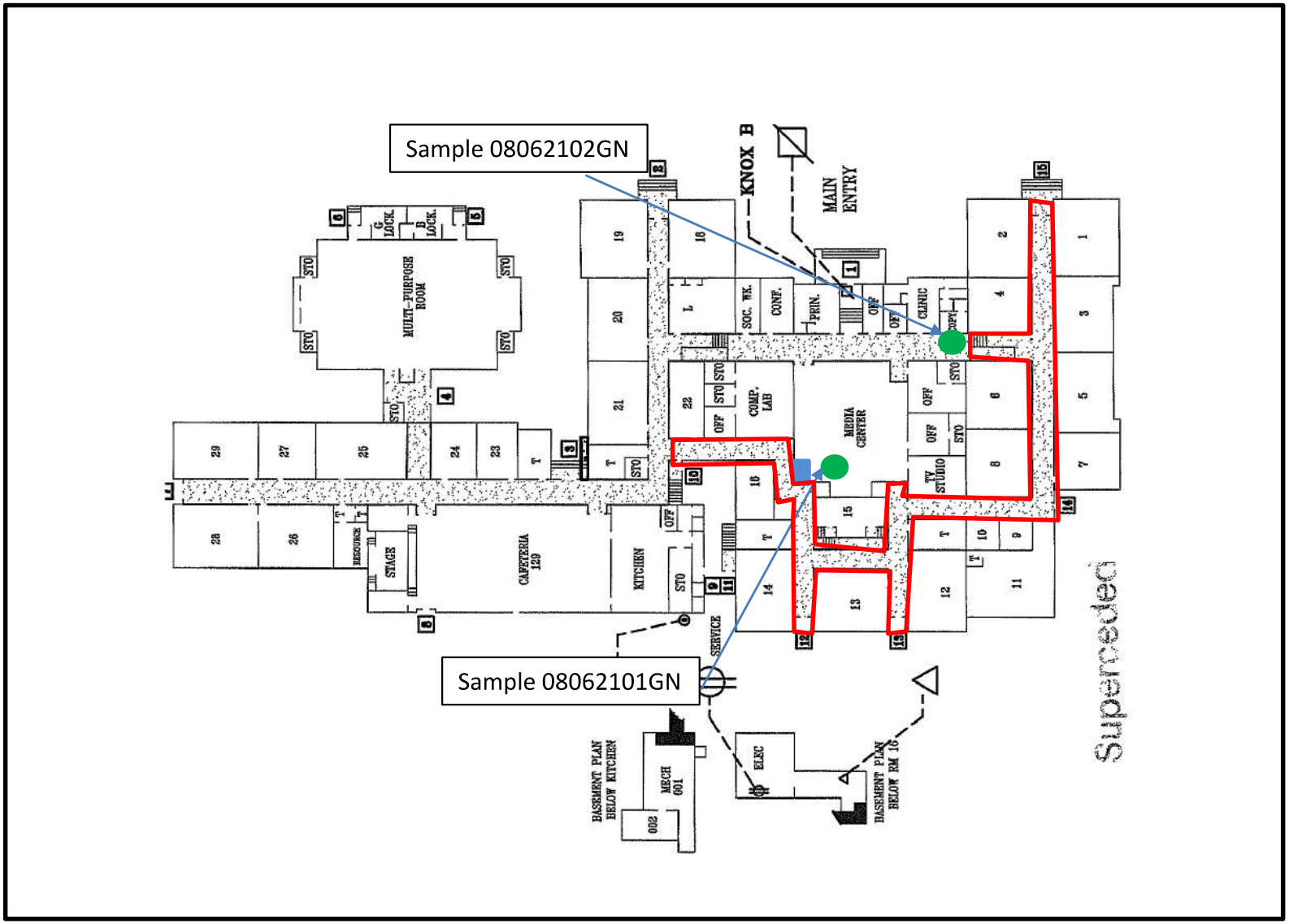
Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: First Floor Hallway Work Area Between Rooms 1 - 16 - Floor Tile and Black Mastic

	Work Area Location/Description	First Floor Hallway Work Area
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: John A. O'Neil **Date:** 8/7/2021



Legend

= Regulated Work Area

= Decontamination Unit

= Sample Location

Naomi Brooks Elementary School
600 Russell Road
Alexandria, VA 22301

Work Area Sketch

SCALE NTS

Project No. 47:11652-H

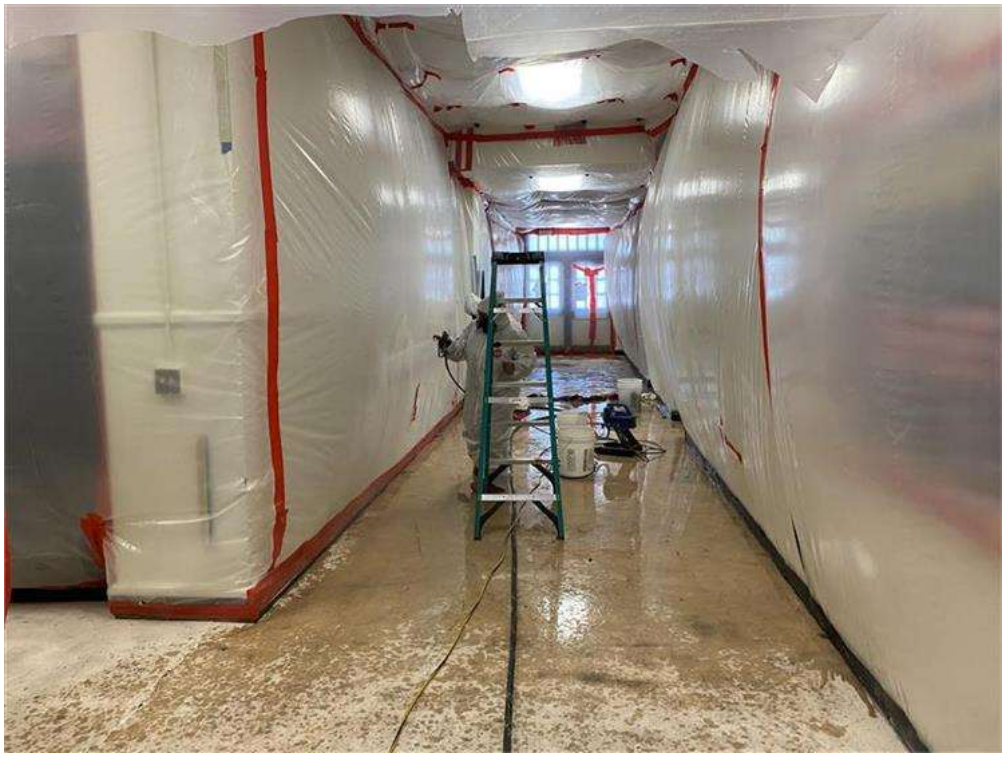
Date 08/06/21

Attachments



View of abatement activities in the 1st floor hallway work area (1)

Figure 1



View of abatement activities in the 1st floor hallway work area (2)

Figure 2

Attachments



View of abatement activities in the 1st floor hallway work area (3)

Figure 3



View of the micromanometer for the 1st floor hallway work area

Figure 4

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

August 10, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: John Finnigan

RE: **ACPS Naomi L Brooks ES Abatement Monitoring**
ECS Job # **47:11652-H**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X Field Reports **X** For your use **X** As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - Norman Wiebusch
Waco, Inc - Chris Lanham

ENCL: Field Report # 5 8/7/2021

Michael P. Hamill, CIH
Environmental Senior Project Manager

John A. O'Neil
Environmental Staff Project Manager

Disclaimer

1. *This report (and any attachments) shall not be reproduced except in full without prior written approval of ECS.*
2. *The information in this report relates only to the activities performed on the report date.*
3. *Where appropriate, this report includes statements as to compliance with applicable project drawings, and specifications for the activities, performed on this report date.*
4. *Incomplete or non-conforming work will be reported for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project	**ACPS Naomi L Brooks ES Abatement Monitoring**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Project No.	**47:11652-H**
Report No.	**5**
Day & Date	**Saturday 8/7/2021**
Weather	**88 °/ Sunny**
On-Site Time	**9.50**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**9.50**
Re Obs Time	**0.00**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Time of	Arrival	Departure
Chargeable Items				**6:00A**	**3:30P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The material to be removed today is floor tile and mastic from the first-floor hallway (between classrooms 1 and 16). Photographs and a sketch for today's regulated work area are attached to this report.

FIRST FLOOR HALLWAY WORK AREA

Between 7:30 and 7:32 am, PCM air samples were started outside the work area at the decontamination unit entry and the critical barrier in the stairwell. The sampling pumps were calibrated using a rotameter to 2.0 liters per minute.

Abatement workers were observed completing a final cleaning of the work area following removal of the floor tile and associated black mastic.

Between 2:30 and 2:32 pm, the sampling pumps were checked using a rotameter. The flow rate was 2.0 liters per minute. The PCM air samples were stopped and gathered from outside the work area.

The abatement contractor stated the specified materials have been removed from the regulated work area and requested a visual survey to confirm compliance. The Final Clearance Visual Survey Checklist was completed and is attached to this report.

Following the successful completion of the final clearance visual survey, the abatement contractor applied an encapsulant to surfaces within the regulated work area. ECS will collect the final clearance TEM air samples during the next working shift.

GENERAL

By JP Nuique 1825

The regulated work area was surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

ECS observed the abatement contractor placing the specified asbestos-containing materials in 6-mil polyethylene bags in barrels which were double-bagged and sealed in general accordance with applicable regulations. Waste bags/barrels were labeled and placed in a waste hauling container.

The undersigned prepared and analyzed the PCM air samples cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.

The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results from outside the work area were reported to be less than 0.01 f/cc.

The sample results reflect the conditions where the air samples were collected at the time and dates of collection.

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 8/7/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
08072101GN	OWA,1st floor hallway work area at decontamination unit entry	7:30 AM	2:30 PM	2.0	2.0	2.0	420	840.0	2.0	100	0.001
08072102GN	OWA,1st floor hallway work area at critical barrier in the hallway	7:32 AM	2:32 PM	2.0	2.0	2.0	420	840.0	2.0	100	0.001
080721FB01GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
080721FB02GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The US EPA and Commonwealth of Virginia PCM re-occupancy criteria is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results from outside the work area were reported to be less than 0.01 f/cc.

ECS Technician: JP Nuique **Date:** 8/7/2021

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H **Date:** 8/7/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: First Floor Hallway Work Area Between Rooms 1 - 16 - Floor Tile and Black Masti

	Work Area Location/Description	First Floor Hallway Work Area
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: John A. O'Neil **Date:** 8/7/2021

ECS Mid-Atlantic, LLC

Final Clearance Checklist

Project Number: 47:11652-H **Date:** 8/7/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: First Floor Hallway Work Area Between Rooms 1 - 16 - Floor Tile and Black Mastic

	Work Area Location/Description	First Floor Hallway Work Area
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	Floors	Satisfactory
	Walls	Satisfactory
	Ceiling	Satisfactory
	Windows	N/A
	Mechanical Equipment	N/A
	Ducts	N/A
	Pipes	N/A
	Lighting	N/A
	Other Surfaces	N/A
	Specified ACM Removed	Satisfactory
	Work Area Encapsulated	Satisfactory
	Negative Air Filtration Functioning	Satisfactory
	Waste Bags Removed	Satisfactory
	Final Clearance Air Sample Type	N/A
	Number of Samples Collected	0
	Sample Volume (liters)	0
	Work Area Acceptable	Yes

Notes: ECS will collect the final clearance TEM air samples on the next working shift.

ECS Technician: John A. O'Neil **Date:** 8/7/2021

Naomi Brooks Elementary School
600 Russell Road
Alexandria, VA 22301

Work Area Sketch

SCALE NTS
Project No. 47:11652-H
Date 08/07/21

Transmittal Page 7/12

Attachments



View of the 1st floor hallway work area following abatement activities

Figure 1



View of the 1st floor hallway work area following abatement activities

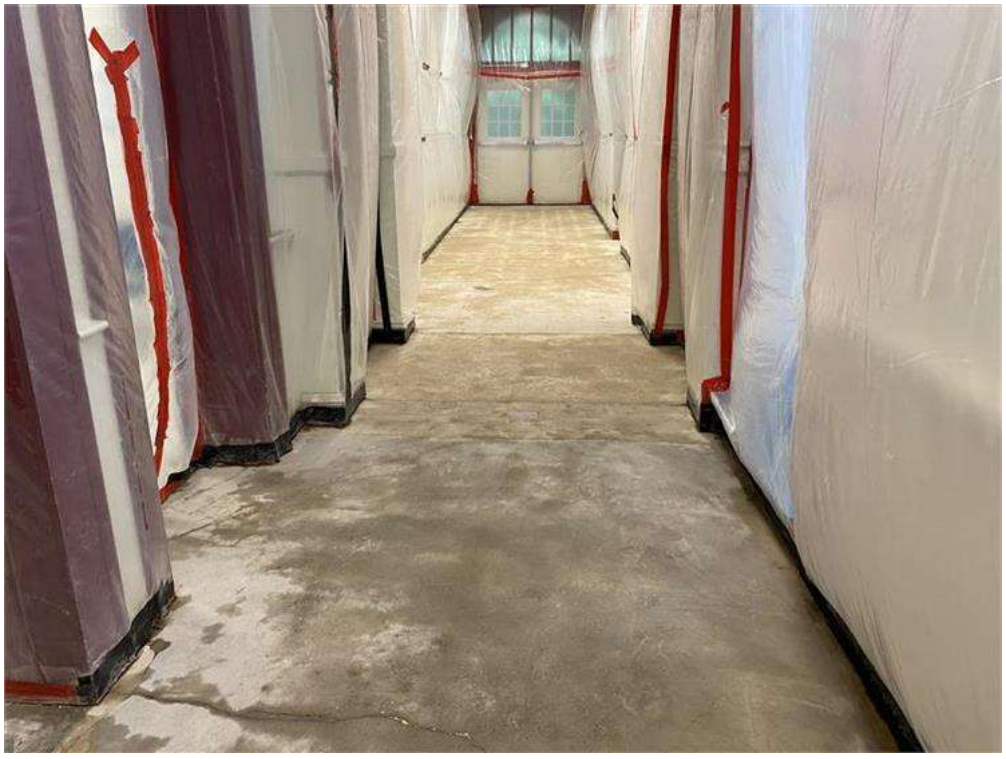
Figure 2

Attachments



View of the 1st floor hallway work area following abatement activities

Figure 3



View of the 1st floor hallway work area following abatement activities

Figure 4

Attachments



View of the 1st floor hallway work area following abatement activities

Figure 5



View of the 1st floor hallway work area following abatement activities

Figure 6

Attachments



View of the 1st floor hallway work area following abatement activities

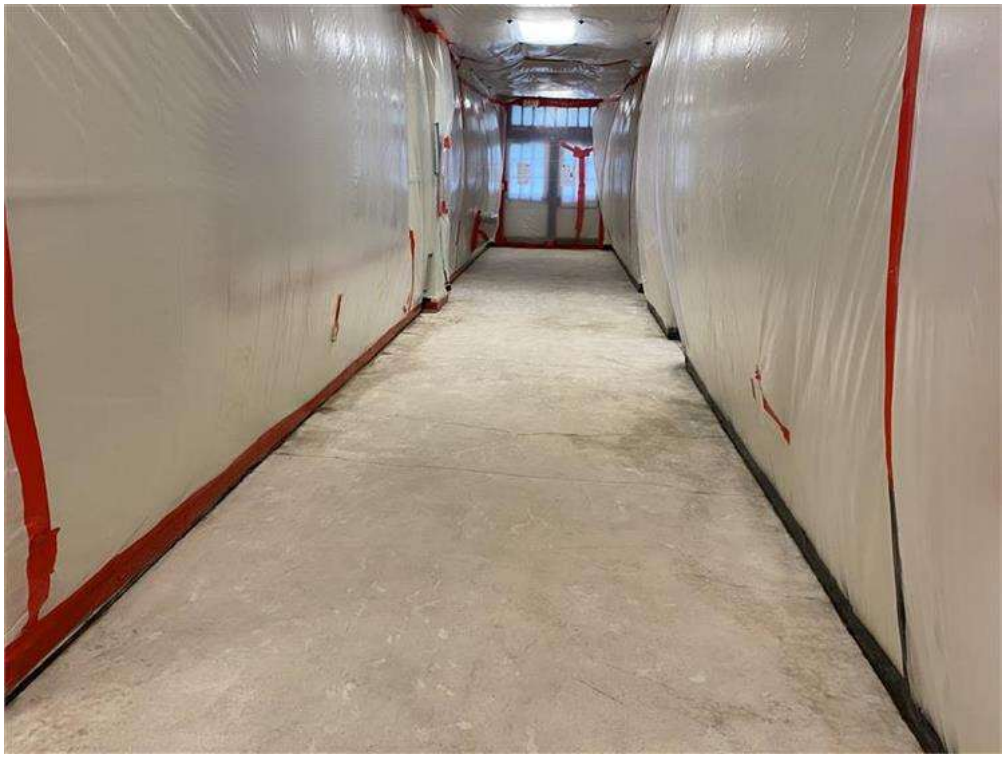
Figure 7



View of the 1st floor hallway work area following abatement activities

Figure 8

Attachments



View of the 1st floor hallway work area following abatement activities

Figure 9



View of the 1st floor hallway work area following abatement activities

Figure 10

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

August 11, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: John Finnigan

RE: **ACPS Naomi L Brooks ES Abatement Monitoring**
ECS Job # **47:11652-H**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X Field Reports **X** For your use **X** As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - Norman Wiebusch
Waco, Inc - Chris Lanham

ENCL: Field Report # 6 8/8/2021

Michael P. Hamill, CIH
Environmental Senior Project Manager

John A. O'Neil
Environmental Staff Project Manager

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4. *Incomplete or non-conforming work will be reported for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project	**ACPS Naomi L Brooks ES Abatement Monitoring**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Project No.	**47:11652-H**
Report No.	**6**
Day & Date	**Sunday 8/8/2021**
Weather	**68 °/ Sunny**
On-Site Time	**3.75**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**3.75**
Re Obs Time	**0.00**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Time of	Arrival	Departure
Chargeable Items				**6:15A**	**10:00A**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived onsite, as requested, to perform final clearance air sampling in the 1st floor hallway work area. A floor plan for final clearance air sample locations is attached to this report.

After waiting for the encapsulant to dry from previous workday, aggressive air sampling was performed. Five (5) TEM air samples were started within the regulated work area and five (5) TEM air samples were started outside the work area. The sampling pumps were calibrated using a rotameter to 8.0 liters per minute. One field blank sample was opened within the work area for 30 seconds. One field blank sample was opened outside the work area for 30 seconds.

Between 9:46 am and 9:50 am, the sampling pumps were checked using a rotameter after the air within and outside the regulated work area was sampled using TEM cassettes for 150 minutes at 8.0 liters per minute. The sampling cassettes, including the two field blanks and one sealed blank were labeled with unique identification and transported to EMSL Analytical, Inc. Laboratory located in Beltsville, Maryland for analysis. A copy of the chain of custody has been attached.

The US EPA and Commonwealth of Virginia maximum allowable airborne asbestos concentration from within the work area is 70 structures per millimeter squared (s/mm2). In order to be deemed acceptable, the average of the interior samples analyzed must have asbestos concentrations of 70 s/mm2 or less. EMSL Analytical, INC. informed ECS that the analytical results of the TEM final clearance air samples collected from the first floor work area found the airborne asbestos fiber concentrations to be less than the maximum allowable concentration. The client and abatement contractor supervisor, Ingrid Chan, were informed of the results. A copy of the laboratory report is attached.

By Suhel Shafaat 1825

EMSL Analytical, Inc.

10768 Baltimore Avenue Beltsville, MD 20705

Tel/Fax: (301) 937-5700 / (301) 937-5701

http://www.EMSL.com / beltsvillelab@emsl.com

EMSL Order: 192107577
Customer ID: ECMA78
Customer PO:
Project ID:

Attention: JOHN ONEIL
ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151
Project: ACPS Naomi Brooks ES / 47:11652

Phone: (703) 471-8400
Fax: (703) 471-8400
Received Date: 08/09/2021 08:30 AM
Analysis Date: 08/09/2021
Collected Date: 08/09/2021

Test Report: Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM) Performed by EPA 40 CFR Part 763 Appendix A to Subpart E

Sample	Location	Volume (Liters)	Area Analyzed (mm²)	Non Asb	Asbestos Type(s)	#Structures ≥0.5µ < 5µ	#Structures ≥5µ	Analytical Sensitivity (S/cc)	Asbestos Concentration (S/mm²)	Asbestos Concentration (S/cc)
08082101SS	Final Clearance- Inside Work Area, 1st Fl. Hallway Work Area	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
192107577-0001										
08082102SS	Final Clearance- Inside Work Area, 1st Fl. Hallway Work Area	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
192107577-0002										
08082103SS	Final Clearance- Inside Work Area, 1st Fl. Hallway Work Area	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
192107577-0003										
08082104SS	Final Clearance- Inside Work Area, 1st Fl. Hallway Work Area	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
192107577-0004										
08082105SS	Final Clearance- Inside Work Area, 1st Fl. Hallway Work Area	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
192107577-0005										

Analyst(s)

Joe Centifonti (5)

Joe Centifonti, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. Results reported in structures/cm3 are not covered by the laboratory's NVLAP accreditation. Measurement of uncertainty available upon request.

Samples analyzed by EMSL Analytical, Inc. Beltsville, MD NVLAP Lab Code 200293-0

Initial report from: 08/09/2021 18:06 PM

OrderID: 192107577

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number (Lab Use Only): 192107577

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Company Name: ECS Mid-Atlantic, LLC		EMSL Customer ID:	
Street: 14026 Thunderbolt Place, Suite 100		City: Chantilly	State/Province: VA
Zip/Postal Code: 20151	Country: USA	Telephone #: 571-510-5595	Fax #:
Report To (Name): John O'Neal		Please Provide Results: ☐ Fax ☒ Email	
Email Address: JONeil@ecslimited.com,		Purchase Order:	
Project Name/Number: ALPS Naomi Brooks ES/41:11552		EMSL Project ID (Internal Use Only):	
U.S. State Samples Taken: VA		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 (fnable 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 (<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: Suhel Shafaat | Samplers Signature:

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
0808210155	Final Clearance - Inside Work Area, 1st Floor Hallway Work Area	1200 Liters	8/8/21
02			
03			
04			
05			

Client Sample # (s): 0808210155 - 0808211355 Total # of Samples: 13

Relinquished (Client): Date: 8/8/21 Time:

Received (Lab): Date: 8-9-21 Time: 8:30

Comments/Special Instructions: Only analyze inside work area samples. Aggressive sampling Performed.

EMSL ANALYTICAL, INC.
LABORATORY / PRODUCTS / TRAINING

Asbestos Chain of Custody

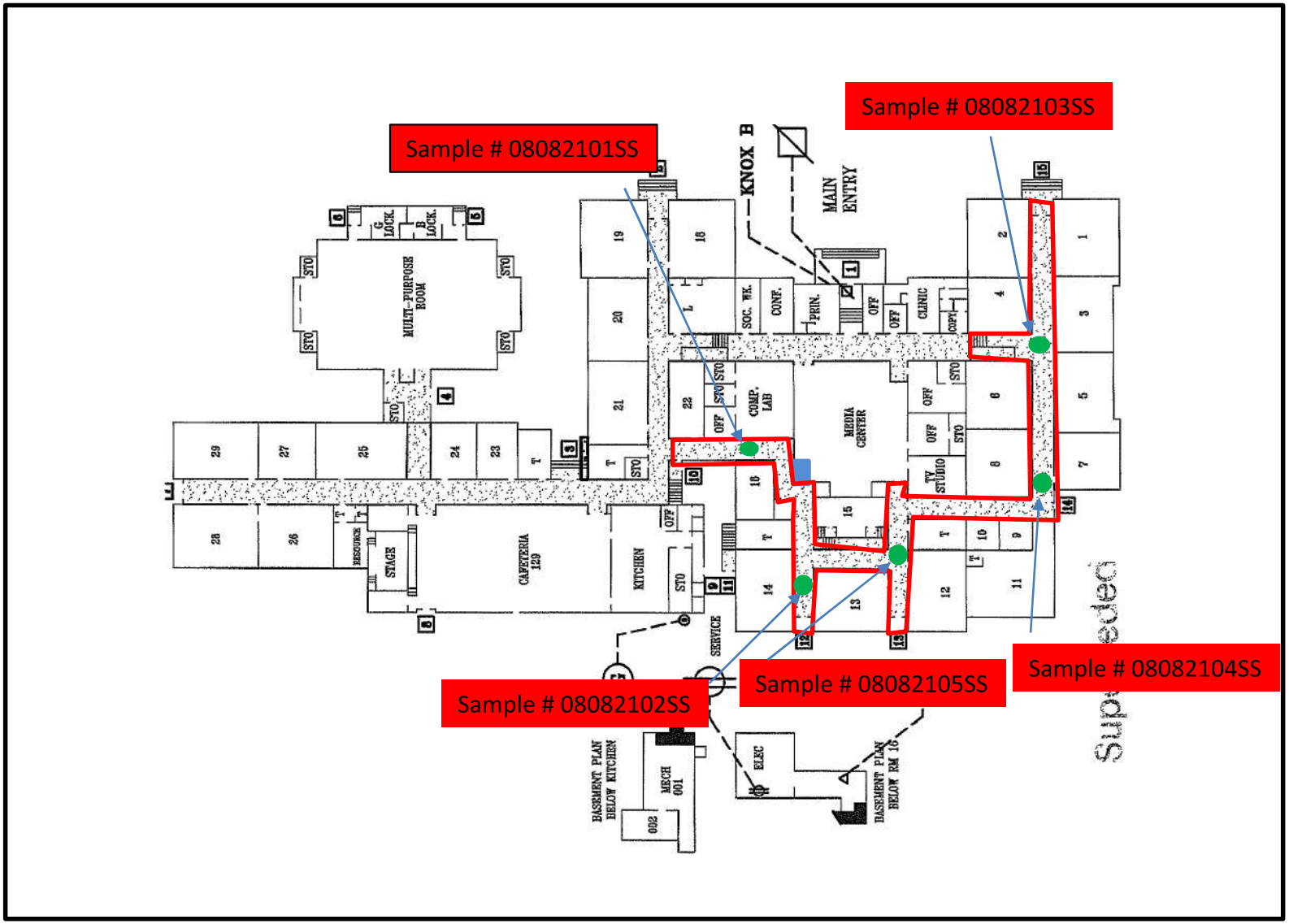
EMSL Order Number *(Lab Use Only).*

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
0808210655	Final Clearance - Duplex Work Area 1st Floor Hallway Work Area	1200 Liters	8/8/21
07			
08			
09			
10			
11	Field Blank (opened 30secs before by entrance)	N/A	
12	Field Blank (opened 30secs before in ambient)		
13	Sealed Blank (Not Opened)		

*Comments/Special Instructions:



Legend

= Regulated Work Area

= Decontamination Unit

= FC-IWA Air Sample Location

Naomi Brooks Elementary School
600 Russell Road
Alexandria, VA 22301

Work Area Sketch

SCALE NTS

Project No. 47:11652-H

Date 08/08/21

ASBESTOS ABATEMENT MONITORING SUMMARY REPORT

NAOMI L BROOKS ELEMENTARY SCHOOL

600 RUSSEL ROAD
ALEXANDRIA, VIRGINIA 22301

ECS PROJECT NO. 47:11652-H1/H2

FOR: ALEXANDRIA CITY PUBLIC SCHOOLS

JANUARY 25, 2022

January 25, 2022

Mr. Norman Wiebusch
Alexandria City Public Schools
1340 Braddock Place
Suite 620
Alexandria, Virginia 22301

ECS Project No. 47:11652-H1/H2

Reference: Asbestos Abatement Monitoring Summary Report, Naomi L Brooks Elementary School, 600 Russel Road, Alexandria, Virginia

Dear Mr. Wiebusch:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide Alexandria City Public Schools with this summary report of the asbestos abatement work performed during the above-referenced project. ECS performed visual assessments, evaluations, and air monitoring and sampling during the removal of asbestos-containing materials (ACMs). This report includes a project description, a summary of the asbestos abatement activities observed by ECS, and a summary of the work conducted by ECS including laboratory results.

ECS appreciates this opportunity to provide Alexandria City Public Schools with our services. If we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

ECS Mid-Atlantic, LLC

Jennifer Turner
Environmental Scientist
jturner@ecscapitolservices.com
703-471-8400

Michael Hamill, CIH, CSP
Environmental Senior Project Manager
MHamill@ecslimited.com
703-471-8400

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1.0 PROJECT DESCRIPTION

The asbestos abatement work was performed by Waco, Inc, in general from December 20 through December 26 and included the removal of the following asbestos-containing materials (ACMs):

- Floor tiles and associated mastic from the 1st floor corridor

2.0 ECS SCOPE OF WORK

ECS was tasked with performing visual assessments and evaluations, monitoring and air sampling during and after the removal of the above-identified asbestos-containing materials (ACMs) within the above-referenced subject building.

3.0 ASBESTOS ABATEMENT ACTIVITIES

3.1 Asbestos Removal

Asbestos abatement was performed by Waco, Inc within regulated work areas. The regulated work areas within the subject building consisted of enclosures placed under negative pressure constructed of 6-mil polyethylene sheeting.

No other materials or areas of the building were included in this asbestos abatement. Please note that the above-referenced asbestos-containing materials (ACMs), other identified ACMs, and/or assumed ACMs are most likely present in other areas of the building.

3.2 Daily Air Sampling

During the asbestos abatement project, ECS collected and analyzed air samples using Phase Contrast Microscopy (PCM) in general accordance with applicable federal and Virginia regulations. Samples were collected during the project outside the work areas to monitor airborne fiber concentrations. In general, the air sampling found the engineering controls (i.e., polyethylene sheeting, negative air pressure, High Efficiency Particulate Air (HEPA) filtration adequate to keep fiber concentrations on air samples collected outside the regulated work areas below the Virginia PCM re-occupancy limit of <0.01 fibers per cubic centimeter (f/cc). Air sample results are included within the technicians' daily field notes.

3.3 ECS Observations

ECS reviewed the asbestos credentials of the abatement workers. The credential documentation reviewed was noted to be current at the time presented to ECS.

ECS observed abatement workers utilizing personal protective equipment deemed necessary for asbestos abatement work by applicable OSHA and Virginia regulations (respirators, disposable protective clothing, eye protection, hard hats, gloves, etc.).

ECS observed the abatement contractor seal the asbestos waste in 6-mil waste bags prior to removal from the work area for disposal. ECS observed that the waste was collected by the abatement contractor in sealed shipping containers for transport to an EPA accredited landfill authorized to accept asbestos waste. ECS recommends that the property owner obtain a copy of the waste transport and disposal manifests from the abatement contractor, if not already provided.

4.0 FINAL CLEARANCE AIR SAMPLING

After Waco, Inc had removed the specified asbestos-containing materials (ACMs) and related waste from the work areas, ECS performed final clearance visual assessments to survey each work area and evaluate if the ACMs had been removed and if dust and/or debris remained in the work areas. Following the completion of the final clearance visual assessments, ECS reported the results to Waco, Inc .

Final clearance air samples were collected from work areas in accordance with aggressive sampling protocol described in Unit III.B.7.d of 40 CFR 763 Subpart E Appendix A and analyzed via Transmission Electron Microscopy (TEM) in accordance with federal and Virginia regulations. The results of the TEM final clearance air samples collected from each work area were found to be below the Virginia re-occupancy limit of 70 structures per square millimeter (70 s/mm^2).

5.0 CLOSING

Copies of ECS's daily monitoring field reports are enclosed along with copies of laboratory reports. If we can be of further assistance to you, please do not hesitate to contact us at (703) 471-8400.

The results of the above referenced abatement activities should be added to this school building's AHERA management plan and this summary letter should be included in the building's management plan for reference.

6.0 LIMITATIONS

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

Our recommendations are in part based on federal, state, and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies, any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of

services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

The client agrees to notify the appropriate local, state, or federal public agencies as required by law, or otherwise to disclose, in a timely manner, information that may be necessary to prevent any danger to public health, safety, or the environment.

Appendix I: Daily Field Reports with PCM Air Sample Results

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

December 26, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: Mr. Norman Wiebusch

RE: **ACPS Naomi L Brooks ES - E/W Corridor Abatement**
ECS Job # **47:11652-H1**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X	Field Reports	**X**	For your use	**X**	As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - John Finnigan
Waco, Inc - Chris Lanham

ENCL: Field Report # 1 12/20/2021

Michael P. Hamill, CIH, CSP
Environmental Senior Project Manager

Jennifer Turner
Environmental Scientist

Disclaimer

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2. *The information in this report relates only to the activities performed on the report date.*
3. *Where appropriate, this report includes statements as to compliance with applicable project drawings, and specifications for the activities, performed on this report date.*
4. *Incomplete or non-conforming work will be reported for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project No.	**47:11652-H1**
Report No.	**1**
Day & Date	**Monday 12/20/2021**
Weather	**42 °/ Sunny**
On-Site Time	**3.25**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**3.25**
Re Obs Time	**0.00**

Project	**ACPS Naomi L Brooks ES - E/W Corridor**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Times of	Arrival	Departure
Chargeable Items				**6:00A**	**7:00A**
				11:15A	**1:30P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The materials to be removed today are asbestos-containing asbestos-containing floor tile and mastic in the 1st floor corridor work area.

Prior to starting the removal of the specified material, the abatement permit was reviewed. The abatement contractor was notified the permit was on-site and the removal of the specified materials could begin.

Prior to starting the removal of the specified material, the abatement contractor employees were asked to provide their asbestos abatement licenses for review. No workers were found to be without valid asbestos abatement licenses.

1ST FLOOR CORRIDOR WORK AREA MONITORING

The abatement contractor requested a pre-abatement survey of the regulated work area. The Pre-Abatement Checklist was completed and is attached to this report. Please refer to the attached drawing for Work Area and Phase Contrast Microscopy (PCM) air sample locations.

Between 6:50 am-6:51 am, PCM air samples were started inside and outside the work area at decontamination unit entry. The sampling pumps were calibrated using a rotameter to 1.5 liters per minute.

ECS observed the abatement workers removing floor tiles and black mastic using motorized floor scraper and hand tools. The abatement contractor workers were placing the removed floor tiles inside waste drums.

Between 1:29-1:30 pm, the sampling pump was checked using a rotameter. The flow rate was 1.5 liters per minute. The PCM air samples were stopped and gathered for analysis.

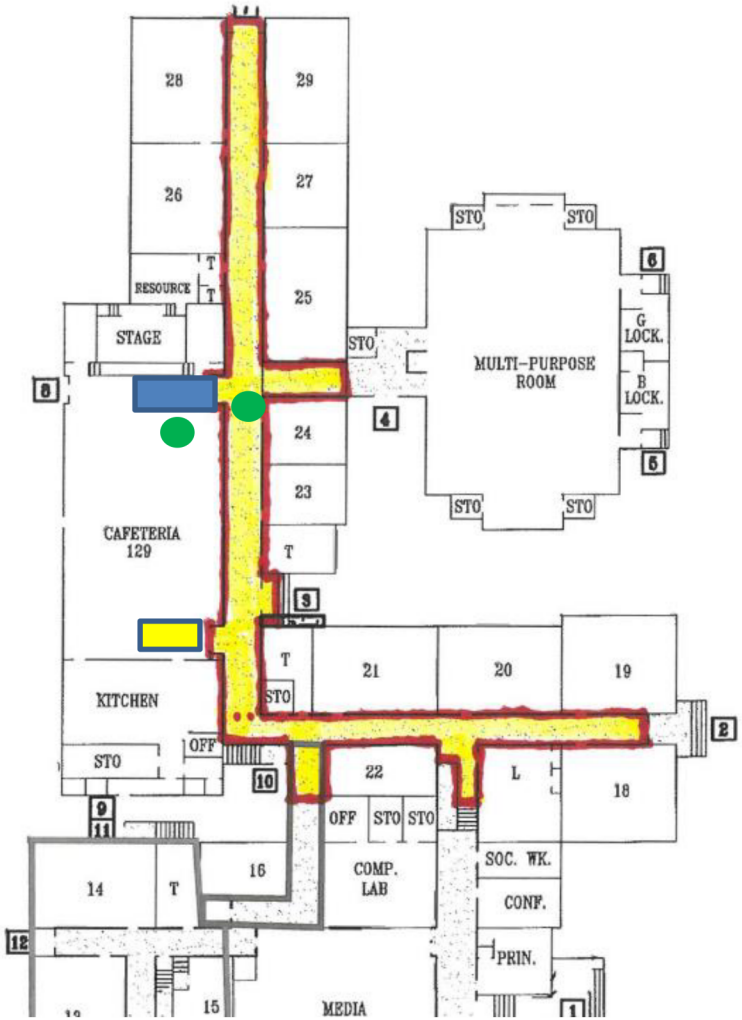
By JP Nuique 1625

GENERAL

The regulated work areas were surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

ECS observed the abatement contractor placing the specified asbestos-containing materials in waste drums which were sealed in general accordance with applicable regulations. Waste drums were placed inside the work area.

The undersigned prepared and analyzed the PCM air sample cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.



Work Area

Decontamination Unit

Sample Location

Waste Decontamination Unit

Naomi Brooks
600 Russel Rd Alexandria VA 22301

WORK AREA SKETCH

Scale: NTS

Project No.
47:11652- F1

12/20/21

ECS Mid-Atlantic, LLC

Pre-Abatement Work Area Checklist

Project Number: 47:11652-H1 **Date:** 12/20/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: 1st floor corridor

	Work Area Location/Description	1st floor corridor
Administrative	Training Certificates/Licenses	Satisfactory
	Permits	Satisfactory
	EPA/State/Local Notification	Satisfactory
Work Area	Public Access Restricted	Satisfactory
	Warning Signs/Tape Posted	Satisfactory
Negative Air Filtration	Number of Units	5
	Pre-Filters In-Use/Available	Satisfactory
	Exhausted from Work Area	Satisfactory
	Pressure Differential Monometer Operating	Satisfactory
Equipment	HEPA Vacuum Available	Satisfactory
	Amended Water Sprayers	Satisfactory
Decontamination Enclosure	Clean Room	Satisfactory
	Shower Water Available	Satisfactory
	Waste Water Filtration In-Use	Satisfactory
	Disposable Towels	Satisfactory
	Soap	Satisfactory
	Equipment Room	Satisfactory
Personal Protective Equipment	Type of Respirator	P100
	Type of Filters Used	P100
	Disposable Protective Clothing	Satisfactory
	Work Area Acceptable	Yes

Notes:

ECS Technician: Jennifer Turner **Date:** 12/20/2021

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H1
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 12/20/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
12202101GN	IWA,1st floor corridor	6:50 AM	1:29 PM	1.5	1.5	1.5	399	598.5	8.5	100	0.007
12202102GN	OWA,1st floor corridor work area at decontamination unit by the cafeteria	6:51 AM	1:30 PM	1.5	1.5	1.5	399	598.5	2.0	100	0.002
122021FB01GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
122021FB02GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The US EPA and Commonwealth of Virginia re-occupancy limit is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results of the PCM air samples collected from inside and outside the work area were reported to be less than the maximum allowable limits set by the applicable regulations, which meets the project requirements.

ECS Technician: JP Nuique **Date:** 12/20/2021

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H1 **Date:** 12/20/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: 1st floor corridor

	Work Area Location/Description	1st floor corridor
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: Jennifer Turner **Date:** 12/20/2021

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

December 26, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: Mr. Norman Wiebusch

RE: **ACPS Naomi L Brooks ES - N/S Corridor Abatement**
ECS Job # **47:11652-H2**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X	Field Reports	**X**	For your use	**X**	As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - John Finnigan
Waco, Inc - Chris Lanham

ENCL: Field Report # 1 12/21/2021

Michael P. Hamill, CIH, CSP
Environmental Senior Project Manager

Jennifer Turner
Environmental Scientist

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ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project	**ACPS Naomi L Brooks ES - N/S Corridor**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Project No.	**47:11652-H2**
Report No.	**1**
Day & Date	**Tuesday 12/21/2021**
Weather	**44 °/ Cloudy**
On-Site Time	**1.25**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**1.25**
Re Obs Time	**0.00**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Times of	Arrival	Departure
Chargeable Items				**6:00A**	**7:00A**
				1:30P	**1:45P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The materials to be removed today are asbestos-containing asbestos-containing floor tile and mastic in the 1st floor corridor work area.

1ST FLOOR CORRIDOR WORK AREA MONITORING

Please refer to the attached drawing for Work Area and Phase Contrast Microscopy (PCM) air sample locations.

Between 6:20 am-6:21 am, PCM air samples were started outside the work area at decontamination unit entry and at the waste decontamination unit. The sampling pumps were calibrated using a rotameter to 1.5 liters per minute.

ECS observed the abatement workers removing floor tiles on the edges and black floor mastic using buffer and hand tools.

Between 1:44-1:45 pm, the sampling pump was checked using a rotameter. The flow rate was 1.5 liters per minute. The PCM air samples were stopped and gathered for analysis.

GENERAL

The regulated work areas were surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

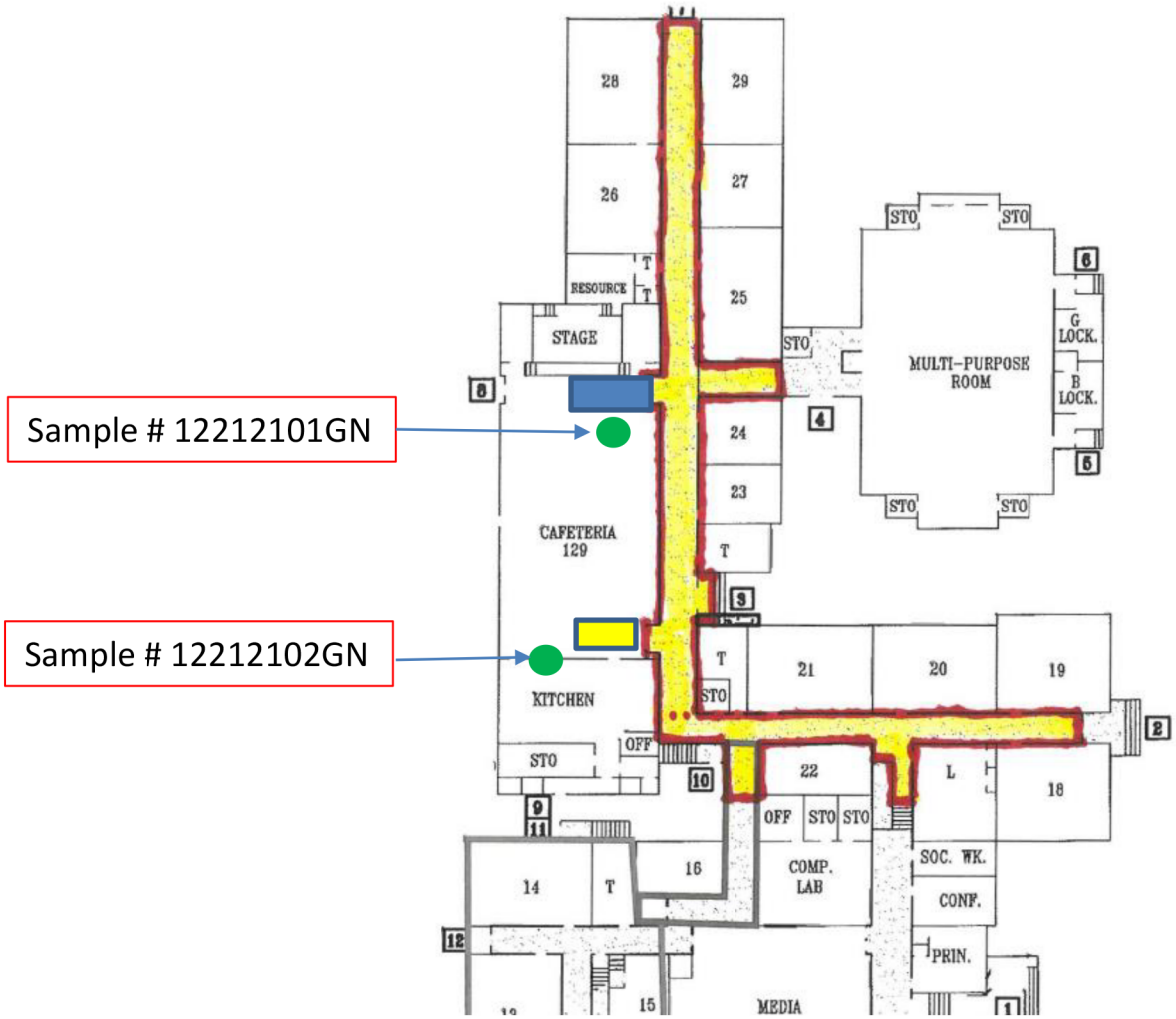
ECS observed the abatement contractor placing the specified asbestos-containing materials in waste drums which were sealed in general accordance with applicable regulations. Waste drums were placed in

waste hauling container.

The undersigned prepared and analyzed the PCM air sample cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.

Naomi Brooks
600 Russel Rd Alexandria VA 22301

WORK AREA SKETCH



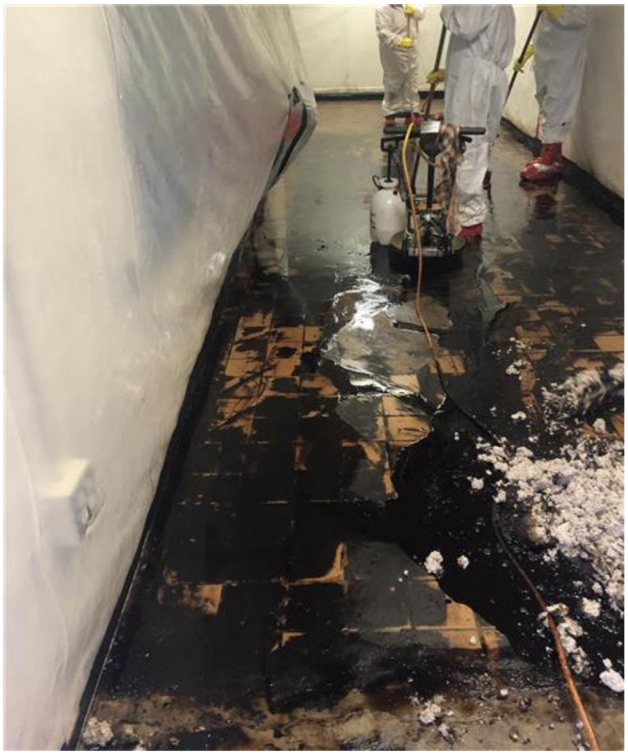
Work Area
Decontamination Unit
Sample Location
Waste Decontamination Unit

Scale: NTS

Project No.

12/21/21

Attachments



View of abatement activities within the 1st floor hallway work area

Figure 1

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H2
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 12/21/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
12212101GN	OWA,1st floor hallway work area at decontamination unit entry	6:20 AM	1:44 PM	1.5	1.5	1.5	444	666.0	3.0	100	0.002
12212102GN	OWA,1st floor hallway work area at waste decontamination unit	6:21 AM	1:45 PM	1.5	1.5	1.5	444	666.0	1.0	100	0.001
122121FB01GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
122121FB02GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The US EPA and Commonwealth of Virginia re-occupancy limit is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results of the PCM air samples collected from inside and outside the work area were reported to be less than the maximum allowable limits set by the applicable regulations, which meets the project requirements.

ECS Technician: JP Nuique **Date:** 12/21/2021

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H2 **Date:** 12/22/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: 1st floor hallway

	Work Area Location/Description	1st floor hallway
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: Jennifer Turner **Date:** 12/22/2021

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

December 26, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: Mr. Norman Wiebusch

RE: **ACPS Naomi L Brooks ES - N/S Corridor Abatement**
ECS Job # **47:11652-H2**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X	Field Reports	**X**	For your use	**X**	As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - John Finnigan
Waco, Inc - Chris Lanham

ENCL: Field Report # 2 12/22/2021

Michael P. Hamill, CIH, CSP
Environmental Senior Project Manager

Jennifer Turner
Environmental Scientist

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ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project No.	**47:11652-H2**
Report No.	**2**
Day & Date	**Wednesday 12/22/2021**
Weather	**45 °/ Sunny**
On-Site Time	**0.75**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**0.75**
Re Obs Time	**0.00**

Project	**ACPS Naomi L Brooks ES - N/S Corridor**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Times of	Arrival	Departure
Chargeable Items				**6:00A**	**6:30A**
				2:00P	**2:15P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The materials to be removed today are asbestos-containing asbestos-containing floor mastic in the 1st floor corridor work area.

1ST FLOOR CORRIDOR WORK AREA MONITORING

Please refer to the attached drawing for Work Area and Phase Contrast Microscopy (PCM) air sample locations.

Between 6:29 am-6:30 am, PCM air samples were started outside the work area at decontamination unit entry and at the waste decontamination unit. The sampling pumps were calibrated using a rotameter to 1.5 liters per minute.

ECS observed the abatement workers were removing black floor mastic using buffer and hand tools.

Between 2:10-2:11 pm, the sampling pump was checked using a rotameter. The flow rate was 1.5 liters per minute. The PCM air samples were stopped and gathered for analysis.

GENERAL

The regulated work areas were surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

ECS observed the abatement contractor placing the specified asbestos-containing materials in waste drums which were sealed in general accordance with applicable regulations. Waste drums were placed in waste hauling container.

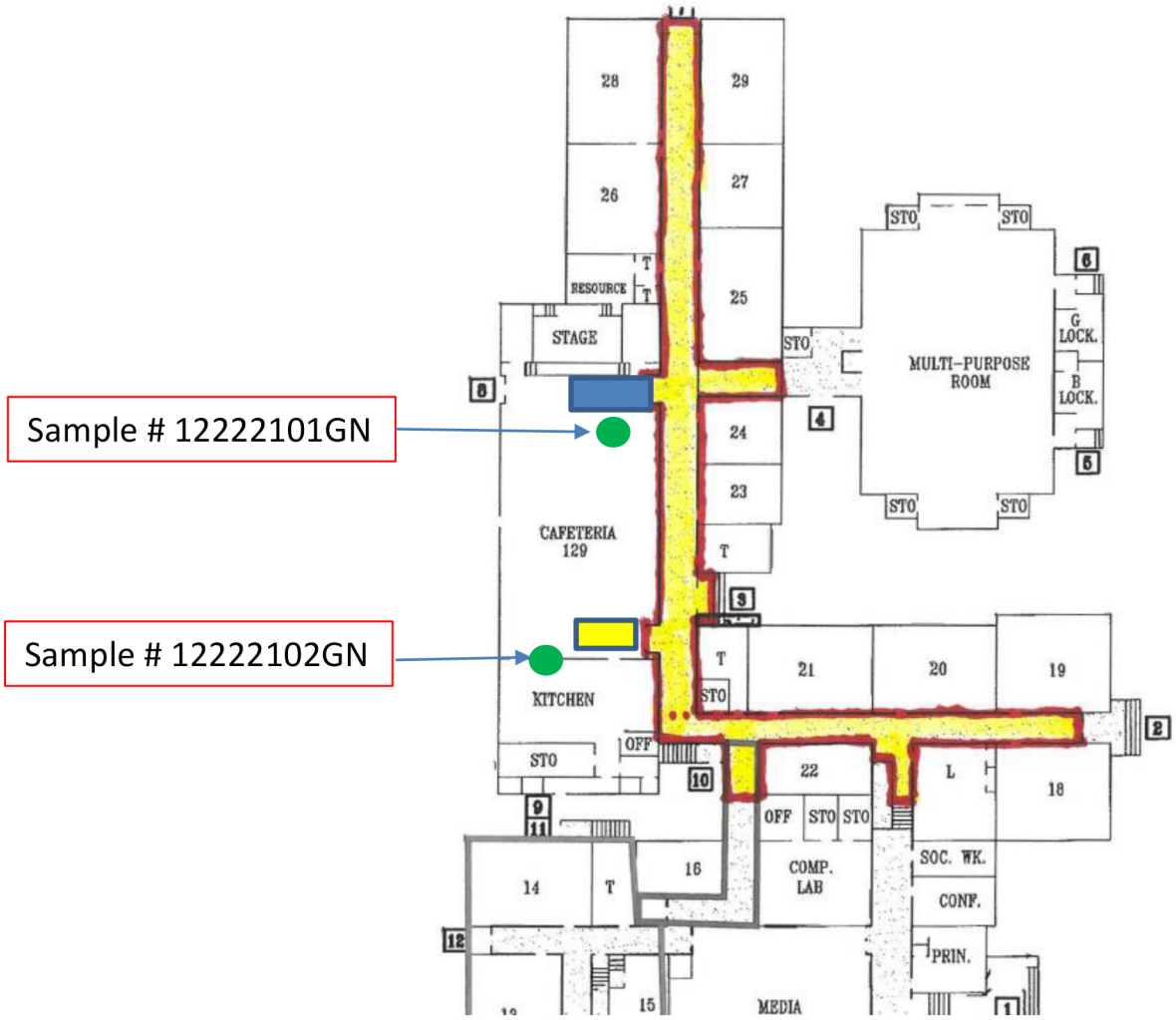
By JP Nuique 1625

The undersigned prepared and analyzed the PCM air sample cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.

By JP Nuique 1625

Naomi Brooks
600 Russel Rd Alexandria VA 22301

WORK AREA SKETCH



Work Area
Decontamination Unit
Sample Location
Waste Decontamination Unit

Scale: NTS

Project No.

12/22/21

Attachments



View of abatement activities within the 1st floor hallway work area

Figure 1



View of abatement activities within the 1st floor hallway work area

Figure 2

Attachments



View of abatement activities within the 1st floor hallway work area

Figure 3



View of abatement activities within the 1st floor hallway work area

Figure 4

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H2 **Date:** 12/23/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: 1st floor corridor

	Work Area Location/Description	1st floor corridor
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: Jennifer Turner **Date:** 12/23/2021

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H2
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 12/22/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
122121FB01GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
122121FB02GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
12222101GN	OWA,1st floor corridor work area at decontamination unit entry by the cafeteria	6:29 AM	2:10 PM	1.5	1.5	1.5	461	691.5	2.0	100	0.001
12222102GN	OWA,1st floor corridor work area at waste decontamination unit by the cafeteria	6:30 AM	2:11 PM	1.5	1.5	1.5	461	691.5	1.0	100	0.001

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The EPA and Commonwealth of Virginia PCM Re-occupancy limit is less than or equal to 0.01 fibers per cubic centimeter. The results of the samples collected were below the re-occupancy limit.

ECS Technician: JP Nuique **Date:** 12/22/2021

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

December 27, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: Mr. Norman Wiebusch

RE: **ACPS Naomi L Brooks ES - N/S Corridor Abatement**
ECS Job # **47:11652-H2**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X Field Reports **X** For your use **X** As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - John Finnigan
Waco, Inc - Chris Lanham

ENCL: Field Report # 3 12/23/2021

Michael P. Hamill, CIH, CSP
Environmental Senior Project Manager

Jennifer Turner
Environmental Scientist

Disclaimer

1. *This report (and any attachments) shall not be reproduced except in full without prior written approval of ECS.*
2. *The information in this report relates only to the activities performed on the report date.*
3. *Where appropriate, this report includes statements as to compliance with applicable project drawings, and specifications for the activities, performed on this report date.*
4. *Incomplete or non-conforming work will be reported for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project	**ACPS Naomi L Brooks ES - N/S Corridor**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Project No.	**47:11652-H2**
Report No.	**3**
Day & Date	**Thursday 12/23/2021**
Weather	**44 °/ Sunny**
On-Site Time	**1.50**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**1.50**
Re Obs Time	**0.00**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Times of	Arrival	Departure
Chargeable Items				**6:00A**	**6:45A**
				11:45A	**12:30P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The materials to be removed today are asbestos-containing floor mastic in the 1st floor corridor work area.

1ST FLOOR CORRIDOR WORK AREA MONITORING

Please refer to the attached drawing for Work Area and Phase Contrast Microscopy (PCM) air sample locations.

Between 6:32 am-6:33 am, PCM air samples were started outside the work area at decontamination unit entry and at the waste decontamination unit. The sampling pumps were calibrated using a rotameter to 1.5 liters per minute.

ECS observed the abatement workers were removing black floor mastic using buffer and hand tools.

Between 12:25-12:26 pm, the sampling pump was checked using a rotameter. The flow rate was 1.5 liters per minute. The PCM air samples were stopped and gathered for analysis.

The abatement contractor stated the specified materials have been removed from the regulated work area and requested a visual survey to confirm compliance. The Final Clearance Visual Survey Checklist was completed and is attached to this report.

Following the successful completion of the final clearance visual survey, the abatement contractor applied an encapsulant to surfaces within the regulated work area.

ECS will collect the final clearance TEM air samples on the next working days.

By JP Nuique 1625

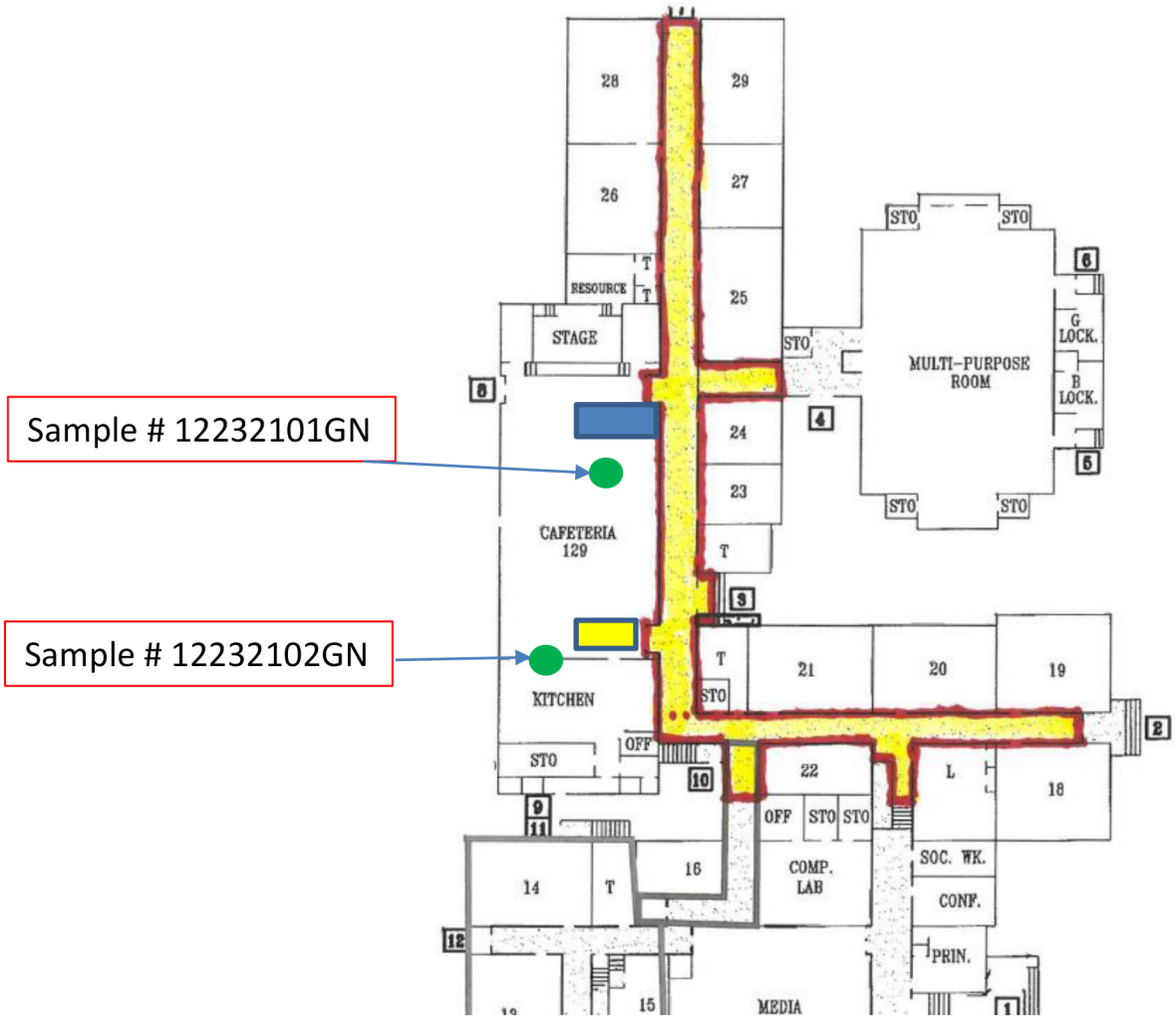
GENERAL

The regulated work areas were surveyed to evaluate general compliance with applicable regulations. The Daily Work Area Survey Checklist was completed and is attached to this report.

ECS observed the abatement contractor placing the specified asbestos-containing materials in waste drums which were sealed in general accordance with applicable regulations. Waste drums were placed in waste hauling container.

The undersigned prepared and analyzed the PCM air sample cassettes for total fiber concentration in general accordance with NIOSH Method 7400. Results were recorded on the PCM Chain of Custody which is attached.

The US EPA and Commonwealth of Virginia re-occupancy limit is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results of the PCM air samples collected from outside the work area were reported to be less than the maximum allowable limits set by the applicable regulations.



Work Area
Decontamination Unit
Sample Location
Waste Decontamination Unit

Naomi Brooks
600 Russel Rd Alexandria VA 22301

WORK AREA SKETCH

Scale: NTS

Project No.
47:11652-H2

12/23/21

Attachments



View of the 1st floor hallway work area following abatement activities

Figure 1



View of the 1st floor hallway work area following abatement activities

Figure 2

Attachments



View of the 1st floor hallway work area following abatement activities

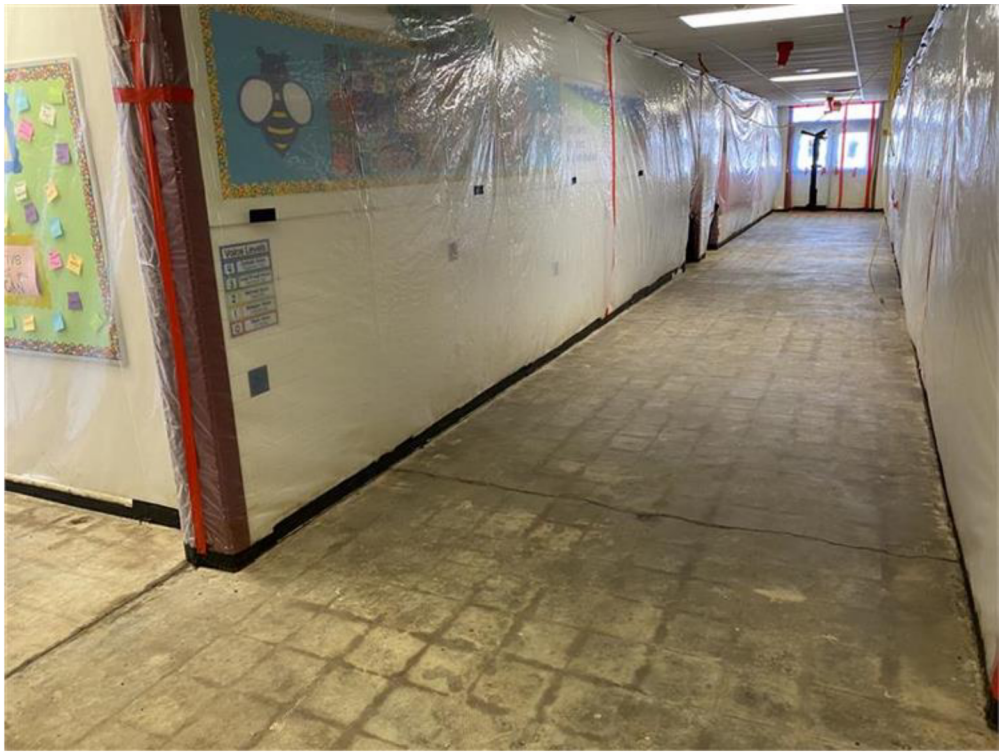
Figure 3



View of the 1st floor hallway work area following abatement activities

Figure 4

Attachments



View of the 1st floor hallway work area following abatement activities

Figure 5



View of the 1st floor hallway work area following abatement activities

Figure 6

Attachments



View of the 1st floor hallway work area following abatement activities

Figure 7

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet

WORK AREA SAMPLES

Project Number: 47:11652-H2
Project Address: 600 Russell Rd
Alexandria, VA-22301

Date: 12/23/2021
Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (lpm)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
122232101GN	OWA,1st floor hallway work area at decontamination unit entry by the cafeteria	6:32 AM	12:25 PM	1.5	1.5	1.5	353	529.5	1.0	100	0.001
122232102GN	OWA,1st floor hallway work area at waste decontamination unit by the cafeteria	6:33 AM	12:26 PM	1.5	1.5	1.5	353	529.5	0.0	100	0.000
1222321FB01GN	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
1222321FB02GN	Field Blank	N/A	N/A	N/A	N/A	N/A			0.0	100	NFD

Notes: NFD = None Fibers Detected OWA = Outside Work Area IWA = Inside Work Area

Notes: The US EPA and Commonwealth of Virginia re-occupancy limit is less than or equal to 0.01 fibers per cubic centimeter of air (f/cc). The analytical results of the PCM air samples collected from outside the work area were reported to be less than the maximum allowable limits set by the applicable regulations.

ECS Technician: JP Nuique **Date:** 12/23/2021

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 47:11652-H2 **Date:** 12/24/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: 1st floor hallway

	Work Area Location/Description	1st floor hallway
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	2
	Number of PCM Blank Samples	1
	Work Area Acceptable	Yes

Notes:

ECS Technician: Jennifer Turner **Date:** 12/24/2021

ECS Mid-Atlantic, LLC

Final Clearance Checklist

Project Number: 47:11652-H2 **Date:** 12/24/2021

Project Address: 600 Russell Rd
Alexandria, VA-22301

Work Area Location/Description: 1st floor hallway

	Work Area Location/Description	1st floor hallway
Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	Floors	Satisfactory
	Walls	Satisfactory
	Ceiling	Satisfactory
	Windows	N/A
	Mechanical Equipment	N/A
	Ducts	N/A
	Pipes	N/A
	Lighting	Satisfactory
	Other Surfaces	N/A
	Specified ACM Removed	Satisfactory
	Work Area Encapsulated	Satisfactory
	Negative Air Filtration Functioning	Satisfactory
	Waste Bags Removed	Satisfactory
	Final Clearance Air Sample Type	N/A
	Number of Samples Collected	0
	Sample Volume (liters)	0
	Work Area Acceptable	Yes

Notes: ECS will collect the final clearance TEM air samples on the next working shift.

ECS Technician: Jennifer Turner **Date:** 12/24/2021

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
7034718400
7038345527

LETTER OF TRANSMITTAL

December 30, 2021

Alexandria City Public Schools
1340 Braddock Place Suite 620
Alexandria, VA 22314

ATTN: Mr. Norman Wiebusch

RE: **ACPS Naomi L Brooks ES - N/S Corridor Abatement**
ECS Job # **47:11652-H2**

Permits:
Location: **600 Russell Rd**
Alexandria, VA 22301

X	Field Reports	**X**	For your use	**X**	As requested

CC: Alexandria City Public Schools - John Contreras
Alexandria City Public Schools - John Finnigan
Waco, Inc - Chris Lanham

ENCL: Field Report # 4 12/26/2021

Michael P. Hamill, CIH, CSP
Environmental Senior Project Manager

Jennifer Turner
Environmental Scientist

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4. *Incomplete or non-conforming work will be reported for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project No.	**47:11652-H2**
Report No.	**4**
Day & Date	**Sunday 12/26/2021**
Weather	**55 °/ Sunny**
On-Site Time	**3.25**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**3.25**
Re Obs Time	**0.00**

Project	**ACPS Naomi L Brooks ES - N/S Corridor**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools**
Contractor	**None Listed**

Remarks

Trip Charges*	Tolls/Parking*	Mileage*	Time of	Arrival	Departure
Chargeable Items				**7:15A**	**10:30A**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform final clearance TEM air samples in the 1st floor corridor work area. The materials to be

1ST FLOOR CORRIDOR WORK AREA FINAL CLEARANCE TEM AIR SAMPLES

Following the successful completion of the final clearance visual survey, the abatement contractor applied an encapsulant to surfaces within the regulated work area the previous shift. Aggressive air sampling was performed. Five (5) TEM air samples were started within the regulated work area and Five (5) TEM air samples were started outside the work area. The sampling pumps were calibrated using a rotameter to 8.0 liters per minute. One field blank sample was opened within the work area for 30 seconds. One field blank sample was opened outside the work area for 30 seconds.

At 10:00 am, the sampling pumps were checked using a rotameter after the air within and outside the regulated work area was sampled using TEM cassettes for 150 minutes at 8.0 liters per minute. The sampling cassettes, including the two field blanks and one sealed blank were labeled with unique identification and transported to EMSL, Beltsville MD for analysis. A copy of the chain of custody has been attached.

The EPA and VA maximum allowable airborne asbestos concentration from within the work area is 70 structures per millimeter squared (s/mm2). In order to be deemed acceptable, the average of the interior samples analyzed must have asbestos concentrations of 70 s/mm2 or less. EMSL Analytical Inc., Beltsville MD, informed ECS that the analytical results of the TEM final clearance air samples collected from 1st floor hallway work area found the airborne asbestos fiber concentrations to be less than the maximum allowable concentration. The client and abatement contractor supervisor were informed of the results. A copy of the laboratory report is attached.

By JP Nuique 1625

EMSL Analytical, Inc.

10768 Baltimore Avenue Beltsville, MD 20705
Tel/Fax: (301) 937-5700 / (301) 937-5701
http://www.EMSL.com / beltsvillelab@emsl.com

EMSL Order: 192112065
Customer ID: ECMA78
Customer PO:
Project ID:

Attention: Michael Hamill
ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151
Project: NAOMI BROOKS / 47:11652-H1

Phone: (703) 471-8400
Fax: (703) 471-8400
Received Date: 12/27/2021 08:30 AM
Analysis Date: 12/27/2021
Collected Date: 12/26/2021

Test Report: Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM) Performed by EPA 40 CFR Part 763 Appendix A to Subpart E

Sample	Location	Volume (Liters)	Area Analyzed (mm²)	Non Asb	Asbestos Type(s)	#Structures ≥0.5µ < 5µ	#Structures ≥5µ	Analytical Sensitivity (S/cc)	Asbestos Concentration (S/mm²)	Asbestos Concentration (S/cc)
122621-01 GN *192112065-0001*	FC, IWA, 1ST FL HALLWAY	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
122621-02 GN *192112065-0002*	FC, IWA, 1ST FL HALLWAY	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
122621-03 GN *192112065-0003*	FC, IWA, 1ST FL HALLWAY	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
122621-04 GN *192112065-0004*	FC, IWA, 1ST FL HALLWAY	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
122621-05 GN *192112065-0005*	FC, IWA, 1ST FL HALLWAY	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049

Analyst(s)

Emily Baker (5)

Joe Centifonti, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. Results reported in structures/cm3 are not covered by the laboratory's NVLAP accreditation. Measurement of uncertainty available upon request.

Samples analyzed by EMSL Analytical, Inc. Beltsville, MD NVLAP Lab Code 200293-0

Initial report from: 12/27/2021 16:05 PM

OrderID: 192112065

Asbestos Chain of Custody

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

EMSL Order Number *(lab use only)*: 192112065

PHONE:
FAX:

Company Name: ECS Mid Atlantic LLC		**EMSL Customer ID:**	
Street:		**City:**	**State or Province:**
Zip/Postal Code:	**Country:**	**Telephone #:**	**Fax #:**
Report To (Name): Michael Hamill		**Please Provide Results via:** ☐ Fax ☑ Email	
email Address: MHamill@ecslimited.com		**Purchase Order Number:**	
Client Project ID: Naomi Brooks / 47:11652-H1		**EMSL Project ID** *(internal use only)*:	
State or Province Collected: VA		**CT only** ☐ **Commercial/Taxable** ☐ **Residential/Tax Exempt**	

EMSL-Bill to: ☑ Same ☐ Different - *If bill to is different note instructions in comment. Third party billing requires written authorization from third party*

Turnaround Time (TAT) Options Please Check

☐ 3 Hr[1]	☐ 4-4.5Hr[1] AHERA Only	☑ 6 Hr[1]	☐ 24 Hr	☐ 32 Hr[2]	☐ 48 Hr	☐ 72 Hr	☐ 96 Hr	☐ 1 Week	☐ 2 Week

[1]*Premium Service Charge applies for 3 Hour TEM AHERA or EPA Level II TAT – you will be asked to sign an authorization form. TEM Air 3-6 Hour, please call ahead to schedule*
[2]*32 Hour TAT available for select tests only; samples must be submitted by 11:30 am.*

PCM - Air
- ☐ 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 - NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NYS 198.8 SOF-V
- ☐ NIOSH 9002 (<1%)

TEM – Air[1]
- ☑ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ TEM EPA 600/R-93/116 with milling prep (<0.1%)*

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Settled Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil – Rock – Vermiculite (reporting limit)
- ☐ 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

**Lower reporting limits available on request*

Other test (please specify):

☐ **Stop At First Positive** *(clearly identify homogenous areas below)*

Filter Pore Size (Air Samples): ☐ 0.8µm ☑ 0.45µm

Sampler's Name: Gallardo Nuique **Sampler's Signature:**

Sample #	Sample Description/Location	Volume, Area or Homogenous Area	Date/Time Sampled
122621 01 GN	FC, IWA, 1st Fl. Hallway	1200 L	12/26/21
02			
03			
04			
05			

Client Sample # (s): 01GN - 13 GN **Total # of Samples:** 13

Relinquished by (Client): Gallardo Nuique **Date:** 12/26/21 **Time:**

Received by (Lab): Marcus Nybea DB **Date:** **Time:**

Comments/Special Instructions: Aggressive
Analyze IWA only

'21 DEC 27 AM 7:39

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*:

192112065

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
122621 06 GW	FC, OWA, 1st Fl. Hallway	1200 L	12/26/21
07			
08			
09			
10			
11	Field Blank opened 30 secs. by Entrance	N/A	
12	Field Blank opened 30 secs. in Ambient	N/A	
13	Sealed Blank (not opened)	N/A	

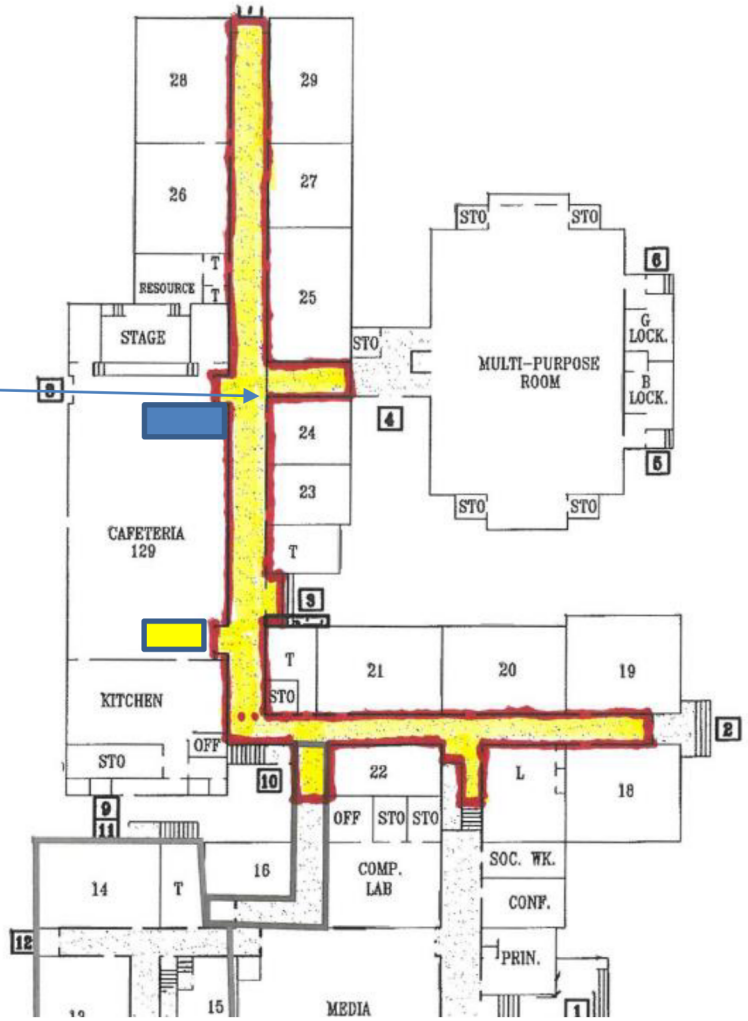
***Comments/Special Instructions:**

Sample Instructions

Controlled Document – COC-05 Asbestos – R12.1 – 11/01/2019

EMSL Analytical, Inc.'s (DBA: LA Testing) Laboratory Terms and Conditions are incorporated into this chain of custody by reference in their entirety. Submission of samples to EMSL Analytical Inc. constitutes acceptance and acknowledgment of all terms and conditions.

Final Clearance TEM air samples collected.



Work Area
Decontamination Unit
Sample Location
Waste Decontamination Unit

Naomi Brooks
600 Russel Rd Alexandria VA 22301

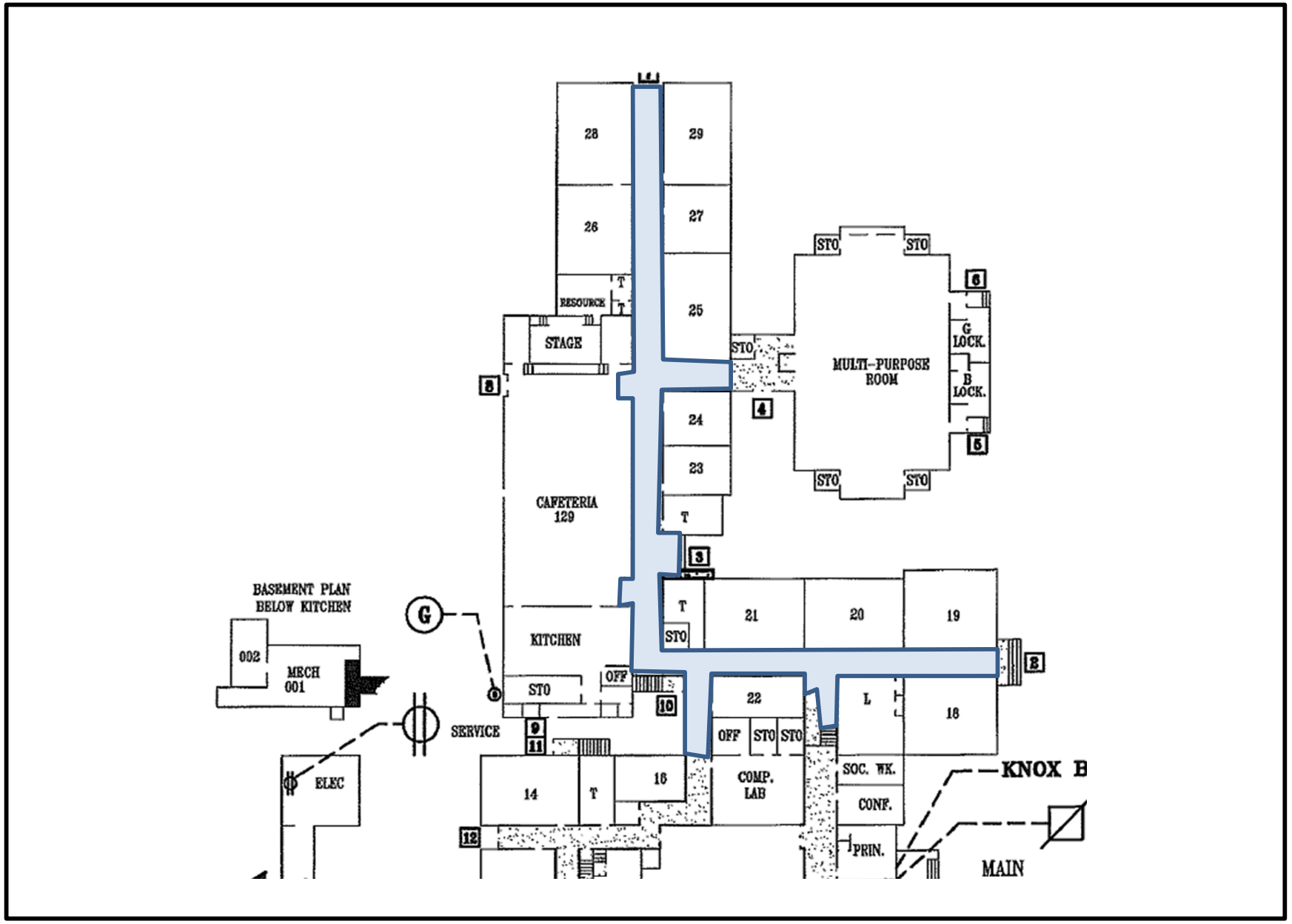
WORK AREA SKETCH

Scale: NTS

Project No.

12/26/21

Appendix II: Drawings



Legend

= Area Where Asbestos-Containing Floor Tile and Mastic was Abated

Naomi Brooks Elementary School
600 Russell Road
Alexandria, VA 22301

Work Area Sketch

SCALE NTS

Project No. 47:11652-H1/H2

Date 12/20-12/26-21

Appendix III: Certifications/ Licenses

DPOR License Lookup License Number 3309001288

License Details

Name	NUIQUE, GALLARDO SEDILLO
License Number	3309001288
License Description	Asbestos Project Monitor License
Rank	Asbestos Project Monitor
Address	ROCKVILLE, MD 20851
Initial Certification Date	2004-07-13
Expiration Date	2021-07-31

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DPOR License Lookup build 1,472 (built 2021-02-15 10:16:48).



REPORT OF SUSPECT ASBESTOS-CONTAINING MATERIAL SAMPLING

MATHEW MAURY ELEMENTARY SCHOOL
600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA 22301

ECS PROJECT NO. 01:21493
ALEXANDRIA CITY SCHOOL BOARD P.O. NO. 13006562-00

FOR
ALEXANDRIA CITY PUBLIC SCHOOLS

JULY 3, 2013

July 3, 2013

Mr. Derrick Fulcher
Alexandria City Public Schools
4701 Seminary Road
Alexandria, Virginia 22304

ECS Project No. 01:21493

Reference: Suspect Asbestos-Containing Floor Tile and Associated Mastic Sampling
Matthew Maury Elementary School, 600 Russell Road, Alexandria, Virginia 22301.

Dear Mr. Fulcher:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide Alexandria City Public Schools with the results of the above referenced suspect asbestos-containing floor tile sampling.

If we can be of further assistance to you, please do not hesitate to contact us at (703) 471-8400.

Respectfully,

ECS MID-ATLANTIC, LLC

Rachael Rossmeissl-Stone
Senior Environmental Project Manager

Stephen R. Geraci
Senior Environmental Project Manager

I:\Environmental\RPT\21000\21493 - Maury ES\Maury Floor Tile Sampling.doc

TABLE OF CONTENTS

PAGE

SITE DESCRIPTION **1**

RESULTS **1**

TABLE 1 1

RECOMMENDATIONS **2**

Limitations 3

ATTACHMENTS: Table 2 – Asbestos Sampling Results
Laboratory Analytical Results

SITE DESCRIPTION

The subject property consists of a one-story school building, this sampling was limited to flooring within the multi-purpose room. Maury Elementary School was occupied at the time of our site survey.

RESULTS

Samples of suspect asbestos-containing materials (ACMs) were collected utilizing hand tools and placed into individual, labeled plastic bags. A total of 9 unique suspect ACM samples were sent to Scientific Analytical Institute, Inc. (SAI) for analysis via Polarized Light Microscopy in accordance with current EPA-600 methodology. Materials consisting of additional layers were analyzed separately.

SAI is listed as an accredited laboratory by the National Voluntary Laboratory Accreditation Plan (NVLAP) managed by the National Institute of Standards and Technology (NIST) for bulk sample analysis. Multiple samples of each unique material were submitted. Samples were analyzed using "Positive Stop" methodology. If one sample of a homogeneous material is found to contain asbestos, the remaining samples of that material are not analyzed. EPA regulations stipulate that if one sample contains asbestos the entire quantity of that material contains asbestos, regardless of additional analysis. In total, 17 layers were analyzed.

A summary of materials found to contain asbestos or assumed to contain asbestos can be found in Table 1. A list of materials sampled and tested for asbestos content is located in Table 2 which can be found in the appendix.

TABLE 1
ASBESTOS-CONTAINING MATERIALS SUMMARY
MAURY ELEMENTARY SCHOOL
600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA

General Location	Material	Friability
Multi-Purpose Room	Brown Floor Tile and Associated Black Mastic (bottom layer)	Category I Non-Friable

RECOMMENDATIONS

The materials listed in Table 1 consist of non-friable (i.e., not able to be crumbled, pulverized, and/or reduced to powder by hand pressure when dry) materials which contain greater than one percent (> 1%) asbestos. By definition, these materials are considered ACM. Friable materials will easily produce airborne asbestos fibers if disturbed. Non-Friable materials may also produce airborne asbestos fibers if disturbed.

ECS recommended the identified asbestos-containing materials and any assumed asbestos-containing materials found to be present within the elementary school during renovations be removed by a Commonwealth of Virginia licensed asbestos abatement contractor prior to disturbance.

If asbestos-containing materials are to be removed an industrial hygienist should monitor the project daily. This involves collecting air samples from within and outside abatement work areas to evaluate the abatement contractor's work practices to prevent asbestos fiber release from within the work area. The project monitor should inform the building owner if the asbestos abatement contractor is not performing his work in accordance with project specifications, Commonwealth of Virginia and local regulations as well as EPA regulation 40 CFR Part 61-National Emission Standards for Hazardous Air Pollutants Subpart M: National Emission Standard for Asbestos, and U.S. Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1926.1101 – Asbestos in Construction which, in part, requires the contractor to perform personal exposure monitoring for all workers abating and disposing of asbestos containing materials.

The project monitor should assess each work area to monitor the removal of asbestos-containing materials. Only after the monitor has determined the identified ACMs have been removed should final clearance air samples be collected.

Prior to the removal of regulated ACM, notification of an asbestos project must be made to the EPA 10 business days and to the Commonwealth of Virginia 20 days before starting asbestos abatement activities. If the ACMs identified are removed using wet methods and hand tools they are not considered "regulated ACM".

Prior to renovations of the elementary school, ECS recommends that a project specification be developed to delineate and quantify known and suspect hazardous and regulated materials in the building and to outline proper procedures for the abatement. This will help protect the owner's liability in better defining the scope if work and contractor's roles and responsibilities in the abatement process and holding the contractor accountable for the performance of the project. The specification typically defines the Contractor's scope of work and outline requirements and procedures that must be followed for this project. The intent of the specification is to give performance requirements for the Contractor so that the project can be completed safely and in compliance with applicable federal and state regulations. Typically, the specification document serves as part of the site owner's contract with the contractor.

Limitations

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

During this study, suspect asbestos samples were submitted for analysis at an NVLAP-accredited laboratory via polarized light microscopy. As with any similar survey of this nature, actual conditions exist only at the precise locations from which suspect asbestos samples were collected. Certain inferences are based on the results of this sampling and related testing to form a professional opinion of conditions in areas beyond those from which the samples were collected. No other warranty, expressed or implied, is made.

Our recommendations are in part based on federal and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

The client agrees to notify the appropriate local, state, or federal public agencies as required by law, or otherwise to disclose, in a timely manner, information that may be necessary to prevent any danger to public health, safety, or the environment.

TABLE 2
BULK SAMPLING OF SUSPECT ASBESTOS-CONTAINING MATERIALS

Sample #	Sampling Location	Material/Description	Analytical Results
01	Multi-Purpose Room	Brown Floor Tile and Associated Black Mastic (bottom layer)	Floor Tile: Asbestos 7% Chrysotile Mastic: Asbestos 5% Chrysotile
02	Multi-Purpose Room	Brown Floor Tile and Associated Black Mastic (bottom layer)	Floor Tile: N/A Mastic: N/A
03	Multi-Purpose Room	Brown Floor Tile and Associated Black Mastic (bottom layer)	Floor Tile: N/A Mastic: N/A
04	Multi-Purpose Room	Grey Floor Tile and Associated Yellow Mastic (middle layer)	Floor Tile: NAD Mastic: NAD
05	Multi-Purpose Room	Grey Floor Tile and Associated Yellow Mastic (middle layer)	Floor Tile: NAD Mastic: NAD
06	Multi-Purpose Room	Grey Floor Tile and Associated Yellow Mastic (middle layer)	Floor Tile: NAD Mastic: NAD
07	Multi-Purpose Room	White Floor Tile and Associated Yellow Mastic (top layer)	Floor Tile: NAD Mastic: NAD
08	Multi-Purpose Room	White Floor Tile and Associated Yellow Mastic (top layer)	Floor Tile: NAD Mastic: NAD
09	Multi-Purpose Room	White Floor Tile and Associated Yellow Mastic (top layer)	Floor Tile: NAD

NAD = No Asbestos Detected
N/A = Not Analyzed Due to Positive Stop

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: ECS Chantilly
14026 Thunderbolt Place
Suite 100
Chantilly VA 20151

Attn: Stephen Geraci

Project: 01:21493

Lab Order ID: 1311098
Analysis ID: 1311098_PLM
Date Received: 6/13/2013
Date Reported: 6/13/2013

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
1 - A	Bottom Layer Floor Tile - Multi-Purpose Room	**7% Chrysotile**		**93% Other**	Brown Non Fibrous Homogeneous
1311098PLM_1	*tile*				Dissolved
1 - B	Bottom Layer Floor Tile - Multi-Purpose Room	**5% Chrysotile**		**95% Other**	Black Non Fibrous Homogeneous
1311098PLM_10	*mastic*				Dissolved
2 - A	Bottom Layer Floor Tile - Multi-Purpose Room	**Not Analyzed**			
1311098PLM_2	*tile*				
2 - B	Bottom Layer Floor Tile - Multi-Purpose Room	**Not Analyzed**			
1311098PLM_11	*mastic*				
3 - A	Bottom Layer Floor Tile - Multi-Purpose Room	**Not Analyzed**			
1311098PLM_3	*tile*				
3 - B	Bottom Layer Floor Tile - Multi-Purpose Room	**Not Analyzed**			
1311098PLM_12	*mastic*				
4 - A	Middle Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Gray Non Fibrous Heterogeneous
1311098PLM_4	*tile*				Crushed
4 - B	Middle Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Yellow Non Fibrous Homogeneous
1311098PLM_13	*mastic*				Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bobby Wheatley (17)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: ECS Chantilly
14026 Thunderbolt Place
Suite 100
Chantilly VA 20151

Attn: Stephen Geraci

Project: 01:21493

Lab Order ID: 1311098
Analysis ID: 1311098_PLM
Date Received: 6/13/2013
Date Reported: 6/13/2013

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
5 - A	Middle Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Gray Non Fibrous Heterogeneous
1311098PLM_5	*tile*				Crushed
5 - B	Middle Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Yellow Non Fibrous Homogeneous
1311098PLM_14	*mastic*				Dissolved
6 - A	Middle Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Gray Non Fibrous Heterogeneous
1311098PLM_6	*tile*				Crushed
6 - B	Middle Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Yellow Non Fibrous Homogeneous
1311098PLM_15	*mastic*				Dissolved
7 - A	Top Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	White Non Fibrous Homogeneous
1311098PLM_7	*tile*				Dissolved
7 - B	Top Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Yellow Non Fibrous Homogeneous
1311098PLM_16	*mastic*				Dissolved
8 - A	Top Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	White Non Fibrous Homogeneous
1311098PLM_8	*tile*				Dissolved
8 - B	Top Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Yellow Non Fibrous Homogeneous
1311098PLM_17	*mastic*				Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bobby Wheatley (17)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: ECS Chantilly
14026 Thunderbolt Place
Suite 100
Chantilly VA 20151

Attn: Stephen Geraci

Project: 01:21493

Lab Order ID: 1311098
Analysis ID: 1311098_PLM
Date Received: 6/13/2013
Date Reported: 6/13/2013

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
9	Top Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	White Non Fibrous Homogeneous
1311098PLM_9	*tile only*				Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bobby Wheatley (17)

Analyst

Approved Signatory

1311098

Version 1-15-2012

Client:	ECS Mid-Atlantic, LLC	***Instructions:**
Contact:	Stephen Geraci	*Use Column "B" for your contact info*
	14026 Thunderbolt Place, Suite 100	
Address:	Chantilly, VA 20151	
Phone:	703-471-8400	*To See an Example Click the*
Fax:	703-834-5527	*bottom Example Tab.*
Email:	sgeraci@ecslimited.com	
		Enter samples between "<<" and ">>"
Project:	01:21493	***Begin Samples with a "<< "above the first sample and end with a ">>" below the last sample.***
Client Notes:	[Enter Client Notes Here]	*Only Enter your data on the first sheet "Sheet1"*
P.O. #.	[Enter P.O. # Here]	*Note: Data 1 and Data 2 are optional*
Date Submitted:	6/12/2013 0:00	*fields that do not show up on the official report, however they will be included*
Analysis:	PLM EPA 600, Positive Stop	*in the electronic data returned to you*
TurnAroundTime:	24-Hr	*to facilitate your reintegration of the report data.*

Scientific Analytical Institute

4604 Dundas Drive
Greensboro, NC 27407
Phone: 336.292.3888
Fax: 336.292.3313
Email: lab@sailab.com

Sample Number	HA	Sample Description	Date
<<			
1	Brown Floor Tile & Mastic	Bottom Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
2	Brown Floor Tile & Mastic	Bottom Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
3	Brown Floor Tile & Mastic	Bottom Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
4	Gray Floor Tile & Mastic	Middle Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
5	Gray Floor Tile & Mastic	Middle Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
6	Gray Floor Tile & Mastic	Middle Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
7	White Floor Tile & Mastic	Top Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
8	White Floor Tile & Mastic	Top Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
9	White Floor Tile & Mastic	Top Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
>>			

Accepted ☑

Rejected ☐

MB 6/13
9:30 AM

ASBESTOS ABATEMENT PROJECT MONITORING SUMMARY REPORT

MATTHEW MAURY ELEMENTARY SCHOOL
600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA 22301

ECS PROJECT NO. 47:1519-L

FOR

ALEXANDRIA CITY PUBLIC SCHOOLS

SEPTEMBER 08, 2020

September 08, 2020

Mr. John Finnigan
Alexandria City Public Schools
1340 Braddock Place
Suite 620
Alexandria, Virginia 22314

ECS Project No. 47:1519-L

Reference: Asbestos Abatement Project Monitoring Summary Report, Matthew Maury Elementary School, 600 Russell Road, Alexandria, Virginia

Dear Mr. Finnigan:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide Alexandria City Public Schools with this summary report of the asbestos abatement work performed during the above-referenced project. ECS performed visual assessments, evaluations, and air monitoring and sampling during the removal of asbestos-containing materials (ACMs). This report includes a project description, a summary of the asbestos abatement activities observed by ECS, and a summary of the work conducted by ECS including laboratory results.

ECS appreciates this opportunity to provide Alexandria City Public Schools with our services. If we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

ECS Mid-Atlantic, LLC

Bobby L. Rhett
Project Manager
brhett@ecslimited.com
703-471-8400

Diana Krass
Senior Project Manager
dkrass@ecslimited.com
703-471-8400

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1.0 PROJECT DESCRIPTION

The asbestos abatement work was performed by WACO, Inc., in general on December 26, and 27, 2019, and included the removal of the following asbestos-containing material (ACM):

- Black Floor Mastic (underneath carpet) - Near the East Main Entrance Area (Psychology Office and Adjacent Rooms)

In ECS's Daily Reports, the above-referenced rooms are referred to as the North and South Areas. Please note that the above-referenced ACM, other identified ACMs, and/or assumed ACMs are most likely present in other areas of the school building.

2.0 ECS SCOPE OF WORK

ECS was tasked with performing visual assessments and evaluations, abatement activity monitoring and air sampling during and after the removal of the above-identified asbestos-containing material (ACM) within the above-referenced school building.

3.0 ASBESTOS ABATEMENT ACTIVITIES

During the asbestos abatement project, ECS collected and analyzed air samples using Phase Contrast Microscopy (PCM) in general accordance with applicable federal and Virginia regulations. Samples were collected during the project outside the work areas to monitor airborne fiber concentrations. In general, the air sampling found the engineering controls (i.e., polyethylene sheeting, negative air pressure, High Efficiency Particulate Air (HEPA) filtration) adequate to keep fiber concentrations on air samples collected outside the regulated work areas below the Virginia PCM re-occupancy limit of <0.01 fibers per cubic centimeter (f/cc). Air sample results are included within the technicians' daily field notes.

The abatement contractor stated the specified materials had been removed as well as possible from the regulated work area and requested a visual survey to confirm compliance. The Final Clearance Survey Checklist was completed and is attached to this report. The carpet and the bulk of the asbestos-containing black mastic had been removed; however, black mastic still remains on some areas of the wood sub-floor located in the work areas.

3.1 Asbestos Removal

Asbestos abatement was performed by WACO, Inc. within the above-referenced regulated work areas of the school building. The regulated work areas within the subject building consisted of isolated areas with critical barriers, signs, and danger tape. Carpet and mastics were abated within enclosures constructed of 6-mil polyethylene sheeting placed under negative pressure.

3.2 ECS Observations

ECS reviewed the asbestos credentials of the abatement workers. The credential documentation reviewed was noted to be current at the time presented to ECS.

ECS observed abatement workers utilizing personal protective equipment deemed necessary for asbestos abatement work by applicable OSHA and Virginia regulations (respirators, disposable protective clothing, eye protection, hard hats, gloves, etc.).

3.3 Daily Air Sampling

During the asbestos abatement project, ECS collected and analyzed air samples using Phase Contrast Microscopy (PCM) in general accordance with applicable federal and Virginia regulations. Samples were collected during the project outside the work areas to monitor airborne fiber concentrations.

In general, the air sampling found the engineering controls (i.e., polyethylene sheeting, negative air pressure, High Efficiency Particulate Air (HEPA) filtration, wet methods) adequate to keep fiber concentrations on air samples collected outside the regulated work areas below the EPA PCM re-occupancy limit of 0.01 fibers per cubic centimeter (f/cc). Air sample results are included with the attached daily field notes.

4.0 FINAL CLEARANCE AIR SAMPLING

After WACO, Inc. had removed the specified asbestos-containing materials (ACMs) and related waste from the work areas, ECS performed final clearance visual assessments to survey each work area and evaluate if the ACMs had been removed and if dust and/or debris remained in the work areas. Following the completion of the final clearance visual assessments, ECS reported the results to WACO, Inc.

Final clearance air samples were collected from work areas in accordance with aggressive sampling protocol described in Unit III.B.7.d of 40 CFR 763 Subpart E Appendix A and analyzed via Transmission Electron Microscopy (TEM) in accordance with federal and Virginia regulations. The results of the TEM final clearance air samples collected from each work area were reported to be below the Virginia re-occupancy limit of 70 structures per square millimeter (70 s/mm^2).

5.0 CLOSING

Copies of ECS's daily monitoring field reports are enclosed along with copies of laboratory reports. If we can be of further assistance to you, please do not hesitate to contact us at (703) 471-8400.

6.0 LIMITATIONS

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

During this study, samples were submitted for analysis at an accredited laboratory via polarized light microscopy. As with any similar survey of this nature, actual conditions exist only at the precise locations from which samples were collected. Certain inferences are based on the results of this sampling and related testing to form a professional opinion of conditions in areas beyond those from which the samples were collected. No warranty, expressed or implied, is made.

The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

Our recommendations are in part based on federal, state, and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies, any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

Appendix I: Daily Field Reports with Air Sample Results

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

LETTER OF TRANSMITTAL

January 3, 2020

Alexandria City Public Schools
1340 Braddock Place
Suite 620
Alexandria, VA 22314

ATTN: Carol Cheney

RE: **ACPS - Matthew Maury Office ACM**
ECS Job # **47:1519-L**

Permits:
Location: **600 Russell Road**
Alexandria, VA

We are enclosing: **X** Field Reports **X** For your use **X** As requested

CC: **Waco Inc. - Steve E. Williams**
Alexandria City Public Schools - John Finnigan
Alexandria City Public Schools - Paul May

ENCL:

Field Report # 1 12/26/2019

Diana D. Krass
Environmental Senior Project Manager

Bobby Rhett
Environmental Project Manager

Disclaimer
1. *This report (and any attachments) shall not be reproduced except in full without prior written approval of ECS.*
2. *The information in this report relates only to the activities performed on the report date.*
3. *Where appropriate, this report includes statements as to compliance with applicable project drawings and specifications for the activities performed on this report date.*
4. *Incomplete or non-conforming work will be recorded for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project No.	**47:1519-L**
Report No.	**1**
Day & Date	**Thursday 12/26/2019**
Weather	**45°/ Cloudy**
On-Site Time	**8.50**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**8.50**
Re Obs.Time	**0.00**

Project **ACPS - Matthew Maury Office ACM**

Location **Alexandria, VA**

Client **Alexandria City Public Schools - Carol Cheney**

Contractor **Waco Inc. - Steve E. Williams**

Remarks

Trip Charges* Tolls/Parking* **17.00** Mileage*

Chargeable Items

Time of Arrival **06:00A** Departure **02:30P**

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The materials specified to be removed today are carpet with asbestos-containing black mastic from three rooms on the first floor near the east main entrance.

Prior to starting the removal of the specified materials, the abatement contractor employees were asked to present their state license for review. No workers were found to be without valid licenses.

At 9:15 am, the abatement contractor requested a pre-abatement survey of the regulated work area South Room. The Pre-Abatement Checklist was completed and is attached to this report.

At 11:00 am, the abatement contractor requested a pre-abatement survey of the regulated work area North Room. The Pre-Abatement Checklist was completed and is attached to this report.

At 11:45 am, the regulated work areas were surveyed to evaluate compliance with the project specifications and applicable regulations. The Daily Work Area survey checklist was completed and is attached to this report.

At 9:30 am (OWA South Room) and 11:45 am (OWA North Room), PCM air samples were started outside the work areas at the decon units of the South and North Rooms. The sampling pumps were calibrated using a rotameter to 2.5 liters per minute.

At 2:15 pm, the sampling pump was calibrated using a rotameter. The flow rate was 2.5 liters per minute. The PCM air samples were stopped and gathered from outside the decon units.

The abatement contractor stated the specified materials have been removed from the regulated work area South Room and requested a visual survey to confirm compliance. The Final Clearance Visual Survey checklist was completed and is attached to this report. The abatement

company encapsulated the work area to be air sampled the following morning (12/27/2019).

The undersigned prepared and analyzed the PCM air sample cassettes for total fiber concentration in accordance with NIOSH 7400. Results were recorded on the PCM Chain of Custody and Field Data Sheet which is attached.

The abatement contractor was observed placing specified asbestos-containing materials in 6-mil polyethylene bags which are double-bagged and sealed in accordance with the project specifications and applicable regulations. Waste bags were labeled and placed in an approved waste hauling container.

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet
WORK AREA SAMPLES

Project Number: 1519-L

Project Address: 600 Russell Road
,Alexandria,VA-22301

Date: 12/29/2019

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (min)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
122619DW-B01	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
122619DW-B02	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
122619DW-E01	OWA South Room	9:30 AM	2:15 PM	2.5	2.5	2.5	285	712.5	4.0	100	0.003
122619DW-E02	OWA North Room	11:45 AM	2:15 PM	2.5	2.5	2.5	150	375.0	5.0	100	0.007

NFD = None Fibers Detected; OWA = Outside Work Area; IWA = Inside Work Area; FC = Final Clearance

Notes:

ECS Technician: Mark D. Wood, II

Date: 12/29/2019

ECS Mid-Atlantic, LLC

Pre-Abatement Work Area Checklist

Project Number: 1519-L **Date:** 12/29/2019

Project Address: 600 Russell Road
,Alexandria,VA-22301

Work Area Location/Description: North Room

Administrative	Training Certificates/Licenses	Satisfactory
	Permits	N/A
	EPA/State/Local Notification	N/A
Work Area	Public Access Restricted	Satisfactory
	Warning Signs/Tape Posted	Satisfactory
Negative Air Filtration	Number of Units	2
	Pre-Filters In-Use/Available	Satisfactory
	Exhausted from Work Area	Satisfactory
	Pressure Differential Monometer Operating	Satisfactory
Equipment	HEPA Vacuum Available	Satisfactory
	Amended Water Sprayers	Satisfactory
Decontamination Enclosure	Clean Room	Satisfactory
	Shower Water Available	Satisfactory
	Waste Water Filtration In-Use	N/A
	Disposable Towels	Satisfactory
	Soap	Satisfactory
	Equipment Room	Satisfactory
Personal Protective Equipment	Type of Respirator	half face
	Type of Filters Used	p100
	Disposable Protective Clothing	Satisfactory
	Work Area Acceptable	Yes

Notes:

ECS Technician: Mark D. Wood, II **Date:** 12/29/2019

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 1519-L **Date:** 12/29/2019

Project Address: 600 Russell Road
,Alexandria,VA-22301

Work Area Location/Description: North Room

Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	N/A
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	1
	Number of PCM Blank Samples	1
	Work Area Acceptable	Yes

Notes:

ECS Technician: Mark D. Wood, II **Date:** 12/29/2019

ECS Mid-Atlantic, LLC

Pre-Abatement Work Area Checklist

Project Number: 1519-L **Date:** 12/29/2019

Project Address: 600 Russell Road
,Alexandria,VA-22301

Work Area Location/Description: South Room

Administrative	Training Certificates/Licenses	Satisfactory
	Permits	N/A
	EPA/State/Local Notification	N/A
Work Area	Public Access Restricted	Satisfactory
	Warning Signs/Tape Posted	Satisfactory
Negative Air Filtration	Number of Units	1
	Pre-Filters In-Use/Available	Satisfactory
	Exhausted from Work Area	Satisfactory
	Pressure Differential Monometer Operating	Satisfactory
Equipment	HEPA Vacuum Available	Satisfactory
	Amended Water Sprayers	Satisfactory
Decontamination Enclosure	Clean Room	Satisfactory
	Shower Water Available	Satisfactory
	Waste Water Filtration In-Use	N/A
	Disposable Towels	Satisfactory
	Soap	Satisfactory
	Equipment Room	Satisfactory
Personal Protective Equipment	Type of Respirator	half face
	Type of Filters Used	p100
	Disposable Protective Clothing	Satisfactory
	Work Area Acceptable	Yes

Notes:

ECS Technician: Mark D. Wood, II **Date:** 12/29/2019

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 1519-L **Date:** 12/29/2019

Project Address: 600 Russell Road
,Alexandria,VA-22301

Work Area Location/Description: South Room

Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	Satisfactory
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	1
	Number of PCM Blank Samples	1
	Work Area Acceptable	Yes

Notes:

ECS Technician: Mark D. Wood, II **Date:** 12/29/2019

ECS Mid-Atlantic, LLC

Final Clearance Checklist

Project Number: 1519-L **Date:** 12/29/2019

Project Address: 600 Russell Road
,Alexandria,VA-22301

Work Area Location/Description: South Room

Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	N/A
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	Floors	Satisfactory
	Walls	N/A
	Ceiling	N/A
	Windows	N/A
	Mechanical Equipment	N/A
	Ducts	N/A
	Pipes	N/A
	Lighting	Satisfactory
	Other Surfaces	N/A
	Specified ACM Removed	Satisfactory
	Work Area Encapsulated	Satisfactory
	Negative Air Filtration Functioning	Satisfactory
	Waste Bags Removed	Satisfactory
	Final Clearance Air Sample Type	TEM
	Number of Samples Collected	5
	Sample Volume (liters)	1200
	Work Area Acceptable	Yes

Notes: Carpet and gross mastic removal was completed. The wood subfloor still contains traces of asbestos-containing black mastic.

Final Air Clearance was performed the following morning (12/27/19)

ECS Technician: Mark D. Wood, II **Date:** 12/29/2019



Attachment No. 1
View of signage outside the work area



Attachment No. 2
View of containment barriers in the south work area



Attachment No. 3
View of air filtration device exhausted from the South room



Attachment No. 4
View of south work area following removal of carpet and mastic

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

LETTER OF TRANSMITTAL

January 3, 2020

Alexandria City Public Schools
1340 Braddock Place
Suite 620
Alexandria, VA 22314

ATTN: Carol Cheney

RE: **ACPS - Matthew Maury Office ACM**

ECS Job # **47:1519-L**

Permits:

Location: **600 Russell Road**
Alexandria, VA

We are enclosing: **X** Field Reports **X** For your use **X** As requested

CC: **Waco Inc. - Steve E. Williams**
Alexandria City Public Schools - John Finnigan
Alexandria City Public Schools - Paul May

ENCL:

Field Report # 2 12/27/2019

Diana D. Krass
Environmental Senior Project Manager

Bobby Rhett
Environmental Project Manager

Disclaimer

1. *This report (and any attachments) shall not be reproduced except in full without prior written approval of ECS.*
2. *The information in this report relates only to the activities performed on the report date.*
3. *Where appropriate, this report includes statements as to compliance with applicable project drawings and specifications for the activities performed on this report date.*
4. *Incomplete or non-conforming work will be recorded for future resolution.*
5. *The results of samples and/or specimens obtained or prepared for subsequent laboratory testing will be presented in separate reports/documents.*

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project No.	**47:1519-L**
Report No.	**2**
Day & Date	**Friday 12/27/2019**
Weather	**50°/ Sunny**
On-Site Time	**12.25**
Lab Time	**0.00**
Travel Time*	**0.00**
Total	**12.25**
Re Obs.Time	**0.00**

Project	**ACPS - Matthew Maury Office ACM**
Location	**Alexandria, VA**
Client	**Alexandria City Public Schools - Carol Cheney**
Contractor	**Waco Inc. - Steve E. Williams**

Remarks

Trip Charges* Tolls/Parking* Mileage*

Chargeable Items

Time of Arrival Departure
06:00A 06:15P

* Travel time and mileage will be billed in accordance with the contract.

Summary of Services Performed (field test data, locations, elevations & depths are estimates) & Individuals Contacted.

The undersigned arrived on-site, as requested, to perform air monitoring and observe asbestos abatement. The materials specified to be removed today are carpet and asbestos-containing black mastic from the two north rooms near the east entrance.

SOUTH WORK AREA MONITORING

Following the successful completion of the final clearance visual survey for the South Room on the previous afternoon (12/26/19), the abatement contractor applied an encapsulant to surfaces within the regulated work area. After waiting overnight for the encapsulant to dry, five (5) TEM air samples were started within the regulated work area and five (5) TEM air samples were started outside the work area. The sampling pumps were calibrated using a rotameter to 8 liters per minute. One blank sample was opened within the work area for 60 seconds. One blank sample was opened outside the work area for 60 seconds.

At 09:09 am, the sampling pumps were calibrated using a rotameter after the air within and outside the regulated work area was sampled using TEM cassettes for 150 minutes at 8.0 liters per minute.

The TEM air sampling cassettes were labeled with unique identification and transported to EMSL Analytical Laboratory, Inc. (EMSL) in Beltsville, Maryland for asbestos analysis.

NORTH WORK AREA MONITORING

Prior to starting the removal of the specified materials, the abatement contractor employees were asked to present their State license for review. No workers were found to be without valid licenses.

At 6:45 am, one PCM air sample was started outside the work area at the north decon unit. The

sampling pump was calibrated using a rotameter to 2.0 liters per minute.

The abatement contractor placed specified asbestos-containing materials in 6-mil polyethylene bags which are double-bagged and sealed in accordance with applicable regulations. Waste bags are labeled and placed in an approved waste hauling container.

At 11:45 am, the regulated work area was surveyed to evaluate compliance with the project specifications and applicable regulations. The Daily Work Area survey checklist was completed and is attached to this report.

At 2:00 pm, the sampling pump was calibrated using a rotameter. The flow rate was 2 liters per minute. The PCM air sample was stopped and gathered from the north decon unit.

The abatement contractor stated the specified materials have been removed as well as possible from the regulated work area and requested a visual survey to confirm compliance. The Final Clearance Visual Survey checklist was completed and is attached to this report. The carpet and the bulk of the asbestos-containing black mastic had been removed. However, black mastic still remains on the wood subfloor materials in the work area.

Following the successful completion of the final clearance visual survey for the North Room, the abatement contractor applied an encapsulant to surfaces within the regulated work area. After waiting for the encapsulant to dry, five (5) TEM air samples were started within the regulated work area. The sampling pumps were calibrated using a rotameter to 8.0 liters per minute.

At 5:50 pm, the sampling pumps were calibrated using a rotameter after the air within and outside the regulated work area was sampled using TEM cassettes for 150 minutes at 8.0 liters per minute.

The TEM air sampling cassettes were labeled with unique identification and transported to EMSL Analytical Laboratory, Inc. (EMSL) in Beltsville, Maryland for asbestos analysis.

GENERAL

The undersigned prepared and analyzed the PCM air sample cassettes for total fiber concentration in accordance with NIOSH 7400. Results were recorded on the PCM Chain of Custody and Field Data Sheet which is attached.

ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151-3232
(703) 471-8400 [Phone]
(703) 834-5527 [Fax]

FIELD REPORT

Project No. **47:1519-L**
Report No. **2**
Project **ACPS - Matthew Maury Office ACM**
Day & Date **Friday 12/27/2019**

The US EPA and Commonwealth of Virginia maximum allowable airborne asbestos concentration is 70 structures per square millimeter (s/mm2). In order to be deemed acceptable, the average of all samples analyzed must be less than 70 s/mm2. EMSL informed ECS that the analytical results of the TEM final clearance air samples collected from the north and south work areas were less than this maximum allowable limit, which meets the project requirements. The client and abatement contractor Project Manager, Chris Lanham of Waco, were informed of the results. A copy of the laboratory report is attached.

ECS Mid-Atlantic, LLC

PCM Air Sample Field Data Sheet
WORK AREA SAMPLES

Project Number: 1519-L

Date: 12/29/2019

Project Address: 600 Russell Road
,Alexandria,VA-22301

Page: 1 of 1

Sample #	Location/Description	Start	Stop	Start Flow (lpm)	Stop Flow (lpm)	Average Flow (lpm)	Total Time (min)	Volume (l)	Fibers (#)	Field (#)	Result (f/cc)
122719DW-B01	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
122719DW-B02	Field Blank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	100	NFD
122719DW-E03	OWA North Room	6:45 AM	2:00 PM	2.0	2.0	2.0	435	870.0	3.5	100	0.002

NFD = None Fibers Detected; OWA = Outside Work Area; IWA = Inside Work Area; FC = Final Clearance

Notes:

ECS Technician: Mark D. Wood, II

Date: 12/29/2019

EMSL Analytical, Inc.

10768 Baltimore Avenue Beltsville, MD 20705
Tel/Fax: (301) 937-5700 / (301) 937-5701
http://www.EMSL.com / beltsvillelab@emsl.com

EMSL Order: 191915639
Customer ID: ECMA78
Customer PO:
Project ID:

Attention: Bobby Rhett
ECS Mid-Atlantic, LLC
14026 Thunderbolt Place
Suite 100
Chantilly, VA 20151
Project: ACPS Matthew Maury / 47:1346-U

Phone: (703) 471-8400
Fax: (703) 471-8400
Received Date: 12/28/2019 08:30 AM
Analysis Date: 12/28/2019
Collected Date: 12/27/2019

Test Report: Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM) Performed by EPA 40 CFR Part 763 Appendix A to Subpart E

Sample	Location	Volume (Liters)	Area Analyzed (mm²)	Non Asb	Asbestos Type(s)	#Structures ≥0.5µ < 5µ	#Structures ≥5µ	Analytical Sensitivity (S/cc)	Asbestos Concentration (S/mm²)	Asbestos Concentration (S/cc)
122719DW-F01	IWA South Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0001										
122719DW-F02	IWA South Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0002										
122719DW-F03	IWA South Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0003										
122719DW-F04	IWA South Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0004										
122719DW-F05	IWA South Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0005										
122719DW-F11	IWA North Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0006										
122719DW-F12	IWA North Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0007										
122719DW-F13	IWA North Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0008										
122719DW-F14	IWA North Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0009										
122719DW-F15	IWA North Room	1200.00	0.0650	0	None Detected	0	0	0.0049	<15.00	<0.0049
191915639-0010										

Analyst(s)

Joe Centifonti (10)

Joe Centifonti, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. Results reported in both structures/cm3 and structures/mm2 are dependent on the volume of air sampled and measured by non-laboratory personnel are not the responsibility of EMSL and are not covered by the laboratory's NVLAP accreditation. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request.

Samples analyzed by EMSL Analytical, Inc. Beltsville, MD NVLAP Lab Code 200293-0

Initial report from: 12/28/2019 13:14 PM

OrderID: 191915639

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number (*Lab Use Only*): 191915639

PHONE:
FAX:

Company Name: ECS Mid-Atlantic		**EMSL Customer ID:**	
Street:		**City:**	**State/Province:**
Zip/Postal Code:	**Country:**	**Telephone #:**	**Fax #:**
Report To (Name): Bobby Rhett		**Please Provide Results:** ☐ Fax ☑ Email	
Email Address: BRhett@ecslimited.com		**Purchase Order:**	
Project Name/Number: ACPS Matthew Henry/47:1346-U		**EMSL Project ID** (*Internal Use Only*):	
U.S. State Samples Taken: Virginia		**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 (<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
122719DW-F01	IWA South Room	1200 L	12-27-19 06:39
122719DW-F02	IWA South Room	1200 L	12-27-19 06:39
122719DW-F03	IWA South Room	1200 L	12-27-19 06:39
122719DW-F04	IWA South Room	1200 L	12-27-19 06:39
122719DW-F05	IWA South Room	1200 L	12-27-19 06:39

Client Sample # (s):

Total # of Samples:

Relinquished (Client): Dallas Wood **Date:** 12-27-19 **Time:** 16:45

Received (Lab): DHW Drop Box **Date:** 12/28/19 **Time:** 8:30 AM

Comments/Special Instructions: Aggressive air sampling performed
Analyze IWA only

Page 1 of 2 pages

Controlled Document – COC-05 Asbestos R11 – 07/22/2019

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*:

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
122719DW-F06	OWA	1200 L	12-27-19 06:41
122719DW-F07	OWA	1200 L	12-27-19 06:41
122719DW-F08	OWA	1200 L	12-27-19 06:41
122719DW-F09	OWA	1200 L	12-27-19 06:41
122719DW-F10	OWA	1200 L	12-27-19 06:41
122719DW-F11	IWA North Room 1	1200 L	12-27-19 15:20
122719DW-F12	IWA North Room 2	1200 L	12-27-19 15:20
122719DW-F13	IWA North Room 3	1200 L	12-27-19 15:20
122719DW-F14	IWA North Room 4	1200 L	12-27-19 15:20
122719DW-F15	IWA North Room 5	1200 L	12-27-19 15:20
122719DW-B01	Blank	—	12-27-19
122719DW-B02	Blank	—	12-27-19
122719DW-B03	Blank	—	12-27-19

***Comments/Special Instructions:**

Page 2 of 2 pages

Controlled Document – COC-05 Asbestos – R11 – 07/22/2019

ECS Mid-Atlantic, LLC

Daily Work Area Checklist

Project Number: 1519-L **Date:** 12/29/2019

Project Address: 600 Russell Road
,Alexandria,VA-22301

Work Area Location/Description: North Room

Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	N/A
	Used Suits/Towels in Waste Bag	Satisfactory
Interior of Work Area	All Critical Barriers Intact	Satisfactory
	Wet Methods In-Use	Satisfactory
	Prompt Clean-Up	Satisfactory
	Adequate Lighting	Satisfactory
	Respiratory Protection	Satisfactory
	Disposable Clothing Worn Properly	Satisfactory
	No Respirators Stored in Work Area	Satisfactory
	Negative Air Filtration In-Use	Satisfactory
	Pre-Filters Clean	Satisfactory
	Exhaust Properly Vented	Satisfactory
	No Eating/Drinking/Smoking in Work Area	Satisfactory
End of Shift Checklist	Negative Air Filtration Machines Operating	Satisfactory
	Debris Bagged/Sealed	Satisfactory
	Work Area Secured from Public Access	Satisfactory
Air Samples Collected	Number of PCM Air Samples	1
	Number of PCM Blank Samples	2
	Work Area Acceptable	Yes

Notes:

ECS Technician: Mark D. Wood, II **Date:** 12/29/2019

ECS Mid-Atlantic, LLC

Final Clearance Checklist

Project Number: 1519-L **Date:** 12/29/2019

Project Address: 600 Russell Road
,Alexandria,VA-22301

Work Area Location/Description: North Room

Decontamination Enclosure	Floors and Walls Clean	Satisfactory
	No Debris Present	Satisfactory
	Signage Intact	Satisfactory
	Shower Functioning	N/A
	Used Suits/Towels in Waste Bag	N/A
Interior of Work Area	Floors	Satisfactory
	Walls	N/A
	Ceiling	N/A
	Windows	N/A
	Mechanical Equipment	N/A
	Ducts	N/A
	Pipes	N/A
	Lighting	Satisfactory
	Other Surfaces	N/A
	Specified ACM Removed	Satisfactory
	Work Area Encapsulated	Satisfactory
	Negative Air Filtration Functioning	Satisfactory
	Waste Bags Removed	Satisfactory
	Final Clearance Air Sample Type	TEM
	Number of Samples Collected	5
	Sample Volume (liters)	1200
	Work Area Acceptable	Yes

Notes: Carpet and gross mastic removal completed. Residual black mastic remains on the wood subfloor.

ECS Technician: Mark D. Wood, II **Date:** 12/29/2019

Appendix II: Certifications/ Licenses

DPOR License Lookup License Number 3309001948

License Details

Name	WOOD, MARK DALLAS II
License Number	3309001948
License Description	Asbestos Project Monitor License
Rank	Asbestos Project Monitor
Address	MIDLOTHIAN, VA 23114
Initial Certification Date	2018-07-10
Please Note:	**The validity of this license, certification, or registration has been extended until 30 days after the date which the state of emergency (Executive Order 51) is lifted.**

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DPOR License Lookup build 1,422 (built 2020-07-31 09:09:29).

April 11, 2017

Mr. Derrick Fulcher
Alexandria City Public Schools
1340 Braddock Place
Alexandria, Virginia 22314

ECS Project No. 47:1519-D

Reference: AHERA Management Plan, Matthew Maury Elementary School, 600 Russell Road, Alexandria, Virginia

Dear Mr. Fulcher:

ECS Mid-Atlantic, LLC (ECS), is pleased to provide Alexandria City Public Schools (ACPS) with an AHERA Management Plan for the Matthew Maury Elementary School. This work was performed in general conformance with ECS Proposal No. 47:1750-EP2, dated October 19, 2016 and ACPS Purchase Order Number 17003633. This Management Plan contains the asbestos survey results, procedures for managing the asbestos-containing materials in place, procedures for asbestos removal, and other documentation regarding asbestos-containing materials located within the school building. It is our understanding that asbestos removal and replacement procedures will be performed by asbestos abatement contractors rather than training in-house personnel to perform these tasks. The Management Plan has been modified to these conditions.

ECS appreciates this opportunity to provide these services. If we can be of further assistance to you, please do not hesitate to contact us.

Respectfully,

ECS MID-ATLANTIC, LLC

Beverly Sedon
Senior Environmental Project Manager

Diana Krass-Hofmann
Senior Industrial Hygiene Manger

I:_e-projects\1501-1600\1519-D ACPS 3 YR AHERA - O&M Plans\Matthew Maury\MMP\Matthew Maury Management Plan.doc

14026 Thunderbolt Place, Suite 100, Chantilly, VA 20151-3296 • T: 703-471-8400 • F: 703-834-5527 • www.ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Texas, LLP

DISCLOSURE

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Recommendations within this Management Plan are based on our information and data provided to ECS, survey data and information previously performed by ECS for the subject school building, and on the application of generally accepted technology for reducing human asbestos exposure. This Management Plan may require future revisions if asbestos detection, abatement technologies, or applicable regulations change in the future, or if additional materials are discovered or exiting materials abated. This information contained in this management plan shall not replace the requirements for asbestos assessments for renovations and/or demolition as required by regulation under 40 CFR 61 subpart M.

ORGANIZATION

The sections in this Manual are organized into three general groups:

- Sections 1.0 through 7.0 provide an orientation to the Management Plan program, present a regulatory framework, and define the affected personnel and activities. Particular attention should be given to Section 6.0, which outlines the duties and responsibilities of the personnel who will be individually and corporately responsible for implementing this Management Plan.

- Sections 8.0 through 14.0 describe how the various required Management Plan program elements are to be implemented. The Activity Reference Guide on the following page is intended as a quick reference to those elements.

- Sections 15.0 through 17.0 provide a detailed discussion of the issues, philosophy, and duties associated with removal of asbestos-containing materials.

ACTIVITY REFERENCE GUIDE

NOTE: THIS LIST IS NOT ALL-INCLUSIVE.

Activity Requiring Action	Action Required	Section	Responsible Person
Employee designated to perform asbestos related work.	Determine if employee's work will contact/disturb asbestos-containing materials (ACM)	7.0	Coordinator
	Obtain & file a signed Employee Notice	13.1	" "
	Provide Initial/Annual Training	12.0	" "
	Determine if Worker Protection is required	16.0	
Maintenance or engineering work in areas where asbestos-containing materials are present.	Determine OSHA Work Class	5.0	Competent Person
	If ACM will be disturbed: Check for Negative Exposure Assessment	15.2	" "
	Specify/verify proper work practices	App. L	
	Obtain and file a signed O&M Worker Form	13.1	" "
	Issue Work Control/Permit	App. H	" "
	Determine need for Air Monitoring	15.3, 15.4	" "
			" "
New outside contractor on-site to do maintenance or repair work in areas where asbestos-containing materials are present.	Obtain and file signed Contractor Notice	13.1	Coordinator
	Determine OSHA Work Class	5.0	Competent Person
	Verify that proper Work Practices are followed	App. I	" "
	Issue Work Control/Permit	App. H	" "

ACTIVITY REFERENCE GUIDE (CONTINUED)

New department or teacher occupies space containing asbestos-containing materials	Annual Notice	13.1	Coordinator
New custodial firm doing housekeeping in areas where asbestos-containing materials are present.	Obtain and file signed Contractor Notice Ensure proper work practices	13.1 8.0	Coordinator Competent Person
Renovation or demolition project.	Determine whether asbestos-containing materials are present within project limits Determine Response Action – If asbestos present have abatement plan/specification prepared by licensed project designer as a response action Determine OSHA Work Class Issue Work/Control Permit Determine need for Air Monitoring Ensure proper work practices Provide notifications as appropriate Keep project records	10.1 10.4 5.0 App. H 15.3,15.4 17.0 13.2 14.0	Competent Person " " " " " " " " " " Coordinator Coordinator
Emergency involving disturbance of asbestos-containing materials.	Implement Emergency Response	9.0	Competent Person

Periodic asbestos-containing material assessment.	Perform periodic surveillance Perform Hazard Assessment Determine need for Air Monitoring Determine Response Actions Determine need for signs/labels and verify posting where needed	10.2 10.3 15.0 10.4 11.0	Competent Person " " " " " " " "
O&M worker ends employment.	Obtain and file a signed Exit Exam Acknowledgement	App. K	Coordinator

DIRECTORY
BUILDING REPRESENTATIVES

Asbestos Coordinator

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Facilities Occupational Health, Safety Specialist
Alexandria City Public Schools
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Competent Person

Project Specific Asbestos Removal Contractor
Commonwealth of Virginia Licensed Asbestos Supervisor

Asbestos Consultant

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Chantilly, Virginia 20151
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Asbestos Removal Contractor

To be determined as necessary.

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1.0 OVERVIEW

1.1 BACKGROUND

Matthew Maury Elementary School is located at 600 Russell Road in Alexandria, Virginia. The facility encompasses approximately 51,766 square feet and was reportedly built in 1945. The school consists of one floor level with two lower level mechanical rooms. The structure appears to have had various renovations in the past.

Alexandria City Public Schools (ACPS) currently maintains an asbestos Operations and Maintenance Plan for the school, prepared by A.F. Meyer and Associates, Inc., dated April 1989. ECS was retained by ACPS to develop a newly prepared comprehensive plan to manage the identified asbestos-containing materials (ACMs) in place until such time as building renovation, demolition or other disturbances necessitate their removal. The newly prepared plan includes information and data collected at the facility by ECS or others. This Management Plan was prepared by a Commonwealth of Virginia licensed Asbestos Management Planners (Nos. 3304001593; 3304001626).

1.2 INTRODUCTION TO ASBESTOS

Asbestos is a naturally occurring mineral. It is distinguished from other minerals because its crystals form long, thin fibers. Deposits of asbestos are found throughout the world. Asbestos minerals are divided into two groups — ***serpentine*** and ***amphibole***. The distinction between groups is based upon crystalline structure. The six recognized categories of asbestos are: chrysotile, amosite, crocidolite, anthophyllite, tremolite, and actinolite.

Airborne microscopic asbestos fibers pose a health hazard to humans. Certain activities can release asbestos fibers into the air. Friable asbestos is more likely to release fiber than non-friable material. A material is friable when it is capable of being crumbled, pulverized or reduced to powder by hand pressure. ACM usually becomes more friable with age. Damage caused by natural or human activity could result in increased friability and may be cause for facility management to re-evaluate the potential hazard and take further corrective actions. A glossary of technical terms is provided in Appendix D.

1.3 PURPOSE OF THE MANAGEMENT PLAN

This Management Plan is a document developed to outline how the Local Education Agency (LEA) plans to manage ACM within the school. The mere presence of ACM in good condition does not constitute an exposure risk to students, teachers, employees, visitors, or contractors. ACM presents an exposure risk when asbestos fibers become airborne. This Management Plan establishes protocols to minimize fiber release.

People, who may come in contact with ACM, particularly custodial or maintenance personnel, must be informed of the presence of ACM. Disturbing the ACM should be

avoided unless proper precautions and personnel protection are provided. Remodeling and renovation plans should be carefully reviewed with respect to disturbing the ACM.

ACM in the building could be impacted or disturbed during activities related to housekeeping, maintenance, repair or renovation. These activities may include routine tasks, pre-planned situations such as a renovation project, or unscheduled emergencies that could potentially require ACM abatement.

The objective of this Management Plan is to maintain a safe and healthy building environment for students, teachers, employees, visitors, and contractors through adherence to the following:

- Accurate identification of ACM at the school;
- Proper worker training for all individuals who may contact or disturb ACM;
- Notifications to parents, teachers, employees, and contractors of the presence and location of ACM;
- A record keeping system to maintain asbestos-related information;
- Proper work practices to minimize fiber releases;
- A work control/permit process to review activities that may contact or disturb ACM;
- Periodic surveillance to assess, evaluate and respond to changes in the condition of ACM; and
- Worker protection programs (as applicable).

2.0 HEALTH EFFECTS OF ASBESTOS EXPOSURE

The United States Environmental Protection Agency's (EPA) Model Accreditation Plan (40 CFR 763) includes the requirement to discuss the potential health effects of asbestos exposure. This information is not established as scientific fact, but merely represents EPA's current viewpoint, and is presented herein to facilitate an understanding of EPA guidance.

Most of the information on the health effects of exposure to asbestos has been derived from studies of workers exposed to asbestos in the course of their work. Asbestos fiber concentrations for such workers are many times higher than those encountered by the general public, or by most workers in buildings with ACM. Because their exposure was much higher, asbestos workers will have a much higher incidence of asbestos-related diseases than people who live or work in buildings with ACM. This is known as the dose-response effect. However, people in buildings with ACM are still likely to experience higher risks than the public at large. Unfortunately, available data do not allow us to reliably estimate the actual risk.

Because asbestos fibers appear to be ubiquitous, virtually everyone is exposed to some extent. During autopsy, asbestos fibers have been detected in the lungs of most urban residents. Exposure of the general public is troublesome, because a large population includes unhealthy as well as healthy persons. Moreover, exposure may begin during childhood, leaving a long period for the manifestation of asbestos-related disease. Furthermore, asbestos may enhance the carcinogenic effects of other materials. Thus, additional exposure to asbestos caused by living or working in buildings with ACM should be avoided.

2.1 THE RESPIRATORY SYSTEM

The body has several mechanisms by which it filters the air it breathes. The tiny hairs in the nose filter out dust and airborne particles. Like the nose, the trachea and the bronchi are lined with small fine hairs called cilia. Together with mucous secreted by cells lining the airways, cilia trap particles and help prevent respiratory infections. The cilia beat in an upward direction sweeping foreign particles up the back of the mouth from where they are expelled or swallowed.

Cigarette smoking temporarily paralyzes the cilia. If smoking continues long enough, the cilia wither and die. They are never replaced. The efficiency of the cilia is replaced by the smoker's inefficient cough, which attempts to rid the respiratory tract of foreign particles and excess mucous.

Dirty contaminated air presents the greatest challenge to the respiratory system. Some of the particles entering the airways reach the alveoli. When this occurs, white blood cells called macrophages attempt to engulf and digest the particles. In the case of asbestos, we are dealing with a mineral fiber, a substance that macrophages can often not successfully attack. As a means of secondary defense, the macrophages deposit a coating on the fibers that are then deposited in small passages in the lungs. Here they clog airways and scar surrounding tissues. The walls of the alveoli lose their elasticity and useful function in respiration. Coated asbestos fibers (asbestos bodies) are often seen during autopsy.

Asbestos is known to be hazardous based on studies of asbestos workers and laboratory animals. However, the risks associated with low-level non-occupational exposure (for example, as a student or teacher occupying a building containing ACM) are not well established. Attempts have been made to estimate low-level risks by extrapolation from occupational exposure data; however, this is not a straightforward process and its validity is questionable.

Based on a thorough review of the health effects literature, the EPA concludes: there is no level of exposure below which the risk of contracting an asbestos-related disease is zero. That is, there is no safe threshold level of exposure.

A 1984 survey sponsored by EPA attempted to assess exposure to ACM in public and commercial buildings. According to the data, a lower percentage of public and commercial buildings contain friable ACM than do school buildings (20 percent vs. 35 percent). However, limitations in the data prevent firm conclusions regarding the number of persons exposed, exposure levels or the exposure levels of service/maintenance workers in comparison with the public.

Asbestos fibers accumulate in the lungs. As exposure increases, the risk of disease likewise increases. Measures to minimize exposure and consequently minimize the accumulation of fibers reduce the risk of adverse health effects.

2.2 ASSOCIATED DISEASES

Modern knowledge concerning asbestos and a lung disease called **asbestosis** dates to 1900. Autopsy reports from 1938 to 1949 indicated that a large number of persons who died with asbestosis also had **lung cancer**. In the 1960s, the link between asbestos and a rare form of cancer called **mesothelioma** was established. These diseases are discussed below:

> **Asbestosis** is a scarring (fibrosis) of the lung. The scarring impairs the lung tissue's elasticity and hampers its ability to exchange gases. This leads to inadequate oxygen transfer to the blood. The disease restricts breathing and leads to decreased lung volume, and it increases resistance in the airways. Those last two impairments make breathing difficult. It is a slowly progressive disease with a latency period of 15 to 30 years. Asbestosis is irreversible and may progress even after exposure to asbestos has ceased.

Lung cancer is a malignant tumor of the bronchi covering. The tumor grows through surrounding tissue, invading and often obstructing the air passages. The earliest symptom is often a persistent cough; a physical exam may attribute the symptoms to chronic bronchitis. Chest x-rays sometimes show shadows that indicate tumors and enlarged lymph nodes. However, the definitive diagnosis of lung cancer is based upon microscopic examination of lung tissue. The time between exposure to asbestos and the occurrence of lung cancer is 20 to 30 years. Although there are many causes of lung cancer, a clear increase in risk has been found among people who work with asbestos. Moreover, there is no threshold or limit of exposure below which the risk of lung cancer is not increased.

Mesothelioma is a cancer of the mesothelium — the lining of the chest or abdominal wall. It is considered a marker disease for asbestos exposure. Early stages are associated with few symptoms. By the time it is diagnosed, it is almost always fatal. Effective therapy does not exist. There is no exposure threshold for mesothelioma. Mesothelioma has an extended latency period of 30 to 40 years.

Other diseases and adverse health effects have been noted among those exposed to asbestos fibers. Increased incidence of non-respiratory cancers has been observed in some recent epidemiological studies. Cancers of the larynx, esophagus, stomach, colon-rectum, kidney and pancreas are present at slightly higher than predicted levels. An abnormality found on x-rays of persons exposed to asbestos is pleural plaque, a fibrous thickening of the lining of the chest cavity.

2.3 RELATIONSHIP BETWEEN ASBESTOS AND SMOKING

Cigarette smoking is the single most important known cause of lung cancer in humans. People who smoke 20 cigarettes per day increase their risk of developing lung cancer by ten-fold when compared to a non-smoker. Workers exposed to the same level of asbestos as insulation workers historically increase their risk of developing lung cancer by five-fold. These two factors working together have a synergistic effect; the smoker exposed to asbestos fibers is at least fifty times more likely to develop lung cancer than the general public.

Accordingly, the Occupational Safety & Health Administration (OSHA) regulations require that asbestos training session attendees be encouraged to quit smoking. Many local agencies conduct smoking cessation programs.

3.0 FEDERAL AND STATE REGULATIONS

A directory of appropriate regulatory agencies is provided in Appendix N. The listing of federal and Commonwealth of Virginia asbestos regulations and guidance documents is provided in Appendix O.

There are currently two federal government agencies responsible for the regulations regarding exposure to asbestos at the school: the EPA and OSHA. The occasionally referenced National Institute for Occupational Safety and Health (NIOSH) is an independent entity which is the research arm of OSHA.

3.1 EPA

In *Guidance for Controlling Asbestos-Containing Materials in Buildings* (EPA Document 560/5-85-024, the "Purple Book," June 1985), the EPA states: "*The presence of asbestos in a building does not mean that the health of building occupants is necessarily endangered. As long as asbestos-containing material (ACM) remains in good condition and is not disturbed, exposure is unlikely. When building maintenance, repair, renovation or other activities disturb ACM, or if it is damaged, asbestos fibers may be released creating a potential hazard. Although not required to do so by federal law, the prudent building Owner will take steps to limit building occupants' exposure to airborne asbestos."*

In *Managing Asbestos In Place* (EPA Document 20T 2003 the "Green Book," July 1990), where ACM has been identified and is not to be removed immediately, the EPA recommends that a proactive O&M Program be implemented.

The EPA National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61, Subpart M, dated November 10, 1990, states that "*the Owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos and requires asbestos to be properly handled during renovation, demolition and disposal*." For an abstract of the rules and the text of the EPA NESHAP regulation, refer to Appendix P.

The EPA Asbestos Hazard Emergency Response Act (AHERA), 40 CFR Part 733, Subpart E, requires LEAs to identify friable and non-friable asbestos-containing materials in schools. It requires the use of accredited persons to conduct inspections, develop management plans or to design and perform response actions. In addition, the rule specifies final clearance criteria to all response actions and includes recordkeeping requirements.

3.2 OSHA

The current OSHA regulations take a risk-based approach to classify the activities more likely to create elevated airborne asbestos concentrations. As part of that assessment, OSHA has identified facilities built before 1981 to have a greater potential for ACM to be present.

The OSHA asbestos regulations were first issued in 1971, and were amended in 1976, 1986, 1988, 1994 and 1995. They specify airborne exposure standards, engineering controls, work practices, medical surveillance and worker protection requirements. The current OSHA asbestos rules are divided into three sets of regulations:

- The Construction Industry Standard, 29 CFR 1926.1101, which applies to individuals engaged in building maintenance, repair, renovation (including remodeling and decoration) and demolition, or in asbestos control (ACM enclosure, encapsulation or removal);

- The Shipyard Industry Standard, 29 CFR 1915.1001, which includes all work performed on ships or vessels; and,

- The General Industry Standard 29 CFR 1910.1001, which applies to facilities where ACM is present.

Both the Construction Industry and General Industry regulations can apply to workers in a building with ACM. For example, both teachers and custodial personnel (housekeeping and maintenance staff) are covered by the General Industry regulations since asbestos is present in the school. Custodial and maintenance personnel are also covered by the Construction Industry regulations when they perform maintenance, repair, renovation or asbestos abatement tasks. Outside contractors (e.g., electricians, plumbers, carpenters, asbestos contractors) are covered by the Construction Industry regulations.

OSHA's Respiratory Protection Standard, 29 CFR 1910.134, establishes how employers are to ensure proper training, selection, use and maintenance of respirators for employees who are required to wear them.

The text of the OSHA General Industry, Construction Industry and Respiratory Protection regulations is provided in Appendix Q.

3.3 COMMONWEALTH OF VIRGINIA

The Commonwealth of Virginia agency responsible for asbestos abatement operations is the Department of Labor and Industry. The Department's Asbestos Notification and Permit Program was established in 1992 as part of a larger state program requiring licensing and certification of asbestos contractors and workers by the Department of Professional and Occupational Regulation.

4.0 ASBESTOS RESPONSE ACTIONS

The four commonly accepted approaches to controlling asbestos exposure in buildings are as follows:

Removal: Asbestos material is removed and properly disposed.

Encapsulation: Asbestos material is coated with a bonding agent called a sealant or an encapsulant.

Enclosure: Asbestos material is isolated from the building environment by an airtight barrier.

O&M Program: No immediate removal action is taken. An O&M Program is instituted and designed to reduce the risk of generating airborne fibers through disturbance of the materials by those individuals present within the facility.

4.1 REMOVAL

Proper removal is the most effective solution to problems created by ACM in buildings. Removal eliminates the asbestos source and the need for subsequent special operations and maintenance procedures. However, due to the physical constraints and location of materials, complete removal of ACM in a building is sometimes impractical. Removal often requires replacement of the removed materials with non-asbestos-containing materials.

4.2 ENCAPSULATION

Encapsulation consists of spraying ACM with a sealant to bind asbestos fibers and other components together to reduce the risk of fiber release and increase the material's resistance to damage. With encapsulation, the source of the hazard remains in the building and must be considered when planning renovation, demolition or extensive maintenance activities. In some cases the encapsulant can cause separation of ACM from building surfaces, increasing the potential for fiber release. In addition, encapsulation can make subsequent removal more difficult and hazardous since some of these products create a hard and impermeable surface that cannot be wetted easily to reduce fiber releases.

4.3 ENCLOSURE

Enclosure involves the construction of an air-tight barrier around the ACM. Carefully constructed airtight enclosures can reduce or even eliminate release of airborne fibers into the building environment. Enclosure is impractical in certain instances, particularly where the existence of or need for access to other building components in close proximity to the ACM exists. This alternative does not require replacement of the ACM and usually exhibits

a lower initial cost than removal. However, since the ACM remain in the building, special procedures are required for controlling access to the enclosure, performing maintenance activities or conducting renovations in the enclosure area.

4.4 OPERATIONS AND MAINTENANCE PROGRAM

When the existing ACM in a school or other building is in good condition, the implementation of an O&M Program is widely accepted as an interim provision prior to removal. Whenever ACM is known to exist in a building, O&M procedures should be established to maintain a minimal level of airborne fibers and limit exposure to them. Use of this O&M Program should continue as long as ACM remain present in the building.

Periodic inspections to monitor changes in the exposure potential of ACM are an integral part of this Program. Removing damaged ACM and cleaning up debris are O&M Program requirements. To be effective, an O&M Program requires thoughtful input and participation by building management. A good O&M Program is proactive in nature, and requires an ongoing commitment.

5.0 OSHA WORK CLASSIFICATIONS

5.1 CLASSES OF WORK

The OSHA Construction Industry regulations correlate work classifications to the type of material being removed or the intent of the work. OSHA specifies minimum work practices and engineering controls, training requirements and respirator protection for each class of work. The work classifications are:

Class I: Renovation or demolition activities that involve the removal of Thermal System Insulation (TSI) and surfacing materials (e.g., plaster and spray-applied fire proofing);

Class II: Removal of all other ACM present with the building, that includes, but is not limited to, the removal of ACM and Presumed Asbestos-Containing Materials (PACM) floor tile and mastics;

Class III: Repair or maintenance operations where ACM or PACM are likely to be disturbed;

Class IV: Maintenance and custodial activities where employees contact ACM or PACM and activities to clean-up dust, waste or debris containing ACM or PACM generated by Class I, II or III work.

5.2 CLASS I AND CLASS II ASBESTOS WORK

The Asbestos Coordinator must select an appropriate abatement strategy before Class I and Class II activities are performed. Personnel must be trained and licensed by the Commonwealth of Virginia as abatement workers to perform Class I and Class II activities or an abatement contractor may perform this work. Site-specific procedures, including appropriate plans and abatement specifications for the abatement activity, should be developed by a Commonwealth of Virginia licensed asbestos Project Designer.

5.3 CLASS III ASBESTOS WORK

OSHA defines Class III asbestos work as repair or maintenance operations where any ACM is likely to be disturbed. Personnel must have completed 16-hour O&M Worker Training to do this work. Typical Class III activities include:

- Installing, removing or repairing pipe supports, valves, flanges or fittings that may cause the disturbance of ACM insulation;
- Repairing portions of insulated equipment or accidentally damaged insulation that may cause the disturbance of ACM insulation;

- Coring, drilling or sawing through ACM or PACM floor tile and mastic;

- Installing new flooring that may cause the disturbance of ACM or PACM floor tile and mastic; and,

- Coring floor slabs to create penetrations that may cause the disturbance of ACM or PACM floor tile and mastic.

OSHA defines Class III asbestos work as disturbance of less than 10 square feet or 25 linear feet of ACM where the debris can all be placed into one standard (60" x 60") waste bag. Disturbance of ACM in quantities greater than this should only be undertaken as Class I or II work.

OSHA regulations allow persons who are trained as O&M workers and who participate in a Respiratory Protection and a Medical Surveillance Program to perform Class III asbestos activities. Management should make equipment available if its employees perform Class III asbestos work. If trained employees and equipment are not available to perform Class III work, an abatement contractor should be retained.

Prior to any Class III work, the Asbestos Coordinator shall prepare a general description of the maintenance activity to be performed, along with the size and location of the project area. The Asbestos Coordinator shall determine that the work is not Class I or II work.

5.4 CLASS IV ASBESTOS WORK

OSHA defines Class IV asbestos work as maintenance and custodial activities during which employees contact ACM and activities to clean-up dust, waste or debris containing asbestos generated from Class I, II or III work. Building employees must have satisfactorily completed two-hour “Awareness Training” to do this work. Contract workers must be properly trained and notified by their employers (see Section 13.1). Typical Class IV activities or conditions include:

- Water leakage or activities that are likely to cause damage or abrasion to ACM insulation;

- Maintaining ACM or PACM floor tile and associated mastic;

- Housekeeping activities in areas where damaged ACM or PACM are present.

- Water damage, or installing or renovating electrical or telecommunication lines, lighting fixtures, vents diffusers, or alarms that requires the temporary removal of ceilings where damaged ACM thermal system insulation is present above; and,

- Housekeeping activities in areas where damaged ACM is present.

6.0 PROGRAM ORGANIZATION

6.1 ASBESTOS COORDINATOR

An Asbestos Coordinator shall be assigned to implement, or arrange for the implementation of, the procedures of this O&M Program. The duties of the Asbestos Coordinator include:

a. Program Administration

- Schedule required training **(Section 12.0)** for appropriate employees.
- Establish a system and location within the school and facilities office for retaining the records specified herein **(Section 14.0)**.
- Notify parents, teachers, employees and contractors about the presence and location of ACM in the building and the requirements of this Management Plan **(Section 13.1)**.
- Determine the need for, and ensure adherence to, medical surveillance and respirator fit-testing programs **(Section 16.0)**.
- Purchase and maintain equipment as recommended in **Appendix L** if in-house staff will perform Class III activities.

b. Replacement Construction Materials

The EPA has banned the use of asbestos in spray-applied insulation and select paper products. Other building materials may still contain asbestos. Therefore, the Asbestos Coordinator shall ensure that all new construction materials and products used at the building are sampled and analyzed via Polarized Light Microscopy (PLM) for asbestos content. This documentation shall be maintained for each construction project at the school.

6.2 COMPETENT PERSON

OSHA regulations require that a Competent Person oversee asbestos work at each work site. The competent person must be capable of identifying asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, and is someone who has the authority to take prompt corrective measures to eliminate them.

The Competent Person therefore should be able to determine:

- The Class of work involved in specific situations;
- Whether regulated areas are required;

- The hazard ranking for specific materials; and,

- Appropriate response actions.

Typically, an abatement contractor's supervisor is the Competent Person for Class I, II or III work. OSHA mandates that competent persons overseeing Class III or IV work satisfactorily complete 16-hour O&M Worker Training, with annual updates. If properly trained in the 16-hour O&M Worker Class, the Asbestos Coordinator can also fill the roll of the Competent Person for Class III or IV work performed in the building. The duties of the Competent Person can be grouped into the following general categories:

a. Ongoing Assessment

- Coring, drilling or sawing through ACM floor tile/sheet vinyl flooring and mastic;

- Scheduling and coordinating periodic ACM condition surveys **(Section 10.2)**, hazard assessments **(Section 10.3)**.

- Determining appropriate response actions and evaluating whether areas may require special cleaning to remove ACM dust, waste or debris **(Section 10.4)**.

- Determining whether a Negative Exposure Assessment can be made for specific asbestos-associated activities **(Section 15.2)**.

- Arranging for appropriate air monitoring before, during and after abatement activities. See **Sections 15.3 & 15.4** for detailed air monitoring recommendations.

- Determining the need for, and monitoring both placement and condition of, warning labels and signs **(Section 11.0)**.

b. Routine Maintenance

- Monitoring housekeeping, custodial and building engineering activities that are likely to contact ACM, and ensure compliance with appropriate work practices **(Section 8.0)**.

- Ensuring that Class III maintenance and related activities likely to disturb ACM comply with recommended procedures **(Section 17.0)**.

c. Coordinating Renovation/Construction Activity

- Reviewing and approving all planned maintenance, renovation or installation activities that may contact or disturb ACM. Completing a Work Control/Permit Form **(Appendix H)** before any such work in the facility begins. Reviewing the completed form and the applicable work practices with the affected workers.

- Reviewing available asbestos surveys and previous abatement project reports well in advance of any Renovation/Construction activity. Additionally, visually assessing

the planned affected area. Conclude that all potentially affected materials that could be ACM have been rebutted as non-ACM, or arrange for a qualified consultant to perform a survey of the area as outlined in **Section 10.1**.

- Coordinating work between asbestos abatement contractor(s) and non-abatement contractor(s). Refer to **Section 17.0** for a discussion of the issues, decisions and typical sequence for managing Class I or II asbestos abatement projects.

- Heading the Emergency Response Team and determining and coordinating the response to fiber releases **(Section 9.0)**.

7.0 ASBESTOS-CONTAINING MATERIALS AT THE SCHOOL

While it is often possible to suspect that a material or product is, or contains asbestos, by visual determination, actual determinations can only be made by microscopic analysis. To prove that a material is not an ACM, the EPA requires that the asbestos content of the suspect material be determined by collecting bulk samples and analyzing them by Polarized Light Microscopy (PLM). The PLM technique determines both the percent and type of asbestos in the bulk material.

ACM is defined by EPA and OSHA as any material or product containing asbestiform minerals in concentrations greater than or equal to one percent. Asbestos-containing building material (ACBM) is defined by EPA as surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a school building. For the purpose of this management plan, ACBMs will be referred to as ACMS.

Current OSHA regulations designate surfacing materials and TSI found in buildings constructed prior to 1981 as ACM. Resilient flooring installed prior to 1981 must be treated as ACM. Sampling of these materials is required to rebut this designation. If the designation is not rebutted, the materials must be treated as ACM (refer to Section 10.1). LEAs are to exercise due diligence in determining whether miscellaneous materials are ACM. In this document, the term ACM shall be understood to also include presumed asbestos-containing materials (PACM) and assumed asbestos-containing materials.

7.1 IDENTIFIED ACM

A copy of the asbestos summary tables for the subject building that document the below listed materials and associated locations and conditions of ACM are attached in Appendix C. These materials will be maintained by Alexandria City Public Schools for reference by the staff, public, and contractors and appropriate inspection agencies including the OSHA and the EPA.

The following materials have been reported as asbestos-containing materials:

- 9" x 9" Green floor Tiles
- 9" x 9" Medium Green Floor Tiles and associated Mastic
- 9" x 9" Tan w/White Streaks Floor Tiles
- Beige Interior Wood Door Caulk
- Black floor Tiles
- Black Mastic associated with Brown Floor Tile (under Blue Floor Tile)
- Black Tar Paper/Waterproofing
- Blue TS-Mudded Elbows
- Brown 2" Pipe Insulation
- Brown Adhesive Divot
- Brown Floor Tile and Associated Black Mastic (Bottom Layer)
- Fire Doors
- Glue Dots associated with 1' x 1' Ceiling Tile on Plaster Ceiling

- Incandescent Light Fixture Insulation
- Plaster on Steel Support Beam
- TSI-6" Mudded Elbows/Joints
- TSI-Mudded Elbows/Joints
- Vibration Damper
- White 4" Pipe Insulation
- White Interior Window Glazing
- White Mastic on Fiberglass Insulation and Duct

The following materials were assumed or presumed to be asbestos-containing materials:

- 1' x 1' Ceiling Tiles and associated Mastic
- Advertisement Fiberboards and associated Mastic
- Asphalt-Based Roofing Material and Caulks/Sealants
- Chalk Board and associated Mastic
- Drywall/Joint Compound
- Electrical Panels: Transite Components
- Hardwood Underlayment and associated Mastic
- Interior Pipe Wrap associated with Water Fountains and Radiators
- Mirror Mastic
- Pipe Flange Gaskets
- Plaster Walls
- Rubber Floor and associated Mastic
- Sink Underlayment Mastic
- Thermal System Insulation (TSI)
- Waterproofing Membranes/Mastics
- Window and Door Caulking
- Wood Window sills and associated Mastic

Materials identified as asbestos-containing by bulk sample analysis and materials presumed or assumed to be asbestos-containing are listed in the ACPS Summary Table and the Asbestos Summary Table in Appendix C. If these materials are observed at locations in the building other than those noted in this inventory, please notify the Asbestos Coordinator immediately. If other suspect ACM is observed, contact the Asbestos Coordinator to have them evaluated and added to the asbestos inventory, if appropriate.

This information is presented based on provided data from ACPS and assessments performed by ECS. Should additional data be presented, it should be included in this management plan. Please note, renovations and/or modifications that have occurred at the school may have altered materials present within visible locations. ACMs may be present within enclosed areas, hard ceilings, walls, floors, beneath fixed furniture, shelves, carpeting or other floor overlayments, partition walls, etc.

8.0 CUSTODIAL/HOUSEKEEPING WORK PRACTICES

All custodial and maintenance personnel are required to successfully complete an annual two-hour Awareness Training program.

The following prevention measures require implementation to reduce the potential disturbance of asbestos during all Class IV asbestos work. A Regulated Area (Section 16.2) is required to be created only when airborne concentrations of asbestos within the work area exceed, or may exceed, the Permissible Exposure Limit (PEL). If the following prevention measures are taken, a Regulated Area typically will not be needed:

- Assuming dust, waste and debris in areas where friable thermal system insulation, or surfacing material is present, contains asbestos.
- Using only vacuum cleaners equipped with High Efficiency Particulate Air (HEPA) filters to collect all debris and dust containing asbestos.
- Using wet methods or wetting agents when cleaning or disturbing ACM dust, waste or debris. Do not dry mop or sweep.
- Cleaning up waste and debris contaminated with asbestos and dispose of in leak-tight containers promptly.
- Stripping of ACM floors shall be performed using wet methods and low abrasion pads at speeds lower than 300 rounds per minute.
- Burnishing or dry buffing may only be performed over ACM flooring that has a finish sufficient to prevent pads from contacting the flooring.
- Sanding or grinding of ACM flooring is prohibited.
- Using compressed air is prohibited.

9.0 EMERGENCY SITUATIONS

An emergency situation is an occurrence that would cause an immediate increase in airborne fiber levels (a fiber release) due to disturbance of friable ACM or contamination of the building environment by unprotected ACM. Special procedures are required to properly respond to a fiber release episode. These procedures will vary depending upon the friability, quantity and location of the asbestos. For example, a minor response would likely be required if one asbestos ceiling tile was crumbled in a storage area, whereas a full containment and clean-up by an abatement contractor would likely be required if several feet of asbestos pipe insulation delaminated in an air-handling room.

9.1 TYPICAL OCCURRENCES

Typical occurrences that might create a fiber release are:

- Fire;
- Water damage from roof leakage, pipe rupture or other sources;
- Construction procedures causing excessive vibrations such as coring, jackhammering or vibrations from other mechanical constructive devices;
- Improperly planned or executed renovation or remodeling activities that subject ACM to sanding, cutting, grinding or abrasion; and
- Earthquakes, structural failures or other catastrophic building movements.

A small fiber release involves up to three square or linear feet of ACM. A large fiber release involves over three square or linear feet of ACM. The Competent Person shall determine the extent of the response to fiber release episodes.

9.2 IMMEDIATE PROCEDURES TO BE IMPLEMENTED

The personnel assigned to an Asbestos Emergency Response Team (see Appendix G) shall be notified in case of an emergency situation affecting ACM. They shall immediately implement the following procedures when a large fiber release occurs:

- Turn off air handling system in affected area;
- Vacate contaminated area of all non-essential occupants;
- Without hampering life-safety activities and within the scope of the Team's authority, ensure that personnel in the potentially contaminated area are aware of the asbestos hazard and that they are properly protected;

- Isolate affected areas by closing all doors. This should be performed by trained staff while wearing appropriate worker protection (e.g., respirators and protective clothing).

- Immediately notify the Asbestos Coordinator and the designated consultant's representative;

- Arrange for the construction of airtight sealed door spaces, window spaces and other openings in the area with plastic sheeting;

- Additional procedures, as required, shall be developed by a qualified consultant in conjunction with the Asbestos Coordinator. These shall also be reviewed more in-depth with required awareness training for asbestos with all staff.

9.3 SECONDARY PROCEDURES TO BE IMPLEMENTED

The Asbestos Coordinator should do the following when an emergency situation affects ACM:

- Secure the affected area of the building from unauthorized entry;

- Establish written procedures for authorization and access to affected area;

- Keep security team informed of the status of the emergency situation;

- Providing security in the work area to protect property during remediation;

- Arrange for specialty consultants if required; and

- Consider the effect of emergency situation on utilities, Heating, Ventilating and Air Conditioning (HVAC) systems, and the building structure.

9.4 GENERAL INFORMATION

- Fire can significantly disperse asbestos fibers.

- After an incident, treat the environment as contaminated until proven otherwise.

- Collect as much data about the situation as possible, as quickly as possible.

- Stairwells are first on the critical path of restoration.

10.0 SURVEYS AND SURVEILLANCE

10.1 BUILDING SURVEY

An asbestos inspection has been conducted at the school. The inspection identified ACM as described in Appendix A and formed the basis for this Management Plan. If renovation or construction activities are planned that may disturb ACM or assumed ACM, those materials should be further surveyed according to OSHA regulations unless:

- A survey in compliance with current OSHA standards is on file; or
- Documentation is on file that the space is “asbestos free” as the result of abatement; or
- There is a certification that all existing installed materials are “non-asbestos.”

10.2 PERIODIC SURVEILLANCE

To detect deterioration that, in addition to disturbance, may lead to fiber release, surveillance of ACM by knowledgeable personnel is required. Recommended procedures for detection of deterioration are as follows:

- Visually assess exposed ACM semi-annually for water damage, maintenance damage or deterioration, utilizing the condition assessment and potential for disturbance factors explained in Section 10.3 and 10.4 below.

10.3 ASBESTOS HAZARD ASSESSMENT

There are various recognized schemes for ranking asbestos hazards and prioritizing response actions. The most common is the decision tree described in AHERA, which the EPA promulgated for use in schools (refer to Appendix E). The “Classifications for Material Conditions and their Potential for Disturbance” is defined below:

a. Surfacing Materials

Poor Condition (Significantly Damaged, as defined in AHERA)

ACM means damaged friable surfacing ACM in a functional space where the damage is extensive and severe.

Fair Condition (Damaged, as defined in AHERA)

Friable surfacing ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or which has delaminated such that its bond to the substrate (adhesion) is inadequate, or which,

for any other reason, lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

Good Condition (Undamaged, as defined by AHERA)

Material with no visible damage or deterioration, or showing only very limited damage or deterioration (less than definition of damaged)

b. Thermal System Insulation (TSI)

Poor Condition (Significantly Damaged, as defined in AHERA)

Material with one or more of the following characteristics: missing jackets on at least one tenth of the piping or equipment; crushed, heavily gouged or punctured insulation on at least one tenth of pipe runs, risers, boilers, tank, duct, etc., if the damage is evenly distributed (one quarter if localized).

Accumulation of powder, dust or debris similar in appearance to the suspect material on surfaces beneath the pipe, boiler, tank, duct, etc., can be used as confirmatory evidence.

Fair Condition (Damaged, as defined in AHERA)

Material with one or more of the following characteristics: a few water stains or less than one tenth of insulation with missing jackets; crushed insulation or water stains, gouges, punctures or mars on up to one tenth of the insulation if the damage is evenly distributed (up to one quarter if localized).

Good Condition (Undamaged, as defined by AHERA)

Material with no visible damage or deterioration, or showing only very limited damage or deterioration (less than definition of damaged)

c. Miscellaneous Materials

Poor Condition (Significantly Damaged, as defined in AHERA)

Material with one or more of the following characteristics: the surface is crumbling or blistered over at least one tenth of the surface if the damage is evenly distributed (one quarter if localized).

Fair Condition (Damaged, as defined in AHERA)

Material with the following characteristics: the surface is crumbling, blistered, water-stained, gouged, marred or otherwise abraded over less than one tenth of the surface if the damage is evenly distributed (one quarter if localized).

Good Condition (No Damage, as defined by AHERA)

Material with no visible damage or deterioration, or showing only very limited damage or deterioration (less than the definition of damaged).

10.4 POTENTIAL FOR DISTURBANCE FACTORS

a. Potential for Contact with Material

HIGH	Custodial or maintenance personnel work in the vicinity of the material more than once per week, or The material is in a public area such as a hallway, corridor or auditorium and accessible to building occupants.
MODERATE	Service workers work in the vicinity of the material once per month to once per week.
LOW	Service workers work in the vicinity of the material less than once per month, or The material is visible but not within reach of occupants.

b. Potential for Vibration to Affect Material

HIGH	Loud motors or engines present (e.g., some fan rooms), or intrusive noises or easily sensed vibrations (e.g., major airports, a major highway).
MODERATE	Motors or engines present but not obtrusive (e.g., ducts vibrating but no fan in the area), or Occasional loud sounds.
LOW	None of the above.

c. Potential for Air Erosion to Affect Material

HIGH	High velocity air (e.g., fan room).

MODERATE Noticeable movement of air (e.g., ventilator air stream).

LOW None of the above.

10.5 APPROPRIATE RESPONSE ACTIONS

Based upon the condition assessment and potential for disturbance factors, use the decision tree in Appendix E to determine the material's current Hazard Rank. Note that over time, hazard assessment factors can change. After determining Hazard Rank, assign a Response as follows:

Hazard Rank	Condition	Response
7	Significantly Damaged	Isolate area and restrict access. Remove or enclose the material as soon as possible.
6,5,4	Damaged	Include material in an O&M Program. Repair or remove material as soon as possible, or eliminate material's potential for disturbance.
3,2	Good	Include material in an O&M Program. Schedule removal of material when practical and cost-effective, or reduce material's potential for disturbance.
1	Good	Include material in an O&M Program. Continue O&M until major renovation or demolition would disturb the material, thereby requiring removal under NESHAP.

11.0 WARNING SIGNS AND LABELS

The OSHA regulations require that Building Owners and employers ensure that workers in and adjacent to Regulated Areas comprehend warning signs and labels. Further routine maintenance areas such as boiler rooms are also required to pose warning signs.

Where feasible, the Asbestos Coordinator shall arrange for labels to be placed on identified ACM within routine maintenance areas. Where it is not feasible to directly label the materials (i.e., flooring or ceilings), informational signs can be placed in nearby areas frequented by persons likely to disturb the subject materials. Additionally, "Non-Asbestos" labels can be placed on infill replacement sections of insulation in locations where ACM is prevalent. The Asbestos Coordinator should post labels to be positioned with an orientation and frequency to minimize the unknowing disturbance of ACM. Labels shall read as follows:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

The Asbestos Coordinator shall arrange for signs to be posted at the entries to mechanical areas where PACM/ACM is present to notify employees of the material, its location and the appropriate work practices that, if followed, will minimize disturbance to ACM. The signs shall read:

CAUTION
ASBESTOS HAZARD
DO NOT DISTURB WITHOUT PROPER
TRAINING AND EQUIPMENT
(insert: the material, its location, and appropriate work practices)

The employer shall also attach similar signs at all entries to each regulated area so they will clearly be noticed by employees who are likely to be exposed. Since the Regulated Areas will normally only be created by a licensed abatement contractor, they would be responsible for placing these signs.

Where use of respirators and protective clothing is required in the regulated area, the warning signs shall also include the following text:

RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

12.0 TRAINING OF BUILDING STAFF

An annual two-hour (minimum) Awareness Training Session must be conducted for all management, maintenance and housekeeping employees reasonably expected to contact ACM as part of their work, or who may perform Class IV asbestos work. The Competent Person or Asbestos Consultant can conduct this training. A record of each person attending should be kept, along with a signed certificate indicating that the employee understood the material presented (see Appendix H).

A training program is required to meet the General Industry Standard for housekeeping or maintenance employees who work in areas where asbestos is present. Information contained in this Management Plan can be used as the textbook for this Awareness Training as outlined below.

Topic	*Manual Section Number*
• Introduction to asbestos	1.2
• Purpose of the O&M Program	1.3
• The health risks associated with asbestos exposure	2.0
• The relationship between smoking and asbestos exposure	2.3
• Basic understanding of OSHA work classifications	5.1
• Role and identity of the Competent Person	6.2
• Recognition of ACM in the facility	7.0
• Appropriate custodial and housekeeping work procedures	8.0
• Emergency response procedures to fiber release episodes	9.0
• Asbestos hazard assessment	10.3
• Understanding warning signs and labels	11.0

In addition, any person who performs Class III asbestos work must annually attend a state agency-accredited course equivalent in curriculum and training to the 16-hour course developed by the EPA for maintenance and custodial workers (O&M Training) who conduct activities that will result in the disturbance of ACM.

Requirements for Competent Person training vary by the work that the Competent Person directly supervises:

- *Class I & II Asbestos Work* – The Competent Person must be trained as "Supervisor." Normally an abatement contractor would provide this competent person.

- *Class III & IV Asbestos Work* – The Competent Person must successfully complete at least the 16-hour O&M course or alternatively, a 16-hour Asbestos Management Planner course. ECS recommends that the Asbestos Coordinator, or other designated employee of the building, obtain this training.

13.0 NOTIFICATIONS

13.1 BUILDING OCCUPANTS

a. General Industry Standard requires Owners to exercise due diligence to notify employers and employees of the presence and location of ACM to prevent the unintentional and improper disturbance of ACM.

1) The Asbestos Coordinator shall inform affected outside contractors who enter the facility of the presence and location of ACM in the areas where they will work, and emphasize the need for these firms to comply with the facility's O&M Program procedures. A signed copy of the **Contractor** Asbestos Notice (Appendix H) should be received from each affected authorized representative.

2) The Asbestos Coordinator shall inform employers of housekeeping employees of the presence and location of ACM present in the work areas of their employees. A signed copy of the **Custodial/Maintenance** Asbestos Notice (Appendix H) should be received from each employee.

b. Before work subject to the OSHA Construction Industry Standard occurs (including Class IV work), the building Owner shall identify the presence, location and quantity of ACM in the affected work site, and shall notify the following:

1) Bidding contractors (including short-term utility, communications, electrical or mechanical installers) whose employees reasonably can be expected to work in or adjacent to areas containing ACM:

- A signed copy of the **Contractor** Asbestos Notice (Appendix H) shall be received from each affected authorized representative.

2) All employers of employees who will perform work within or adjacent to areas containing ACM. This notification also shall extend to short-term workers, to the extent that they are reasonably likely to contact ACM:

- Any such individuals reasonably likely to disturb ACM will be required to be fit-tested for a respirator and to sign an **Outside Worker** Acknowledgement Form (Appendix H).

3) Facility manager/Owner's employees (i.e., management, housekeeping, engineering, security) who will work in or adjacent to areas containing ACM:

- Persons who are reasonably likely to contact ACM during the course of their normal work duties shall be advised of potential asbestos hazards and be asked to sign an **Employee** Asbestos Notice (Appendix H).

- Provide a copy of *Guide for Minimizing Disturbance of Asbestos-Containing Materials* (Appendix I) to all custodial/maintenance employees reasonably likely to contact ACM.

- Individuals reasonably likely to disturb ACM shall be instructed in methods to both reduce fiber release and provide for their personal protection and should be fit-tested semi-annually. They also shall sign an **O&M Worker** Acknowledgement Form (Appendix H).

4) Tenants who will occupy areas containing ACM:

- A signed copy of the **Contractor** Asbestos Notice (Appendix H) shall be received from each affected authorized representative.

13.2 GOVERNMENT AGENCIES

The EPA and the Commonwealth of Virginia's Department of Labor and Industry require notification of demolition/renovation activities involving asbestos. Notification is required to be sent to the following relevant government agencies:

- EPA Region III
  1650 Arch Street
  Philadelphia, PA 19103
  (800) 438-2474

- Department of Labor and Industry
  Powers-Taylor Building
  13 South Thirteenth Street
  Richmond, Virginia
  (804) 371-2327

14.0 RECORD KEEPING

ECS recommends establishing and maintaining special files for permanent records. Additional publication or electronic reproduction for security or safety is also recommended. Pursuant to 29 CFR Section 1910.1001 (General Industry Standard), all employee exposure records and medical records pertaining to employees exposed to toxic substances or harmful physical agents must be preserved and maintained by the employer for 30 years.

Whenever an employee or his designated representative requests access to a record, the employer must assure that such access is provided in a reasonable time, place and manner. This provision does not require the employer to post such records. However, specific OSHA asbestos regulations have been interpreted to require that within 15 working days after the receipt of the results of any monitoring performed under the standard that the employer notifies the affected employees of the results in writing either individually or by posting the results in an appropriate location accessible to affected employees.

The following records shall be maintained:

14.1 SURVEY AND SURVEILLANCE REPORTS

- A copy of all building inspection reports documenting the location and condition of ACM must be maintained as long as relied upon, and shall be transferred to subsequent Owners.
- Reports of re-inspections performed to monitor subsequent conditions of affected materials.
- Log of warning sign and label locations.
- 6-Month Surveillance Reports

14.2 WORK CONTROL/PERMITS

- Work Control/Permit forms should be maintained chronologically associated documentation, such as sketches and contractor proposals, should be attached to the forms to identify the work.

14.3 COPIES OF NOTIFICATIONS

- Employee Asbestos Notice
- Contractor Asbestos Notice
- Annual Notification to Parents, PTA, and teachers/staff

- Housekeeping Employer Asbestos Notice
- Outside Worker Acknowledgement

14.4 FLOOR PLANS

ECS recommends that floor plans, including the following information, at a minimum, be maintained and updated as required. Floor plans for the building are included in Appendix B.

- Location of known ACM
- Clear identification of removed ACM and replacement material location
- Date of each abatement activity and contractor's name

14.5 TRAINING RECORDS

The following training records must be maintained for a period of one year beyond the last date of employment:

- A list of attendees at each training program
- The agenda of each training program
- The signed acknowledgement of training
- Copies of certificates for employees who complete EPA-accredited training.

14.6 ASBESTOS ABATEMENT PROJECT DOCUMENTATION

Specific records of each Class I or II asbestos project should include:

- Contractor correspondence
- Consultant correspondence
- Abatement Plans and Specifications
- Abatement Project Reports
- All EPA "Notification of Demolition or Renovation" forms
- Exact locations of the work site within the building
- Type and Scope of asbestos work conducted
- All ACM left within work site boundaries
- Type of replacement material used (if applicable)
- Dates of Work
- Abatement Contractor's Name and address
- Contractor's Insurance Certificate

- Landfill receipts and Asbestos Waste Shipment Records
- Tabulation of all air sampling results
- "In/Out" Log to document all persons who entered the work area
- For Each Abatement Worker:

    1. *Name*
    2. *Training Certifications*
    3. *Licenses*
    4. *Physician's Opinion Letter*
    5. *Fit Test Records*

The Asbestos Coordinator shall maintain all asbestos-free certifications and documentation related to replacement material or new construction activities at the building.

14.7 AIR MONITORING REPORTS

Reports indicating the following shall be maintained for future reference:

- Documentation of Negative Exposure Assessments
- Any employee personal air sampling results
- Airborne fiber concentrations collected for abatement activities
- Airborne fiber concentrations during or following emergency situations

In addition, 29 CFR Section 1926.1101 (Construction Industry Standard) requires that an employer notify affected employees of the monitoring results that represent that employee's exposure as soon as possible following receipt either in writing individually or by posting at a central location that is accessible to affected employees.

14.8 MEDICAL RECORDS

Medical records for any of the building Owner's employees required to wear respirators must be retained for a period of at least 30 years. A copy of each employee's medical record should be placed in the employee's personnel file. Records to be maintained shall include:

- All medical examinations
- All fit tests
- Worker Acknowledgement

15.0 AIR MONITORING

Air sample analysis must be performed by Transmission Electron Microscopy (TEM), in accordance with AHERA protocols per 40 CFR Part 763. TEM is mandated under AHERA for clearance sampling of certain asbestos abatement projects in primary and secondary schools.

The various categories of air monitoring and the purpose of each are discussed in the following four sections:

15.1 NEGATIVE EXPOSURE ASSESSMENT

A Negative Exposure Assessment (NEA) is only made by a "Competent Person" (see Section 6.1). An NEA utilizes an evaluation of air monitoring data, work practices and engineering controls to determine "with a high degree of certainty" that a specific activity will not generate airborne asbestos fiber concentrations above OSHA exposure limits.

ECS recommends that an NEA should not be made for activities found to generate airborne asbestos fiber concentrations above prevalent (background) levels. Unless an NEA is made, activities that may disturb ACM are to be treated as asbestos O&M or abatement work.

The following guidelines must be followed in making an NEA:

- Sampling must be performed on the same individuals, or individuals who have the same level of OSHA-specified training as those individuals who will perform the work being assessed.

- Sampling can be done during the initial phase of a project to conclude that an NEA can be made for that project.

- Data from a recent previous project (within the last 12 months) that closely resembles a proposed job can be used to make an NEA for a proposed project. However, all of the following must be similar:

    1. level of worker training;

    2. type of material being disturbed;

    3. work practices; and

    4. engineering controls (i.e., work area isolation procedures).

- An NEA cannot be made when untrained workers will be involved.

15.2 AIR MONITORING DURING CLASS I OR II ASBESTOS WORK

Air monitoring should be performed during all abatement activities to document airborne fiber concentrations both inside and outside the regulated work area. OSHA requires that daily perimeter air monitoring be performed adjacent to regulated areas in occupied buildings. Specific project requirements should be addressed and performed by a qualified consultant. Air monitoring should be performed to obtain both environmental (area) and personal samples. The types and purposes of air monitoring are as follows:

a. Environmental (Area) Air Monitoring

Asbestos fibers that are too small to be seen by the human eye are potentially the most dangerous to one's health. Insight can be gained by collecting air samples and analyzing them by TEM or Phase Contrast Microscopy (PCM). Area air monitoring indicates how well airborne fibers are being contained inside the work areas. Samples should be taken prior to and during the full period of the removal operation.

Air samples should be taken immediately outside of the work area to detect leakage of fibers from the work area. This is especially important in situations where people who are not protected are present in immediately adjacent areas. Areas around entrances and exits to the work area shall be tested.

Area air samples taken within the work area indicate the effectiveness of the contractor's work procedures. Note that area air samples are not a substitute for OSHA-required personal sampling to determine actual worker exposure levels. Only personal air monitoring indicates worker fiber exposure levels, which in turn indicate the type of respirator that the employee should wear. Both sample types should be taken during any major asbestos activity.

The actual number of samples and air volumes required at each work area may change from day-to-day depending on the work activity. Remember that the most important area samples are those taken outside the work area. This data records whether or not asbestos fibers are confined to the work area. Also, maintaining low fiber concentrations during the removal will make the clean-up procedures easier at the end of the job.

As with personal sampling records, the results of all area sampling should be maintained along with other documentation (landfill receipts, medical records, etc.) from each job.

b. Personal Air Monitoring

Personal air monitoring is the method used to determine a maintenance employee's or abatement worker's exposure to airborne fibers. During asbestos removal projects, the abatement contractor is responsible for personal monitoring of its workers. During O&M activities performed by the building staff, it is recommended that periodic personal air sampling be conducted.

Personal air samples [that must include both PEL and Excursion Limit (EL) sampling] are used to verify whether exposure levels exceed those that correspond to the protection afforded by the type of respiratory protection being used. The higher the concentration of fibers detected, the greater the degree of protection that is needed from a respirator. Under the current OSHA asbestos standard, employees have the right to review the results of their personal monitoring and to be informed of measures being taken to protect them. The Asbestos Coordinator is to maintain personal air sampling records that may be generated during typical or test O&M activities by employees of the building.

If properly used, the personal sampling data can indicate what methods of removal and control result in the lowest employee exposure. Air sampling results from past projects shall be kept on file.

c. Final Clearance Air Monitoring

Following abatement or other major activities during which ACM are disturbed; air monitoring should be performed to document airborne fiber concentrations after final cleaning. This will serve to assess the effectiveness of abatement operations and compliance with pre-specified clearance airborne fiber concentrations.

TEM sampling/analysis is mandated under AHERA for clearance sampling of asbestos abatement projects in primary and secondary schools for certain projects. The average concentration of asbestos of five air samples collected at the same time within the affected functional space and analyzed by the TEM method in CFR 40 Part 763 Appendix A of subpart E is below the filter background level of 70 structures per square millimeter (70 s/mm^2).

A local education agency may analyze air monitoring samples collected for clearance purposes by phase contrast microscopy (PCM) to confirm completion of removal, encapsulation, or enclosure of ACM that is greater than small-scale, short-duration and less than or equal to 160 square feet or 260 linear feet. The action shall be considered complete when the results of samples collected in the affected functional space and analyzed by phase contrast microscopy using the National Institute for Occupational Safety and Health (NIOSH) Method 7400, show that the concentration of fibers for each of the five samples is less than or equal to a limit of quantitation for PCM (0.01 fibers per cubic centimeter (0.01 f/cm3) of air).

Sampling:

Per 40 CFR Part 763 Subpart E, a minimum of 13 samples are to be collected for each testing site consisting of the following:

a) A minimum of five samples per abatement area.

b) A minimum of five samples per ambient area positioned at locations representative of the air entering the abatement site.

c) Two field blanks are to be taken by removing the cap for not more than 30 seconds and replacing it at the time of sampling before sampling is initiated at the following places:

    a. Near the entrance to each abatement area.

    b. At one of the ambient sites. (DO NOT leave the field blanks open during the sampling period.)

d) A sealed blank is to be carried with each sample set. This representative cassette is not to be opened in the field.

15.3 AIR MONITORING DURING CLASS III ASBESTOS WORK

Personal air monitoring is recommended during representative maintenance activities where ACM is likely to be disturbed. Repeat sampling annually thereafter to obtain exposure levels that can be expected during similar activities. Generally this sampling will document that respirators and regulated areas are not required and will form part of the basis for a potential NEA.

Class III asbestos activities as defined in Section 17.0 should be monitored periodically by a qualified consultant to determine typical airborne fiber levels that may be generated. Monitoring should include both area and personal sampling as previously defined. Any activities that are likely to generate fiber counts greater than the PEL or EL should only be performed as an abatement activity.

16.0 WORKER PROTECTION

OSHA regulations have established exposure standards for airborne fibers, as measured by PCM, for all asbestos work in all industries, as follows:

- PEL of 0.1 fibers per cubic centimeter (f/cc), as an 8 hour time-weighted average; and,
- EL of 1.0 f/cc, averaged over a sampling period of thirty minutes.

It is not anticipated that these limits will be exceeded in normal operations of education facilities (or for this building). However, if Class I, II, or III asbestos work does occur within the school or there is a possibility of exceeding these limits, the Asbestos Coordinator shall oversee engineering and work practice controls, establishment of regulated areas, respiratory protection, medical surveillance, disposable clothing and decontamination facilities for exposed employees. Refer to Appendix I for Guide for Minimizing Disturbance of ACM.

16.1 RESPIRATORY PROTECTION

OSHA requires that respirators be worn in the following situations:

- During the interval necessary to implement work practices (e.g., exhaust ventilation with filtered dust collection, general ventilation, vacuum cleaners, enclosure and isolation practices, etc.) and engineering controls;
- Work operations (e.g. maintenance and repair activities) or other activities for which engineering controls are not feasible;
- Work situations where feasible engineering controls are not yet sufficient to reduce exposure below the PEL or EL; and,
- In emergencies (refer to Section 9.0).

Refer to Appendix J for Respiratory Protection Program Requirements and Respirator Selection Guidelines. At this time, ECS does not anticipate users of this plan to require respirators.

16.2 REGULATED AREAS

Regulated areas are required to be established at the following locations:

- Areas where Class I, II and III asbestos work is conducted (i.e., where an abatement contractor is working).

- Areas where debris and waste from asbestos work accumulates (i.e., rooms where asbestos is stored).

- Areas within which airborne concentrations of asbestos exceeds, or may exceed, the PEL.

Typically, only an asbestos-containing material that is significantly damaged and friable, with either “moderate” or “high” potential for disturbance would necessitate this action (refer to Section 10.3). If such a condition is detected, the Asbestos Coordinator should arrange for removal, repair or clean-up as discussed in Section 10.5.

Requirements for regulated areas include the following:

- Demarcate in any manner that minimizes the number of persons within the work area and protects persons outside the area from exposure to airborne concentrations of asbestos;

- Specified signs shall be provided and displayed (see Section 11.0);

- Access to regulated areas shall be limited to persons who have received asbestos training appropriate to the work they perform inside the regulated area (at least two hours of Awareness Training since contact with asbestos will occur).

- All persons entering a regulated area are required to wear respirators;

- Employees shall not drink, eat, smoke, chew tobacco or gum, or apply cosmetics;

- All work performed in regulated areas must be supervised by a Competent Person.

16.3 MEDICAL SURVEILLANCE

Medical surveillance is not required for general building occupants or persons involved in only Class IV work. ECS does not anticipate school employees falling under this requirement.

Employers must obtain a respiratory determination for those personnel whose responsibility is to respond to potential emergency situations, or wear respirators only occasionally, or perform Class I, II or III work less than 30 days per year. A physician shall determine whether the individual is able to wear a respirator based upon evaluation of a pulmonary function test of forced expiratory volume at 1 second and forced vital capacity.

Employers must provide comprehensive examinations for personnel who (for more than 30 days per year) will be required to wear respirators or will be exposed to airborne

concentrations of asbestos fibers at or above the PEL or EL, or perform Class I, II or III work. Refer to Appendix K for the requirements of a full Medical Surveillance Program.

17.0 TYPICAL PROCEDURES FOR RENOVATION WORK

This section outlines the recommended operating procedures when planning and executing work that involves: flooring installation or removal, or mechanical system changes.

These projects may or may not affect ACM. It is important that the below-outlined process is followed so that liability is reduced and compliance with regulations occurs without needless expenditure of funds. A re-inspection for asbestos of any areas to be renovated/demolished shall be performed by a licensed asbestos inspector by the Commonwealth of Virginia.

17.1 DETERMINE THE PRESENCE AND EXTENT OF ACM

- Review the proposed construction activity and assess whether any known or suspected ACM will be affected. Refer to Section 7.0.
- Review available asbestos survey reports to determine whether all suspect materials have been sampled and analyzed. If appropriate, perform supplementary sampling per the guidance in Section 10.1.
- Map the extent of materials determined to be ACM. If any ACM is present, continue with the following steps.

17.2 EXAMINE OPTIONS

Response options should be evaluated by a qualified consultant/licensed project designer in conjunction with the Asbestos Coordinator. Abatement alternatives generally include the following:

- Clean dust and debris in the planned construction area
- Clean, repair and/or encapsulate any damaged or friable ACM
- Modify construction plans or details so ACM is not disturbed
- Clean and enclose the ACM from the construction area

If it is determined that asbestos removal is required, follow the general procedures outlined in Appendix M. Long-term cost consequences should be considered, keeping in mind that NESHAP regulations require removal of all friable or potentially friable ACM from a facility before demolition.

17.3 BIDDING

- If ACM will be cleaned up, encapsulated or enclosed (but not removed), provide the renovation bidders with an asbestos notice.

17.4 NOTIFICATIONS AND PERMITS

- Compare the project extent with the notification requirements given in Appendix O. Also be aware of any additional state and local notification and/or permit requirements. Allow time for the agency approval process.

- Obtain copies of accepted notifications before allowing work to start. Ensure that other employers whose workers are likely to contact ACM on this work site have been notified per Section 13.0.

17.5 MAJOR ASBESTOS WORK

Major asbestos work (Class I or II work) requires implementing extensive work area isolation and barriers, the use of sufficient respiratory protective equipment and protective clothing, as well as progress and clearance air monitoring. All major asbestos work must be performed in regulated areas and a Competent Person must supervise the work. The scope of major abatement projects typically limits this work to unoccupied areas where access is restricted and HVAC and electrical systems are shut down.

Procedures for these activities should be addressed in specifications prepared by a qualified consultant who is a licensed project designer. All major activities should be performed solely by qualified asbestos abatement contractors. Air sampling before, during and at the completion of the abatement activities (Section 15.4) should be performed by a qualified consultant retained directly by the LEA. U.S. EPA stipulates that the testing be performed by a qualified consultant who is independent of the abatement contractor.

APPENDIX A

PREVIOUS REPORTS



REPORT OF SUSPECT ASBESTOS-CONTAINING MATERIAL SAMPLING

MATHEW MAURY ELEMENTARY SCHOOL
600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA 22301

ECS PROJECT NO. 01:21493
ALEXANDRIA CITY SCHOOL BOARD P.O. NO. 13006562-00

FOR
ALEXANDRIA CITY PUBLIC SCHOOLS

JULY 3, 2013

July 3, 2013

Mr. Derrick Fulcher
Alexandria City Public Schools
4701 Seminary Road
Alexandria, Virginia 22304

ECS Project No. 01:21493

Reference: Suspect Asbestos-Containing Floor Tile and Associated Mastic Sampling
Matthew Maury Elementary School, 600 Russell Road, Alexandria, Virginia 22301.

Dear Mr. Fulcher:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide Alexandria City Public Schools with the results of the above referenced suspect asbestos-containing floor tile sampling.

If we can be of further assistance to you, please do not hesitate to contact us at (703) 471-8400.

Respectfully,

ECS MID-ATLANTIC, LLC

Rachael Rossmeissl-Stone
Senior Environmental Project Manager

Stephen R. Geraci
Senior Environmental Project Manager

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SITE DESCRIPTION

The subject property consists of a one-story school building, this sampling was limited to flooring within the multi-purpose room. Maury Elementary School was occupied at the time of our site survey.

RESULTS

Samples of suspect asbestos-containing materials (ACMs) were collected utilizing hand tools and placed into individual, labeled plastic bags. A total of 9 unique suspect ACM samples were sent to Scientific Analytical Institute, Inc. (SAI) for analysis via Polarized Light Microscopy in accordance with current EPA-600 methodology. Materials consisting of additional layers were analyzed separately.

SAI is listed as an accredited laboratory by the National Voluntary Laboratory Accreditation Plan (NVLAP) managed by the National Institute of Standards and Technology (NIST) for bulk sample analysis. Multiple samples of each unique material were submitted. Samples were analyzed using "Positive Stop" methodology. If one sample of a homogeneous material is found to contain asbestos, the remaining samples of that material are not analyzed. EPA regulations stipulate that if one sample contains asbestos the entire quantity of that material contains asbestos, regardless of additional analysis. In total, 17 layers were analyzed.

A summary of materials found to contain asbestos or assumed to contain asbestos can be found in Table 1. A list of materials sampled and tested for asbestos content is located in Table 2 which can be found in the appendix.

TABLE 1
ASBESTOS-CONTAINING MATERIALS SUMMARY
MAURY ELEMENTARY SCHOOL
600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA

General Location	Material	Friability
Multi-Purpose Room	Brown Floor Tile and Associated Black Mastic (bottom layer)	Category I Non-Friable

RECOMMENDATIONS

The materials listed in Table 1 consist of non-friable (i.e., not able to be crumbled, pulverized, and/or reduced to powder by hand pressure when dry) materials which contain greater than one percent (> 1%) asbestos. By definition, these materials are considered ACM. Friable materials will easily produce airborne asbestos fibers if disturbed. Non-Friable materials may also produce airborne asbestos fibers if disturbed.

ECS recommended the identified asbestos-containing materials and any assumed asbestos-containing materials found to be present within the elementary school during renovations be removed by a Commonwealth of Virginia licensed asbestos abatement contractor prior to disturbance.

If asbestos-containing materials are to be removed an industrial hygienist should monitor the project daily. This involves collecting air samples from within and outside abatement work areas to evaluate the abatement contractor's work practices to prevent asbestos fiber release from within the work area. The project monitor should inform the building owner if the asbestos abatement contractor is not performing his work in accordance with project specifications, Commonwealth of Virginia and local regulations as well as EPA regulation 40 CFR Part 61-National Emission Standards for Hazardous Air Pollutants Subpart M: National Emission Standard for Asbestos, and U.S. Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1926.1101 – Asbestos in Construction which, in part, requires the contractor to perform personal exposure monitoring for all workers abating and disposing of asbestos containing materials.

The project monitor should assess each work area to monitor the removal of asbestos-containing materials. Only after the monitor has determined the identified ACMs have been removed should final clearance air samples be collected.

Prior to the removal of regulated ACM, notification of an asbestos project must be made to the EPA 10 business days and to the Commonwealth of Virginia 20 days before starting asbestos abatement activities. If the ACMs identified are removed using wet methods and hand tools they are not considered "regulated ACM".

Prior to renovations of the elementary school, ECS recommends that a project specification be developed to delineate and quantify known and suspect hazardous and regulated materials in the building and to outline proper procedures for the abatement. This will help protect the owner's liability in better defining the scope if work and contractor's roles and responsibilities in the abatement process and holding the contractor accountable for the performance of the project. The specification typically defines the Contractor's scope of work and outline requirements and procedures that must be followed for this project. The intent of the specification is to give performance requirements for the Contractor so that the project can be completed safely and in compliance with applicable federal and state regulations. Typically, the specification document serves as part of the site owner's contract with the contractor.

Limitations

The conclusions and recommendations presented within this report are based upon a reasonable level of assessment within normal bounds and standards of professional practice for a site in this particular geographic setting. ECS is not responsible or liable for the discovery and elimination of hazards that may potentially cause damage, accidents, or injuries.

The observations, conclusions, and recommendations pertaining to environmental conditions at the subject site are necessarily limited to conditions observed, and/or materials reviewed at the time this study was undertaken. No warranty, expressed or implied, is made with regard to the conclusions and recommendations presented within this report. This report is provided for the exclusive use of the client. This report is not intended to be used or relied upon in connection with other projects or by other unidentified third parties without the written consent of ECS and the client.

During this study, suspect asbestos samples were submitted for analysis at an NVLAP-accredited laboratory via polarized light microscopy. As with any similar survey of this nature, actual conditions exist only at the precise locations from which suspect asbestos samples were collected. Certain inferences are based on the results of this sampling and related testing to form a professional opinion of conditions in areas beyond those from which the samples were collected. No other warranty, expressed or implied, is made.

Our recommendations are in part based on federal and local regulations and guidelines. ECS does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies any conditions at the site that may present a potential danger to public health, safety, or the environment. Under this scope of services, ECS assumes no responsibility regarding any response actions initiated as a result of these findings. General compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements.

The client agrees to notify the appropriate local, state, or federal public agencies as required by law, or otherwise to disclose, in a timely manner, information that may be necessary to prevent any danger to public health, safety, or the environment.

TABLE 2
BULK SAMPLING OF SUSPECT ASBESTOS-CONTAINING MATERIALS

Sample #	Sampling Location	Material/Description	Analytical Results
01	Multi-Purpose Room	Brown Floor Tile and Associated Black Mastic (bottom layer)	Floor Tile: Asbestos 7% Chrysotile Mastic: Asbestos 5% Chrysotile
02	Multi-Purpose Room	Brown Floor Tile and Associated Black Mastic (bottom layer)	Floor Tile: N/A Mastic: N/A
03	Multi-Purpose Room	Brown Floor Tile and Associated Black Mastic (bottom layer)	Floor Tile: N/A Mastic: N/A
04	Multi-Purpose Room	Grey Floor Tile and Associated Yellow Mastic (middle layer)	Floor Tile: NAD Mastic: NAD
05	Multi-Purpose Room	Grey Floor Tile and Associated Yellow Mastic (middle layer)	Floor Tile: NAD Mastic: NAD
06	Multi-Purpose Room	Grey Floor Tile and Associated Yellow Mastic (middle layer)	Floor Tile: NAD Mastic: NAD
07	Multi-Purpose Room	White Floor Tile and Associated Yellow Mastic (top layer)	Floor Tile: NAD Mastic: NAD
08	Multi-Purpose Room	White Floor Tile and Associated Yellow Mastic (top layer)	Floor Tile: NAD Mastic: NAD
09	Multi-Purpose Room	White Floor Tile and Associated Yellow Mastic (top layer)	Floor Tile: NAD

NAD = No Asbestos Detected
N/A = Not Analyzed Due to Positive Stop

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: ECS Chantilly
14026 Thunderbolt Place
Suite 100
Chantilly VA 20151

Attn: Stephen Geraci

Project: 01:21493

Lab Order ID: 1311098
Analysis ID: 1311098_PLM
Date Received: 6/13/2013
Date Reported: 6/13/2013

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
1 - A	Bottom Layer Floor Tile - Multi-Purpose Room	**7% Chrysotile**		**93% Other**	Brown Non Fibrous Homogeneous
1311098PLM_1	*tile*				Dissolved
1 - B	Bottom Layer Floor Tile - Multi-Purpose Room	**5% Chrysotile**		**95% Other**	Black Non Fibrous Homogeneous
1311098PLM_10	*mastic*				Dissolved
2 - A	Bottom Layer Floor Tile - Multi-Purpose Room	**Not Analyzed**			
1311098PLM_2	*tile*				
2 - B	Bottom Layer Floor Tile - Multi-Purpose Room	**Not Analyzed**			
1311098PLM_11	*mastic*				
3 - A	Bottom Layer Floor Tile - Multi-Purpose Room	**Not Analyzed**			
1311098PLM_3	*tile*				
3 - B	Bottom Layer Floor Tile - Multi-Purpose Room	**Not Analyzed**			
1311098PLM_12	*mastic*				
4 - A	Middle Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Gray Non Fibrous Heterogeneous
1311098PLM_4	*tile*				Crushed
4 - B	Middle Layer Floor Tile - Multi-Purpose Room	**None Detected**		**100% Other**	Yellow Non Fibrous Homogeneous
1311098PLM_13	*mastic*				Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bobby Wheatley (17)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: ECS Chantilly
14026 Thunderbolt Place
Suite 100
Chantilly VA 20151

Attn: Stephen Geraci

Project: 01:21493

Lab Order ID: 1311098
Analysis ID: 1311098_PLM
Date Received: 6/13/2013
Date Reported: 6/13/2013

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
5 - A	Middle Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1311098PLM_5	*tile*				Crushed
5 - B	Middle Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1311098PLM_14	*mastic*				Dissolved
6 - A	Middle Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1311098PLM_6	*tile*				Crushed
6 - B	Middle Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1311098PLM_15	*mastic*				Dissolved
7 - A	Top Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	White Non Fibrous Homogeneous
1311098PLM_7	*tile*				Dissolved
7 - B	Top Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1311098PLM_16	*mastic*				Dissolved
8 - A	Top Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	White Non Fibrous Homogeneous
1311098PLM_8	*tile*				Dissolved
8 - B	Top Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1311098PLM_17	*mastic*				Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bobby Wheatley (17)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: ECS Chantilly
14026 Thunderbolt Place
Suite 100
Chantilly VA 20151

Attn: Stephen Geraci

Project: 01:21493

Lab Order ID: 1311098
Analysis ID: 1311098_PLM
Date Received: 6/13/2013
Date Reported: 6/13/2013

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
9	Top Layer Floor Tile - Multi-Purpose Room	None Detected		100% Other	White Non Fibrous Homogeneous
1311098PLM_9	*tile only*				Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bobby Wheatley (17)

Analyst

Approved Signatory

1311098

Version 1-15-2012

Client:	ECS Mid-Atlantic, LLC	***Instructions:**
Contact:	Stephen Geraci	*Use Column "B" for your contact info*
	14026 Thunderbolt Place, Suite 100	
Address:	Chantilly, VA 20151	
Phone:	703-471-8400	*To See an Example Click the*
Fax:	703-834-5527	*bottom Example Tab.*
Email:	sgeraci@ecslimited.com	
		Enter samples between "<<" and ">>"
Project:	01:21493	***Begin Samples with a "<< "above the first sample and end with a ">>" below the last sample.***
Client Notes:	[Enter Client Notes Here]	*Only Enter your data on the first sheet "Sheet1"*
P.O. #.	[Enter P.O. # Here]	*Note: Data 1 and Data 2 are optional*
Date Submitted:	6/12/2013 0:00	*fields that do not show up on the official report, however they will be included*
Analysis:	PLM EPA 600, Positive Stop	*in the electronic data returned to you*
TurnAroundTime:	24-Hr	*to facilitate your reintegration of the report data.*

Scientific Analytical Institute

4604 Dundas Drive
Greensboro, NC 27407
Phone: 336.292.3888
Fax: 336.292.3313
Email: lab@sailab.com

Sample Number	HA	Sample Description	Date
<<			
1	Brown Floor Tile & Mastic	Bottom Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
2	Brown Floor Tile & Mastic	Bottom Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
3	Brown Floor Tile & Mastic	Bottom Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
4	Gray Floor Tile & Mastic	Middle Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
5	Gray Floor Tile & Mastic	Middle Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
6	Gray Floor Tile & Mastic	Middle Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
7	White Floor Tile & Mastic	Top Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
8	White Floor Tile & Mastic	Top Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
9	White Floor Tile & Mastic	Top Layer Floor Tile - Multi-Purpose Room	Date Collected 6-11-13
>>			

Accepted ☑

Rejected ☐

6/12/13
9:30 AM

MATHEW MAURY ELEMENTARY SCHOOL

Asbestos Sampling

A summary of materials found to contain asbestos or assumed to contain asbestos can be found in Table 1. A list of materials sampled and tested for asbestos content can be found in Table 3.

TABLE 1
ASBESTOS-CONTAINING MATERIALS SUMMARY

Location	Material	Friability
REPORTED ON PRIOR SURVEYS		
Crawl Space in Basement Boiler Room	Black Tar Paper / Waterproofing*	Category II Non-Friable
Basement Boiler Room (Assumed throughout the Building)	White Mastic on Fiberglass Duct Insulation*	Category II Non-Friable
Café Stage Storage (Assumed in other Areas)	9” x 9” Tan with White Streaks Floor Tiles	Category I Non-Friable
Classrooms 1-5 (Assumed under Carpet in other Areas)	Black Floor Tiles (under Carpet and Leveling Compound)	Category I Non-Friable
Classrooms 1-5 (Assumed under Carpet in other Areas)	9” x 9” Medium Green Floor Tiles and associated Mastic (under Carpet and Leveling Compound)	Category I Non-Friable
Gym	Blue TSI – Mudded Elbows*	Friable
Hallways (Observed in other Areas)	Fire Door Insulation	Friable
Gym Storage Room (Assumed in other Areas)	TSI – Mudded Elbows/Joints	Friable

Location	Material	Friability
Room 20 (Observed above Drop Ceiling Tile in other Classrooms)	Glue Dots**	Category II Non-Friable
SAMPLED BY ECS IN OCTOBER 22, 2013		
Storage Room in Basement at Exit Door 11 (Assumed in other Areas)	White 4" Pipe Insulation*	Friable
Storage Room in Basement at Exit Door 11 (Assumed in other Areas)	Brown 2" Pipe Insulation*	Friable
Storage Room in Basement at Exit Door 11 (Assumed in other Areas)	White Interior Window Glazing*	Category II Non-Friable
Hallway at Girl Restroom (Toilet Room) (Assumed in other Areas)	Black Mastic associated with Brown Floor Tile (under Blue Floor Tile)	Category I Non-Friable
Cafeteria (Assumed in other Areas)	Beige Interior Wood Door Caulk	Category II Non-Friable
MATERIALS ASSUMED TO CONTAIN ASBESTOS * **		
Stage and Gymnasium	Wood Floor Underlayment and associated Mastic	Category I Non-Friable
Hallways	Boards and associated Mastics	Category II Non-Friable
Classrooms	Chalkboards and associated Mastics	Category II Non-Friable
Pipes within chases behind walls and above ceiling throughout the building	Thermal System Insulation (TSI)	Friable
Throughout Building	Pipe Flange Gaskets	Unknown

Location	Material	Friability
Throughout Building	Interior Pipe Wrap associated with Water Fountains and Radiators	Category II Non-Friable
Mechanical Rooms	Electric Panels: Transite Components	Category II Non-Friable
Bathrooms	Mirror Mastics	Category II Non-Friable
Behind Interior Finishes, Exterior Veneer and/or Subgrade Walls, and under Ceramic Flooring	Waterproofing Membranes/Mastics	Category II Non-Friable
Roof	Asphalt-Based Roofing Materials and Caulks/Sealants	Non-Friable

Notes: * These materials were observed damaged in the above listed locations.
** Debris from plaster ceiling with residual of this material was observ ed on top of drop ceiling tiles. Water stained and missing ceiling tiles associated with this material were observed throughout the building.
*** These materials, if present, could not be reached at the time of the survey. These materials should be presumed to be asbestos-containing materials (ACMs).

Physical Assessment

A summary of the physical assessment category for each identified and presumed friable ACM can be found in Table 2.

TABLE 2
PHYSICAL ASSESSMENT OF FRIABLE ASBESTOS CONTAINING MATERIALS

Location	Material	Physical Assessment Category
Gym	Blue TSI Mudded Elbows	1 – Damaged or Significantly Damaged TSI ACBM
Hallways (Observed in other Areas)	Fire Door Insulation	7 – Any Remaining Friable ACBM
Gym Storage Room	TSI – Mudded Elbows/Joints	6 – ACBM with Potential for Significant Damage

Location	Material	Physical Assessment Category
Storage Room in Basement at Exit Door 11	White 4” Pipe Insulation	1 – Damaged or Significantly Damaged TSI ACBM
Storage Room in Basement at Exit Door 11	Brown 2” Pipe Insulation	1 – Damaged or Significantly Damaged TSI ACBM

Recommendations

1) The following friable materials were observed damaged and should be repaired or removed by a Commonwealth of Virginia licensed asbestos abatement contractor:
   - Blue TSI – mudded elbows in the gymnasium;
   - White 4” pipe wrap and insulation and brown 2” pipe insulation in the basement storage room at Exit Door 11.

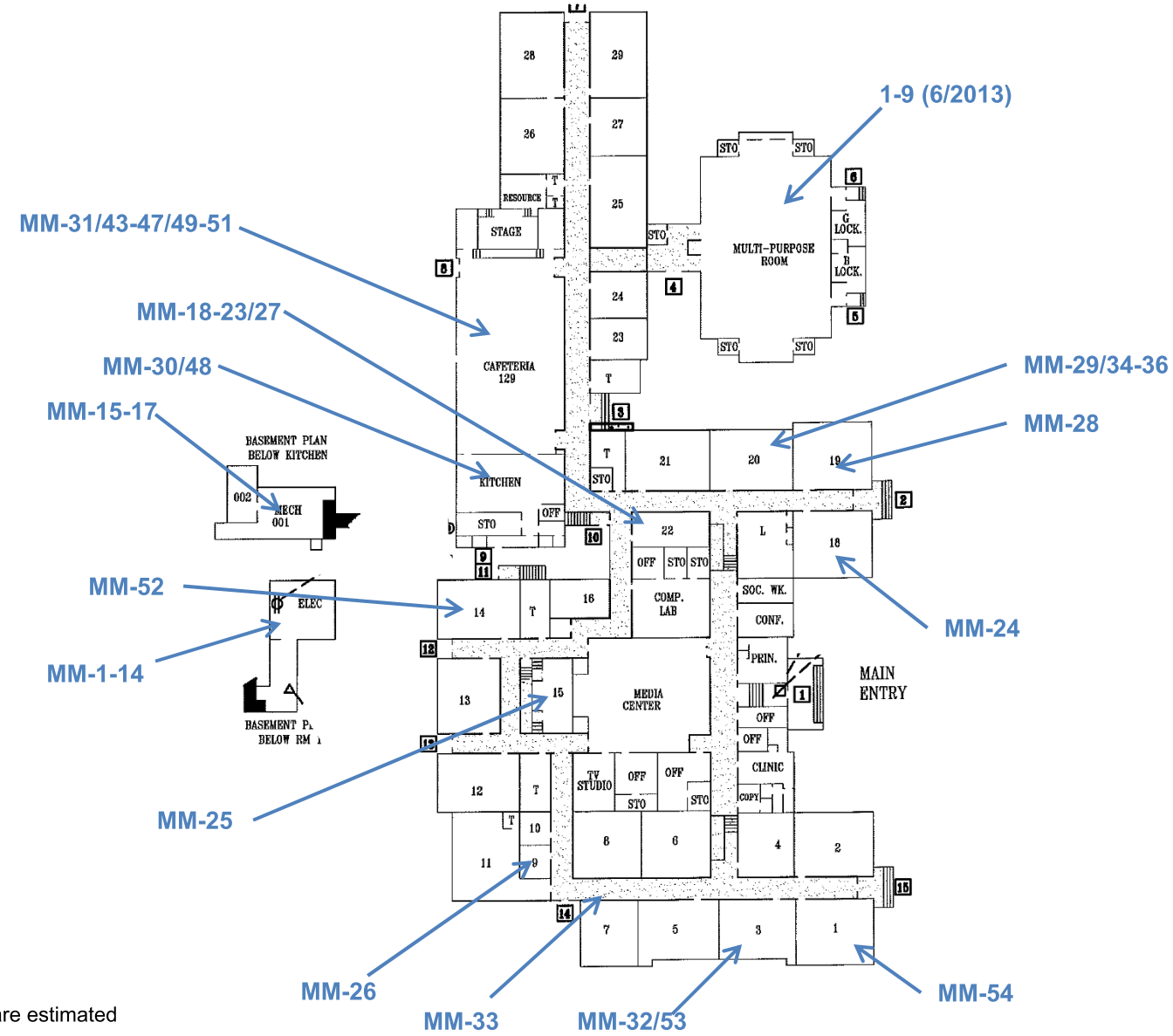
2) The following non-friable materials were observed damaged and should be removed or repaired by personnel designated by the School and trained in Operations & Maintenance asbestos activities:
   - Black tar paper/waterproofing within the crawl space in basement boiler room;
   - White mastic on fiberglass duct insulation in the basement storage room;
   - White interior window glazing in the basement storage room at Exit Door 11.

3) Debris from plaster ceiling with glue dot residual was observed on top of drop ceiling tiles in the Classroom 19. Water stained and missing 1’ x 1’ ceiling tiles associated with this material were also observed throughout the building. Any damaged 1’ x 1’ ceiling tile and residual glue dots should be removed by personnel designated by the School and trained in Operations & Maintenance asbestos activities. Missing 1’ x 1’ ceiling tiles should be replaced as soon as possible to avoid future damage to the asbestos containing glue dots.

APPENDIX B

FLOOR PLANS

1st FL



Legend
- Sample Number

Notes
1. Sample Locations are estimated

MATTHEW MAURY
600 RUSSELL ROAD
ALEXANDRIA, VIRGINIA

SAMPLING LOCATIONS
ACPS

SCALE NTS

Project No. 47:1519-D

Date 3/31/2017

APPENDIX C

ASBESTOS SUMMARY TABLES

MATTHEW MAURY ELEMENTARY SCHOOL
ACPS ASBESTOS CONTAINING MATERIALS SUMMARY

Updated as of December 28, 2016

MATERIAL	LOCATION	FRIABILITY	CONDITION	COMMENTS	LAST INSPECTION DATE	RECOMMENDATION	SEMI-ANNUAL INSPECTION DATE	REMARKS
MATERIALS REPORTED AS ASBESTOS-CONTAINING MATERIALS ON PRIOR SURVEYS								
Incandescent Light Fixture Insulation	Kitchen	F	Intact	None	28-Dec-16	Maintain in O & M Plan		Verify Analytical Results
Black Tar Paper/Waterproofing	Basement Storage Room	NF	Crawlspace in the Boiler Room	Pipe leaking water nearby	28-Dec-16	Maintain in O & M Plan		Verify Analytical Results
White Mastic on Fiberglass Insulation and Duct	Crawlspace in Basement Storage Room	NF	Unable to locate	Materials may be under existing partition walls, fixtures, cabinets, etc. throughout the building	28-Dec-16	Maintain in O & M Plan		Verify Analytical Results
9" x 9" Tan w/White Streaks Floor Tiles	Café Stage Storage	NF	Intact	Materials may be under existing partition walls, fixtures, cabinets, etc. throughout the building	28-Dec-16	Maintain in O & M Plan		Verify Analytical Results
Black floor Tiles	Classroom 1-5	NF	Intact	Materials may be under existing partition walls, fixtures, cabinets, etc. throughout the building	28-Dec-16	Maintain in O & M Plan		May be under newer flooring
9" x 9" Medium Green Floor Tiles and associated Mastic	Classroom 1-5	NF	Intact	Materials may be under existing partition walls, fixtures, cabinets, etc. throughout the building	28-Dec-16	Maintain in O & M Plan		May be under newer flooring
Blue TS-Mudded Elbows	Gym	F	Intact	1 Damaged By Roof Drain	28-Dec-16	Maintain in O & M Plan		Verify Analytical Results
Fire Doors	Hallways	F	Intact	Observed in other areas	28-Dec-16	Maintain in O & M Plan		Verify Analytical Results
TSI-Mudded Elbows/Joints	Gym Storage Room	F	Removed	Observed in other areas	28-Dec-16	Maintain in O & M Plan		Verify Analytical Results
Glue Dots associated with 1' x 1' Ceiling Tile on Plaster Ceiling	Room 18, 19, & 20	NF	Damaged	Assumed in all classrooms; In Room 19 there was damaged plaster ceiling associated with this material	28-Dec-16	Maintain in O & M Plan		Verify Analytical Results
MATERIALS REPORTED AS ASBESTOS-CONTAINING MATERIALS ON PRIOR SURVEYS THAT WERE NOT IDENTIFIED/OBSERVED BY ECS IN OCTOBER 22, 2013 SURVEY								
Vibration Damper	Gym AHU	F	Intact	This material is reported as ACM; however it was not observed in this area	28-Dec-16	Maintain in O & M Plan		Sampling if proposed for disturbance
9" x 9" Green floor Tiles	Room 20	NF	N/A	Materials may be under existing partition walls, fixtures, cabinets, etc. throughout the building	28-Dec-16	Maintain in O & M Plan		Unable to Locate
Brown Adhesive Divot	Room 3	NF	N/A	Materials may be under existing partition walls, fixtures, cabinets, etc. throughout the building	28-Dec-16	Maintain in O & M Plan		Unable to Locate

MATTHEW MAURY ELEMENTARY SCHOOL
ACPS ASBESTOS CONTAINING MATERIALS SUMMARY

MATERIAL	LOCATION	FRIABILITY	CONDITION	COMMENTS	LAST INSPECTION DATE	RECOMMENDATION	SEMI-ANNUAL INSPECTION DATE	REMARKS
TSI-6" Mudded Elbows/Joints	Room 19	F	N/A	Need verification	28-Dec-16	Maintain in O & M Plan		Unable to Locate
Plaster on Steel Support Beam	Room 19/Kindergarten	F	N/A	Above 1' x 1' ceiling tiles	28-Dec-16	Maintain in O & M Plan		Unable to Locate
ASBESTOS CONTAINING MATERIALS SAMPLED BY ECS IN JUNE 11, 2013 SURVEY								
Brown Floor Tile and Associated Black Mastic (Bottom Layer)	Multipurpose Room	NF	N/A		28-Dec-16	Add to O&M Plan		
ASBESTOS CONTAINING MATERIALS SAMPLED BY ECS IN OCTOBER 22, 2013 SURVEY								
White 4" Pipe Insulation	Storage Room in Basement at Exit Door 11	F	Damaged	Assumed to be in other areas	28-Dec-16	Remove or Enclose ASAP		Asbestos : Wrap-40% Chrysotile Insulation-15% Chrysotile, 15% Amosite
Brown 2" Pipe Insulation	Storage Room in Basement at Exit Door 11	F	Intact	Assumed to be in other areas	28-Dec-16	Add to O & M Plan		Asbestos : 30% Amosite
White Interior Window Glazing	Storage Room in Basement at Exit Door 11	NF	Damaged	Assumed to be in other areas	28-Dec-16	Remove or Enclose ASAP		Asbestos : 3% Chrysotile
Black Mastic associated with Brown Floor Tile (under Blue Floor Tile)	Hallway at Girl's Restroom (Toilet Room)	NF	Intact	Assumed to be in other areas	28-Dec-16	Add to O & M Plan		Asbestos: Mastic - 5% Chrysotile
Beige Interior Wood Door Caulk	Cafeteria	NF	Intact	Assumed to be in other areas	28-Dec-16	Add to O & M Plan		Asbestos : 3% Chrysotile
MATERIALS ASSUMED TO CONTAIN ASBESTOS								
Plaster Walls	Throughout Building	F	Intact	Sampled NAD in Storage/Sprinkler Room in the Basement by ECS. This material may be present in other areas	28-Dec-16	Remove from O & M Plan		None
1' x 1' Ceiling Tiles and associated Mastic	Above Ceiling Tiles in Room 18 Kitchen/Cafeteria	NF	Intact	PACM until tested/ Only brown glue dots on wall columns in the Cafeteria	28-Dec-16	Maintain in O & M Plan		Sampling if proposed for disturbance
Drywall/Joint Compound	Throughout Building	NF	Intact	Sampled NAD in Staff Work Room 22 by ECS. This material may be present in other areas	28-Dec-16	Remove from O & M Plan		None
Hardwood Underlayment and associated Mastic	Stage or Throughout the Building	NF	Intact	PACM until tested	28-Dec-16	Maintain in O & M Plan		Sampling if proposed for disturbance
Rubber Floor and associated Mastic	Gym and Gym AHU	NF	Intact	PACM until tested	28-Dec-16	Maintain in O & M Plan		Sampling if proposed for disturbance

MATTHEW MAURY ELEMENTARY SCHOOL
ACPS ASBESTOS CONTAINING MATERIALS SUMMARY

MATERIAL	LOCATION	FRIABILITY	CONDITION	COMMENTS	LAST INSPECTION DATE	RECOMMENDATION	SEMI-ANNUAL INSPECTION DATE	REMARKS
Advertisement Fiberboards and associated Mastic	Hallways	NF	Intact	PACM until tested	28-Dec-16	Maintain in O & M Plan		Sampling if proposed for disturbance
Sink Underlayment Mastic	Art Room, Room 14, Classrooms 18-21 & 1-5	NF	Intact	Sampled NAD in Classrooms 1, 3, & 14 by ECS. This material may be present in other areas	28-Dec-16	Remove from O & M Plan		None
Chalk Board and associated Mastic	All Classrooms	NF	Intact	PACM until tested	28-Dec-16	Maintain in O & M Plan		Sampling if proposed for disturbance
Window and Door Caulking	Throughout Building	NF	Intact	PACM until tested	28-Dec-16	Maintain in O & M Plan		Sampling if proposed for disturbance
Wood Window sills and associated Mastic	Classroom	NF	Intact	PACM until tested	28-Dec-16	Maintain in O & M Plan		Sampling if proposed for disturbance
Thermal System Insulation (TSI)	Throughout the Building	F	Intact	PACM until tested	28-Dec-16	Add to O & M Plan		Sampling if proposed for disturbance
Pipe Flange Gaskets	Throughout the Building	Unknown	Intact	PACM until tested	28-Dec-16	Add to O & M Plan		Sampling if proposed for disturbance
Electrical Panels: Transite Components	Mechanical Rooms	NF	Intact	PACM until tested	28-Dec-16	Add to O & M Plan		Sampling if proposed for disturbance
Mirror Mastic	Bathrooms	NF	Intact	PACM until tested	28-Dec-16	Add to O & M Plan		Sampling if proposed for disturbance
Interior Pipe Wrap associated with Water Fountains and Radiators	Throughout the Building	F	Intact	PACM until tested	28-Dec-16	Add to O & M Plan		Sampling if proposed for disturbance
Waterproofing Membranes/Mastics	Behind Interior Finishes, Exterior Veneer and/or Subgrade Walls, and Under Ceramic Flooring	NF	Intact	PACM until tested	28-Dec-16	Add to O & M Plan		Sampling if proposed for disturbance
Asphalt-Based Roofing Material and Caulks/Sealants	Roof	NF	Intact	PACM until tested	28-Dec-16	Add to O & M Plan		Sampling if proposed for disturbance
NON-ASBESTOS CONTAINING MATERIALS SAMPLED BY ECS IN June 11, 2013 SURVEY								
Grey Floor Tile and Associated Yellow Mastic (middle layer)	Multipurpose Room	N/A	N/A	N/A	N/A	N/A	N/A	NAD
White Floor Tile and Associated Yellow Mastic (top layer)	Multipurpose Room	N/A	N/A	N/A	N/A	N/A	N/A	NAD
NON-ASBESTOS CONTAINING MATERIALS SAMPLED BY ECS IN OCTOBER 22, 2013 SURVEY								
Plaster Ceiling	Storage/Sprinkler Room in the Basement	N/A	N/A	N/A	N/A	N/A	N/A	NAD
Black Ceiling Coat	Boiler Room	N/A	N/A	N/A	N/A	N/A	N/A	NAD

MATTHEW MAURY ELEMENTARY SCHOOL
ACPS ASBESTOS CONTAINING MATERIALS SUMMARY

MATERIAL	LOCATION	FRIABILITY	CONDITION	COMMENTS	LAST INSPECTION DATE	RECOMMENDATION	SEMI-ANNUAL INSPECTION DATE	REMARKS
Drywall	Staff Work Room 22	N/A	N/A	N/A	N/A	N/A	N/A	NAD
Joint Compound	Staff Work Room 22	N/A	N/A	N/A	N/A	N/A	N/A	NAD
Yellow Carpet Mastic	Classroom 9, 15, and 18	N/A	N/A	N/A	N/A	N/A	N/A	NAD
Plaster Wall/Ceiling	Kitchen, Cafeteria, and Classrooms 3, 19, 20, & 22	N/A	N/A	N/A	N/A	N/A	N/A	Finish-NAD Base- NAD
Yellow Carpet Mastic and Leveling Compound	Classroom 20	N/A	N/A	N/A	N/A	N/A	N/A	Mastic-NAD Leveling- NAD
Blue Floor Tile and under 12"x12" Floor Tile	Hallway at Girl's Restroom (Toilet Room)	N/A	N/A	N/A	N/A	N/A	N/A	Vinyl-NAD Mastic- NAD
Brown Glue Dot	Cafeteria (Walls and Columns)	N/A	N/A	N/A	N/A	N/A	N/A	NAD
Black Waterproofing	Kitchen (behind Plaster Wall)	N/A	N/A	N/A	N/A	N/A	N/A	NAD
Gray Sink Undercoat	Classrooms 1, 3, & 14	N/A	N/A	N/A	N/A	N/A	N/A	NAD
Brown Floor Tile (under Blue Floor Tile) associated with Black Mastic	Hallway at Girl's Restroom (Toilet Room)	NF	N/A	The mastic associated wit this material is ACM, and is listed as such in the corresponding section of this table.	N/A	N/A	N/A	Floor Tile - NAD
NON-ASBESTOS CONTAINING MATERIALS SAMPLED BY ECS IN DECEMBER 28, 2016 SURVEY								
12"x12" White Mottled Floor Tile & Yellow Mastic	Main Hallway	N/A	N/A	N/A	N/A	N/A	N/A	NAD
12"x12" Magenta Mottled Floor Tile & Yellow Mastic	Main Hallway	N/A	N/A	N/A	N/A	N/A	N/A	NAD
4" Blue Cove Base & Yellow Mastic	Lower Hallway	N/A	N/A	N/A	N/A	N/A	N/A	NAD

Notes: F = Friable; NF = Non-Friable; PACM = Presumed Asbestos Containing Material; O & M Plan = Operations and Maintenance Plan; NAD = No Asbestos Detected, N/A = Not Applicable.

TABLE 1

BULK SAMPLING OF SUSPECT ASBESTOS-CONTAINING MATERIALS

Sample #	Sampling Location	Material/Description	Analytical Results
1	Main Hallway	12"x12" White Mottled Floor Tile & Yellow Mastic	NAD
2	Main Hallway	12"x12" White Mottled Floor Tile & Yellow Mastic	NAD
3	Main Hallway	12"x12" Magenta Mottled Floor Tile & Yellow Mastic	NAD
4	Main Hallway	12"x12" Magenta Mottled Floor Tile & Yellow Mastic	NAD
5	Lower Hallway	4" Blue Cove Base & Yellow Mastic	NAD
6	Lower Hallway	4" Blue Cove Base & Yellow Mastic	NAD

Table Notes:
NAD = No Asbestos Detected
N/A = Sample Not Analyzed; Positive Stop
Bold = Asbestos-Containing Materials

APPENDIX D

GLOSSARY

GLOSSARY

Accessible when referring to ACM means that the material is subject to disturbance by school building occupants or custodial or maintenance personnel in the course of their normal activities.

Accredited or accreditation when referring to a person or laboratory means that such person or laboratory is accredited in accordance with section 206 of Title II of the Act.

Air erosion means the passage of air over friable ACBM which may result in the release of asbestos fibers.

Asbestos means the asbestiform varieties of: Chrysotile (serpentine); crocidolite (riebeckite); amosite (cum- mingtonitegrunerite); anthophyllite; tremolite; and actinolite.

Asbestos-containing material (ACM) when referring to school buildings means any material or product which contains more than 1 percent asbestos.

Asbestos-containing building material (ACBM) means surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a school building.

Asbestos debris means pieces of ACBM that can be identified by color, texture, or composition, or means dust, if the dust is determined by an accredited inspector to be ACM.

Damaged friable miscellaneous ACM means friable miscellaneous ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate or which for any other reason lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

Damaged friable surfacing ACM means friable surfacing ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or which has delaminated such that its bond to the substrate (adhesion) is inadequate, or which, for any other reason, lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

Damaged or significantly damaged thermal system insulation ACM means thermal system insulation ACM on pipes, boilers, tanks, ducts, and other thermal system insulation equipment where the insulation has lost its structural integrity, or its covering, in whole or in part, is crushed, water-stained, gouged, punctured, missing, or not intact such that it is not able to contain fibers. Damage may be further illustrated by occasional punctures, gouges or other signs of physical injury to ACM; occasional water damage on the protective coverings/jackets; or exposed ACM ends or joints. Asbestos debris originating from the ACBM in question may also indicate damage.

Encapsulation means the treatment of ACBM with a material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent the release of fibers, as the encapsulant creates a membrane over the surface (bridging encapsulant) or penetrates the material and binds its components together (penetrating encapsulant).

Enclosure means an airtight, impermeable, permanent barrier around ACBM to prevent the release of asbestos fibers into the air.

Fiber release episode means any uncontrolled or unintentional disturbance of ACBM resulting in visible emission.

Friable when referring to material in a school building means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously nonfriable material after such previously nonfriable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.

Functional space means a room, group of rooms, or homogeneous area (including crawl spaces or the space between a dropped ceiling and the floor or roof deck above), such as classroom(s), a cafeteria, gymnasium, hallway(s), designated by a person accredited to prepare management plans, design abatement projects, or conduct response actions.

High-efficiency particulate air (HEPA) refers to a filtering system capable of trapping and retaining at least 99.97 percent of all monodispersed particles 0.3 m in diameter or larger.

Homogeneous area means an area of surfacing material, thermal system insulation material, or miscellaneous material that is uniform in color and texture.

Local education agency means:

(1) Any local educational agency as defined in section 198 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. *3381*).

(2) The owner of any nonpublic, nonprofit elementary, or secondary school building.

(3) The governing authority of any school operated under the defense dependent's education system provided for under the Defense Dependents' Education Act of 1978 (20 U.S.C. 921, et seq.).

Miscellaneous ACM means miscellaneous material that is ACM in a school building.

Miscellaneous material means interior building material on structural components, structural members or fixtures, such as floor and ceiling tiles, and does not include surfacing material or thermal system insulation.

Nonfriable means material in a school building which when dry may not be crumbled, pulverized, or reduced to powder by hand pressure.

Operations and maintenance program means a program of work practices to maintain friable ACBM in good condition, ensure clean up of asbestos fibers previously released, and prevent further release by minimizing and controlling friable ACBM disturbance or damage.

Potential damage means circumstances in which:

(1) Friable ACBM is in an area regularly used by building occupants, including maintenance personnel, in the course of their normal activities.

(2) There are indications that there is a reasonable likelihood that the material or its covering will become damaged, deteriorated, or delaminated due to factors such as changes in building use, changes in operations and maintenance practices, changes in occupancy, or recurrent damage.

Potential significant damage means circumstances in which:

(1) Friable ACBM is in an area regularly used by building occupants, including maintenance personnel, in the course of their normal activities.

(2) There are indications that there is a reasonable likelihood that the material or its covering will become significantly damaged, deteriorated, or delaminated due to factors such as changes in building use, changes in operations and maintenance practices, changes in occupancy, or recurrent damage.

(3) The material is subject to major or continuing disturbance, due to factors including, but not limited to, accessibility or, under certain circumstances, vibration or air erosion.

Preventive measures means actions taken to reduce disturbance of ACBM or otherwise eliminate the reasonable likelihood of the material's becoming damaged or significantly damaged.

Removal means the taking out or the stripping of substantially all ACBM from a damaged area, a functional space, or a homogeneous area in a school building.

Repair means returning damaged ACBM to an undamaged condition or to an intact state so as to prevent fiber release.

Response action means a method, including removal, encapsulation, enclosure, repair, operations and maintenance, that protects human health and the environment from friable ACBM.

Routine maintenance area means an area, such as a boiler room or mechanical room, that is not normally frequented by students and in which maintenance employees or contract workers regularly conduct maintenance activities.

School means any elementary or secondary school as defined in section 198 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 2854).

School building means:

(1) Any structure suitable for use as a classroom, including a school facility such as a laboratory, library, school eating facility, or facility used for the preparation of food.

(2) Any gymnasium or other facility which is specially designed for athletic or recreational activities for an academic course in physical education.

(3) Any other facility used for the instruction or housing of students or for the administration of educational or research programs.

(4) Any maintenance, storage, or utility facility, including any hallway, essential to the operation of any facility described in this definition of school building under paragraphs (1), (2), or (3).

(5) Any portico or covered exterior hallway or walkway.

(6) Any exterior portion of a mechanical system used to condition interior space.

Significantly damaged friable miscellaneous ACM means damaged friable miscellaneous ACM where the damage is extensive and severe.

Significantly damaged friable surfacing ACM means damaged friable surfacing ACM in a functional space where the damage is extensive and severe.

State means a State, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the Northern Marianas, the Trust Territory of the Pacific Islands, and the Virgin Islands.

Surfacing ACM means surfacing material that is ACM.

Surfacing material means material in a school building that is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

Thermal system insulation means material in a school building applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain, or water condensation, or for other purposes.

Thermal system insulation ACM means thermal system insulation that is ACM.

Vibration means the periodic motion of friable ACBM which may result in the release of asbestos fibers.

APPENDIX E

AHERA HAZARD RANKING

AHERA HAZARD RANKING/RESPONSE ACTIONS

Hazard Rank	Condition	Disturbance Potential	Response Actions
1	Significantly Damage	Any	Evacuate or isolate the area if needed. Remove the ACBM (or enclose or encapsulate if sufficient to contain fibers). Repair of thermal system insulation is allowed if feasible and safe. O&M required for all friable ACBM.
2	Damaged	Potential for Significant Damage	Evacuate or isolate the area if needed. Remove, enclose, encapsulate, or repair to correct damage. Take steps to reduce potential for disturbance. O&M required for all friable ACBM.
3	Damaged	Potential for Damage	Remove, enclose, encapsulate, or repair to correct damage. O&M required for all friable ACBM.
4	Damaged	Low to No Potential for Damage	Same as hazard rank 3.
5	Good	Potential for Significant Damage	Take steps to reduce potential for disturbance. O&M required for all friable ACBM and TSI.
6	Good	Potential for Damage	O&M required for all friable ACBM and TSI.
7	Good	Low to No Potential for Damage	O&M required for all friable ACBM and TSI but measures need not be as extensive as above.

APPENDIX F

ASBESTOS AWARENESS TRAINING DOCUMENTATION

(USE THIS SECTION TO MAINTAIN COPIES OF TRAINING FOR STAFF RECEIVING ASBESTOS AWARENESS TRAINING)

APPENDIX G

ASBESTOS EMERGENCY RESPONSE TEAM

As of the date of this Management Plan no Emergency Response Team has been designated by Alexandria Public Schools. All emergencies involving damage or disturbance to the asbestos-containing materials listen herein shall be reported immediately to:

Mr. Derrick Fulcher
Facilities Occupational Health, Safety Specialist
Alexandria City Public Schools
116 South Quaker Lane
Alexandria, Virginia 22314

APPENDIX H

MISCELLANEOUS FORMS

FORM 1

PARENT/OCCUPANT NOTIFICATION FORM

Example Parent/Occupant Notification Form

Parent/Occupant
Street Address
City, State, Zip Code

Alexandria City Public Schools has contracted the services of an independent engineering consulting firm (ECS Mid-Atlantic, LLC) to conduct a survey of our school to determine if asbestos-containing materials (ACM) are present or were used in its construction. Asbestos was detected in _____. The ACMs were observed to be in good condition at the time of the survey and can be maintained and monitored as part of an AHERA Management Plan in accordance with EPA asbestos requirements.

ECS has prepared an AHERA Management Plan that will enable Alexandria City Public Schools to manage the asbestos-containing material without adversely affecting the operation of our school and, more importantly, the health and safety of our students, visitors, teachers, and other employees. This program defines specific operating and maintenance procedures to be followed at all times. This is particularly important when the work involved may disturb or damage some of the asbestos-containing materials.

Alexandria City Public Schools requires that all such work be coordinated through the Asbestos Program Manager/LEA Designee who will monitor the condition of the ACMs and take appropriate action if the materials become damaged in any way or will be disturbed by renovation or demolition activities. This requirement is very critical to continue safe maintenance activities. Every six months, as required by the Commonwealth of Virginia and the U.S. Environmental Protection Agency, the condition of ACMs within the school will be observed and recorded in order to ensure no asbestos-related hazards are present.

Please be assured that the implementation of the AHERA Management Plan will play a major role in the continued safe operations of this school. If you have any questions concerning this matter, please contact us.

Sincerely,

FORM 2 (Sample)

EMPLOYEE AWARENESS FORM

Form 2

EMPLOYEE AWARENESS FORM

DATE:

LOCATION:

RE: Notification of Presence of Asbestos

I acknowledge and understand that I will be working in areas of the _____ School in which there are known to be asbestos-containing materials. I acknowledge that I have been advised of the dangers inherent in handling asbestos and breathing asbestos dust.

Signature:

Employee ID or Social Security Number:

Witness:

FORM 3 (Sample)

CONTRACTOR NOTIFICATION FORM

Form 3

CONTRACTOR NOTIFICATION FORM

DATE:

LOCATION:

RE: Notification of Presence of Asbestos

I acknowledge that I have informed all of the employees involved in the contractor labor that they will be working in areas of the facility which are known to contain asbestos materials and I have advised them of the dangers inherent in handling asbestos and breathing asbestos dust, including, but not limited to, THE FACT THAT ASBESTOS CAN CAUSE ASBESTOSIS AND IS A KNOWN CARCINOGEN AND CAN, THEREFORE, CAUSE VARIOUS TYPES OF CANCER.

I further acknowledge that I have informed all of the employees involved in the contracted labor that ANY CONTACT WITH ASBESTOS, WHETHER IT CAN BE SEEN OR NOT, MAY CAUSE ASBESTOSIS AND VARIOUS TYPES OF CANCER which may not become apparent for many years.

Signature:

Witness:

FORM 4 (Sample)

MAINTENANCE WORK REQUEST FORM

Form 4

MAINTENANCE WORK REQUEST FORM

Building Asbestos Coordinator:
Date:
Telephone No.
Job Request No._____
Requested Starting Date: _____ Anticipated Finish Date: _____
Address of Facility, Floor, Location on Floor (or description of area) where work is to be performed:

Description of work:

Description of any ACM that might be affected, if known (including location and type:

Name and telephone number of requester:

Name and telephone number of BAC:

Submit this application to:

(The Asbestos Program Manager/LEA Designee)

Note: An application must be submitted for all maintenance work when asbestos-containing material might be affected. An authorization must then be received before any work can proceed.

___ Granted (Job Request No. _____)
___ With conditions *
___ Denied
*Conditions:

FORM 5 (Sample)

MAINTENANCE WORK AUTHORIZATION FORM

Form 5

MAINTENANCE WORK AUTHORIZATION FORM

AUTHORIZATION

Authorization is given to proceed with the following maintenance work:

PRESENCE OF ASBESTOS-CONTAINING MATERIALS

___ Asbestos-containing materials are not present in the vicinity of the maintenance work.

___ ACM is present, but its disturbance is not anticipated; however, if conditions change, the Asbestos Program Manager/LEA Designee will re-evaluate the work request prior to proceeding.

___ ACM is present and may be disturbed.

Signature: _____ Date: _____
(Asbestos Program Manager/LEA Designee)

FORM 6 (Sample)

EVALUATION OF WORK AFFECTING ASBESTOS-CONTAINING MATERIALS

Form 6

EVALUATION OF WORK AFFECTING ASBESTOS-CONTAINING MATERIALS

This evaluation covers the following maintenance work:

Location of work (address, building, room number(s), or general description):

Date(s) of Work:

Description of Work:

Work Approval Form Number:

Evaluation of Work Practices Employed to Minimize Disturbance of Asbestos:

Evaluation of Work Practices Employed to Contain Released Fibers and to Clean Up the Work Area:

Evaluation of Equipment and Procedures Used to Protect Workers:

Personal Air Monitoring Results: (in-house worker or contract)

Worker Name: _____ Results:

Worker Name: _____ Results:

Handling or Storage of ACM Waste:

Signed: _____ Date:
(Asbestos Program Manager/LEA Designee)

FORM 7 (Sample)

ASBESTOS TRAINING DOCUMENTATION

Form 7

ASBESTOS TRAINING DOCUMENTATION

Date of Training:

Instructor:

Representing:

Agenda:

1. General Overview of Problems and Definitions
2. Health Considerations
3. Use of Work Permit System
4. Emergency Situations
5. Personnel Protection and Standard Procedure
6. Removal of Asbestos-Containing Materials
7. Proper Disposal of Materials

ATTENDEES	COMPANY	SIGNATURE
1.		
2.		
3.		
4.		
5.		

FORM 8 (Sample)

ASBESTOS DISPOSAL FORM

Form 8

ASBESTOS DISPOSAL FORM

RQ HAZARDOUS SUBSTANCE
SOLID NOS ID# NA9188 (Asbestos)

NAME OF BUILDING:_____ DATE:
OWNER OR OPERATOR OF LANDFILL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE: (__)
NAME OF LANDFILL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE: (__)
HAULER:
APPROXIMATE WEIGHT OF ASBESTOS RECEIVED:
TYPE OF ASBESTOS CONTAINER:
ASBESTOS CONTAINERS LABELED? YES ____ NO

I certify that the above statements are true and that the landfill has been approved for the disposal of asbestos. The delivered material will be covered with six inches (15 centimeters) of non-asbestos materials within 24 hours.

Landfill Owner - Operator

FORM 9 (Sample)

EMERGENCY ABATEMENT FORM

Form 9

EMERGENCY ABATEMENT FORM

DATE:

BUILDING:
LOCATION:
CAUSE OF EMERGENCY ABATEMENT:

OPERATION AND MAINTENANCE PROCEDURES FOLLOWED:
DESCRIPTION OF ACTIONS TAKEN:

SIGNED:

TITLE:

FORM 10 (Sample)

BUILDING INSPECTION FORM

Form 10

BUILDING INSPECTION FORM

DATE: _____ BUILDING: _____ FLOOR:
INSPECTION LOCATIONS:

1. TYPE OF MATERIAL DAMAGED:

2. CAUSE OF DAMAGE:

3. APPROXIMATE SIZE OF DAMAGED AREA:

4. IS THERE MATERIAL DEBRIS ON FLOOR OR OTHER LOCATIONS?

5. ARE EMPLOYEES/TENANTS/SUBCONTRACTORS IN IMMEDIATE AREA?

COMMENTS:

NEXT SCHEDULED INSPECTION DATE:
INSPECTOR SIGNATURE:

FORM 11 (Sample)

BUILDING REINSPECTION FORM

Form 11

BUILDING REINSPECTION FORM

Location of Asbestos-Containing Material (address, building, room, or general description):

Type of Asbestos-Containing Material(s):

_____

Abatement Status:

1. The material has been encapsulated ___, enclosed ___, neither ___, removed ___.

Assessment

1. Evidence of physical damage: _____
2. Evidence of water damage: _____
3. Evidence of delamination or other damage: _____
4. Degree of accessibility of the material: _____
5. Degree of activity near the material: _____
6. Location in an air plenum, air shaft, or airstream: _____
7. Other observations (including the condition of the encapsulant or enclosure, if any):

_____

Recommended Action:_____

Signed: _____ Date: _____

APPENDIX I

EPAs - GUIDE FOR MINIMIZING DISTURBANCE OF ASBESTOS-CONTAINING MATERIALS

United States
Environmental Protection
Agency

Office of Pesticides
and Toxic Substances
Washington, DC 20460

EPA 560/5-85-024
June 1985

Toxic Substances

EPA

Guidance for Controlling Asbestos-Containing Materials in Buildings



NOTICE

"Guidance for Controlling
Asbestos-Containing Materials in Buildings,"
June 1985
(EPA 560/5-85-024)

This document may contain dated material. It is the responsibility of the user of this document to verify the accurateness of the material. Special attention should be given to the NESHAPS regulations (Appendix C) and the OSHA regulations (Appendix F).

For copies of updated information on NESHAP regulations, call:
1-800-368-5888
(in metropolitan Washington DC, call 1-703-305-5938)

For copies of updated information on OSHA regulations, call:
1-202-219-4667
For general information on OSHA regulations, call:
1-202-219-8151.

GUIDANCE FOR CONTROLLING ASBESTOS-CONTAINING MATERIALS IN BUILDINGS

1985 EDITION

Exposure Evaluation Division
Office of Toxic Substances
Office of Pesticides and Toxic Substances
U.S. Environmental Protection Agency
Washington, D.C. 20460

NOTE TO SCHOOL DISTRICTS

The regulations at 40 CFR §763.114(a)(5) require that schools with asbestos-containing material retain one copy of “Asbestos-Containing Materials in School Buildings: A Guidance Document” Parts 1 and 2, also known as the orange books, in the school’s administrative office (EPA No. C00090).

This book, “Guidance for Controlling Asbestos-Containing Materials in Buildings” (the purple book), may be kept in lieu of the document “Asbestos-Containing Material in School Buildings: A Guidance Document," Parts 1 and 2 (orange books), to satisfy the requirement at 40 CFR §763.114(a)(5). Please note that schools must continue to retain copies of the “Guide for Reducing Asbestos Exposure” found at 40 CFR §763.111(b), which is also required by 40 CFR §763.114(a)(5).

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DISCLAIMER

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Elizabeth Dutrow, Exposure Evaluation Division

Dave Mayer, Asbestos Action Program

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SUMMARY OF GUIDANCE

INTRODUCTION

Airborne asbestos contamination in buildings is a significant environmental problem. Various diseases have been linked with industrial exposure to airborne asbestos, and the extensive use of asbestos products in buildings has raised concerns about exposure to asbestos in nonindustrial settings. Surveys conducted by the Environmental Protection Agency (EPA) estimate that asbestos containing materials can be found in approximately 31,000 schools and 733,000 other public and commercial buildings in this country.

The presence of asbestos in a building does not mean that the health of building occupants is necessarily endangered. As long as asbestos-containing material (ACM) remains in good condition and is not disturbed, exposure is unlikely. When building maintenance, repair, renovation or other activities disturb ACM, or if it is damaged, asbestos fibers are released creating a potential hazard to building occupants. Although not required to do so by federal law, the prudent building owner will take steps to limit building occupants' exposure to airborne asbestos. In 1983 EPA prepared and distributed "Guidance for Controlling Friable Asbestos-Containing Materials in Buildings" (USEPA 1983a). Since this guidance was published, EPA has gathered additional information and has gained valuable experience through its continuing Asbestos-in-Buildings Program. The guidance document has been substantially revised to incorporate this new information and to reflect the comments and suggestions of building owners and other readers. EPA offers building owners guidance to understand the technical issues, determine if asbestos is present in a building, plan a control program, and choose the course of further action if necessary.

This summary is divided into two parts. The first is an introduction to the problem of asbestos in buildings and summarizes the material that is presented in Chapter 1. The second part of the summary provides a concise outline of the remainder of the report. It lists the major steps needed to determine whether asbestos is present in a building (Chapter 2), establish a special operations and maintenance (O&M) program (Chapter 3), assess the need for further action (Chapters 4 and 5), and carry out an abatement project (Chapter 6). It is intended as a checklist for the building owner.

ACM IN BUILDINGS

ACM in buildings is found in three forms: (1) sprayed or troweled on ceilings and walls (surfacing material); (2) in insulation around hot or cold pipes, ducts, boilers, and tanks (pipe and boiler insulation); and (3) in a variety of other products such as ceiling and floor tiles and wall boards (miscellaneous materials). In general, ACM in the first two categories is of greatest concern, especially if it is friable. (Friable material can be crumbled, pulverized, or reduced to powder by hand pressure.)

Testing for ACM is required in primary and secondary schools only. (Regulations are specified in ''The Friable Asbestos-Containing Materials in Schools; Identification and Notification Rule.") At present, no parallel rule applies to other public or commercial buildings. Further, no Federal regulations require abatement actions (repair or removal, enclosure, encapsulation).

The OSHA (Occupational Safety and Health Administration) regulations specifying work practices and the EPA rules governing the handling and disposal of asbestos apply to abatement actions. State regulations on these issues vary and may be more stringent than federal requirements.

ASBESTOS CONTROL ACTIVITIES

The following pages outline the steps that a building owner should take to control asbestos. Each step is described in more detail in the body of the report.

Survey to See if Asbestos is Present

- Appoint an asbestos program manager and assemble a survey team.
- Check building records for evidence of asbestos- containing surfacing materials, pipe and boiler insulation, or miscellaneous ACM.
- Locate and document all ACM identified in building records.
- Inspect the building for friable materials on walls or ceilings. Inspection means touching walls and ceilings.
- Inspect the building for insulation on pipes and boilers. Inspection means looking at pipes and boilers.
- Be persistent. Friable materials may be hidden behind dropped ceilings or partitions,
- Collect samples of friable ceiling and wall materials following EPA procedures.
- Collect samples of pipe and boiler wrap if the insulation is exposed. Otherwise, assume the insulation contains asbestos.
- Send samples to a qualified laboratory for analysis by polarized light microscopy (PLM). If the samples show more than one percent asbestos, the building contains ACM,
- Document all findings.

Establish a Special Operations and Maintenance (O&M) Program

- Obtain cooperation of building maintenance and custodial managers.
- Educate building occupants and employees about ACM.
- Tram custodial and maintenance workers in special cleaning techniques and maintenance precautions,
- Clean the building thoroughly using wet cleaning and HEPA-vacuum techniques.
- Repeat the cleaning monthly (near surfacing materials) or semi-annually (near wrapped insulation).
- Take special precautions before starting maintenance and construction work.
- Inspect ACM at least twice a year for evidence of damage or deterioration.
- Continue the O&M program until all ACM is removed.

Assess the ACM to Determine the Need for Further Action

- Assess the likelihood of fiber release from the ACM by evaluating its current condition and the potential for future disturbance, damage or erosion.
- Determine:

— The need for further action.

— When it should be done.

— What abatement method should be used.

Conduct Abatement Actions if Needed

- Hire an abatement contractor or, if in-house capabilities are available, use building staff.
- To select a contractor:
  - — Write precise contract specifications.
  - — Check references.
  - — Conduct interviews.
  - — Review insurance coverage.
  - — Select the “best” contractor, not necessarily the lowest bidder.
- To Manage the work:
  - — Inspect the work site at least four times a day to insure compliance with all prescribed work practices and worker protection measures. These include:
    - * Construction of a containment barrier around the entire work area, or the use of containment bags for wrapped insulation.
    - * Use of coveralls and respirators by the workers.
    - * Provision of worker change and decontamination facilities.
  - — Stop abatement work immediately if any condition of the worksite appears to be hazardous.
  - — Release the contractor only after:
    - * The work site has been thoroughly cleaned at least twice.
    - * The work site passes a visual test for abatement completion and cleanliness.
    - * The work site passes a test for airborne asbestos.

CHAPTER 1. BACKGROUND ON EXPOSURE TO ASBESTOS INSIDE BUILDINGS

Construction materials containing asbestos have been used extensively in schools and other buildings. The concern about exposure to asbestos in these buildings is based on evidence linking various respiratory diseases with occupational exposure in the shipbuilding, mining, milling, and fabricating industries. The presence of asbestos in a building does not mean that the health of building occupants is endangered. If asbestos-containing material (ACM) remains in good condition and is unlikely to be disturbed, exposure will be negligible. However, when ACM is damaged or disturbed — for example, by maintenance or repairs conducted without proper controls — asbestos fibers are released. These fibers can create a potential hazard for building occupants.

This chapter describes ACM found in buildings and the potential health risks to occupants of buildings where ACM is present. Also, federal regulations addressing asbestos in buildings are briefly summarized.

SUMMARY

ACM in Buildings: Three forms of asbestos are typically found in buildings: (1) sprayed-or troweled-on surfacing materials; (2) insulation on pipes, boilers, and ducts; and (3) miscellaneous forms, such as wallboard, ceiling tiles, and floor tiles. EPA surveys estimate that 31,000 schools and 733,000 public and commercial buildings contain friable (easily crumbled) ACM. Friable ACM and ACM disturbed during maintenance, repair or renovation are of greatest concern from an exposure perspective.

Levels of Airborne Asbestos in Buildings and Other Settings: Prevalent levels of airborne asbestos inside buildings with ACM may be 10 to 100 times higher than outdoor levels. However, these indoor levels are typically 10,000 to 100,000 times lower than levels in asbestos industry workplaces where asbestos-related diseases have been well-documented.

Asbestos-Related Disease: Most people with asbestos-related diseases (asbestosis, lung cancer, and mesothelioma) were exposed to high levels of asbestos while working in asbestos industries prior to 1972. Extrapolation of the relationship between exposure level and disease indicates that only a small proportion of people exposed to low levels of asbestos will develop asbestos-related diseases. Smokers, children, and young adults are at somewhat greater risk.

Federal Regulations Regarding Asbestos in Buildings: Current regulations (1) restrict the use of most asbestos products in new buildings, (2) specify work practices for removal of ACM from buildings, and (3) require the identification of asbestos in schools. There are no exposure standards for nonindustrial settings, and no regulations requiring corrective actions in buildings with ACM.

1.1 Asbestos-Containing Materials in Buildings

Asbestos may be found in cement products, acoustical plaster, fireproofing textiles, wallboard, ceiling tiles, vinyl floor tiles, thermal insulation, and other materials.[1] EPA surveys estimate that 31,000 schools and 733,000 federal and commercial buildings have ACM in one form or another (USEPA 1984a, 1984b). ACM has been grouped into three categories: (1) sprayed- or troweled-on materials on ceilings, walls, and other surfaces; (2) insulation on pipes, boilers, tanks, ducts, and other equipment; and (3) other miscellaneous products. (Examples of ACM are shown in Figure 1.) Material in the first two categories can be friable, that is, it can be crumbled, pulverized, or reduced to powder by hand pressure. Most ACM in the third category is nonfriable.

[1] Descriptions of these and other types of products containing asbestos appear in Appendix A.

Friable materials are more likely than nonfriable materials to release fibers when disturbed or damaged. Although nonfriable ACM is of less immediate concern, it should not be ignored. Fibers will be released if nonfriable material is cut, drilled, sanded, or broken during building repairs or renovation.

1.2 Levels of Airborne Asbestos in Buildings and Other Settings

Levels of airborne asbestos in the asbestos industry workplace are substantially higher than levels found outdoors or in buildings with ACM. Figure 2 shows levels measured in the three settings: asbestos insulation plants before the 1972 Occupational Safety and Health Administration (OSHA) exposure standards, schools with ACM, and outdoor urban areas.[2] The range of values in each category reflects differences in location, source of asbestos, and variability in asbestos measurements. Concentrations may exceed the upper limits of these ranges for short periods if, for example, manufacturing equipment malfunctions, insulating material is pierced with a sharp object, or asbestos-coated surfaces are disturbed by the impact of a ball or similar object.

Figure 2 shows that prevalent concentrations of airborne asbestos in a sample of school buildings were approximately 10 to 100 times higher than outdoors. At the same time, asbestos levels in the schools were 10,000 to 100,000 times lower than pre-1972 levels in asbestos insulation workplaces.[3]

1.3 Diseases Associated with Exposure to Asbestos

Much of what is known about asbestos-related diseases comes from studying workers in the various asbestos industries. Exposure to levels of airborne asbestos typical of the asbestos workplace prior to 1972 has been linked with a debilitating lung disease called asbestosis; a rare cancer of the chest and abdominal lining called mesothelioma; and cancers of the lung, esophagus, stomach, colon, and other organs. In 1972 federal exposure standards were imposed.

The relationship between exposure level and health risk is complex. The potential for disease appears to be related to the physical and chemical characteristics of asbestos fibers as well as to the concentration of fibers in the air. Data on asbestos workers indicate that the risks of asbestosis, lung cancer, and mesothelioma decrease in direct proportion to a decrease in total asbestos dose. Because there is no direct information on health risks from exposure to asbestos in buildings with ACM, the risks are estimated by extrapolation from studies of asbestos industry workers (Nicholson 1984, NRC 1984, The Royal Commission of Ontario 1984). The estimates indicate that only a small proportion of people exposed to low levels of asbestos will develop asbestos-related diseases. However, combining smoking with occupational exposure to asbestos increases the lung cancer rate above the rate due to either smoking or asbestos exposure alone. Also, asbestos exposure in children is of special concern: since they have a greater remaining lifespan than adults, their lifetime risk of developing mesothelioma is greater. Avoiding unnecessary exposure to asbestos is prudent.

---

[2] For comparison, all data are expressed in nanograms per cubic meter (ng/m^3) units. Concentrations of asbestos fibers in the air are measured in terms of either the number of fibers per unit volume (typically, fibers per cubic centimeter) or the mass per unit volume (typically, ng/m^3). A nanogram is one-billionth of a gram. See Appendix B for a simple explanation of measurement units used for airborne asbestos concentrations.

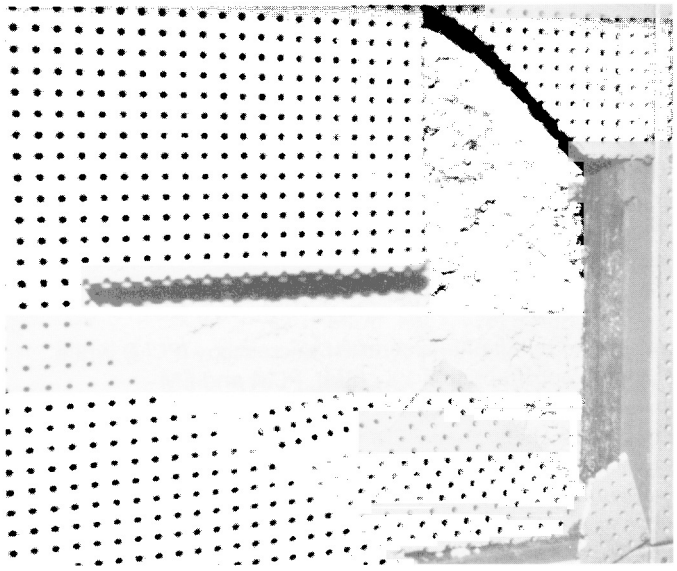
[3] The data in Figure 2 should be interpreted with caution. Estimated concentrations in asbestos workplaces are based on measurements of airborne fibers using the method specified by OSHA (phase contrast microscopy), while the levels in schools and outdoors were measured by a different method (transmission electron microscopy). Comparisons of measurements obtained by the two methods are based on certain assumptions (see footnote to Figure 2). Measurement of airborne asbestos fibers is a complex subject and is discussed in more detail in Section 4.1.2.



Friable, fluffy sprayed-on material



Friable, cementitious sprayed-on or troweled material (acoustical plaster)



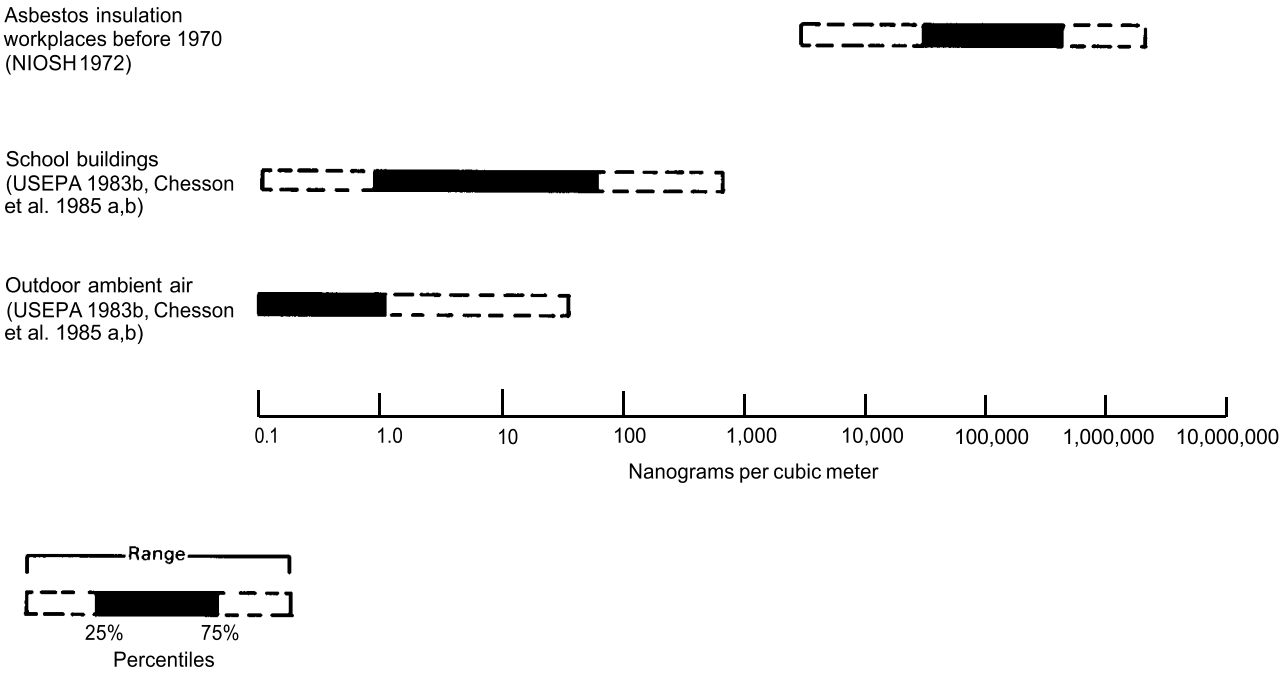
Nonfriable wallboard with friable sprayed-on material behind



Pipe lagging

Figure 1. Examples of asbestos-containing materials found in buildings.

Figure 2. Comparison of measured airborne asbestos concentrations in three settings.*



*Levels in asbestos workplaces were derived from measurements using phase contrast microscopy (PCM) while levels in school buildings and outdoors were measured using electron microscopy (EM). PCM and EM measurements are not directly comparable. PCM measures all fibers whereas EM can distinguish between asbestos and nonasbestos fibers. In addition, EM has a better capability than PCM for detecting small fibers. In order to translate the workplace PCM measurements (expressed as fiber counts) into values of asbestos mass (nanograms) that are approximately comparable to EM measurements, 30 fibers were assumed to equal one nanogram. This value is an average obtained from many comparisons of PCM and EM measurements taken at the same location (industrial settings) and time. Values for individual samples range from about 10 fibers per nanogram of asbestos to well over 100 fibers per nanogram, depending on the average size of fibers and the relative number of asbestos and nonasbestos fibers in the air (Versar 1980 and William Nicholson, personal communication, 1982).

1.4 Federal Regulations Regarding Asbestos in Buildings

Both EPA and OSHA have published regulations to reduce asbestos exposure. EPA regulations focus on: (1) application and removal of ACM in new or remodeled buildings, and (2) identification of friable asbestos in schools. EPA also regulates the industrial emission of asbestos fibers and the disposal of asbestos waste. OSHA addresses worker protection in the workplace.

The first EPA regulations were issued in 1973 under the National Emission Standards for Hazardous Air Pollutants (NESHAPS), as authorized by the Clean Air Act. The first regulations were directed largely at the asbestos industries, but also partially banned spray-applied ACM in new buildings, and established procedures for handling ACM during demolition. The regulations were revised in 1975 and 1976 to cover building renovations, the use of all types of insulating ACM in new buildings, and asbestos emissions from ACM waste disposal.[4]

Of particular interest to owners of buildings with ACM are the following regulations:

- When a building is demolished — or more than 260 linear ft. of asbestos pipe insulation or 160 sq. ft. of asbestos surfacing material are removed during renovation — advance notice must be filed with the EPA regional office and/or the state, giving:

  — name and address of the building owner or manager;
  — description and location of the building;
  — scheduled starting and completion dates of ACM removal;
  — description of the planned removal methods; and
  — name. address, and location of disposal site.

- ACM can be removed only with wet removal techniques (see Section 5.1). Dry removal is allowed only under special conditions and only with written EPA approval.

- No visible emissions of dust are allowed during removal, transportation, and disposal of ACM. (The wet removal techniques described in Section 5.1 are designed to satisfy this requirement.)

The entire text of the NESHAPS regulations appears in Appendix C. Before beginning any ACM removal or building demolition, the building owner should review the NESHAPS requirements in detail. More information can be obtained from the regional NESHAPS contact. Addresses and telephone numbers of the contacts are found in Appendix D.

The second set of EPA regulations is in the “Friable Asbestos-Containing Materials in Schools; identification and Notification Rule," (40 CFR Part 763)[5] promulgated under the Toxic Substances Control Act. Known as the Asbestos-in-Schools rule, it requires all primary and secondary schools, both public and private, to:

- inspect, sample, and analyze friable materials for asbestos;

- document all findings; and

- inform all school employees and the school’s parent-teacher organization (or parents, if there is no organized group) of the location of friable ACM, and provide each custodial worker with a copy of the EPA publication, “A Guide for Reducing Asbestos Exposure." as published in the FEDERAL REGISTER (40 CFR Part 763).

[4] The complete set of regulations was repromulgated on April 5, 1984.

[5] The deadline for compliance with the Rule was June 28, 1983. A Copy of the Rule is available from EPA. See Appendix E.

The OSHA regulations were first issued in 1972 and modified in 1976. They specify airborne exposure standards for asbestos workers, engineering and administrative controls, workplace practices, and medical surveillance and worker protection requirements. In 1982, OSHA announced its intention to tighten the exposure standards. (See the “Calendar of Federal Regulations," published in the FEDERAL REGISTER [47 FR 1807] .)[6] The OSHA regulations apply to all workplace activities involving asbestos, including removal of ACM from buildings. Future OSHA regulations may include separate exposure standards for ACM removal operations. The complete text of the OSHA regulations appears in Appendix F.

OSHA’S worker exposure standards are inappropriate for nonindustrial settings. First, the standards were set to protect workers only against asbestosis, which does not occur at the lower exposure levels typical of buildings with ACM. Second, the measurement technique that determines OSHA compliance does not distinguish between asbestos and nonasbestos fibers and does not measure the small asbestos fibers typically found in buildings with ACM.

The measurement problem is not a major shortcoming in industrial settings where most airborne fibers are expected to be asbestos. However, only a few fibers in building air are asbestos, and the OSHA measurements may be misleading, (Other limitations of the OSHA technique further confound the measurement of airborne asbestos in buildings. See Section 4.1.2 for a more detailed discussion of measuring airborne asbestos.)

[6] As of July 1, 1976, the OSHA standards were set at 2 fibers per cubic centimeter averaged over 8 hours and a ceiling level not to exceed 10 fibers per cubic centimeter “at any time.” OSHA is now evaluating the effect of lowering the 8-hour standard to either 0,5 or 0.2 fibers per cubic centimeter in order to protect workers against cancer, as published in the FEDERAL REGISTER (47 FR 1807).

CHAPTER 2. DETERMINING IF ASBESTOS-CONTAINING MATERIAL (ACM) IS PRESENT IN BUILDINGS

To determine if ACM is present in a building, examine construction records and conduct a thorough inspection of building materials. If asbestos is not present, no further action is required. If asbestos is found, however, a control program should be initiated. In either case, workers and other building occupants will be concerned. The building owner must be prepared to explain the purpose of the survey, its results, and plans for controlling ACM if it is present.

SUMMARY

Planning the Survey: A plan for conducting the ACM survey should include assembling the survey team and gaining cooperation of building management. The plan should also include a public information program.

Conducting the Survey: The survey consists of checking building records and inspecting the building for evidence of ACM. Specific procedures differ for the three types of ACM, and may include sampling and analysis of suspect materials.

2.1 Planning the Survey

The survey has four components:

- Reviewing building records for references to asbestos used in construction or repairs;
- Inspecting materials throughout the building to identify those that may contain asbestos;
- Sampling suspect materials for laboratory confirmation that asbestos is present; and
- Mapping the locations of all confirmed or suspected ACM.

Thorough planning is essential because:

- The survey must provide accurate and reliable information;
- Questions from building occupants or the public about the survey and about asbestos in general must be answered quickly and responsively;
- Complete, accurate, unambiguous documentation of the survey and all test results is critical; and
- If ACM is found, the building owner must be prepared to initiate special operations and maintenance (O&M) practices immediately, and to develop other controls to minimize health risks (see Chapter 3).

The importance of a well-planned public communications program cannot be over- emphasized. Asbestos is an exceptionally emotional issue. A building owner must clearly understand the purpose of the survey in order to anticipate and address the concerns of building occupants and the public.

2.1.1 Assembling the Survey Team

Owners are ultimately responsible for asbestos-related problems in their buildings. The owner should appoint an asbestos program manager to direct all asbestos-related activities. The asbestos program manager

must be able to identify and assess the expertise of the diverse personnel required for an effective team. The asbestos program manager should communicate directly with the building owner. In addition, if ACM is present, the asbestos program manager will oversee the development of the asbestos control program, and provide information to the public. The manager needs to become familiar with the use of ACM in buildings, the potential for building contamination by airborne asbestos, the health risks to building occupants, and options for controlling ACM. The manager needs a general understanding of all the issues in order to review technical tasks and judge whether they are being performed properly. If the building owner has no experienced person on his staff, he should consider hiring a qualified consultant.

The program manager's responsibilities include:

- Implementing a training program for the ACM survey if the survey is to be conducted in-house;
- Selecting a technical advisor to conduct the ACM survey if an outside consultant is needed;
- Selecting a laboratory to analyze samples of material from the building;
- Designing a system to document all information about asbestos in the building; and
- Developing a communications package for discussions with building occupants and others.

If ACM is found, the asbestos program manager should also be prepared to initiate special operations and maintenance (O&M) practices (see Chapter 3), assess the need for other control measures (see Chapters 4 and 5), and oversee abatement projects if additional corrective action is necessary (see Chapter 6). The duties and responsibilities of the manager continue until all ACM is removed from the building.

An asbestos survey team should be assembled under the direction of the asbestos program manager. Figure 3 illustrates the organization of the team. The building architect, the facilities (or physical plant) manager, and the head of building maintenance are obvious choices due to their knowledge of building records and facilities. Maintenance and engineering staffs may also be team members since they likely will conduct the survey. If an outside technical advisor is hired to conduct the survey, he or she would be a member of the team. Other team members acting primarily as special advisors would include an attorney and a risk manager (i.e., a person responsible for insurance).

As indicated by Figure 3, the asbestos program manager should seek advice from the EPA Regional Asbestos Coordinator (RAC). (Addresses and telephone numbers for the 10 RACs are listed in Appendix D.) The RAC has information on ACM surveys, technical advisors, consultants, laboratories for analyzing samples of building materials, training programs, and abatement contractors.

The asbestos program manager should attend one of the asbestos control training courses offered by universities and private organizations. Currently, EPA-sponsored programs are offered in conjunction with Georgia Institute of Technology, Kansas University and Tufts University. The RAC is the best source of further information regarding these programs and others which may be available in each Region.

If a technical advisor will be hired to conduct the survey, the asbestos program manager should require evidence of experience and/or training. Examine references, especially those provided by other building owners. Be sure the advisor has a reputation for being thorough. Most survey errors involve overlooking building areas where there could be ACM. Asbestos control advisors include specially trained engineers, architects, and industrial hygienists.

If ACM is found, the technical advisor may assist with the continuation of the control program. In that case, the advisor should also have experience in developing a special O&M program, assessing the need for additional corrective action, and monitoring abatement projects. Additional information on selecting technical advisors is provided in Chapters 3 and 4.

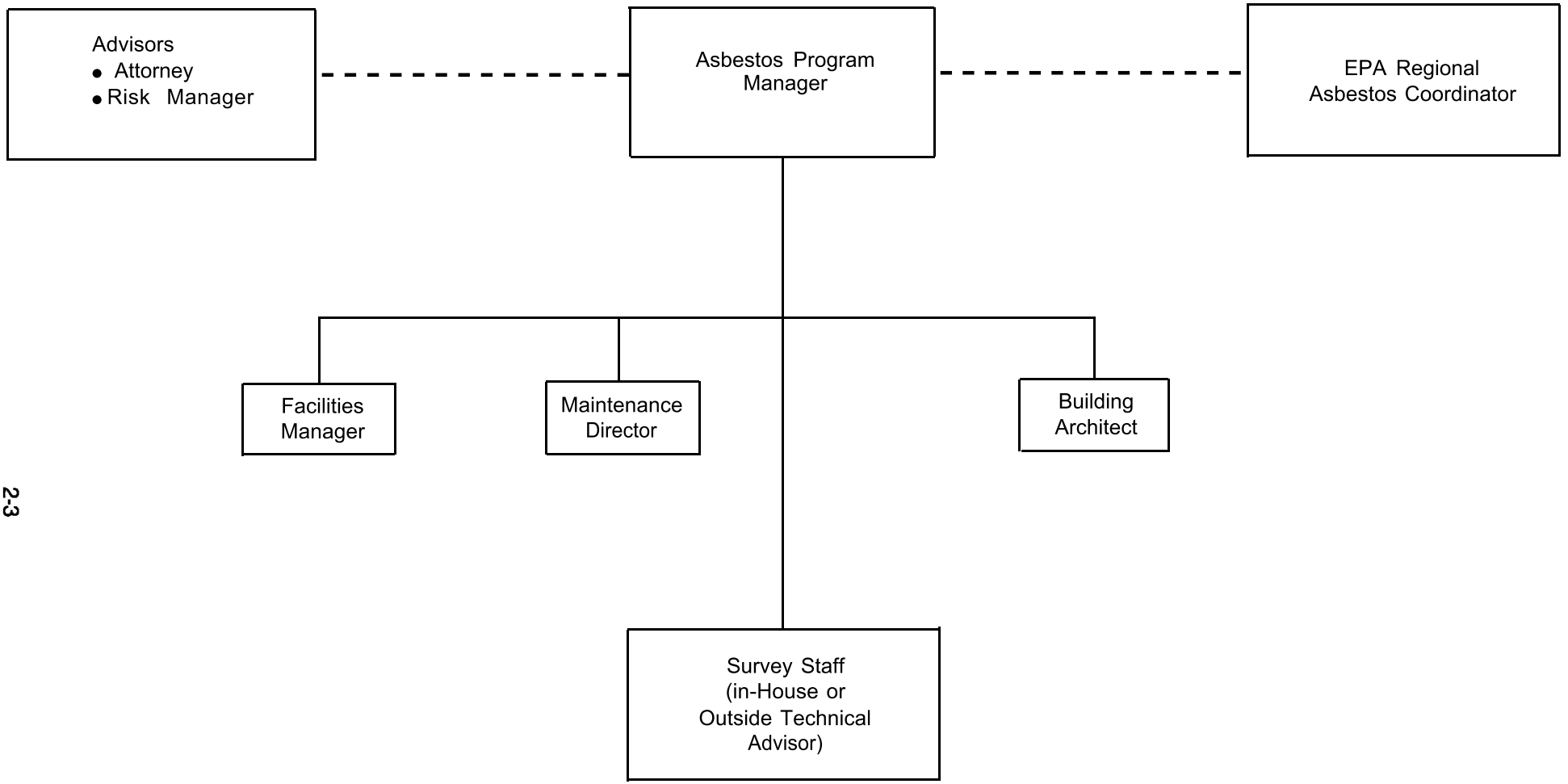


Figure 3. Composition of the ACM survey team.

2.1.2 Obtaining Cooperation

An ACM survey will be successful only if everyone in building management cooperates. Most importantly, the building owner must be convinced that exposure to asbestos is potentially a serious problem, and that a careful survey for ACM is needed. The asbestos program manager and the building owner must have a close working relationship.

Beyond this, cooperation must be obtained from building maintenance, operations, and planning personnel. A survey for ACM can disrupt normal building activities. Occupants will be concerned and curious. The survey team must be prepared to discuss the purpose of the survey in a way that is realistic, yet does not cause undue anxiety. Questions requiring a lengthy response should be referred to the program manager.

2.2 Conducting the Survey

The survey involves a review of building records and an inspection of the building for friable materials. The inspection is the more important component of the survey since building records are often incomplete and unreliable. Whenever the presence of asbestos is in doubt, prudence is recommended: treat the material as if it contains asbestos.

2.2.1 General Survey Elements

Figure 4 illustrates the survey steps. Begin by reviewing building records to see if ACM was specified at any stage. Although building records are often unreliable, they are a useful starting point. Check the original plans, shop drawings, remodeling records, and work change orders. Appendix A is a list of the most common uses and types of ACM in buildings since 1960. If any of these items appears in the records, assume that asbestos is in the building. Identify ACM mentioned in building records by type: (1) troweled-or sprayed-on surfacing material, (2) pipe and boiler insulation, or (3) other miscellaneous ACM.

Next, inspect the building for ACM identified in the building records. Determine if the materials are friable and record the findings. They may be sampled and analyzed to confirm the presence of asbestos. Thoroughly inspect all areas of the building for friable materials and sample them. The specific procedures for inspection and sampling vary depending on which of the three types of material are involved. The sampler of building materials should wear a respirator to prevent inhalation of fibers. (See Section 5.1 for information on respirators.)

2.2.2 Procedures for Sprayed- or Troweled-on Surfacing Materials

Surfacing materials can be friable or nonfriable. Friable forms are either very fibrous and fluffy (sometimes like cotton candy) or granular and cementitious (review Figure 1). Since friable materials are more likely than nonfriable materials to release fibers when disturbed, the first priority is to identify those friable surfacing materials that contain asbestos. As shown in Figure 5, the first step is to locate ACM specified in building records and determine its friability. Then, identify all friable surfacing materials in the building and take samples to be analyzed for asbestos.

2.2.2.1 Surfacing Materials identified as ACM in Building Records

Begin by locating any acoustical plaster or other surfacing materials that, according to building records, contain asbestos. Rub these materials to see if they crumble or produce a light powder. If so, consider them friable. (When disturbing material that may contain asbestos, the inspector should wear protective equipment.) Either assume that these materials contain asbestos, or sample and analyze them, as discussed below. Record the location and degree of friability.

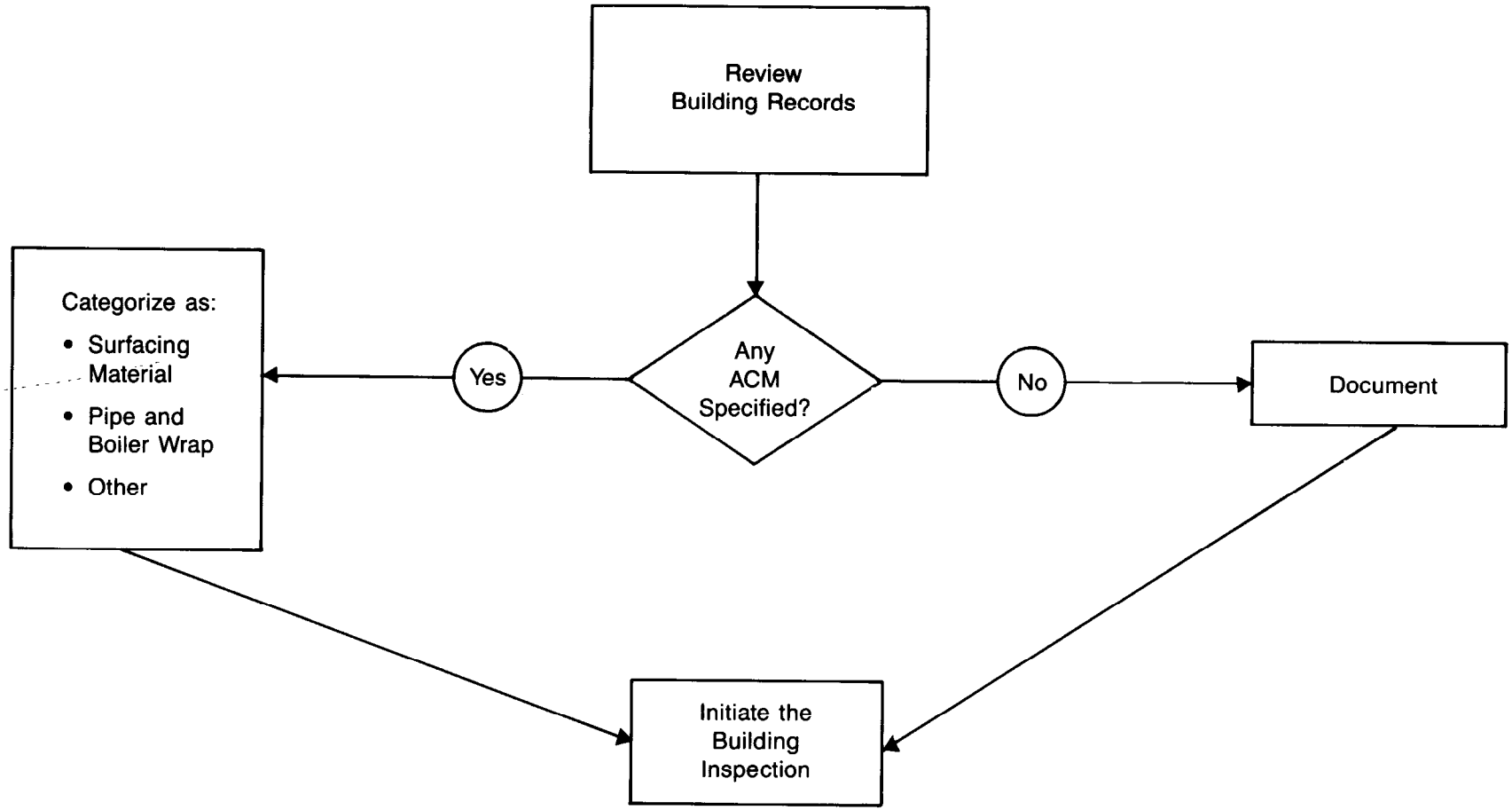


Figure 4. Initial Steps in an ACM Survey.

2.2.2.2 Other Surfacing Materials That May Contain Asbestos

Conduct a thorough building inspection for friable materials on walls, ceilings, beams, ducts, and any other surface. Rub the material to see if it is friable. Following Figure 5, group any friable material into "homogeneous" areas for further study.[1] A homogeneous area contains friable material that seems by texture and color to be uniform. If materials appearing uniform were installed at different times, designate the two materials as distinct homogeneous areas.

Once homogeneous areas of friable materials have been delineated and recorded on floor plans, collect samples of the materials and send them to a qualified laboratory. Sampling and analysis should be conducted according to the following guidelines:[2]

- Appoint a coordinator to oversee the entire sampling and analysis operation and quality assurance program. The asbestos program manager or technical expert may assume this role.

- Choose a qualified laboratory to analyze the samples (see Appendix G.2). The approved method of bulk sample analysis for asbestos is polarized light microscopy. In certain cases, X-ray diffraction may be required to confirm the presence of asbestos.

- Collect at least three core samples of material in each homogeneous sampling area. Select sampling locations that are representative of the homogeneous area. (Either select locations evenly distributed throughout the area or choose the locations by a random selection method such as the one described in USEPA 1980a. It is important that three samples not be collected in the same location.) Remember that everyone taking samples should wear a respirator.

- Collect at least 1 quality control (QC) sample per building or 1 QC sample per 20 samples, whichever is larger. A QC sample is taken from the area abutting a regular sample. (The two samples are referred to as "side-by-side samples.") The QC sample should be analyzed at a second laboratory to confirm the results of the primary laboratory.

- Label all samples with an identifying code and keep a code log. To avoid bias, the laboratory analyst should not know the origin of the samples.

- Asbestos is present if the material analyzed is more than one percent asbestos by weight.

Record the results of the sampling and analysis program and save the records indefinitely. If no asbestos is found in these materials, no further action is necessary for this category of ACM. If asbestos is present, then an asbestos control program should be developed as described in Chapters 3 and 4.

2.2.3 **Procedures for Pipe and Boiler Insulation**

Asbestos-containing insulation is found on equipment containing hot air or liquid — pipes, boilers, tanks, and sometimes ducts. These insulation materials may be a chalky mixture of magnesia and asbestos, preformed fibrous asbestos wrapping, asbestos fiber felt, corrugated paper, or insulating cement. In most cases, the insulating material is covered with a protective jacket of cloth, tape, paper, metal, or cements

[1] The Asbestos-in-Schools rule allows schools to skip the sampling and analysis steps by assuming that any friable materials found in the building contain asbestos. The location of all friable materials must be documented and all affected parties must be notified whether asbestos is assumed to be present or confirmed by laboratory analysis. Nonfriable materials are not addressed by the Asbestos-in-Schools rule.

[2] Specific procedures for sampling and analyzing friable materials in schools were presented in the Asbestos-in-Schools rule. These procedures are consistent with the guidelines presented here.

[3] ACM sprayed on ducts should be considered surfacing material.

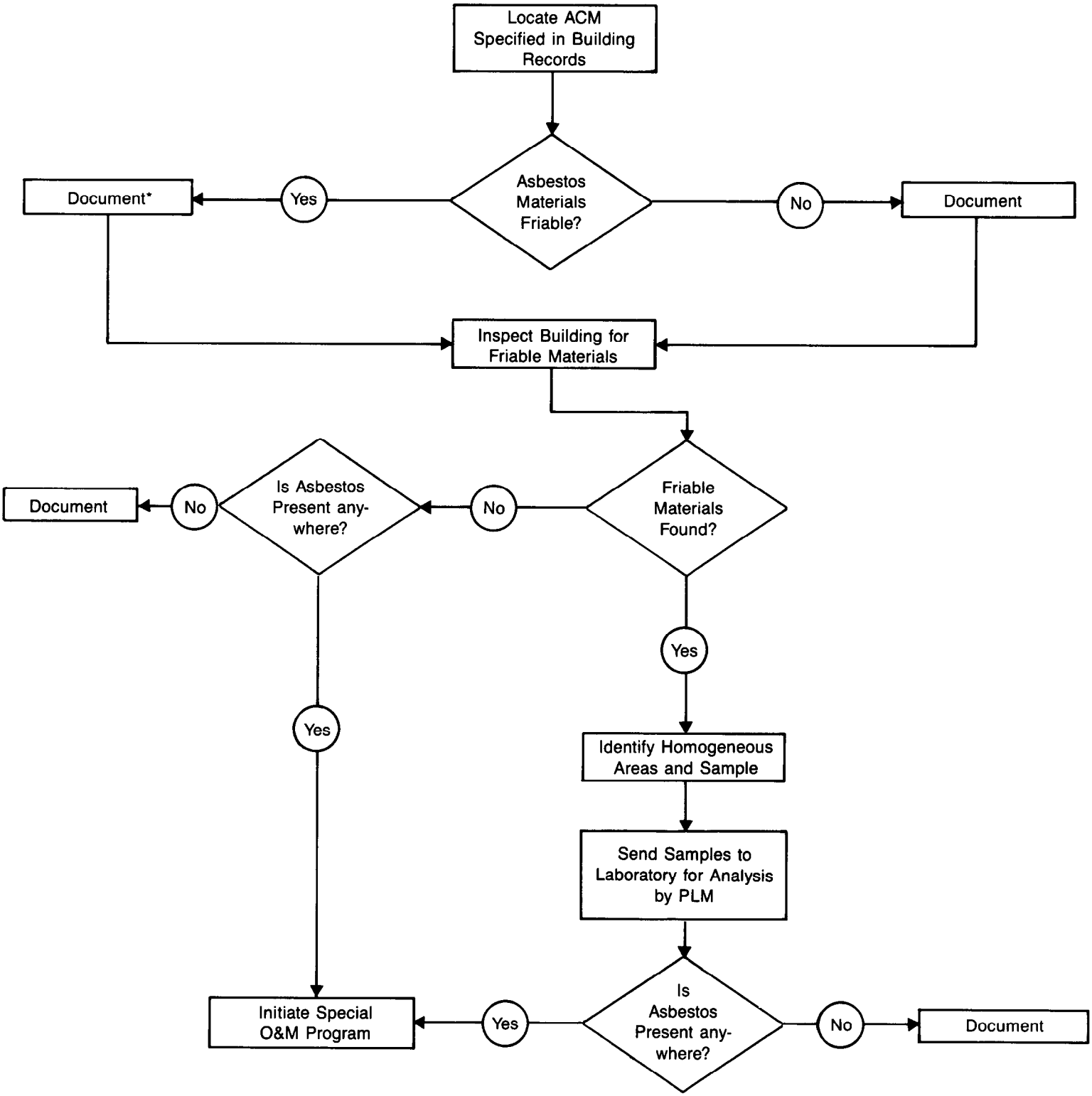


Figure 5. Survey procedures for sprayed- or troweled-on surfacing material.

* These materials can be sampled and analyzed to confirm that they do contain asbestos, and that a special O&M program is needed.

Boiler insulation may consist of thermal bricks (refractory) or asbestos insulating blankets, and is usually covered with finishing cement. Occasionally, asbestos millboard is used as a stiff outside covering on removable boiler insulation.

Figure 6 outlines how to inspect pipe and boiler insulation. Start in the boiler room and follow air and water distribution systems throughout the building. Building plans should indicate the location of pipes and ducts.

If the insulation is in good condition, leave it undisturbed. Sampling is not recommended in this case: instead, assume that the insulation contains asbestos. An EPA nationwide survey of federal, residential, and commercial buildings revealed that approximately 16 percent (20 percent of those constructed before 1970) contained asbestos pipe or boiler insulation. An exception to this rule is yellow or pink wrapped insulation. The color is usually a clear indication of fibrous glass rather than asbestos material. Even here, however, pipe elbows and joints will likely contain asbestos.

Sample the insulation materials from the damaged or exposed ends or other parts. Procedures for sampling and analyzing insulation materials are similar to those for surfacing materials:

- Identify homogeneous areas (i.e., sections of insulation that appear uniform in color and texture).
- Take samples for each homogeneous area where the insulation is damaged or exposed. Remember, all persons taking samples should wear a respirator.
- Submit samples to a qualified laboratory for analysis (see Appendix G).

As indicated in Figure 6, the presence (assumed or confirmed) or absence (confirmed) of asbestos should be documented in permanent records. If asbestos is present, an asbestos control program should be implemented as described in Chapters 3 and 4. If the presence of asbestos has been assumed, sampling and analysis may be useful for confirmation before any additional corrective action is taken.

2.2.4 Procedures for Other ACM

Most ACM in this category (e.g., wallboard, ceiling tile, floor tile) is hard and nonfriable, and sampling would damage it and release fibers needlessly. Information on asbestos in these materials comes mainly from building records or building personnel. Document the presence and location of these materials in permanent records, and proceed with an asbestos control program as described in Chapter 3.

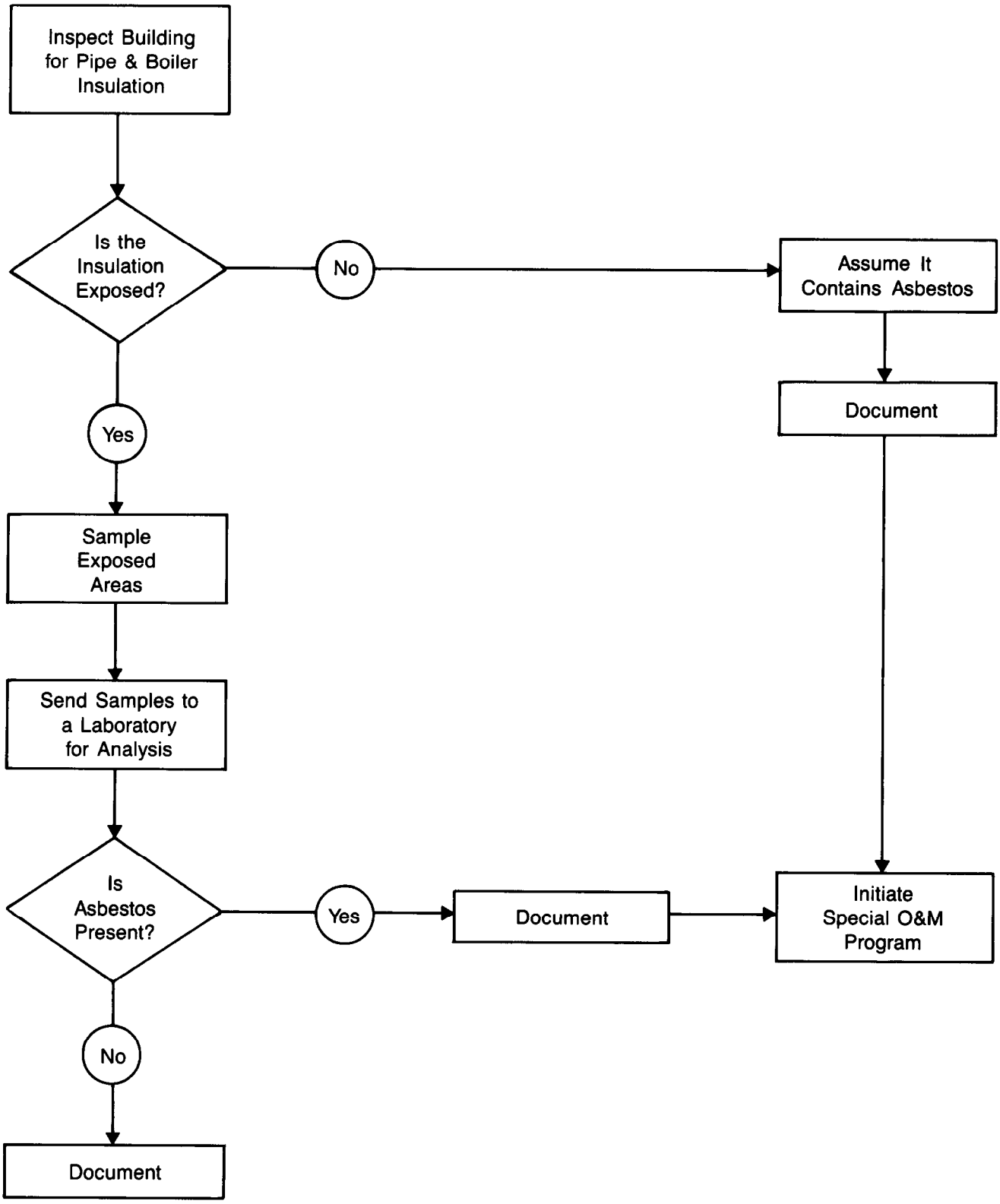


Figure 6. Survey procedures for pipe and boiler insulation.

CHAPTER 3. ESTABLISHING A SPECIAL OPERATIONS AND MAINTENANCE (O&M) PROGRAM

If ACM is found in a building, a special O&M program should be implemented as soon as possible. An O&M program is recommended for each type of ACM: surfacing material, pipe and boiler insulation, and miscellaneous materials. Although many of the procedures are the same, certain steps vary according to the type of ACM.

SUMMARY

Purpose of a Special O&M Program: The program is designed to (1) clean up asbestos fibers previously released, (2) prevent future release by minimizing ACM disturbance or damage, and (3) monitor the condition of ACM. The program should continue until all ACM is removed or the building is demolished.

Who Should Participate: The asbestos program manager, the manager of building maintenance, and the supervisor of the custodial staff are key participants in the O&M program

Program Elements: The program should alert workers and building occupants to the location of ACM, train custodial and maintenance personnel in proper cleaning and maintenance, implement initial and periodic cleaning using special methods (for surfacing materials and pipe and boiler insulation only), establish a process that assures ACM is not disturbed during building repairs and renovations, and periodically re-inspect areas with ACM.

3.1 The Purpose of a Special O&M Program

The discovery of ACM in buildings raises two concerns: (1) how to clean up asbestos fibers previously released, and (2) how to avoid ACM disturbance or damage. The special O&M program addresses both of these issues, with procedures tailored to each of the three types of ACM.

3.2 Who Should Participate

The asbestos program manager develops and implements the special O&M program. He or she may serve as coordinator or delegate that responsibility to the facilities manager or other appropriate employee.

The manager of building maintenance and the custodial staff supervisor are the other key participants. Both must support the program and must generate the same sense of commitment in their staff. A special O&M program will increase cleaning and maintenance work; staff dedication is necessary for an effective program.

Trained building inspectors also participate in all special O&M programs. These inspectors may be the ones who made the initial inspection for ACM. They may or may not be members of the in-house custodial or maintenance staff. In the O&M program, they will be inspecting the condition and other characteristics of the ACM as described in Section 4.1,

3.3 Program Elements

Several aspects of a special O&M program are the same for all three types of ACM. For clarity and completeness, these steps are repeated in the description of each program.

3.3.1 Special Practices for Sprayed- and Troweled-on Surfacing Materials

ACM that is sprayed or troweled on ceilings and walls is often the main source of airborne asbestos fibers in the building. Areas covered by ACM tend to be large. If the material is friable, fibers are slowly released as the material ages.

To reduce the level of released fibers and to guard against disturbing or damaging the ACM, the following measures should be taken:

Documentation, Education, and Training

The O&M program coordinator should:

- Record the exact location of ACM on building documents (plans, specifications, and drawings).
- Inform all building occupants and maintenance and custodial workers about the location of ACM and caution them against disturbing or damaging the ACM (e.g., by hanging plants or mobiles from the ceiling, or pushing furniture against walls). Be sure to give this information to new occupants and employees.
- Require all maintenance and custodial personnel to wear a half-face respirator with disposable cartridge filters or a more substantial respirator (see Section 5.1) during the initial cleaning and whenever they come in contact with ACM.
- Train custodial workers to clean properly and maintenance workers to handle ACM safely. (As noted in Chapter 2, EPA is sponsoring three pilot training programs. Contact the RAC for information on these and other training programs.)

Initial Cleaning

Custodial staff should:

- Steam-clean all carpets throughout the building or vacuum them with a High Efficiency Particulate Air (HEPA)-filtered vacuum cleaner, but never with a conventional vacuum cleaner. Spray vacuum cleaner bags with water before removal and discard in sealed plastic bags according to EPA regulations for removal and disposal of asbestos (see Section 5.1 and USEPA 1985a). Discard vacuum filters in a similar manner.
- HEPA-vacuum all curtains and books. Discard vacuum bags and filters in sealed plastic bags according to EPA regulations for disposal of asbestos waste.
- Mop all noncarpeted floors with wet mops. Wipe all shelves and other horizontal surfaces with damp cloths. Use a mist spray bottle to keep cloths damp. Discard cloths and mopheads in sealed plastic bags according to EPA regulations for disposal of asbestos waste.

Monthly Cleaning

Custodial staff should:

- Spray with water any debris found near surfacing ACM and place the debris in plastic bags using a dustpan. Rinse the pan with water in a utility sink. Report presence of debris immediately to the O&M program coordinator.

- HEPA-vacuum all carpets.
- Wet-mop all other floors and wipe all other horizontal surfaces with damp cloths.
- Dispose of all debris, filters, mopheads, and cloths in plastic bags according to EPA regulations for disposal of asbestos waste.

Building Maintenance

The special O&M program coordinator should:

- Ensure that recommended procedures and safety precautions will be followed before authorizing construction and maintenance work involving surfacing ACM (see Section 5.1). Specifically, containment barriers should be erected around the work area and workers should wear coveralls as well as respirators.

Maintenance staff should:

- Clear all construction, renovation, maintenance, or equipment repair work with the O&M program coordinator in advance.
- Avoid patching or repairing any damaged surfacing ACM until the ACM has been assessed by the asbestos program manager.
- Mist filters in a central air ventilation system with water from a spray bottle as the filters are removed. Place the filters in plastic bags and dispose of them according to EPA regulations.

Periodic Inspection

Building inspectors should:

- Inspect all ACM materials for damage or deterioration at least twice a year and report findings to the O&M program coordinator. (See Chapter 4 for detailed information on assessing ACM.)
- Investigate the source of debris found by the custodial staff.

Custodial and maintenance staff should:

- Inform the O&M program coordinator when damage to ACM is observed or when debris is cleaned up.

An illustrated EPA pamphlet, “Asbestos in Buildings—Guidance for Service and Maintenance Personnel” (USEPA 1985a), maybe especially useful in publicizing and initiating the special O&M program. Contact the RAC or call the EPA toll-free line for copies of the pamphlet (see Appendix E for telephone numbers).

The special O&M program should continue until all surfacing ACM is removed. Overtime, the special O&M program may need to be altered if the ACM is enclosed or encapsulated (refer to Section 5.1).

3.3.2 Special Practices for Pipe and Boiler Insulation

Asbestos-containing pipe and boiler insulation typically is a less significant source of airborne asbestos fibers than surfacing ACM. Unless damaged, protective jackets around such insulation prevent fiber release.

Thus, the special O&M program for pipe and boiler insulation focuses on alerting workers to its location, inspecting the protective jacket (and pipe joints or elbows) for damage, and taking precautions prior to building construction activities. The program also includes repair and selected special cleaning practices.

Documentation, Education, and Training

The O&M program coordinator should:

- Record the exact location of asbestos-containing insulation on building documents (plans, specifications, and drawings).
- Inform maintenance and custodial workers about the location of asbestos-containing insulation, and caution them about disturbing it.
- Post signs reading, “Caution — Asbestos.” on boilers, tanks, pipes. and ducts with asbestos-containing insulation.
- Require all maintenance and custodial personnel to wear at least a half-face respirator with disposable HEPA cartridge filters (see Section 5.1) during initial cleaning and whenever they come in contact with asbestos-containing insulation.
- Train custodial workers to clean properly and maintenance workers to handle ACM safely. (As noted in Chapter 2, EPA is sponsoring three pilot training programs. Contact the RAC for more information on these and other programs.)

Initial Cleaning

Custodial staff should:

- Clean carpets in rooms containing heating, cooling, air-handling, and similar equipment that has asbestos-containing insulation. Use a HEPA-filtered vacuum cleaner or steam cleaner. Discard filters in sealed plastic bags according to EPA regulations for removal and disposal of asbestos.
- Wet-mop all other floors in rooms with asbestos-containing insulation. Wipe all shelves and other horizontal surfaces with damp cloths. Use a mist spray bottle to keep cloths damp. Discard cloths and mopheads in sealed plastic bags according to EPA regulations for removal and disposal of asbestos.
- HEPA-vacuum all curtains in rooms with asbestos-containing insulation, and discard vacuum filters in sealed plastic bags according to EPA regulations for removal and disposal of asbestos.

Semiannual Cleaning

Custodial staff should:

- Spray with water any debris found near asbestos-containing insulation, and place the debris in a plastic bag using a dustpan. Clean the pan with water in a utility sink. Report presence of debris immediately to the O&M program coordinator.
- HEPA-vacuum all carpets in rooms with asbestos-containing insulation.

- Wet-mop all other floors and dust all other horizontal surfaces with damp cloths in rooms with asbestos-containing insulation.

- Seal all debris, vacuum bags, vacuum filters, cloths, and mopheads in plastic bags for disposal according to EPA regulations for asbestos waste.

Maintenance

The special O&M program coordinator should:

- Ensure that recommended procedures and safety precautions will be followed before authorizing construction and maintenance work involving pipe and boiler insulation (see Section 5.2). Specifically, containment barriers or bags should be positioned around the work area and workers should wear coveralls and respirators. Insulation damaged during construction and maintenance activities should be repaired with non-asbestos mastic, new protective jackets, and/or replacement insulation.

- Authorize repair of minor insulation damage with non-asbestos mastic, new protective jackets, and/or non-asbestos insulation following recommended repair techniques and precautions (see Section 5.2).

- Authorize large-scale abatement only after a complete assessment of the asbestos-containing insulation (see Section 5.2).

The maintenance staff should:

- Clear all construction, renovation, maintenance, or equipment repair work with the O&M program coordinator in advance.

- Avoid patching and repair work on insulation until the ACM has been assessed by the asbestos program manager.

Periodic Inspection

Building inspectors should:

- Inspect all insulation for damage or deterioration at least twice a year and report findings to the O&M program coordinator. (See Chapter 4 for detailed information on assessing ACM.)

- Investigate the source of debris found by the custodial staff.

Custodial and maintenance staff should:

- Inform the O&M program coordinator when damage to the insulation is observed or when debris is cleaned up.

The illustrated EPA pamphlet, “Asbestos in Buildings—Guidance for Service and Maintenance Personnel” (USEPA 1985a), may be useful for the special O&M program for pipe and boiler insulation. The O&M program should continue until all asbestos-containing insulation (including materials on pipe joints and elbows) is removed and replaced with another type of insulation.

3.3.3 Special Practices for Other ACM

Most ACM that is neither surfacing material nor pipe and boiler insulation is hard and nonfriable. This type of ACM releases fibers only when manipulated (e.g., cut, drilled, sawed) or damaged. The special O&M program is designed to alert workers to the location of ACM, and to avoid its disturbance or damage.

Documentation, Education, and Training

The O&M program coordinator should:

- Record the exact location of these types of ACM on building documents (plans, specifications, and drawings).
- Inform maintenance and custodial workers about the location of ACM and caution them about disturbance or damage.
- Train maintenance workers to handle ACM safely. (As noted in Chapter 2, EPA is sponsoring three pilot training programs. Contact the RAC for information on these and other programs.)

Maintenance

The O&M program coordinator should:

- Ensure that recoin mended procedures and safety precautions will be followed before authorizing construction or maintenance work involving ACM. Specifically, containment barriers should be erected around the construction and maintenance work area and workers should wear coveralls as well as respirators. All tools should be equipped with HEPA-filtered vacuum devices.

The maintenance staff should:

- Clear all construction, renovation, maintenance, or equipment repair work with the O&M program coordinator in advance.
- Avoid removing, sanding, or stripping floor tiles containing asbestos. If tiles are removed, do not sand asbestos backing material remaining on the floor.

Periodic Inspection

Building inspectors should:

- Inspect all ACM for damage or deterioration at least twice a year, and report findings to the O&M program coordinator.

Custodial and maintenance staff should:

- Report any ACM damage to the O&M program coordinator.

The special O&M program for miscellaneous ACM should continue until all ACM is removed,

CHAPTER 4. ASBESTOS CONTROL BEYOND SPECIAL OPERATIONS AND MAINTENANCE

If a building contains ACM, implementing a special O&M program will remove asbestos fibers and limit further fiber release. Once the program is operational, the need for additional asbestos control or abatement should be considered. Three questions need to be answered:

- Is abatement necessary?
- When should abatement be done?
- What abatement method should be used?

In some situations, assessing the need for abatement is a straightforward process. Badly damaged ACM in public areas should be removed immediately. ACM in good condition with virtually no chance of being disturbed except under controlled conditions (e.g., during scheduled repairs) requires no additional action, at least not immediately. (An example of the latter is tightly bound, undamaged ACM insulation wrapped around heating or water pipes.) Deciding how to control ACM is complicated; assessment requires simultaneous consideration of the type and condition of the material, timing and alternative abatement methods, as well as constraints that are specific to individual buildings.

This chapter contains an approach to assessing the need for abatement, determining its timing, and choosing an abatement method. Factors used in the decision-making process are introduced and discussed. The three types of ACM — surface material, pipe and boiler insulation and miscellaneous products — are treated separately. Constraints that affect individual owners or buildings are also discussed,

SUMMARY

Assessment Information:

- The likelihood of fiber release from ACM is based on evaluating its current condition and the potential for future disturbance, damage, or erosion.
- Air monitoring alone should not be used for assessment.

The Assessment Process:

The likelihood of fiber release from ACM determines the need for and timing of additional action. The nature and location of the material determines the abatement method.

- **Surfacing Materials**

  Need: Surfacing material in good condition and with a low potential for future disturbance, damage, or erosion may need no further action.

  Timing: ACM in poor condition should be dealt with first. If ACM is in good condition but has a high potential for future fiber release, abatement can be scheduled with building renovation or maintenance.

  Method: Removing the ACM is the only permanent solution. Enclosure and encapsulation are temporary solutions to be implemented in special circumstances.

- **Pipe and Boiler Insulation**

  Need: If the insulation is intact, no further action is needed.

  Timing: Damaged insulation should be repaired or replaced as soon as possible.

  Method: Removal is appropriate where the insulation is extensively damaged or deteriorated
  Repair is appropriate where the insulation has minor damage.

- Other Types of ACM

  A special O&M program is usually all that is needed.

Further Considerations in Selecting an Abatement Schedule:

- If an abatement project is not urgent, it will be less costly if combined with building repair, renovation, or expansion, or with scheduled maintenance to equipment and building systems.

- Other factors that may influence the timing of abatement include:

  — The pattern of normal building operations;
  — The building owner's legal liability;
  — Pressures from building occupants and the public; and
  — Expected useful life of the building.

4.1 Assessment Information

The need for asbestos control beyond a special O&M program depends on the likelihood of fiber release from ACM. The possibility of fiber release should be assessed by evaluating the material's condition, physical characteristics, and location. Another approach is to measure the current levels of asbestos in the air. As explained below, however, assessment by air monitoring alone is not recommended because it reflects conditions only at the time of sampling. In addition, air monitoring is technically difficult and expensive.

4.1.1 Potential Fiber Release

Factors for assessing fiber release potential are listed in Table 1. (Figures 7 and 8 illustrate some of these factors.) The first set of factors focuses on the current condition of ACM. If water or physical damage, deterioration, or delamination of the material is evident, then fiber release has occurred, is occurring, or is likely to occur. The appearance of the material and the presence of broken or crumbled material on horizontal surfaces indicate fiber release.

Factors under the second heading in Table 1 reflect potential fiber release due to disturbance or erosion. Visible, highly accessible materials in areas frequently used or needing periodic maintenance are most vulnerable to physical damage. Also in this category are materials subject to vibration from mechanical equipment, sound, or athletic activities — for example, materials near a gymnasium or band room, or in buildings near an airport or highway. ACM in an air plenum or near a forced airstream (e.g., air from a heating vent) is likely to suffer surface erosion. In addition, fibers released into an airstream may be transported to other parts of the building, possibly exposing more people. Any planned changes in building use should also be considered when assessing potential fiber release.

Table 1. Factors for Assessing Potential Fiber Release
(See Appendix H for more detail.)

Current Condition of ACM

- Evidence of deterioration or delamination from the underlying surface (substrate)
- Evidence of physical damage (e.g., presence of debris)
- Evidence of water damage

Potential for Future Disturbance, Damage, or Erosion of ACM

- Proximity to air plenum or direct airstream
- Visibility, accessibility (to building occupants and maintenance personnel), and degree of activity (air movement, vibration, movement of building occupants)
- Change in building use

The factors in Table 1 are fully described in Appendix H. The descriptions should assist the evaluator in assessing ACM at individual sites.

A simple "present" or "absent," "high" or "low" rating should be used for each factor. More elaborate rating schemes have been tried. For example, factors have been assigned numerical scores and, using mathematical formulas, the scores have been combined into indices to reflect potential exposure.[1] These "exposure indices" have met with mixed success. In tests, several indices showed wide variation from one rater to the next and often did not indicate current, elevated airborne asbestos levels (e.g., USEPA 1983b). Assigning numerical ratings to assessment factors and combining them into a single score cannot be recommended. However, the factors are useful when they are scored with a simple, nonnumerical rating scheme.

4.1.2 Air Monitoring

Another way to assess asbestos fiber release is to measure asbestos fibers in the air. This approach is appealing because it quantitatively measures airborne asbestos contamination. However, it measures only current conditions and provides no information about fiber release potential and future air levels. Moreover, implementing an effective monitoring program to measure current levels of airborne asbestos is difficult and can be expensive.

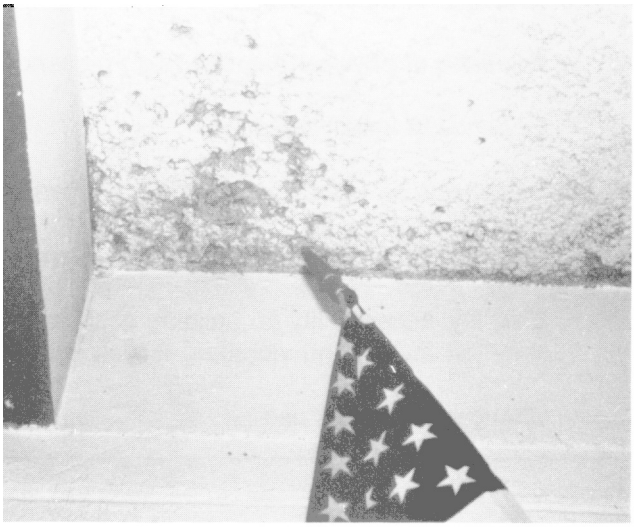
One proposed method for measuring airborne asbestos in buildings was developed by the National Institute for Occupational Safety and Health (NIOSH) in connection with the OSHA asbestos exposure standard for workplace settings. This method uses phase contrast microscopy (PCM), which may be effective for industrial measurements where most airborne fibers are asbestos, but is less useful in settings with much lower asbestos levels. PCM is not sensitive to fibers with diameters less than 0.2 micrometers.[2] In addition, the NIOSH method excludes fibers shorter than 5 micrometers and does not distinguish between

[1] See, for example, Lory 1980, Pinchin 1982, and USEPA 1979.

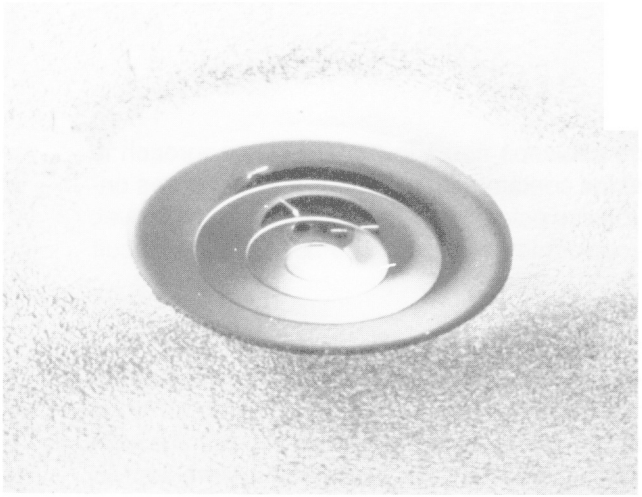
[2] A micrometer is one-millionth of a meter. See Appendix B for a simple discussion of measurement units used to describe and measure asbestos fibers.



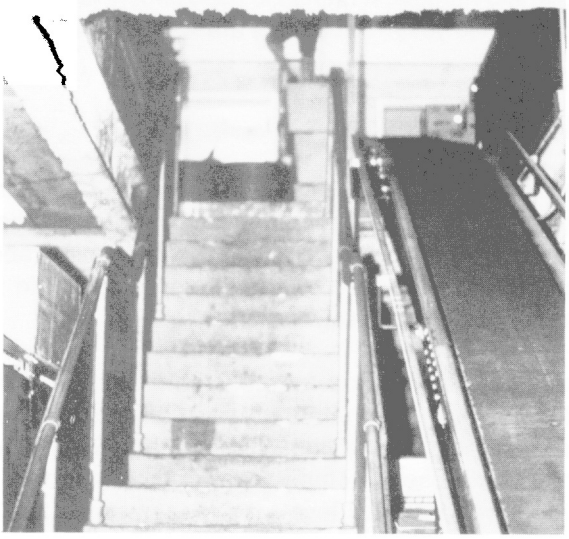
Water damage



Physical damage to ceiling material from a flagpole

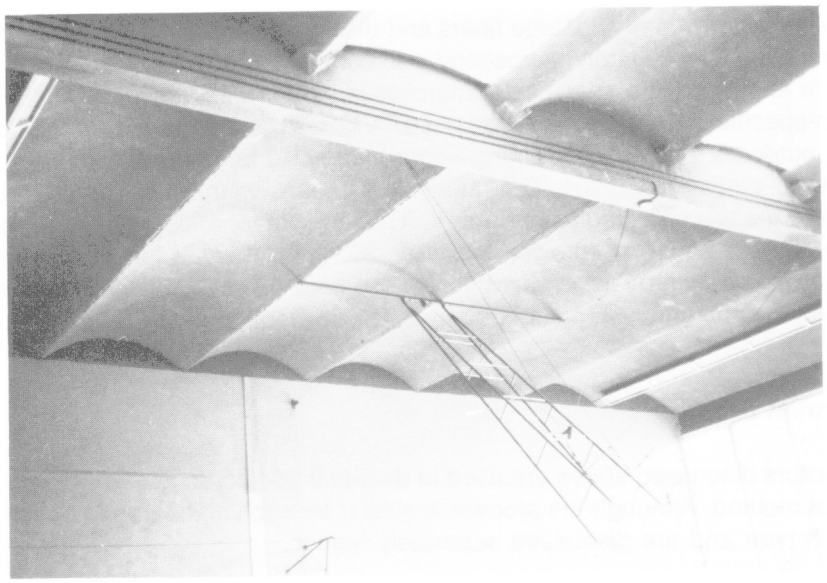


Airstream erosion from a heating vent

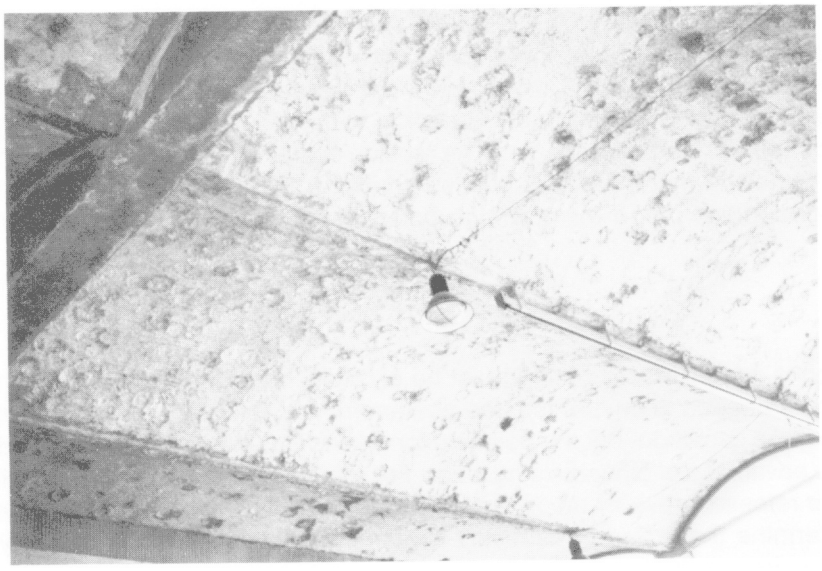


High activity level near friable asbestos

Figure 7. Example assessment characteristics of asbestos-containing materials.



Ceiling of a gymnasium in an elementary school (no basketball marks)



Ceiling of a gymnasium in a high school showing evidence of damage from basketballs thrown by students

Figure 8. An example of the effect of a change in building use.

asbestos and non-asbestos fibers. Many airborne fibers in buildings with ACM are likely to be thinner and shorter than these limits (Chatfield 1983 and NRC 1984), and are likely to include fibers from carpets, clothing, hair, paper, books, and many other sources. As a result, PCM analyses of air inside these buildings could be seriously misleading.

Other methods measure both small and large fibers and distinguish asbestos from non-asbestos materials. Those methods count fibers by electron microscopy, and confirm that the fibers are asbestos with chemical and crystallographic analyses. The analytical transmission electron microscope (TEM)[3] is the most sensitive and asbestos-specific instrument. EPA has used TEM in experiments to establish baseline asbestos levels indoors and outdoors. However, obtaining enough samples to estimate prevalent airborne levels is difficult in occupied buildings. In addition, TEM analysis is expensive (ranging from $200 to $600 per sample) and few laboratories are qualified to perform it. These limitations, combined with the inability of air monitoring to provide information on future conditions, restrict its usefulness for assessment. EPA, therefore, does not recommend it as a primary assessment tool at this time. (Air monitoring does have a role, however, in determining when an abatement project is complete. See Section 6.4.)

4.2 The Assessment Process

The assessment factors discussed above are used to decide if additional asbestos control is needed and, if so, when and what method. Although the process is similar for each of the three types of ACM, the details are specific to each type and are discussed separately below.

4.2.1 Sprayed- and Troweled-on Surfacing Materials

4.2.1.1 Need

Use the factors described in 4.1.1 to determine the current condition of the ACM and the potential for future disturbance, damage, or erosion. Table 2 shows how these two considerations influence the decision regarding action beyond a special O&M program. Surfacing material in good condition may need no further action if potential for future disturbance, damage, or erosion is low. The material must be inspected regularly (see Section 3.3.1) to assure that it remains in good condition. Further action is needed if the material is damaged or in poor condition, or if there is high potential for future disturbance or erosion.

4.2,1.2 Timing

When further action is necessary, its timing must be carefully considered. A well-planned and executed abatement program is needed to ensure that the abatement activity itself does not create a hazard. If the ACM is currently in good condition, but the potential for future fiber release is high, scheduling of asbestos abatement can take advantage of other building plans. For example, renovation work, which requires precautions to control fiber release, provides an opportunity to remove, encapsulate, or enclose ACM. There are no set rules to determine the timing of asbestos abatement, since circumstances vary from building to building. Table 2 provides a guide.

As one moves through the table from left to right (from good to poor condition) and from top to bottom (from low to high potential for disturbance, damage, or erosion), the need for immediate action increases. Material in poor condition should be dealt with first. Materials that are in better condition or have a low potential for disturbance or erosion have a lower priority.

[3] **A provisional method for TEM measurement of asbestos has been developed by EPA (USEPA 1977).**

Table 2. Assessment Table for Surfacing Materials

Potential for Future Damage, Disturbance, or Erosion	Current Condition of ACM: Good*	Minor Damage or Deterioration	Poor
Low	No Further Action Now Beyond Special O & M Program	Selective or Complete Removal as Soon as Possible	Removal as Soon as Possible
High †	Removal, Enclosure, Encapsulation Integrated with Other Building Activities		

* Good condition means no water damage, physical damage, or deterioration.

† High potential means that ACM is exposed or accessible, in an air plenum or airstream, or subject to vibration

Table 3. Comparison of Asbestos Abatement Methods for Surfacing Materials

Method	Advantages	Disadvantages	Appropriate applications	Inappropriate applications	General comments
Removal	Eliminates asbestos source Eliminates need for special operations and maintenance program	Replacement with substitute material may be necessary Porous surfaces also may require encapsulation Improper removal may raise fiber levels	Can be used in most situations		Containment barriers needed Worker protection required Wet removal is required for all types of asbestos, (amosite will not absorb water or water with traditional wetting agents) Disposal may be a problem in some areas Unusual circumstances, complex surfaces, and the presence of utilities may require special removal techniques
Enclosure	Reduces exposure in area outside enclosure Initial costs may be lower than for removal unless utilities need relocating or major changes Usually does not require replacement of material	Asbestos source remains and must be removed eventually Fiber release continues behind enclosure Special operations program required to control access to enclosure for maintenance and renovation Periodic reinspection required to check for damage Repair of damaged enclosure necessary Fibers released in dry form during construction of enclosure Long-term coats could be higher than for removal	ACM is located in a small area (e. g., a column) Disturbance or entry into enclosed area unlikely	Damaged or deteriorating materials causing rapid fiber release Water damage evident Damage or entry into enclosure likely Ceiling to be enclosed IS low	Containment barriers needed Use of tools with HEPA-filtered vacuum attachments advisable Worker protection needed

Table 3. (continued)

Method	Advantages	Disadvantages	Appropriate applications	Inappropriate applications	General comments
Encapsulation	Reduces asbestos fiber release from material Initial costs may be lower than for removal Does not require replacement of material	Asbestos source remains and must be removed later If material is not in good condition, sealant may cause material to delaminate Periodic reinspection required to check for damage or deterioration Repair of damaged or deteriorating encapsulated surface required Encapsulated surface is difficult to remove and may require dry techniques for eventual removal Long-term costs may be higher than removal	Material still retains bonding Integrity Damage to material not likely Material not highly accessible Material granular, cementitious After removal of ACM, if the substrate is porous	Material does not adhere well to substrate Material is deteriorating or damaged, or damage is likely Water damage is evident Material is fibrous, fluffy	Containment barriers needed Worker protection needed Airless sprayers should be used Previously encapsulated materials may have to be re-encapsulated

4.2.1.3 Method

The choice of abatement method is determined mainly by the condition of the ACM. Surfacing materials can be removed, encapsulated with sealant, or enclosed within an airtight structure. The three methods are summarized in Table 3 and described in more detail in Section 5.1. Worker protection and the construction of sealed containment barriers around the work site are required for all three methods.

Removal has the widest applicability. It also is the only truly permanent solution, since no building containing asbestos can be demolished without first removing the ACM. If ACM has only minor, isolated damage, removal of selected areas may be sufficient.

Enclosure and encapsulation have limited application. Enclosure is restricted to situations where ACM can be isolated in small localized areas. Encapsulation can be used only for acoustical plaster in good condition. In addition, the special O&M program must be continued and the enclosed or encapsulated materials reinspected periodically (at least monthly) until the ACM is removed or the building is demolished. Encapsulation may make eventual removal more difficult and costly, since encapsulated ACM may have to be removed in dry form.

Initial cost of removal may be higher than for other abatement methods. However, removal may be less expensive over the long term, since the continued presence of ACM requires special O&M practices, periodic reinspection, and repairs. Enclosure and encapsulation are options only when the ACM is in good condition. These are primarily temporary measures to reduce the potential for future disturbance or erosion until the ACM is eventually removed.

4.2.2 Pipe and Boiler Insulation

4.2.2.1 Need

Pipe and boiler insulation typically presents a more localized fiber release problem than surfacing material. The insulated pipes, boilers, ducts, and other equipment are frequently confined to equipment rooms or placed within walls or behind ceilings. Even accessible insulation is localized to the piece of insulated equipment. Thus, the potential for disturbance, damage, or erosion is lower than for surfacing material; frequent inspection can spot any new disturbance and the damage can be repaired quickly. The condition of the ACM determines the need for further action (see Table 4). If the insulation is intact, no further action is needed.

4.2.2.2 Timing

Damaged insulation should be repaired or replaced as soon as possible. Major renovation, such as installation of a new boiler, is a good time to consider replacing pipe and boiler insulation with non-asbestos material. This will eliminate the need for a continuing special O&M program.

4.2,2.3 Method

Removal is appropriate where the insulation is extensively damaged or deteriorated. It involves cutting and stripping the insulation from pipes (or other equipment) and substituting non-asbestos material. Plaster around elbows, valves, and flanges should also be replaced with non-asbestos materials. Removal of pipe and boiler insulation requires many of the same precautions and worker protection measures for removal of surfacing materials.

Table 4. Assessment Table for Pipe and Boiler Insulation

Potential for Future Damage, Disturbance, or Erosion	Current Condition of ACM: Good*	Minor Damage or Deterioration	Poor
Low	No Further Action Beyond a Special O&M Program	Patching or a New Jacket as Soon as Possible	Removal and Replacement as Soon as Possible
High †	Removal Integrated With Other Building Activities	Patching or a New Jacket as Soon as Possible. Removal Integrated with Other Building Activities	

* Good condition means that the wrapping is intact and there is no water damage, physical damage, or deterioration.

† High potential means the ACM is exposed or accessible, or in an air plenum.

Repair is appropriate where the insulation has minor damage. Repair involves patching the damaged insulation or covering it with a new jacket. A more complete description of insulation removal and repair appears in Section 5.2.

4.2.3 Other Types of ACM

A special O&M program is usually all that is needed for other types of ACM, since most ACM in this category is hard and nonfriable and should not readily release asbestos fibers. The only time abatement (primarily removal) should be considered is when it becomes necessary as part of building renovation or maintenance. The procedures in Section 5.3. should then be followed.

4.3 Further Considerations in Selecting a Schedule for Abatement

Significant cost savings may be realized by coordinating asbestos abatement with other building activities. For example, when a commercial tenant moves, the space will be temporarily unoccupied and the new tenant may request changes such as moving walls and doors, installing dropped ceilings, or building rooms for specialized equipment. ACM will be disturbed by the renovation work, necessitating precautions to control fiber release. This investment in worker protection and site containment creates an opportunity to enclose, encapsulate, or remove ACM. On the other hand, when ACM needs immediate action, abatement may be a cost-effective time to improve building systems — for example, by upgrading electrical systems, repairing vents and ducts, or installing low-energy lights.

Other considerations in scheduling asbestos abatement include the pattern of normal building operations, the long-term legal liability of the building owner, pressures brought by concerned parties, and the expected useful life of the building.

- The pattern of normal building operations. Extensive abatement activities will disrupt building operations. When possible, abatement should coincide with vacations or other periods of low activity.

- The long-term legal liability of the building owner. Some owners choose to remove all ACM as quickly as possible to reduce their liability. However, liability may actually increase if removal is performed by untrained or inexperienced contractors or without proper precautions.

- Pressures brought by workers, building occupants, and other affected parties. Building occupants and the public may have legitimate concerns about possible health risks. However, fear of asbestos often motivates them to call for action before the problem has been properly assessed. The public information program developed with the building survey should include descriptions of the assessment, its results, and a justification of the decision. This is especially important if abatement is not carried out immediately or if no further action will be taken.

- Expected useful life of the building. The comparative costs of removal versus a continuing special O&M program will depend on the expected life of the building.

CHAPTER 5. ABATEMENT METHODS: CHARACTERISTICS AND RECOMMENDED WORK PRACTICES

This chapter provides more detailed information on the advantages, disadvantages, applicability, and relative costs of alternative abatement methods. Information is also given on recommended work practices for worker protection, work site containment, and project surveillance. This information is provided to help building owners determine which method is most appropriate for their situation and what the abatement effort will involve. It is not intended as an instruction manual for abatement.

5.1 Abatement Methods for Sprayed- or Troweled-on Surfacing Material

Each abatement method (removal, enclosure or encapsulation) is a separate and distinct alternative. They share, however, several features. The first is the need to conduct a more detailed inspection of both the ACM to be treated and the underlying surface. Each separate, homogeneous area of ACM, usually a single room, hallway, or central space, should be reinspected. (Remember that seemingly homogeneous areas can be composed of different materials and thus require separate inspections.) It is especially important to inspect for hidden material above a suspended ceiling with lay-in panels (see Figure 9). A second round of material sampling in selected areas may help to confirm the presence of asbestos and better delineate areas needing further corrective action.

The following information should be collected on each area with ACM:

- size of the area, since this affects the cost of abatement;
- type of ceiling construction if the ceiling is coated (for example, concrete joist and beam, concrete waffle slab, steel beam or bar joist, suspended metal lath, suspended lay-in panels, tile, metal, corrugated steel), since different construction types present different control problems;
- ceiling height, which may determine the practicality of enclosing the material;
- type of wall (for example, smooth or rough concrete, block or brick, plasterboard), which may indicate whether an encapsulant is needed if material is removed;
- average thickness of ACM (and variation in thickness), since encapsulant should not be applied to thick material.

A form for collecting the necessary information was developed by EPA's Region VII Office and is included in Appendix I for illustrative purposes.

The second common feature of the three abatement methods is the need for worker protection during abatement activities. Worker protection entails not only proper training and specified work practices, but also protective equipment (special coveralls and respirators) for the workers. The OSHA standards specify three different respirators depending on the expected concentration of fibers in the work area: (1) a full- or half-face mask with either a single-use or replaceable filter, (2) a full-face mask with replaceable filter and a pump to assist breathing, and (3) a full-face mask with a self-contained or remote air supply.

NIOSH now recommends that the first type of respirator with a single-use filter not be used, because these filters have not been tested for effectiveness specifically against asbestos fibers and because they are difficult to seal properly around the face.[1] Supplied air (type "C") units offer the most protection. Respirators

[1] A letter setting forth NIOSH's concerns about these respirators was sent to respirator manufacturers on August 25, 1980. A copy of this letter appeared in the December 1980 issue of the *Journal of the American Industrial Hygiene Association.* An industrial hygienist or other appropriately trained professional should assist workers in fitting any type of respirators.

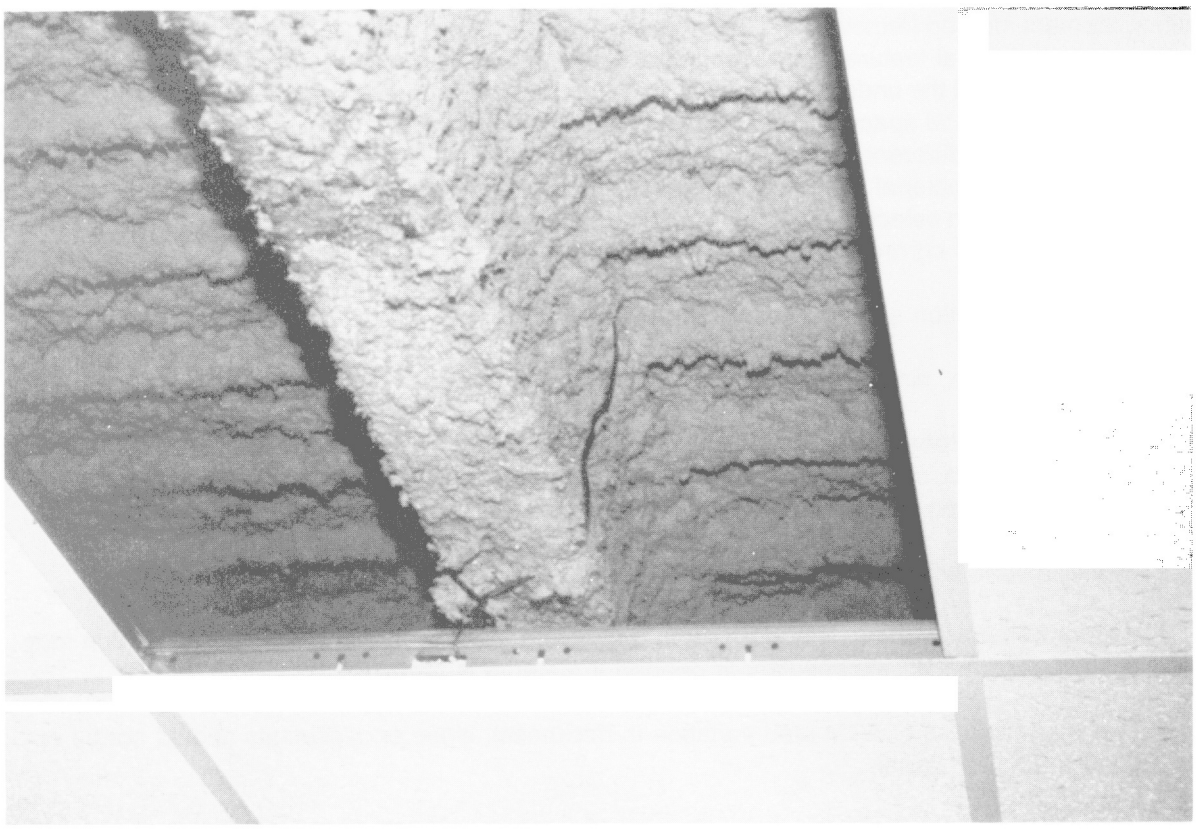


Figure 9. Asbestos-containing material located above a suspended ceiling.

are required for removal of ACM and are highly recommended for other abatement methods, since enclosure and encapsulation may also elevate fiber levels.

The third common feature IS proper work area containment. Containment typically means construction of barriers with 6 mil polyethylene plastic sheets joined with folded seams, and with sealing tape at the seams and boundaries. Some contractors have had problems attaching plastic sheets to walls. Thinner sheets or a better attachment system (for example, stapling and taping sheets to furring strips fastened to walls) may be required. (Figure 10 shows the construction of a typical containment system. Note that respirators should be worn if the ACM will be disturbed during construct ion.) Air locks and worker decontamination facilities with showers are recommended, as well as negative air pressure systems, described in Section 5.1.1 below.[2] All return air vents should be sealed to prevent asbestos contamination of the air-handling system. Without such containment measures, increased exposure for building occupants is likely. Once abatement begins, everyone not participating in the project should be kept out of the area.

The fourth common feature is the need for a rigorous postabatement cleanup. This includes wet-mopping or HEPA-vacuuming all horizontal and vertical surfaces in the work area. (Wet mopheads and cloths should be discarded in sealed plastic bags and treated as asbestos-contaminated waste.) Cleaning of surfaces outside the work area is highly recommended. Two cleanings—the second after at least 24 hours when suspended fibers have settled—will provide better assurance of fiber reduction than a single cleaning. (Section *6.4* contains additional information on cleaning and inspecting the work site.)

5.1.1 Removal, Disposal, and Replacement

Figure 11 is a photograph of a typical removal project. When removing ACM, observe the following requirements:

- The material must first be treated with a solution of water and a wetting agent to reduce fiber release. Some types of amosite-containing materials will not absorb either water or water combined with the wetting agent suggested by EPA (50% polyoxyethylene ester and 50% polyoxyethylene ether). Other wetting agents should be tested on the material for absorption. If the material will not absorb the wetting agent, undertake a dry removal using Type C respiratory protection. EPA must approve all dry removal operations. Get in touch with the NESHAPS contact in your region (see Appendix D).

- Friable ACM must be disposed of in “leak-tight containers," typically 6 mil polyethylene bags. Bags can be placed in 55-gallon drums for additional protection. Bags or drums must be labeled, as specified by NESHAPS (see Appendix C) or OSHA (see Appendix F).

- OSHA procedures for worker protection and decontamination, as well as for measurement of airborne asbestos, must be strictly followed (see Appendix F). While not required by law, EPA procedures for work area containment should also be followed to assure safe removal.

Research on asbestos removal plus EPA’s experience with removal activities in schools since 1979 have pointed up several other important issues:

- A tear in the containment barrier is a significant exposure hazard for building occupants and should be repaired immediately. The use of negative pressure systems together with HEPA filtration (that is, low speed exhaust fans with HEPA filters) to move air from within the work area

[2] OSHA decontamination requirements specify worker change rooms as a minimum provision for asbestos removal projects. If negative air systems are used, “air locks” should not be airtight. That is. make-up air should pass through the air lock. See Appendix J for additional information.



Figure 10. Construction of containment barriers.

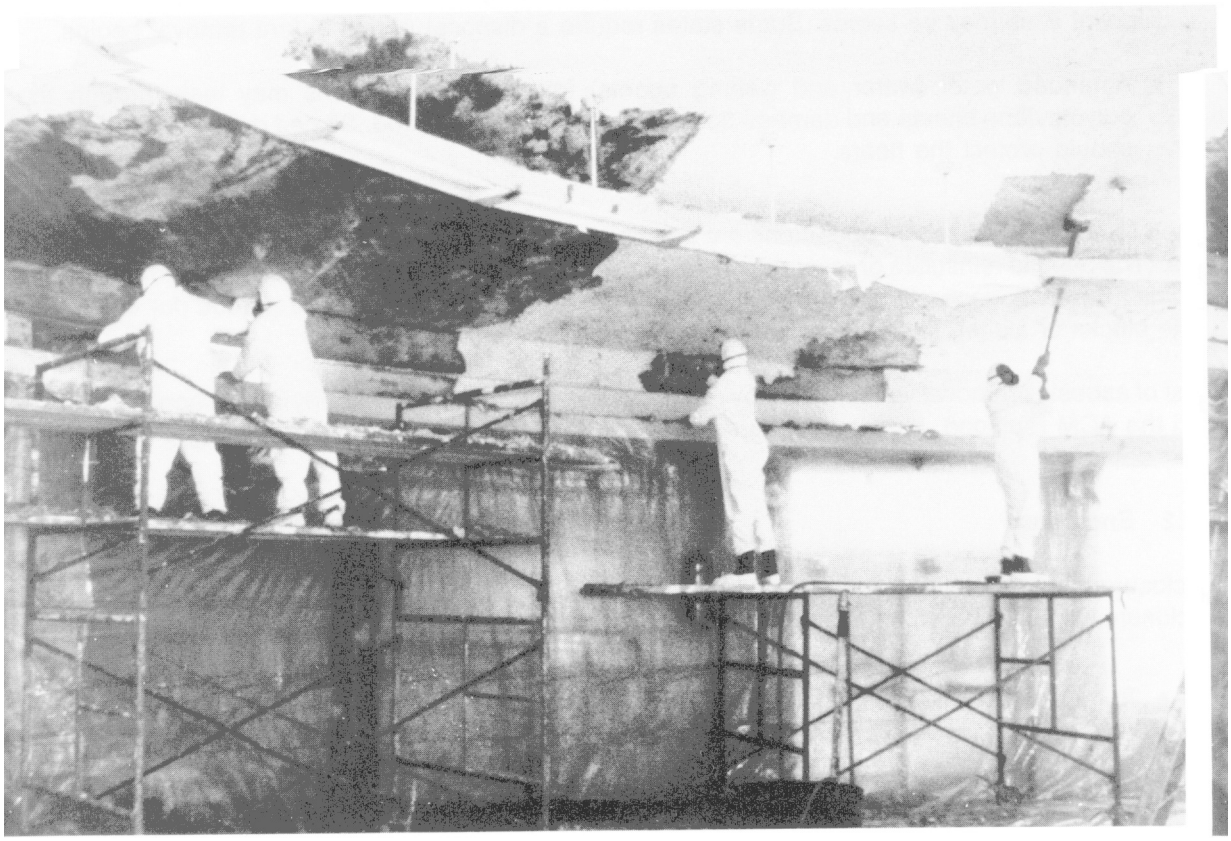


Figure 11. An asbestos removal project.

to outside the building will provide added protection in case of an accident. Appendix J summarizes specifications for negative air systems.

- When containment barriers are dismantled after ACM removal, the sealing tape used to attach the plastic sheets to walls and ceilings frequently removes paint. It is prudent to include the cost of repainting all walls (and ceilings, if appropriate) in estimates of asbestos removal costs.

- Asbestos waste is sometimes spilled both in and outside the work area. Containers full of wet material are very heavy and hard to transport. These containers must be sealed and handled carefully. Workers should continue to wear protective equipment during these operations. Also, disposal sites may be scarce. Some states require a disposal permit before removal begins.

- Amended water (water and wetting agents) from spray operations may leak through the polyethylene sheets and damage floors, especially tile and wood. Sealed double plastic sheets should protect the floors.

When removal and disposal operations are finished, evaluate the need for a sealant on the exposed surface. (The need to reinsulate or resoundproof with asbestos-free materials should be decided before removal begins.) Sealants generally are necessary where the underlying surfaces are porous (for example, concrete blocks or slabs), since a few fibers usually remain after removal.

Cost of asbestos removal varies widely by region and by job. Where the underlying surface must be sealed and the ACM replaced, those costs must be added to removal costs.

5.1.2 Enclosure

Enclosure involves construction of airtight walls and ceilings around the ACM, Figure 12 shows a typical enclosure, These recommendations for constructing enclosures should be followed:

- To reduce fiber release, drills used during installation should be equipped with HEPA-filtered vacuums.

- Underlying structures must be able to support new walls and ceilings.

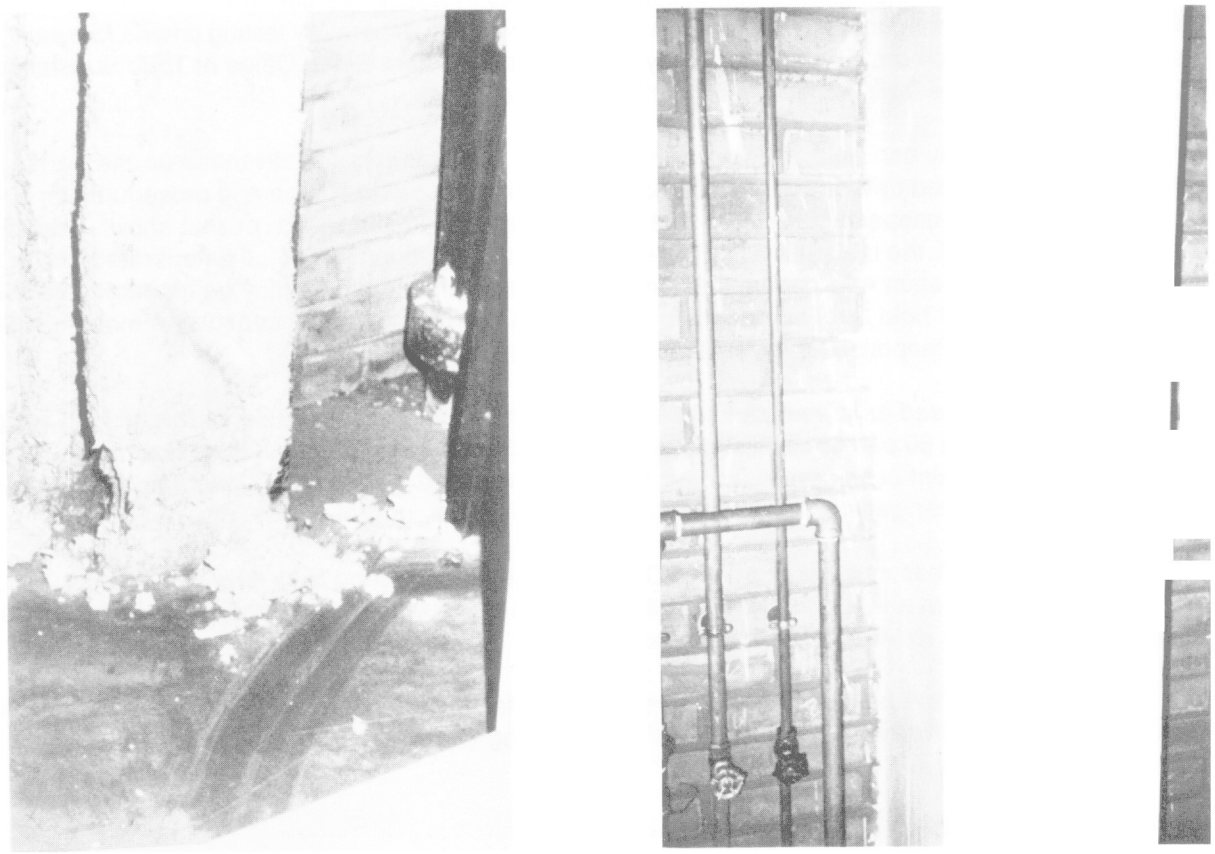
- New construction material should be impact-resistant and assembled to be airtight? Gypsum panels taped at the seams, tongue-and-groove boards, and boards with spline joints all qualify. Suspended ceilings with lay-in panels are not acceptable. Joints between walls and ceilings should be caulked.

- If lights are recessed into ACM, they must be removed carefully to minimize fiber release. Lights should be reinstalled beneath the new ceiling.

- Relocation of plumbing lines and computer cables may be necessary.

- Building records must note the presence of asbestos behind the enclosure to prevent accidental fiber release during remodeling or building demolition. (The presence of ACM should have been documented as part of the special O&M program.) Signs should be posted, noting that ACM is behind the enclosure.

[3] No enclosure will be totally airtight. The practices recommended here are designed to greatly reduce air movement across the enclosure boundary.



Before enclosure

After enclosure

Figure 12. An asbestos enclosure project.

5.1.3 Encapsulation with Sealants

Encapsulation refers to the spraying of ACM with a sealant. The sealant should bind together the asbestos fibers and other material components and offer some resistance to damage from impact. Figure 13 shows an asbestos encapsulation project.

Encapsulation should be used only on granular, cementitious material—commonly known as acoustical plaster. A sealant should penetrate the ACM and adhere to the substrate (or form a tough skin over the material), withstand moderate impact, be flexible and flame-retardant, resist deterioration over time, and be non-toxic. EPA evaluated over 100 sealants, using five criteria: impact resistance, flame spread, smoke generation, toxic gas release during combustion, and adhesive/cohesive strength (USE PA 1981). The American Society of Testing and Materials (ASTM) also is developing laboratory testing criteria for sealants. Additional information on the EPA sealant study can be obtained from EPA's Office of Toxic Substances, TSCA Assistance Office (see Appendix E for phone numbers).

Although the EPA study can help building owners choose a sealant, its effectiveness on the particular ACM should still be tested on-site over several days. (ASTM is developing criteria and procedures for such on-site tests.) Do not encapsulate material that is delaminated or deteriorated, or that shows extensive damage. If delaminated, the material will be pulled down by the additional weight; if deteriorated, the ACM may be blown off by sealant application; if extensively damaged, the material may be repeatedly abused and the sealant will not hold up. The condition of the sealant on previously encapsulated materials also should be inspected. Reapplication of sealant may be necessary.

Latex paint has been used as a sealant for granular, cementitious materials. Select a brand with a high vehicle content (at least 60 percent by weight) and at least 25 percent by weight vehicle resin.[4] For encapsulating ACM, apply paint considerably thicker than recommended for painting. Coverage should be no more than 100 sq. ft. per gallon, and should create a continuous, unbroken coating.

Apply sealants with airless spray equipments One recommended method is to apply a light (mist) coat, then a full coat applied at a 90 degree angle to the direction of the first. If latex paint is used, the full coat can also be applied by roller before the mist coat dries.

Record the type of sealant used and the nature of the material and substrate encapsulated. This information is needed to avoid unintentional release of fibers during later remodeling or demolition.

5.2 Abatement Methods for Pipe and Boiler Insulation

Abatement methods for ACM used to insulate pipes, boilers, ducts, tanks, and related equipment are somewhat different from methods for asbestos sprayed or troweled on surfaces. When damage to pipe or boiler covering is limited, repair is the recommended abatement approach. Non-asbestos plastering can restore open joints, wrapped or plastered areas that are damaged, and areas around valves and flanges. Encapsulant can also be used as a temporary measure. Do not use duct tape; it becomes brittle after exposure to high temperatures.

Where large portions of pipe and boiler insulation must be removed, erect containment barriers and employ the full range of worker protections (see Section 5.1). Containment bags may be used instead of constructing containment barriers around the work area. These bags are available commercially. As shown in Figure 14, the bags are positioned around the pipe insulation to be removed, and sealed to the pipe with tape.

[4] Paint constituents appear on the label of the can.

[5] The use of respirators is recommended for applying any sealant. Solvent-based (as compared to water-based) sealants may require the use of a supplied air (Type C) respirator due to hazards from the solvents.



Figure 13. An asbestos encapsulation project.

Armholes and an inside pouch for tools let the worker remove insulation without exposure to asbestos fibers. A sealed side port also can be constructed to allow access for wetting the asbestos and evacuating the bag with a HEPA-filtered vacuum.[6] Workers who use containment bags should still wear respirators in case a bag leaks.

To remove individual pipe sections or an entire pipe network, a small section (about 6 inches wide) of insulation should be removed. The pipe then can be cut into manageable lengths with a saw or torch. Exposed ends of the insulating material should be sealed with plastic and tape. If the remaining insulation is not in good condition, the entire pipe should be wrapped in 6 mil plastic. Disposal of insulation material must follow EPA procedures discussed earlier for ACM disposal (Sections 1.4 and 5.1). More information on pipe and pipe insulation removal will be provided in a future technical bulletin.

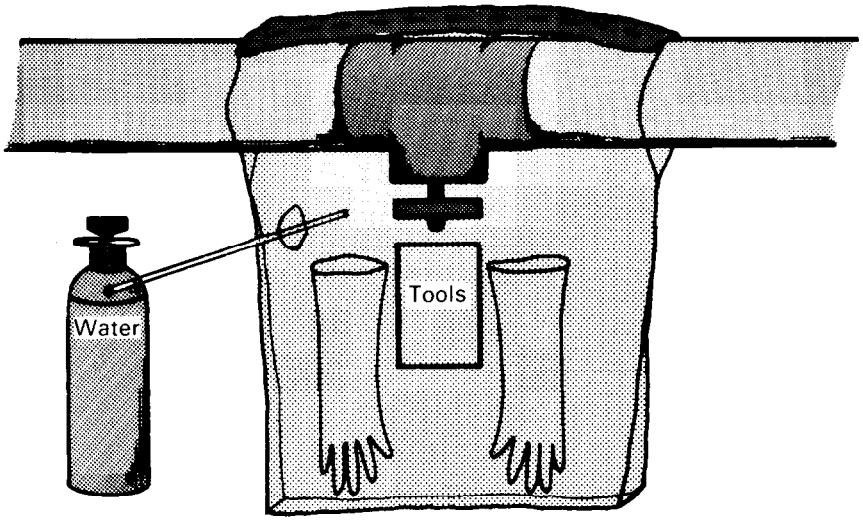


Figure 14. Custom containment bags for repairing or removing pipe insulation.

5.3. Abatement Methods for Other Types of ACM

Additional corrective action generally is not needed for other types of ACM. The special O&M program should continue until building renovation or maintenance requires ACM removal. The ACM should then be removed following the guidelines for surfacing materials (i.e., worker protection and work area containment). Removed ACM should be wrapped in 6 mil plastic sheets or placed in plastic bags, labeled as asbestos waste, and transported to a solid waste site. Unless these materials are friable, OSHA and NESHAPS regulations covering removal operations do not apply.

[6] Seals can be checked with a flashlight and smoke from a smoke tube.

CHAPTER 6. CONDUCTING ABATEMENT PROJECTS

Because efforts to treat ACM may be hazardous to abatement workers and building occupants, careful planning and diligent implementation of the project are essential. Removal, enclosure, or encapsulation of surfacing materials and removal or repair of pipe and boiler insulation may cause large-scale fiber release if proper procedures are not followed. As a result, asbestos levels in the building may increase rather than decrease.

For this reason, key elements of the abatement project include comprehensive and precise contract specifications, workers specially trained in asbestos abatement, rigorously applied worker protection and site containment measures, and the regular monitoring of the work site. When abatement activity is complete, the entire work site should be thoroughly cleaned. The contractor should be released only after the work site has passed visual inspection and a test for airborne asbestos.

SUMMARY

Who Should Do the Work:

Usually a contractor is hired to conduct abatement work that goes beyond special O&M. Occasionally, a large school district or an owner of many buildings will train and dedicate an in-house asbestos abatement team.

Selecting a Contractor:

Steps in selecting a contractor include checking references, conducting interviews, reviewing insurance coverage, and writing precise contract specifications. Note that the most cost-effective contractor is not necessarily the lowest bidder.

Managing the Work:

- Regular on-site inspections will assure conformance with work specifications and avoid costly and hazardous errors.

- Before the contractor is released, the work site should pass both a visual inspection and an air test for asbestos fibers to be sure the site has been adequately cleaned. From a technical point of view, the TEM method is preferred for the air test. Although the PCM method is not as specific for asbestos nor as sensitive to thin fibers as the TEM method, it is frequently more available and easier to implement.

6.1 Who Should Do the Abatement Work

Employees involved in the abatement work must be specially trained and committed to quality work. Training should:

- Familiarize workers with the general problems of airborne asbestos;

- Teach them to handle ACM safely and prevent unnecessary fiber release; and

- Explain how to interpret asbestos abatement work orders.

Either in-house staff or outside contractors can conduct asbestos abatement work. The decision depends primarily on training, equipment, and experience.

In most cases, the in-house maintenance staff will not have enough time to master asbestos abatement methods for surfacing materials—removal, enclosure, and encapsulation. However, some school districts with many buildings containing surfacing ACM have formed asbestos abatement teams whose sole responsibility is control of ACM. These in-house teams can thoroughly learn the requirements and methods of asbestos abatement. With this training and knowledge of the buildings, an in-house team may be the most effective. More typically, however, an outside contractor specializing in asbestos abatement is hired for specific abatement projects.

Building maintenance workers accustomed to repairing equipment with insulation are frequently trained to undertake abatement actions involving pipe and boiler insulation. However, outside contractors are typically hired to remove extensive amounts of insulation or to remove both pipe and insulation.

6.2 Selecting a Contractor

Selecting a competent contractor is the first step toward successful abatement. EPA's experience with asbestos abatement and comments from technical advisors suggest that many contractors cannot properly conduct abatement projects. Several contractors, awarded jobs based on responsive and reasonable cost bids, proved unable or unwilling to follow contract specifications. Suggestions to help building owners avoid these situations are as follows:

- Assign the technical advisor who will monitor the abatement work to assist in writing job specifications and selecting the contractor. The advisor should not be employed by an abatement contractor.
- Require evidence of prospective contractors' experience and/or training in asbestos abatement.
- Check references, including other building owners for whom contractors have worked. (See Appendix K for an example checklist of contractor qualifications.)
- Ask for detailed written descriptions of how bidders will satisfy the project specifications.
- Interview bidders regarding their work, worker protection, and site containment plans. A statement that the contractor will comply with all EPA, OSHA, and state regulations is not sufficient. Ask bidders for copies of their standard operating procedures and employee protection plans, specifically their OSHA medical monitoring and respirator training program. The interview is invaluable for evaluating each contractor's capabilities and understanding of the problem.
- Obtain documentation of each contractor's fiscal qualifications, including financial performance, assets, liabilities, legal judgments, and insurance.
- Be sure that the contractor selected has adequate liability insurance. Some forms of insurance may not provide enough long-term protection against inadequate abatement work. The building owner's attorney and insurance advisor should determine if coverage is adequate.
- Be specific about what constitutes successful job completion. A thorough visual inspection to insure adequate cleaning is an absolute necessity. Air monitoring is also recommended (see Section 6.4). The person carrying out the air monitoring should not be employed by the abatement contractor.
- Require evidence of worker certification or have the contractor conduct an on-site training program for workers.

- Encourage bidding competition, since prices can vary greatly. Multiple bids are desired, but too many can confuse the selection process. Remember that successful abatement, not cost minimization, is the goal.

- If possible, avoid contracting for abatement work during the summer. Many school projects are conducted during that season, taxing the limited number of competent contractors.

Appendix L contains a list of organizations that have prepared model contract specifications for asbestos removal. Together with the above suggestions, these models can serve as the basis for writing specifications tailored to individual projects. Remember that EPA's RAC can provide additional information and suggestions.

6.3 Managing the Work

As in all construction jobs, the program manager or the manager's representative (frequently the technical advisor) should visit the abatement work site often (no less than four times per day) to insure that all plans and procedures are properly implemented. The work site monitor should:

- Be sure the workers follow specifications;

- Confirm compliance with worker protection requirements; and

- Assure that the containment barriers around the work site are properly constructed and maintained.

By carefully monitoring the abatement work, the asbestos program manager can correct errors quickly. Work site inspections are most effective if the manager can refer to a detailed workplan containing specific work practices. Where work does not follow specifications, the project should be stopped immediately. The abatement contractor, the asbestos program manager, and the work site monitor (if different from the program manager) should then identify the problems and take steps to correct them.

The need for worker protection (protective clothing, respirators, and change facilities) was discussed in Section 5.1. Although contractors are responsible for their employees, a building owner's concern for the safety of everyone in the building extends to the abatement workers.

Work area containment is essential for all types of abatement and for both surfacing material and pipe and boiler insulation. Once abatement begins, all persons not directly involved in the work should be barred from the area. The work site monitor should make sure plastic barriers are in place (see Section 5.1) and that warning signs are posted at least 20 ft. in front of the work site entrance.

If abatement activity is limited to repair or minor removal of pipe and boiler insulation, containment bags will probably be used (see Section 5.2). The monitor should inspect the construction and use of the bags. Warning signs should be posted outside the work site.

The monitor should also check the air lock at the entrance to the work site. If a negative pressure system is not used, the air lock (and the entire containment system) should be airtight. If a negative pressure system is used (as recommended), the air lock must allow air from the building to enter the work site to replace the contaminated air that is filtered and exhausted outside. When inspecting the work in progress, the monitor's specific checklist will depend on the type of abatement. Abatement inspection for surfacing materials and pipe and boiler insulation should be based on guidelines and precautions described in Chapter 5 (Sections 5.1 and 5.2, respectively).

Work site inspections greatly increase an abatement project's likelihood of success. The importance of doing the job right the first time cannot be over-emphasized. Tests must be performed when the work is

finished to determine if the project has been conducted properly and the work site adequately cleaned (described in 6.4.) However, if the workers have not been diligent throughout the project, proper cleaning of the work site may not be possible.

6.4 Releasing the Contractor

An asbestos abatement project is successful when the source of fiber release has been controlled and airborne asbestos generated during abatement has been reduced to an acceptable level. As discussed earlier in this chapter, success can be built into the project with a sound work plan and constant monitoring of the work area to insure proper implementation. All workers must be trained and must follow stipulated work practices. Also, it is important to use negative air pressure ventilation to capture asbestos fibers generated during all types of abatement, and to continually remove debris from the site. When the abatement project is completed, the entire site should be cleaned at least twice.

Success is confirmed with a final evaluation at each work area. The evaluation consists of visual inspection and air testing. Visual inspection is used to determine if the work has been performed properly and to check for debris and other obvious signs of poor cleaning. Air testing helps confirm that the work site has been adequately cleaned. Only then is the contractor released.

6.4.1 Visual Inspection

The primary test for releasing the contractor is a thorough visual inspection of the work site. The inspection should be conducted before the containment barriers have been taken down but after the plastic sheets have been cleaned with damp mops and cloths or a HEPA vacuum cleaner. Since elevated levels of airborne asbestos may still be present, the inspector should wear a respirator (see Section 5.1).

First, the inspector should confirm job completeness. If ACM has been removed, substrate surfaces should be checked to be sure no ACM remains. Special attention should be given to pipes, beams, and irregular surfaces that may have corners and hard-to-reach areas. If the materials were enclosed, check the area for tight construction (e.g., no stray drill holes or openings at corners). Inspect encapsulated surfaces to insure that the right amount of sealant has been used: there should be no holes, voids, or cracks. Check surfaces behind obstructions (e.g., pipes or ducts) for these signs.

Next, the inspector should determine that the work site has been adequately cleaned. Any activity that disturbs ACM will release fibers. Therefore, work site cleanup after removal, repair, enclosure, or encapsulation is critical.

Examine all surfaces for dust and debris, especially overhead areas like tops of suspended light fixtures. Use a damp cloth to collect dust from these surfaces and then inspect the cloth for evidence of dust. This is a practical way to establish that the “no dust” requirement has been met.

A more sensitive test for dust is to darken the room and shine a flashlight so that the beam just glances any smooth horizontal surface. Run your finger across the illuminated area. If a line is left on the surface, or if airborne particles shine in the light, dust is still present.

If dust is found by either of the two tests, the entire work area should be recleaned and the tests repeated.

6.4.2 Air Testing

Conduct air monitoring only after the site has passed visual inspection. First, remove all plastic sheets covering floors, walls, and other surfaces. (The plastic barriers separating the site from the rest of the building

and the plastic sheets covering doors, vents, and windows should be left in place until the air test has been passed.) If a negative air pressure ventilation system was used during abatement, it should continue operating while air monitoring is in progress.

As discussed in Section 4.1, measuring airborne asbestos fibers accurately is technically complex and usually expensive. It involves two steps: air sampling to capture fibers on a filter, and laboratory analysis to determine the quantity of asbestos. There are several approaches to air sampling and analysis, varying in technical requirements, cost, and availability. Which approach is more appropriate is a controversial subject. The information presented in the remainder of this chapter is based in part on a 1984 workshop sponsored by EPA and the National Bureau of Standards. A companion EPA guidance document on air monitoring following an abatement action discusses the subject in more detail (USEPA 1985 b).

6.4.2.1 Sampling

Sampling for asbestos consists of collecting fibers by drawing air through a filter at a known rate. Usually, sampling equipment is placed at a fixed location for a certain period of time. But this approach may fail to detect the presence of fibers. For example, if sampling is conducted for a short time during a quiet period (i.e., when air movement is limited), many fibers will settle out of the air onto the floor and other surfaces and may not be captured on the filter. Under these conditions. air measurements could show little or no asbestos.

Previously, EPA recommended sampling for at least eight hours to cover various air circulation conditions and thus increase the likelihood of capturing asbestos fibers if they are present. A quicker and more effective way to accomplish this, however, is to circulate the air artificially so that the fibers remain airborne during sampling.

This “aggressive sampling” is recommended for the post-abatement air test. Recommended methods for conducting aggressive sampling are presented in Appendix M. They use forced-air equipment such as a leaf blower to dislodge free fibers, then slow-speed fans to keep the fibers suspended during sampling.

Persons who conduct the sampling should wear a respirator. Even though the work site has been cleaned and has passed the visual test, levels of airborne asbestos still may be elevated.

6.4.2.2 Analysis of Samples

Three microscopic methods are currently being used to analyze asbestos: phase contrast microscopy (PCM), scanning electron microscopy (SEM), and transmission electron microscopy (TEM). The characteristics and relative merits of each method are summarized in Table 5 and are described in detail in the companion EPA guidance document (USEPA 1985 b).

As indicated in Table 5, PCM is the method that is most familiar, available, and frequently used. It is also the least expensive and has a well-established analytical protocol. (As noted in Section 4.1.2, OSHA specifies PCM for monitoring worker exposure in asbestos industries.) However, the NIOSH protocol for PCM does not distinguish between asbestos and other types of fibers and counts only fibers longer than 5 micrometers. Nor is PCM sensitive enough to detect the extremely thin fibers typical of airborne asbestos in buildings. Thus, the interpretation of PCM results assumes that a low concentration of relatively large airborne fibers means that the concentration of asbestos fibers is also low,

The TEM method gives the most complete information on airborne asbestos: it can distinguish asbestos from other fibers and also is able to detect very thin fibers. However, it can be expensive and time-consuming. TEM is not widely available.

TABLE 5. COMPARISON OF METHODS FOR MEASURING AIRBORNE ASBESTOS

	PCM	SEM	TEM
Standard Methods	NIOSH P&CAM 239 Method.[1]	No standard method.	EPA provisional method & update.[2]
Quality Assurance	Proficiency Analytical Testing Program; no NBS[3] reference materials.	No lab testing, or NBS reference materials.	Limited lab testing; NBS reference materials available.
cost	$25-50	$50-300	$200-600
Availability	Most available	Less available.	Least available.
Time Requirements	1 hr. preparation & analysis, < 6 hrs. turnaround.	4 hrs. preparation & analysis, 6-24 hrs. turnaround.	4-24 hrs. preparation & analysis, 2-7 days turnaround.
Sensitivity (Thinnest Fiber Visible)	0.15 µm at best; 0.25 µm typical.	0.05 µm at best; 0.20 µm typical,	0.0002 µm at best; 0.0025 µm typical.
Specificity	Not specific for asbestos.	More specific than PCM but not definitive for asbestos.	Definitive for asbestos. when used to its fullest capabilities.

[1] NIOSH 1979. The new NIOSH 7400 method is an alternative.
[2] USEPA 1977, Yamate 1984.
[3] National Bureau of Standards.

Source: Taken with modification from USEPA 1985b.

The SEM method can be somewhat more specific for asbestos and more sensitive to thin fibers than PCM, but less so than TEM. It is also less expensive and time-consuming than TEM. At present, however, no standard measurement protocol is available for SEM. As a result, it has not been systematical y evaluated nor has the reliability of SEM measurements been established.

EPA acknowledges that all three methods are used in air testing for the purpose of releasing abatement contractors. However, only PCM and TEM have standard methods and testing programs. A standard method has not yet been developed for SEM. While TEM is technically the method of choice, PCM is the only option in many localities.

6.4.2.3 Recommended Test Specifications

Regardless of the microscopic method for measuring asbestos, identifying homogeneous work sites is the first important step in the process. A site within the abatement work area is homogeneous if it contains one type of ACM and only one type of abatement was used. For sampling purposes, the air in each

homogeneous site is assumed to be relatively uniform. Guidelines for locating the samplers are included in Appendix M. Several other aspects of the air test are identical, regardless of microscopic method:

- Choose sampling locations within the homogeneous work site to assure representative samples. (See Appendix M).
- Begin sampling when the work site is dry (24 hours after cleaning).
- Conduct aggressive air sampling in all cases.
- Follow sampling and analysis specifications, including procedures for quality control.

The asbestos program manager should be sure the technical advisor in charge of the air test knows the specifications listed below. The advisor should insist that recommended procedures be followed for both air sampling and laboratory analysis.

Testing with the TEM Method

Sampling:

- Draw at least 3000 liters of air through each filter at a rate of 2 to 12 liters per minute.
- Collect at least five samples in each homogeneous work site.
- At the same time, collect at least five samples just outside the work site but within the building. These samples will be compared with those collected inside the work site to ensure that the work site is at least as clean as the incoming air (see Appendix M for details).[1]

Analysis:

- Measure the asbestos on each filter with TEM using the EPA provisional procedures and updates (USEPA 1977 and Yamate 1984).
- Use a direct transfer method of sample preparation if possible (see Appendix M).
- Express the results as f/cc, or as ng/m^3 if an indirect sample preparation is used.
- Include at least one field blank [2] and one laboratory blank per abatement job for quality control purposes (see Section 6.4.3). Also, split one work site sample and conduct duplicate analyses.

Release Criterion:

- Release the contractor if the average fiber concentration of the work site samples is not statistically larger than the average of the outside samples. Each homogeneous site must pass the test before the contractor is released. (Appendix M contains information to determine statistical differences.)
- If the average of the work site samples is statistically larger than the average of the outside samples, clean the entire work site again and repeat the test (collect new work site samples and follow the procedures described above).

[1] If a negative pressure system has not been used, collect the “outside” samples outdoors.
[2] A blank is a filter that is not used for sampling but is otherwise treated in the same way as other filters.

Testing with the PCM Method

Sampling:

- Draw at least 3000 liters of air through each filter at a rate of 2 to 12 liters per minute.
- Collect at least five samples per homogeneous work site, or one per room, whichever is greater.

Analysis:

- Measure the asbestos on each filter with PCM using the NIOSH P&CAM 239 procedures. (The newer NIOSH 7400 procedures can also be used. See Appendix M.)
- Include at least one field blank and one laboratory blank per abatement project, for quality control purposes. Also, split one work site sample for duplicate analysis.

Release Criterion:

- Release the contractor if every sample value IS below the limit of reliable quantification (approximately 0.01 f/cc when 3000 liters of air are sampled; see Appendix M).
- If any of the sample values is above the prescribed level, clean the entire work site again, collect new samples, and evaluate the samples as described above.

For each method, the recommended number of samples and the prescribed use of the data defining the release criteria are based on a compromise involving practical considerations of cost, time required for the tests, performance characteristics of the methods, and statistical criteria. Details of the sampling and analysis specifications are provided in Appendix M.

6.4.3 Quality Assurance

Notwithstanding the advantages of one microscopic method over another, no method will produce reliable results unless both the field sampling and laborabory analysis are properly conducted. To obtain reliable results, a quality assurance (QA) program for the collection and analysis of data is essential.

The objective is to produce measurements with sufficient and documented quality for their intended purpose. In this case, the purpose is to determine satisfactory completion of an abatement project. The components of a QA program range from clerical activities such as labeling samples and documenting results, to performing technically complex tasks in the laboratory. When establishing the quality of data, however, all activities are equally important.

Preparing and implementing a QA program requires the assistance of a technical advisor on asbestos measurement. EPA and OSHA have published guidelines on quality assurance for TEM and PCM (Yamate 1984, and NIOSH 1979). The QA Program Checklist below can be used by the asbestos program manager in reviewing a proposed QA program.

QA Program Checklist

- **Training and Experience:** Be sure that all persons producing the measurement understand their roles and are trained. Select a laboratory with demonstrated proficiency in asbestos analysis. Request details of the laboratory's quality control program, and get documentation of the lowest level of fibers routinely reported.

- **Quality Control Checks:** Use field and laboratory blanks to check for fiber contamination, coded sample labels to avoid analyst bias, duplicate analyses to confirm precision. and a second laboratory to spot-check the accuracy of results.

- **Chain-of-Custody:** Assign responsibility for security of the samples to specific persons at each stage of the analysis. Document each step in the passage of the sample from the field to the laboratory.

- **Documentation:** Check and document laboratory results as well as their labeling. The building owner should retain all test results and records documenting the testing process.

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Appendix A. Asbestos-Containing Materials Found in Buildings*

Subdivision	Generic name	Asbestos (%)	Dates of use	Binder/sizing
Surfacing material	**sprayed- or troweled-on**	**1-95**	**1935-1970**	**sodium silicate, portland cement, organic binders.**
Preformed thermal insulating products	batts, blocks, and pipe covering			
	85% magnesia	15	1926-1949	magnesium carbonate
	calcium silicate	6-8	1949-1971	calcium silicate
Textiles	cloth[a]			
	blankets (fire)[a]	100	1910-present	none
	felts:	90-95	1920-present	cotton/wool
	blue stripe	80	1920-present	cotton
	red stripe	90	1920-present	cotton
	green stripe	95	1920-present	cotton
	sheets	50-95	1920-present	cotton/wool
	cord/rope/yarn[a]	80-100	1920-present	cotton/wool
	tubing	80-85	1920-present	cotton/wool
	tape/strip	90	1920-present	cotton/wool
	curtains[a] (theatre, welding)	60-65	1945-present	cotton
Cementitious concrete-like products	extrusion panels:	8	1965-1977	portland cement
	corrugated	20-45	1930-present	portland cement
	flat	40-50	1930-present	portland cement
	flexible	30-50	1930-present	portland cement
	flexible perforated	30-50	1930-present	portland cement
	laminated (outer surface)	35-50	1930-present	portland cement
	roof tiles	20-30	930-present	portland cement
	clapboard and shingles:			
	clapboard	12-15	1944-1945	portland cement
	siding shingles	12-14	unknown–present	portland cement
	roofing shingles	20-32	unknown-present	protland cement
	pipe	20-15	1935-mesent	portland cement
Paper products	corrugated:			
	high temperature	90	1935-present	sodium silicate
	moderate temperature	35-70	1910-present	starch
	Indented	98	1935-present	cotton and organic binder
	mill board	80-85	1925-present	starch, lime, clay
Roofing felts	smooth surface	10-15	1910-present	asphalt
	mineral surface	10-15	1910–present	asphalt
	shingles	1	1971-1974	asphalt
	pipeline	10	1920-present	asphalt

* The information in this Appendix is taken, with modification, from: Lory EE, Coin DC. February 1981. *Management Procedure for Assessment of Friable Asbestos Insulating Material.* Port Hueneme, CA: Civil Engineering Laboratory Naval Construction Battalion Center. The U.S. Navy prohibits the use of asbestos-containing materials when acceptable nonasbestos substitutes have been identified.

[a]Laboratory aprons, gloves, cord, rope, fire blankets, and curtains may be common in schools.

Appendix A. (continued)

Subdivision	Generic name	Asbestos (%)	Dates of use	Binder/sizing
Asbestos-containing compounds	caulking putties	30	1930-present	linseed oil
	adhesive (cold applied)	5-25	1945-present	asphalt
	joint compound		1945-1975	asphalt
	roofing asphalt	5	unknown-present	asphalt
	mastics	5-25	1 920-present	asphalt
	asphalt tile cement	13-25	1959-present	asphalt
	roof putty	10-25	unknown-present	asphalt
	plaster/stucco	2-10	unknown–present	portland cement
	spackles	3-5	1930-1975	starch, casein, synthetic resins
	sealants fire/water	50-55	1935-present	caster oil or polyisobutyler
	cement, insulation	20-100	1900-1973	clay
	cement, finishing	55	1920-1973	clay
	cement, magnesia	15	1926-1950	magnesium carbonate
Asbestos ebony products		50	1930-present	portland cement
Flooring tile and Sheet Goods	vinyl/asbestos tile	21	1950-present	poly(vinyl)chloride
	asphalt/asbestos tile	26-33	1920-present	asphalt
	sheet goods/resilient	30	1950-present	dry oils
Wallcovering	vinyl wallpaper	6-8	unknown-present	
Paints and coatings	roof coating	4-7	1900-present	asphalt
	air tight	1 5	1940-present	asphalt

Appendix B. Common Units Used in Measuring Airborne Asbestos Concentrations

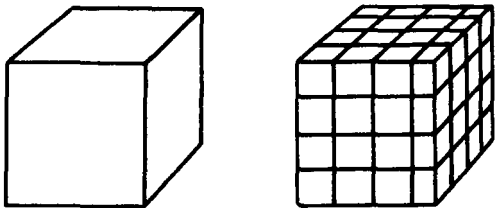
Length

1 meter (m) = 39.37 inches or 3.28 feet

100 centimeters (cm) = 1 meter

1,000,000 micrometers (μm) = 1 meter

Volume



1 cubic m (m^3) = 35.3 cubic feet

1,000,000 cm^3 = 1 m^3

1,000 cm^3 = 1 liter

Weight (mass)

454 grams (g) = 1 pound

1,000,000,000 nanograms (ng) = 1 gram

Concentration (mass contained in a stated volume)

2 fibers per cm^3 (the current 8-hour OSHA industrial standard) means that 2 fibers are present in each cm^3 of air. Since there are 1,000,000cm^3 in 1 m^3, there would be 2,000,000 fibers in a m^3.

If each fiber is chrysotile asbestos (density of 0.0026 ng/μm^3) and is just long and thick enough to be detected by the NIOSH procedure for determining compliance with the OSHA standard (5 μm in length and 0.3 μm in diameter), it would weight 0.0092 ng:

Mass = π /4 $(\text{diameter})^2$ (length) (density)

π /4 $(0.3\ \mu m)^2$ (5 μm) (0.0026 ng/μm^3) = 0.0092 ng

A total of 2,000,000 of these fibers would weigh about 1,800 ng.

Since the fibers in the above example are the smallest (shortest and thinnest) counted by the NIOSH procedure, fibers actually measured using this protocol are typically larger and thus weigh more. Comparison of fibers in this example with those actually measured is further complicated since nonasbestos as well as asbestos fibers are counted by the NIOSH protocol. As noted in the footnote to Figure 1, comparisons of total fibers counted with the mass of

asbestos measured in air samples indicate that, on an average, about 30 fibers counted by the NIOSH procedures equal one nanogram of asbestos. This relationship applies to samples collected during the spray application of asbestos insulation. For these samples, each fiber counted weighs an average of 0.033 ng, or about 37 times more than those in the example, and 2,000,000 of them would weigh about 67,000 ng.

Appendix C. USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M)

AUTHORITY Secs. 112 and 301(a) of the Clean Air Act, as amended (42 U.S.C. 7412, 7601(a)).

SOURCE: 49 FR 13661, Apr. 5, 1964, unless otherwise noted.

§ 61.140 Applicability.

The provisions of this subpart are applicable to those sources specified in §§ 61.142 through 61.153.

§ 61.141 Definitions.

All terms that are used in this subpart and are not defined below are given the same meaning as in the Act and in Subpart A of this part.

Active waste disposal site means any disposal site other than an inactive site.

Adequately wetted means sufficiently mixed or coated with water or an aqueous solution to prevent dust emissions.

Asbestos means the asbestiforrn varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.

Asbestos-containing waste materials means any waste that contains commercial asbestos and is generated by a source subject to the provisions of this subpart. This term includes asbestos mill tailings, asbestos waste from control devices, friable asbestos waste material, and bags or containers that previously contained commercial asbestos. However, as applied to demolition and renovation operations, this term includes only friable asbestos waste and asbestos waste from control devices.

Asbestos material means asbestos or any material containing asbestos.

Asbestos mill means any facility engaged in converting, or in any intermediate step in converting, asbestos ore into commercial asbestos. Outside storage of asbestos material is not considered a part of the asbestos mill.

Asbestos tailings means any solid waste that contains asbestos and is a product of asbestos mining or milling operations.

Asbestos waste from control devices means any waste material that contains asbestos and is collected by a pollution control device.

Commercial asbestos means any asbestos that is extracted from asbestos ore.

Demolition means the wrecking *or* taking out of any load-supporting structural member of a facility together with any related handling operations.

Emergency renovation operation means a renovation operation that was not planned but results from a sudden, unexpected event. This term includes operations necessitated by nonroutine failures of equipment.

Fabricating means any processing of a manufactured product that contains commercial asbestos, with the exception of processing at temporary sites for the construction or restoration of facilities.

Facility means any institutional, commercial, or industrial structure, installation, or building (excluding apartment buildings having no more than four dwelling units).

Facility component means any pipe, duct, boiler, tank, reactor, turbine, or furnace at *or* in a facility: or any structural member of a facility.

Friable asbestos material means any material containing more than 1 percent asbestos by weight that hand pressure can crumble, pulverize, or reduce to powder when dry.

Inactive waste disposal site means any disposal site or portion of it where additional asbestos-containing waste material will not be deposited and where the surface is not disturbed by vehicular traffic.

Manufacturing means the combining of commercial asbestos-or, in the case of woven friction products, the combining of textiles containing commercial asbestos-with any other material(s), including commercial asbestos, and the processing of this combination into a product.

Outside air means the air outside buildings and structures.

Particulate asbestos material means finely divided particles of asbestos material.

Planned renovation operations means a renovation operation, or a number of such operations, in which the amount of friable asbestos material that will be removed or stripped within a given period of time can be predicted. Individual nonscheduled operations are included if a number of such operations can be predicted to occur during a given period of time based on operating experience.

Remove means to take out friable asbestos materials from any facility.

Renovation means altering in any way one or more facility components. Operations in which load-supporting structural members are wrecked or taken out are excluded.

Roadways means surfaces on which motor vehicles travel. This term includes highways, roads, streets, parking areas, and driveways.

Strip means to take off friable asbestos materials from any part of a facility.

Structural member means any load-supporting member of a facility, such as beams and load supporting walls; or any nonload-supporting member, such as ceilings and nonload-supporting walls.

Visible emissions means any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.

[49 FR 13661, Apr. 5, 1984; 49 FR 25453, June 21, 19841

§61.142 Standard for asbestos mills.

Each owner or operator of an asbestos mill shall either discharge no visible emissions to the outside air from that asbestos mill or use the methods specified by $61.154 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

§61.143 Standard for roadways.

No person may surface a roadway with asbestos tailings or asbestos-containing waste material on that roadway, unless it is a temporary roadway on an area of asbestos ore deposits.

[49 FR 13661, Apr. 5, 1984; 49 FR 25453, June 21, 19841

§61.144 Standard for manufacturing.

(a) *Applicability y.* This section applies to the following manufacturing operations using commercial asbestos.

(1) The manufacture of cloth, cord, wicks, tubing, tape, twine, rope, thread, yam, roving, lap, or other textile materials.

(2) The manufacture of cement products.

(3) The manufacture of fireproofing and insulating materials.

(4) The manufacture of friction products.

(5) The manufacture of paper, millboard, and felt.

(6) The manufacture of floor tile.

(7) The manufacture of paints, coatings, caulks, adhesives, and sealants.

(8) The manufacture of plastics and rubber materials.

(9) The manufacture of chlorine.

(10) The manufacture of shotgun shell wads.

(11) The manufacture of asphalt concrete.

(b) *Standard.* Each owner or operator of any of the manufacturing operations to which this section applies shall either:

(1) Discharge no visible emissions to the outside air from these operations or from any building or structure in which they are conducted or

(2) Use the methods specified by § 61.154 to clean emissions from these operations containing particulate asbestos material before they escape to, or are vented to, the outside air.

§61.145 Standard for demolition and renovation Applicability.

The requirements of $$61.146 and 61.147 apply to each owner or operator

of a demolition or renovation operation as follows:

(a) If the amount of friable asbestos materials in a facility being demolished is at least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, all the requirements of §§61.146 and 61.147 apply, except as provided in paragraph (c) of this section.

(b) If the amount of friable asbestos materials in a facility being demolished is less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, only the requirements of paragraphs (a), (b), and (c) (l), (2), (3), (4), and (5) of 361.146 apply.

(c) If the facility is being demolished under an order of a State or local governmental agency, issued because the facility is structural y unsound and in danger of imminent collapse, only the requirements in **§ 61.146** and in paragraphs (d), (e), (f), and (g) of $61.147 apply.

(d) If at least 80 linear meters (260 linear feet) of friable asbestos materials on pipes or at least 15 square meters (160 square feet) of friable asbestos materials on other facility components are stripped or removed at a facility being renovated, all the requirements of $861.146 and 61.147 apply.

(1) To determine whether paragraph (d) of this section applies to planned renovation operations involving individual nonscheduled operations, predict the additive amount of friable asbestos materials to be removed or stripped over the maximum period of time a prediction can be made, not to exceed 1 year.

(2) To determine whether paragraph (d) of this section applies to emergency renovation operations, estimate the amount of friable asbestos materials to be removed or stripped as a result of the sudden, unexpected event that necessitated the renovation.

(e) Owners or operators of demolition and renovation operations are exempt from the requirements of §§ 61.05(a), 61.07, and 61.09.

[49 FR 13661, Am. 5, 1984; 49 FR 25453. June 21, 19841

§61.146 Standard for demolition and renovation: Notification requirements.

Each owner or operator to which this section applies shall:

(a) Provide the Administrator with written notice of intention to demolish or renovate.

(b) Postmark or deliver the notice as follows

(1) At least 10 days before demolition begins if the operation is described in § 61.145(a);

(2) At least 20 days before demolition begins if the operation is described in § 61.145(b);

(3) As early as possible before demolition begins if the operation is described in § 61.145(c);

(4) As early as possible before renovation begins.

(c) Include the following information in the notice:

(1) Name and address of owner or operator.

(2) Description of the facility being demolished or renovated, including the size, age, and prior use of the facilit y.

(3) Estimate of the approximate amount of friable asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components. For facilities described in § 61.145(b), explain techniques of estimation.

(4) Location of the facility being demolished or renovated.

(5) Scheduled starting and completion dates of demolition or renovation.

(6) Nature of planned demolition or renovation and method(s) to be used.

(7) Procedures to be used to comply with the requirements of this Subpart.

(8) Name and location of the waste disposal site where the friable asbestos waste material will be deposited.

(9) For facilities described in § 61.145(c), the name, title, and authority of the State or local governmental representative who has ordered the demolition.

(Approved by the Office of Management and Budget under control number 2000-0264.)

[49 FR 13661, Apr. 5, 1984; 49 FR 25453, June 21.19841

§61.147 Standard for demolition and renovation. Procedures for asbestos emission control.

Each owner or operator to whom this section applies shall comply with the following procedures to prevent emissions of particulate asbestos material to the outside air

(a) Remove friable asbestos materials from a facility being demolished or renovated before any wrecking or dismantling that would break up the materials or preclude access to the materials for subsequent removal. However, friable asbestos materials need not be removed before demolition if:

(1) They are on a facility component that is encased in concrete or other similar material; and

(2) These materials are adequately wetted whenever exposed during demolition.

(b) When a facility component covered or coated with friable asbestos materials is being taken out of the facility as units or in sections:

(1) Adequately wet any friable asbestos materials exposed during cutting or disjointing operations; and

(2) Carefully lower the units or sections to ground level, not dropping them or throwing them.

(c) Adequately wet friable asbestos materials when they are being stripped from facility components before the members are removed from the facility. In renovation operations, wetting that would unavoidably damage equipment is not required if the owner or operator

(1) Asks the Administrator to determine whether wetting to comply with this paragraph would unavoidably damage equipment, and, before beginning to strip, supplies the Administrator with adequate information to make this determination, and

(2) When the Administrator does determine that equipment damage would be unavoidable, uses a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the friable asbestos materials. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in §61.154.

(d) After a facility component has been taken out of the facility as units or in sections, either:

(1) Adequately wet friable asbestos materials during stripping or

(2) Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the strip ping. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in §61.154.

(e) For friable asbestos materials that have been removed or stripped

(1) Adequately wet the materials to ensure that they remain wet until they are collected for disposal in accordance with § 61.152; and

(2) Carefully lower the materials to the ground or a lower floor, not dropping or throwing them; and

(3) Transport the materials to the ground via dust-tight chutes or containers if they have been removed or stripped more than 50 feet above ground level and were not removed as units or in sections.

(f) When the temperature at the point of wetting is below 0ºC (32°F):

(1) Comply with the requirements of paragraphs (d) and (e) of this section, The owner or operator need not comply with the other wetting requirements in this section; and

(2) Remove facility components coated or covered with friable asbestos materials as units or in sections to the maximum extent possible.

(g) For facilities described in § 61.145(c), adequately wet the portion of the facility that contains friable asbestos materials during the wrecking operation.

§ 61.148 Standard for spraying.

The owner or operator of an operation in which asbestos-containing materials are spray applied shall comply with the following requirements

(a) Use materials that contain 1 percent asbestos or less on a dry weight basis for spray-on application on buildings, structures, pipes, and conduits, except as provided in paragraph (c) of this section.

(b) For spray-on application of materials that contain more than 1 percent

asbestos on a dry weight basis on equipment and machinery, except as provided in paragraph (c) of this section:

(1) Notify the Administrator at least 20 days before beginning the spraying operation. Include the following information in the notice:

(i) Name and address of owner or operator.

(ii) Location of spraying operation.

(iii) Procedures to be followed to meet the requirements of this paragraph.

(2) Discharge no visible emissions to the outside air from the spray-on application of the asbestos-containing material or use the methods specified by $61.154 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(c) The requirements of paragraphs (a) and (b) of this section do not apply to the spray-on application of materials where the asbestos fibers in the materials are encapsulated with a bitu*minous or* resinous binder during spraying and the materials are not friable after drying.

(d) Owners and operators of sources subject to this section are exempt from the requirements of §§ 61.05(a), 61.07, and 61.09.

(Approved by the Office of Management and Budget under control number 2000-0264.)

§ 61.149 Standard for fabricating.

(a) *Applicability.* This section applies to the following fabricating operations using commercial asbestos:

(1) The fabrication of cement building products.

(2) The f abdication of friction products, except those operations that primarily install asbestos friction materials on motor vehicles.

(3) The fabrication of cement or silicate board for ventilation hoods; ovens; electrical panels; laboratory furniture, bulkheads, partitions, and ceilings for marine construction; and flow control devices for the molten metal industry.

(b) Standard. Each owner or operator of any of the fabricating operations to which this section applies shall either:

(1) Discharge no visible emissions to the outside air from any of the operations or from any building or structure in which they are conducted; or

(2) Use the methods specified by §61.154 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

§61.150 Standard for insulating materials.

After the effective date of this regulation, no owner or operator of a facility may install or reinstall on a facility component any insulating materials that contain commercial asbestos if the materials are either molded and friable or wet-applied and friable after drying. The provisions of this paragraph do not apply to spray-applied insulating materials regulated under §61.148.

§61.151 Standard for waste disposal for asbestos mills.

Each owner or operator of any source covered under the provisions of $61.142 shall:

(a) Deposit all asbestos-containing waste material at waste disposal sites operated in accordance with the provisions of § 61.156; and

(b) Discharge no visible emissions to the outside air from the transfer of asbestos waste from control devices to the tailings conveyor, or use the methods specified by $61.154 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air. Dispose of the asbestos waste from control devices in accordance with § 61.152(b) or paragraph (c) of this section; and

(c) Discharge no visible emissions to the outside air during the collection, processing, packaging, transporting, or deposition of any asbestos-containing waste material, or use one of the disposal methods specified in paragraphs (c) (1) or (2) of this section, as follows:

(1) Use a wetting agent as follows:

(i) Adequately mix all asbestos-containing waste material with a wetting agent recommended by the manufacturer of the agent to effectively wet dust and tailings, before depositing the material at a waste disposal site. Use the agent as recommended for the

particular dust by the manufacturer of the agent.

(ii) Discharge no visible emissions to the outside air from the wetting operation or use the methods specified by $61.154 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(iii) Wetting may be suspended when the ambient temperature at the waste disposal site is less than – 9.5°C (15°F). Determine the ambient air temperature by an appropriate measurement method with an accuracy of ± l°C(±2°F), and record it at least hourly while the wetting operation is suspended. Keep the records for at least 2 years in a form suitable for inspection.

(2) Use an alternative disposal method that has received prior approval by the Administrator.

§61.152 Standard for waste disposal for manufacturing demolition, renovation, spraying, and fabricating operations.

Each owner or operator of any source covered under the provisions of §§61.144 and 61.149 shall:

(a) Deposit all asbestos-containing waste material at waste disposal sites operated in accordance with the provisions of § 61.156; and

(b) Discharge no visible emissions to the outside air during the collection, processing (including incineration), packaging, transporting, or deposition of any asbestos-containing waste material generated by the source, or use one of the disposal methods specified in paragraphs (b)(l), (2), or (3) of this section, as follows:

(1) Treat asbestos-containing waste material with water

(i) Mix asbestos waste from control devices with water to form a slurry; adequately wet other asbestos-containing waste material; and

(ii) Discharge no visible emissions to the outside air from collection, mixing, and wetting operations, or use the methods specified by §61.154 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air; and

(iii) After wetting, seal all asbestos-containing waste material in leak-tight containers while wet; and

(iv) Label the containers specified in paragraph (b)(1)(iii) as follows:

CAUTION

Contains Asbestos-
Avoid Opening or
Breaking Container
Breathing Asbestos is Hazardous
to Your Health

Alternative y, use warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.1001 (g)(2) (ii).

(2) Process asbestos-containing waste material into nonfriable forms:

(i) Form all asbestos-containing waste material into nonfriable pellets or other shapes; and

(ii) Discharge no visible emissions to the outside air from collection and processing operations, or use the methods specified by $61.154 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(3) Use an alternative disposal method that has received prior approval by the Administrator.

[49 FR 13661, Apr. 5, 1984; 49 FR 25453, June 21, 19841

§61.153 Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations.

Each owner or operator of any inactive waste disposal site that was operated by sources covered under 361.142, §61.144, or § 61.149 and received deposits of asbestos-containing waste material generated by the sources, shall

(a) Comply with one of the following:

(1) Either discharge no visible emissions to the outside air from an inactive waste disposal site subject to this paragraph; or

(2) Cover the asbestos-containing waste material with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, and grow and maintain a cover of vegetation on

the area adequate to prevent exposure of the asbestos-containing *waste* material; or

(3) Cover the asbestos-containing waste material with at least 60 centimeters (2 feet) of compacted nonasbestos-containing material. and maintain it to prevent exposure of the asbestos-containing waste; or

(4) For inactive waste disposal sites for asbestos tailings, apply a resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. Use the agent as recommended for the particular asbestos tailings by the manufacturer of the dust suppression agent. Obtain prior approval of the Administrator to use other equally effective dust suppression agents. For purposes of this paragraph, waste crankcase oil is not considered a dust suppression agent.

(b) Unless a natural barrier adequately deters access by the general public, install and maintain warning signs and fencing as follows, or comply with paragraph (a)(2) or (a)(3) of this section.

(1) Display warning signs at all entrances and at intervals of 100 m (330 feet) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material was deposited. The warning signs must:

(i) Be posted in such a manner and location that a person can easily read the legend; and

(ii) Conform to the requirements for 51 cmx36 cm (20"x14") upright format signs specified in 29 CFR 1910.145(d)(4) and this paragraph; and

(iii) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

Legend	Notation
Asbestos Waste disposal Sta.	2.5 cm (1 inch Sans Serif, Gothic or Black
Do Not Create Dust.....	1.9 cm (¾ inch) Sans Serif, Gothic or Black
Breathing Asbestos is Hazardous to Your Health	14 Point Gothic.

Spacing between any two lines must be at least equal to the height of the upper of the two lines.

(2) Fence the perimeter of the site in a manner adequate to deter access by the general public.

(3) Upon request and supply of appropriate information, the Administrator will determine whether a fence or a natural barrier adequately deters access by the general public.

(c) The owner or operator may use an alternative control method that has received prior approval of the Administrator rather than comply with the requirements of paragraph (a) or (b) of this section.

561.154 Air-cleaning.

(a) The owner or operator who elects to use air-cleaning, as permitted by §§61.142, 61.144, 61.147(c)(2). 61.147(d)(2), 61.148(b)(2), 61.149(b), 61.151(b), 61.151(c)(l)(ii), 61.152(b)(l)(ii), and 61.152(b)(2) shall:

(1) Use fabric filter collection devices, except as noted in paragraph (b) of this section, doing all of the following:

(i) Operating the fabric filter collection devices at a pressure drop of no *more* than .995 kilopascal (4 inches water gage), as measured across the filter fabric; and

(ii) Ensuring that the airflow permeability, as determined by ASTM Method D737-75, does not exceed 9 $m^3/min/m^2$ ($30 ft^3/min/ft^2$) for woven fabrics or $11^3/min/m^2$($35 ft^3/min/ft^2$) for felted fabrics, except that 12 $m^3/min/m^2$(40 $ft^3 min/ft^2$) for woven and 14 m3/min/m2 (45 ft ^{3}min/ft^2) for felted fabrics is allowed for filtering air from asbestos ore dryers; and

(iii) Ensuring that felted fabric weighs at least 475 grams per square meter (14 ounces per square yard) and is at least 1.6 millimeters (one-sixteenth inch) thick throughout and

(iv) Avoiding the use of synthetic fabrics that contain fill yarn other than that which is spun.

(2) Properly install, use, operate, and maintain all air-cleaning equipment authorized by this section. Bypass devices may be used only during upset or emergency conditions and then only for so long as it takes to shut down the operation generating the particulate asbestos material.

(b) There are the following exceptions to paragraph (a)(1):

(1) If the use of fabric creates a fire or explosion hazard, the Administrator may authorize as a substitute the use of wet collectors designed to operate with a unit contacting energy of at least 9.95 kilopascals (40 inches water gage pressure).

(2) The Administrator may authorize the use of filtering equipment other than that described in paragraphs (a)(1) and (b)(1) of this section if the owner or operator demonstrates to the Administrator's satisfaction that it is equivalent to the described equipment in filtering particulate asbestos material.

[49 FR 13661, Apr. 5, 1984; 49 FR 25453, June 21, 19841

§61.155 Reporting.

(a) Within 90 days after the effective date of this subpart, each owner or operator of any existing source to which this subpart applies shall provide the following information to the Administrator, except that any owner or operator who provided this information prior to April 5, 1984 in order to comply with §61.24 (which this section replaces) is not required to resubmit it.

(1) A description of the emission control equipment used for each process; and

(2) If a fabric filter device is used to control emissions, the pressure drop across the fabric filter in inches water gage; and

(i) If the fabric device uses a woven fabric, the airflow permeability in $m^3/min/m^2$ and; if the fabric is synthetic, whether the fill yam is spun or not spun; and

(ii) If the fabric filter device uses a felted fabric, the density in g/m^2, the minimum thickness in inches, and the airflow permeability y in $m^3/min/m^2$.

(3) For sources subject to §§61.151 and 61.152:

(i) A brief description of each process that generates asbestos-containing waste material; and

(ii) The average weight of asbestos-containing waste material disposed of, measured in kg/day; and

(iii) The emission control methods used in all stages of water disposal; and

(iv) The type of disposal site or incineration site used for ultimate disposal, the name of the site operator, and the name and location of the disposal site.

(4) For sources subject to §61.153:

(i) A brief description of the site; and

(ii) The method or methods used to comply with the standard, or alternative procedures to be used.

(b) The information required by paragraph (a) of this section must accompany the information required by §61.10. The information described in this section must be reported using the format of Appendix A of this part.

(Approved by this Office of Management and Budget under control number 2000-0264)

(Sec. 114. Clean Air Act as amended (42 U.S.C.. 7414))

§61.156 Active waste disposal sites.

To be an acceptable site for disposal of asbestos-containing waste material under §§61.151 and 61.152, an active waste disposal site must meet the requirements of this section.

(a) Either there must be no visible emissions to the outside air from any active waste disposal site where asbestos-containing waste material has been deposited, or the requirements of paragraph (c) or (d) of this section must be met.

(b) Unless a natural barrier adequately deters access by the general public, either warning signs and fencing must be installed and maintained as follows, or the requirements of paragraph (c)(1) of this section must be met.

(1) Warning signs must be displayed at all entrances and at intervals of 100 m (330 ft) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material is deposited. The warning signs must:

(i) Be posted in such a manner and location that a person can easily read the legend; and

(ii) Conform to the requirements of 51 cm x 36 cm (20" x 14") upright

format signs specified in 29 CFR 1910.145(d)(4) and this paragraph; and

(iii) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

Legend	Notation
Asbestos Waste Disposal Site.	2.5 cm (1 inch) Sans Serif, Gothic or Block.
Do Not Create Dust	1.9 cm (¾ inch) Sans Serif, Gothic or Block.
Breathing Asbestos is Hazardous to Your Health.	14 Point Gothic.

Spacing between any two lines must be at least equal to the height of the upper of the two lines.

(2) The perimeter of the disposal site must be fenced in a manner adequate to deter access by the general public.

(3) Upon request and supply of appropriate information, the Administrator will determine whether a fence or a natural barrier adequately deters access by the general public.

(c) Rather than meet the *no* visible emission requirement of paragraph (a) of this section, an active waste disposal site would be an acceptable site if at the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material which was deposited at the site during the operating day or previous 24-hour period is covered with either.

(1) At least 15 centimeters (6 inches) of compacted nonasbestos-containing material, or

(2) A resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. This agent must be used as recommended for the particular dust by the manufacturer of the dust suppression agent. Other equally effective dust suppression agents may be used upon prior approval by the Administrator. For purposes of this paragraph, waste crankcase oil is not considered a dust suppression agent.

(d) Rather than meet the no visible emission requirement of paragraph (a) of this section, an active waste disposal site would be an acceptable site if an alternative control method for emissions that has received prior approval by the Administrator is used.

(Sees. 112 and 301(a) of the Clean Air Act as amended (42 U.S.C. 7412, 7601(a))

Appendix D. Addresses of EPA NESHAPS Contacts and Regional Asbestos Coordinators

NESHAPs Contacts

(For information on NESHAPs rule compliance and disposal)

Region 1
Asbestos NESHAPs Contact
Air Management Division
USEPA
JFK Federal Building
Boston, MA 02203
(617) 223-4872

Region 2
Asbestos NESHAPs Contact
Air & Waste Management Division
USEPA
26 Federal Plaza
New York, NY 10007
(212) 264-4479

Region 3
Asbestos NESHAPs Contact
Air Management Division
USEPA
841 Chestnut Street
Philadelphia, PA 19107
(215) 597-6552

Region 4
Asbestos NESHAPs Contact
Air, Pesticide & Toxic Management
USEPA
345 Courtland Street N.E.
Atlanta, GA 30365
(404) 881-4901

Region 5
Asbestos NESHAPs Contact
Air Management Division
USEPA
230 S. Dearborn Street
Chicago, IL 60604
(312) 353-2088

Region 6
Asbestos NESHAPs Contact
Air & Waste Management Division
USEPA
1201 Elm Street
Dallas, TX 75270
(214) 767-9835

Region 7
Asbestos NESHAPs Contact
Air & Waste Management D
USEPA
726 Minnesota Avenue
Kansas City, KS 66101
(913) 236-2576

Region 8
Asbestos NESHAPs Contact
Air & Waste Management Division
USEPA
1860 Lincoln Street
Denver, CO 80295
(303) 293-1767

Region 9
Asbestos NESHAPs Contact
Air Management Division
USEPA
215 Fremont Street
San Francisco, CA 94105
(415) 974-7648

Region 10
Asbestos NESHAPs Contact
Air & Toxics Management Division
USEPA
1200 Sixth Avenue
Seattle, WA 98101
(206) 442-2724

Regional Asbestos Coordinators

(For information on asbestos identification. health effects, abatement options, analytic techniques, asbestos in schools, and contract documents)

Region 1
Regional Asbestos Coordinator
USEPA
JFK Federal Building
Boston, MA 02203
(617) 223-0585

Region 2
Regional Asbestos Coordinator
USEPA
Woodbridge Avenue
Edison, NJ 08837
(201) 321-6668

Region 3
Regional Asbestos Coordinator
USEPA
841 Chestnut Street
Philadelphia, PA 19107
(215) 597-9859

Region 4
Regional Asbestos Coordinator
USEPA
345 Courtland Street N.E.
Atlanta, GA 30365
(404) 881-3864

Region 5
Regional Asbestos Coordinator
USEPA
230 S. Dearborn Street
Chicago, IL 60604
(312) 886-6879

Region 6
Regional Asbestos Coordinator
USEPA
First International Building
1201 Elm Street
Dallas, TX 75270
(214) 767-5314

Region 7
Regional Asbestos Coordinator
USEPA
726 Minnesota Avenue
Kansas City, KS 66101
(913) 236-2838

Region 8
Regional Asbestos Coordinator
USEPA
999 18th Street
Denver, CO 80202
(303) 293-1730

Region 9
Regional Asbestos Coordinator
USEPA
215 Fremont Street
San Francisco, CA 94105
(415) 974-8588

Region 10
Regional Asbestos Coordinator
USEPA
1200 Sixth Avenue
Seattle, WA 98101
(206) 442-2632

Appendix E. Phone Numbers for Obtaining Information and EPA Publications

Information **8001334-8571**

- Sampling and analysis of ACM (bulk materials)
- EPA Sealant Study

Publications **800/424-9065 (554-1404 – in Washington, DC)**

- Friable Asbestos-Containing Materials in Schools: Identification and Notification Rule (40 CFR Part 763).
- Evaluation of the EPA Asbestos-in-Schools Identification and Notification Rule. EPA 560/5-84-005.
- Asbestos in Buildings: National Survey of Asbestos-Containing Friable Materials. EPA 560/5-84-006.
- Asbestos in Buildings: Guidance for Service and Maintenance Personnel. EPA 560/5-85-018.
- Asbestos Waste Management Guidance. EPA 530-SW-85 -007.
- Asbestos Fact Book. EPA Office of Public Affairs.

Appendix F. Occupational Health and Safety (OSHA) Asbestos Regulations (29 CFR 1910.1001)

§1910.1001 Asbestos.

(a) *Definitions.* For the purpose of this section, (1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) *Permissible exposure to airborne concentrations of asbestos fibers-(1) Standard effective July 7, 1972.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) *Standard effective July 1, 1976.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) *Ceiling concentration.* No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) *Methods of compliance—(1) Engineering methods.* (i) *Engineering controls.* Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) *Local exhaust ventilation.* (a) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI 29.2-1971, which is incorporated by reference herein.

(b) See §1910.6 concerning the availability of ANSI Z9.2-1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in §1910.100.

(iii) *Particular tools.* All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(2) *Work practices-(i) Wet methods.* Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) *Particular products and operations.* No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) *Spraying, demolition, or removal.* Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d)(2)(iii) of this section and with special clothing in accordance with paragraph (d)(3) of this section.

(d) *Personal protective equipment—* (1) Compliance with the exposure limits prescribed by paragraph (b) of this section may not be achieved by the use of respirators or shift rotation of employees, except:

(i) During the time period necessary to install the engineering controls and to institute the work practices required by paragraph (c) of this section;

(ii) In work situations in which the methods prescribed in paragraph (c) of this section are either technically not feasible *or* feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by paragraphs (d)(1) (i), (ii), or (iii) of this section, and both are practicable, personnel rotation shall be preferred and used,

(2) Where a respirator is permitted by paragraph (d)(1) of this section, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of

Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 FR 6244, Mar. 25, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

(i) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in paragraph (d)(2) (ii) or (iii) of this section, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) *Powered air purifying respirators.* A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in paragraph (d)(2)(iii) of this section, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) *Type "C" supplied-air respirators, continuous flow or pressure-demand class.* A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) *Establishment of a respirator program. (a)* The employer shall establish a respirator program in accordance with the requirements of the American National Standards Practices for Respiratory protection, ANSI 288.2-1969, which is incorporated by reference herein.

(b) See §1910.6 concerning the availability of ANSI 288.2-1969 and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in 51910.100.

(c) No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) Special clothing: The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) Change rooms: (i) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) Clothes lockers: The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) Laundering *(a)* Laundering of asbestos contaminated clothing shall be done so as to prevent the release of air-borne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(b) Any employer who gives asbestos-contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (d)(4)(iii)(a) of this section to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(c) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 x (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring-(1) Initial determinations.* Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) *Personal monitonng*— (i) Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by paragraph (f)(1) of this section, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) *Environmental monitoring.* (i) Samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by paragraph (f)(1) of this section, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) *Employee observation of monitoring.* Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) *Caution signs and labels-(* 1) *Caution signs—(* i) *Posting.* Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(ii) *Sign specifications.* The warning signs required by paragraph (g)(1)(i) of this section shall conform to the requirements of 20" x 14" vertical format signs specified § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	Notation
Asbestos	1" Sans Serif, Gothic or Block.
Dust Hazard	¾" Sans Serif, Gothic or Block.
Avoid Breathing Dust	¼" Gothic.
Wear Assigned Protective equipment.	¼" Gothic.

Legend	Notation
Do Not Remain in Area Unless Your Work Requires It.	¼" Gothic
Breathing Asbestos Dust May Be Hazardous To Your Health.	14 Point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) *Caution labels-(i) Labeling.* Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) *Label specifications.* The caution labels required by paragraph (g)(2)(i) of this section shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers

Avoid Creating Dust

Breathing Asbestos Dust May Cause Serious Bodily Harm

(h) *Housekeeping-(1) Cleaning.* All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) *Waste disposal* Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed Impermeable bags, or other closed, impermeable containers.

(i) *Recordkeeping-(1) Exposure records.* Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 20 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either.

(2) Access. Employee exposure records required by this paragraph shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20 (a)-(e) and (g)-(l).

(3) *Employee notification.* Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) *Medical examinations-(1) General.* The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) *Preplacement.* The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiatory volume at 1 second ($FEV_{1.0}$).

(3) *Annual examinations.* On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged In occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a minimum. a chest roentgenogram (posteri-

or-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiatory volume at 1 second (FEW,..).

(4) *Termination of employment.* The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include foreed vital capacity (FVC) and forced expiatory volume at 1 second (FEW,..).

(5) *Recent examinations. No* medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past l-year period.

(6) *Medical* records—(i) *Maintenance.* Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) *Access.* Records of the medical examinations required by this paragraph shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20 (a)-(e) and (g)-(i). These records shall also be provided upon the request to the Director of NIOSH. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

Appendix G. Specifications for Sampling Materials and Selecting a Qualified Laboratory to Analyze for Asbestos

G.1 Collecting Samples

Taking a sample of ACM can damage the material and cause significant release of fibers. The following guidelines are designed to minimize both damage and fiber release.[1]

- Wear at least a half-face respirator with disposable filters (see Section 5.1).
- Wet the surface of the material to be sampled with water from a spray bottle or place a plastic bag around the sampler.
- Sample with a reusable sampler such as a cork borer or a single-use sampler such as a glass vial. (Figure G-1 shows a single-use sampler constructed from an acrylic tube.)
- With a twisting motion, slowly push the sampler into the material. Be sure to penetrate any paint or protective coating and all the layers of the material.
- For reusable samplers, extract and eject the sample into a container. Wet-wipe the tube and plunger. For single-use samplers, extract, wet-wipe the exterior, and cap it.
- Label the container.
- Clean debris using wet towels and discard them in a plastic bag.
- For surfacing material, use latex paint or a sealant to cover the sample area. For pipe and boiler insulation, use a nonasbestos mastic.

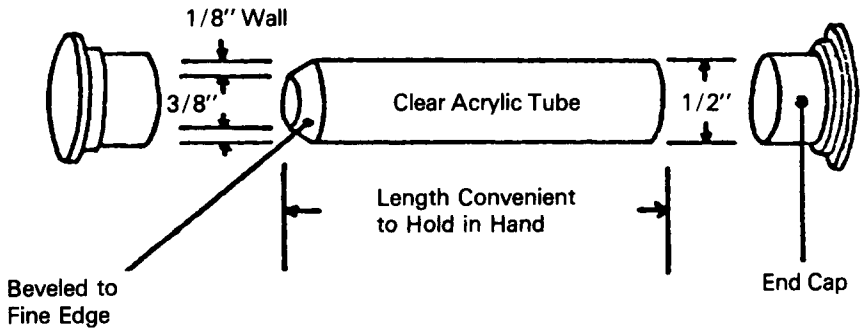


Figure G-1 - Sampler/ container

G.2 Selecting a Qualified Laboratory

The U.S. Environmental Protection Agency (EPA) runs a bulk asbestos sample quality assurance program. Updated lists of participating laboratories, their performance scores, and further information on the program are available from the Asbestos Technical Information Service at (800) 334-8571 (Extension 6741).

[1] **The guidelines are based on information in John T. Jankovic, "Asbestos Bulk Sampling Procedure." American Induatrial Hygiene Association, 46, B-8 to B-10, 1985.**

Appendix H. Definition and Description of Factors for Assessing the Need for Corrective Action*

H.1 Condition of the Asbestos-Containing Material

H.1.1 Factors 1 and 2: Deterioration or Delamination and Physical Damage

An assessment of the condition should evaluate : the quality of the installation, the adhesion of the friable material to the underlying substrate, deterioration, and damage from vandalism or any other cause. Evidence of debris on horizontal surfaces, hanging material, dislodged chunks, scraping, indentations, or cracking are indicators of poor material condition.

Accidental or deliberate physical contact with the friable material can result in damage. Inspectors should look for any evidence that the asbestos-containing material has been disturbed: finger marks in the material, graffiti, pieces dislodged or missing, scrape marks from movable equipment or furniture, or accumulation of the friable material on floors, shelves, or other horizontal surfaces.

Asbestos-containing material may deteriorate as a result of either the quality of the installation or environmental factors which affect the cohesive strength of the asbestos-containing material or the strength of the adhesion to the substrate. Deterioration can result in the accumulation of dust on the surface of the asbestos-containing material, delamination of the material (i.e.. separating into layers), or an adhesive failure of the material where it pulls away from the substrate and either hangs loosely or falls to the floor and exposes the substrate. Inspectors should touch the asbestos-containing material and determine if dust is released when the material is lightly brushed or rubbed.

If the coated surface "gives" when slight hand pressure is applied or the material moves up and down with light pushing, the asbestos-containing material is no longer tightly bonded to its substrate.

H.1.2 Factor 3: Water Damage

Water damage is usually caused by roof leaks, particularly in buildings with flat roofs or a concrete slab and steel beam construction. Skylights can also be significant sources of leaks. Water damage can also result from plumbing leaks and water or high humidity in the vicinity of pools, locker rooms, and lavatories.

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*The information in this Appendix is taken, with modification, from Brandner, W. October 1982. Asbestos Exposure Assessment in Buildings Inspection Manual. Kansas City, MO: U.S. Environmental Protection Agency, Region VII.

Water can dislodge, delaminate, or disturb friable asbestos-containing materials that are otherwise in good condition and can increase the potential for fiber release by dissolving and washing out the binders in the material. Materials which were not considered friable may become friable after water has dissolved and leached out the binders. Water can also act as a slurry to carry fibers to other areas where evaporation will leave a collection of fibers that can become suspended in the air.

Inspect the area for visible signs of water damage, such as discoloration of or stains on the asbestos-containing material; stains on adjacent walls or floors; buckling of the walls or floors; or areas where pieces of the asbestos-containing material have separated into layers or fallen down, thereby exposing the substrate.

Close inspection is required. In many areas, staining may occur only in a limited area while water damage causing delamination may have occurred in a much larger area. In addition, the water damage may have occurred since the original inspection for friable material, causing new areas to become friable and require a reinspection.

Delamination is particularly a problem in areas where the substrate is a very smooth concrete slab. Check to see if the material "gives" when pressure is applied from underneath.

H.2 Potential for Disturbance or Erosion

H.2.1 Factor 4: Air Plenum or Direct Airstream

An air plenum exists when the return (or, in rare cases, conditioned) air leaves a room or hall through vents in a suspended ceiling and travels at low speed and pressure through the space between the actual ceiling and the suspended ceiling or ducts. The moving air may erode any asbestos-containing material in the plenum. In evaluating whether an air plenum or direct airstream is present, the inspector must look for evidence of ducts or cavities used to convey air to and from heating or cooling equipment or the presence of air vents or outlets which blow air directly onto friable material.

A typical construction technique is to use the space between a suspended ceiling and the actual ceiling as a return air plenum. In many cases, the tiles in the suspended ceiling must be lifted to check if this is the case. Inspection of the air handling or HVAC equipment rooms may also provide evidence (such as accumulated fibers) of the presence of this material in the plenums.

Special attention should be paid to whether frequent activities (such as maintenance) disturb the material in the plenum. It is also important to check for evidence that the material is being

released or eroded (i.e., has it deteriorated or been damaged so that the material is free to circulate in the airstream?).

H.2.2 Factor 5: Exposure, Accessibility, and Activity

These three considerations are highly interrelated and have been combined into a single factor. In general, for a site to show a high potential for disturbance, it must be exposed (visible) and accessible, and be located near movement corridors or subject to vibration.

The amount of asbestos-containing material exposed to the area occupied by people will contribute to the likelihood that the material may be disturbed and determines whether the fibers can freely move through the area. An asbestos-containing material is considered exposed if it can be seen. For a material not to be exposed, a physical barrier must by complete, undamaged, and unlikely to be removed or dislodged. An asbestos-containing material should be considered exposed if it is visible, regardless of the height of the material.

If the asbestos-containing material is located behind a suspended ceiling with movable tiles, a close inspection must be made of the condition of the suspended ceiling; the likelihood and frequency of access into the suspended ceiling, and whether the suspended ceiling forms a complete barrier or is only partially concealing the material.

Asbestos-containing material above a suspended ceiling is considered exposed if the space above the suspended ceiling is an air plenum. Suspended ceilings with numerous louvers, grids, or other open spaces should be considered exposed.

If friable asbestos-containing material can be reached by building users or maintenance people, either directly or by impact from objects used in the area, it is accessible and subject to accidental or intentional contact and damage. Material which is accessible is likely to be disturbed in the future.

Height above the floor is one measure of accessibility. However, objects have been observed embedded in ceilings 25 feet or more high. Nearness of the friable asbestos-containing material to heating, ventilation, lighting and plumbing systems requiring maintenance or repair may increase the material's accessibility.

In addition, the activities and behavior of persons using the building should be included in the assessment of whether the material is accessible. For example, persons involved in athletic activities may accidentally damage the material on the walls and ceilings of gymnasiums with balls or athletic equipment. To become fully aware of occupants' use of the building, the inspector should consult with building staff or personnel.

When assessing activity levels, consider not only the movement caused by the activities of people but also movement from other sources such as high vibration from mechanical equipment, highways, and airplanes. Another source of vibration is sound, such as music and noise, which sets airwaves in motion at certain frequencies. As these sound waves impact on asbestos-containing material, they may vibrate the material and contribute to fiber release. Therefore, more fibers may be released in a music practice room or auditorium than in the rest of the building.

The amount of activity of the occupants can best be described by identifying the purpose of the area as well as estimating the number of persons who enter the area on a typical day.

H.2.3 Factor 6: Change in Building Use

A planned change in the use of the building from, for example, a junior to a senior high school may imply significant changes in the potential for erosion or disturbance. Of particular note is the increased potential for damage from balls to previously inaccessible ceilings in gymnasiums. The addition of machinery (such as dust collectors in wood or metal shops) to a school or office building may introduce vibrations which, again, may be a future cause of concern. The inspector should exercise judgement and draw on experience in evaluating the likely effect of such changes.

Appendix I. Example Building Inspection Form

Room: _____ Sample Number(s) : _____

Building: _____ Address: _____

Evaluator: _____ Phone No. : _____

Coated Area: Ceiling Wall(s) Structural Members Above Suspended Ceiling
Pipe Lagging Boiler Insul. Other: _____

Type of Ceiling: Concrete 3 Coat Plaster System Suspended Metal Lath
Concrete Joists and Beams Tile Suspended Lay-In Panels
Metal Deck Corrugated Steel Steel Beam or Bar Joists

Ceiling Height: _____ ft.

Ceiling Shape: Flat Dome Other

(draw) :


Folded Plate


Barrel

Type of Wall (If Coated): Smooth Concrete Rough Concrete Masonry
Plasterboard Other: _____

Amount of Friable Material in Area being Evaluated: _____ sq. ft.

Description of Coating: Fibrous (highly friable) Granular/Cementitious (soft) Concrete Like (hard)

Thickness: _____ inch(s) Is thickness uniform: Yes No

Coating debris on Floor/Furniture/Work Surfaces: Yes No

Curtains, expandable partitions, etc. being pulled across coating: Yes No

Type of Lighting: Surface Mounted Suspended Recessed

No. of Lights: _____ Type of Heating/Cooling Systems: _____

Type of Floor: Concrete Tile Wood Carpet Other: _____

What is above the room being evaluated? _____

_____

Comments: _____

_____

_____

I.1 Notes to Appendix I

The need for collecting most of the information on this form is discussed in Chapter 5 (Section 5.1). The form requires one additional piece of information: the presence of curtains or expandable partitions which are pulled across asbestos-containing material. Where this situation is found, the curtains or partitions should be removed or repositioned to eliminate contact with the material, Any damage to the asbestos-containing material then can be repaired.

This form was provided by Wolfgang Brandner, the Regional Asbestos Coordinator in Region VII.

Appendix J. Recommended Specifications and Operating Procedures for the Use of Negative Pressure Systems for Asbestos Abatement

J.1 Introduction

This appendix provides guidelines for the use of negative pressure systems in removing asbestos-containing materials from buildings. A negative pressure system is one in which static pressure in an enclosed work area is lower than that of the environment outside the containment barriers.

The pressure gradient is maintained by moving air from the work area to the environment outside the area via powered exhaust equipment at a rate that will support the desired air flow and pressure differential. Thus, the air moves into the work area through designated access spaces and any other barrier openings. Exhaust air is filtered by a high-efficiency particulate air (HEPA) filter to remove asbestos fibers.

The use of negative pressure during asbestos removal protects against large-scale release of fibers to the surrounding area in case of a breach in the containment barrier. A negative pressure system also can reduce the concentration of airborne asbestos in the work area by increasing the dilution ventilation rate (i. e., diluting contaminated air in the work area with uncontaminated air from outside) and exhausting contaminated air through HEPA filters. The circulation of fresh air through the work area reportedly also improves worker comfort, which may aid the removal process by increasing job productivity.

J.2 Materials and Equipment

J.2.1 The Portable, HEPA-Filtered, Powered Exhaust Unit

The exhaust unit establishes lower pressure inside than outside the enclosed work area during asbestos abatement. Basically, a unit (see Figure J-1) consists of a cabinet with an opening at each end, one for air intake and one for exhaust. A fan and a series of filters are arranged inside the cabinet between the openings. The fan draws contaminated air through the intake and filters and discharges clean air through the exhaust.

Portable exhaust units used for negative pressure systems in asbestos abatement projects should meet the following specifications.

J.2.1.1 Structural Specifications

The cabinet should be ruggedly constructed and made of durable materials to withstand damage from rough handling and transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. The cabinet must be appropriately sealed to prevent asbestos-containing dust from being emitted during use, transport, or maintenance. There should be easy access to all air filters from the intake end, and the filters must be easy

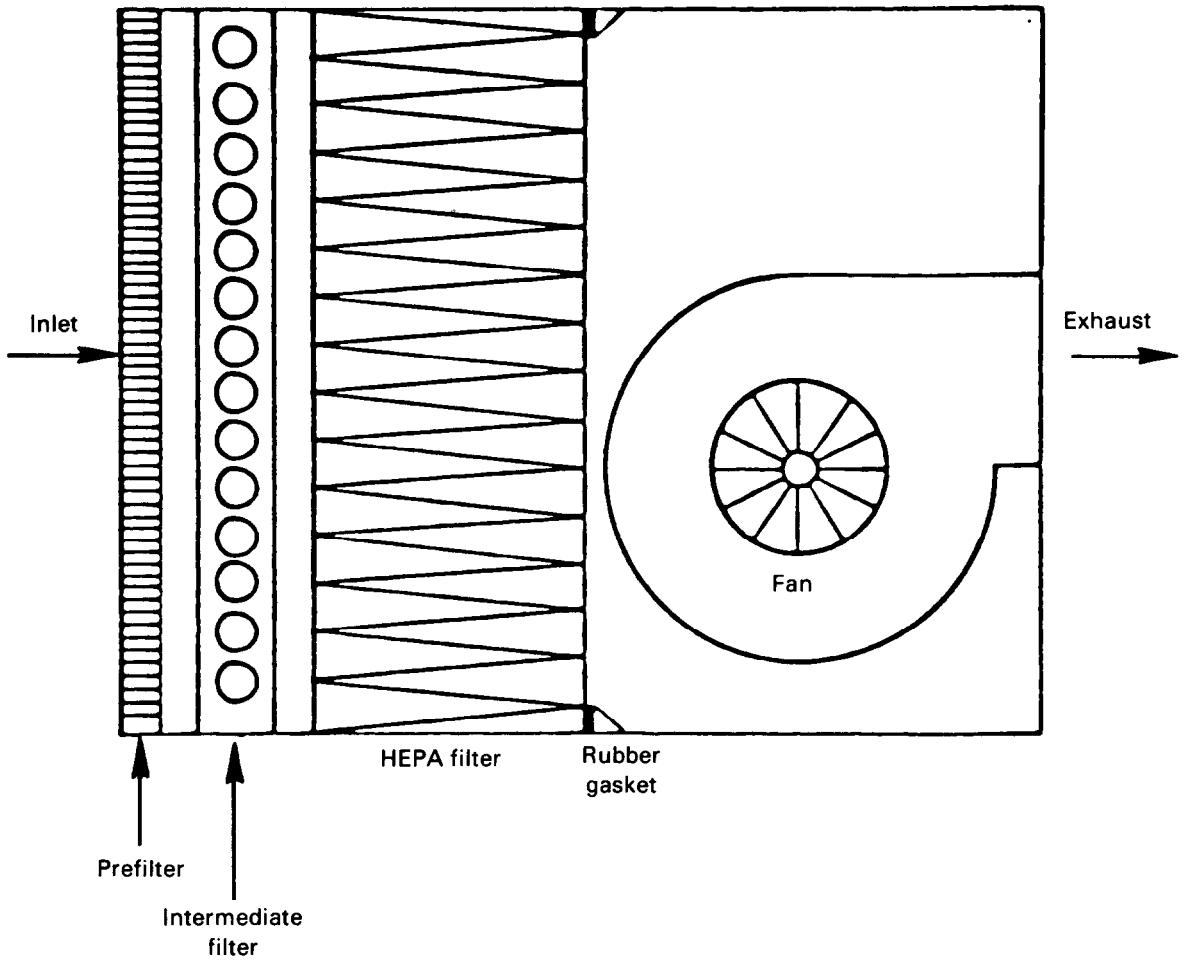

Figure J-1, An example of a HEPA-filtered exhaust unit. This scheme is one of several possible designs.

to replace. The unit should be mounted on casters or wheels so it can be easily moved. It also should be accessible for easy cleaning.

J.2.1.2 Mechanical Specifications

J.2.1.2.1 Fans

The fan for each unit should be sized to draw a desired air flow through the filters in the unit at a specified static pressure drop. The unit should have an air-handling capacity of 1,000 to 2,000 ft^3/min (under "clean" filter conditions). The fan should be of the centrifugal type.

For large-scale abatement projects, where the use of a larger capacity, specially designed exhaust system may be more practical than several smaller units, the fan should be appropriately sized according to the proper load capacity established for the application, i.e.,

$$\text{Total } ft^3/\text{min (load)} = \frac{\text{Volume of air in } ft^3 \times \text{air changes/hour}}{60 \text{ min/hour}}$$

Smaller-capacity units (e.g., 1,000 ft^3/min) equipped with appropriately sized fans and filters may be used to ventilate smaller work areas. The desired air flow could be achieved with several units.

J.2.1.2.2 Filters

The final filter must be the HEPA type. Each filter should have a standard nominal rating of at least 1,100 ft^3/min with a maximum pressure drop of 1 inch H_2O clean resistance. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame and cross-braced as required. The exact dimensions of the filter should correspond with the dimensions of the filter housing inside the cabinet or the dimensions of the filter-holding frame. The recommended standard size HEPA filter is 24 inches high x 24 inches wide x 11 -1/2 inches deep. The overall dimensions and squareness should be within 1/8 inch.

A continuous rubber gasket must be located between the filter and the filter housing to form a tight seal. The gasket material should be 1/4 inch thick and 3/4 inch wide.

Each filter should be individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3-µm dioctylphthalate (DOP) particles. Testing should be in accordance with Military Standard Number 282 and Army Instruction Manual 136-300-1 75A. Each filter should bear a UL586 label to indicate ability to perform under specified conditions.

Each filter should be marked with: the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

Prefilters, which protect the final filter by removing the larger particles, are recommended to prolong the operating life of the HEPA filter. Prefilters prevent the premature loading of the HEPA filter. They can also save energy and cost. One (minimum) or two (preferred) stages of prefiltration may be used. The first-stage prefilter should be a low-efficiency type (e.g., for particles 10 µm and larger). The second-stage (or intermediate) filter should have a medium efficiency (e. g., effective for particles down to 5 µm). Various types of filters and filter media for prefiltration applications are available from many manufacturers. Prefilters and intermediate filters should be installed either on or in the intake grid of the unit and held in place with special housings or clamps.

J.2.1.2.3 Instrumentation

Each unit should be equipped with a Magnehelic gauge or manometer to measure the pressure drop across the filters and indicate when filters have become loaded and need to be changed. The static pressure across the filters (resistance) increases as they become loaded with dust, affecting the ability of the unit to move air at its rated capacity.

J.2.1.3 Electrical

J.2.1.3.1 General

The electrical system should have a remote fuse disconnect. The fan motor should be totally enclosed, fan-cooled, and the nonoverloading type. The unit must use a standard 11 5-V,

single-phase, 60-cycle service. All electrical components must be approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL).

J.2.1.3.2 Fans

The motor, fan, fan housing, and cabinet should be grounded. The unit should have an electrical (or mechanical) lockout to prevent the fan from operating without a HEPA filter.

J.2.1.3.3 Instrumentation

An automatic shutdown system that would stop the fan in the event of a major rupture in the HEPA filter or blocked air discharge is recommended. Optional warning lights are recommended to indicate normal operation, too high of a pressure drop across the filters (i. e., filter overloading), and too low of a pressure drop (i. e., major rupture in HEPA filter or obstructed discharge). Other optional instruments include a timer and automatic shut-off and an elapsed time meter to show the total accumulated hours of operation.

J.3 Setup and Use of a Negative Pressure System

J.3.1 Preparation of the Work Area

J.3.1.1 Determining the Ventilation Requirements for a Work Area

Experience with negative pressure systems on asbestos abatement projects indicates a recommended rate of one air change every 15 minutes. The volume (in ft^3) of the work area is determined by multiplying the floor area by the ceiling height. The total air flow requirement (in ft^3/min) for the work area is determined by dividing this volume by the recommended air change rate (i.e., one air change every 15 minutes). *

$$\text{Total } ft^3/\text{min} = \text{Volume of work area (in } ft^3)/15 \text{ min}$$

The number of units needed for the application is determined by dividing the total ft^3/min by the rated capacity of the exhaust unit.

$$\text{Number of units needed} = [\text{Total } ft^3/\text{min}]/[\text{Capacity of unit (in } ft^3)]$$

J.3.1.2 Location of Exhaust Units

The exhaust unit(s) should be located so that makeup air enters the work area primarily through the decontamination facility and traverses the work area as much as possible. This may be accomplished by positioning the exhaust unit(s) at a maximum distance from the worker access opening or other makeup air sources.

Wherever practical, work area exhaust units can be located on the floor in or near unused doorways or windows. The end of the unit or its exhaust duct should be placed through an opening in the plastic barrier or wall covering. The plastic around the unit or duct should then be sealed with tape,

*The recommended air exchange rate is based on engineering judgment.

Each unit must have temporary electrical power (1 15VAC). If necessary, three-wire extension cords can supply power to a unit. The cords must be in continuous lengths (without splice), in good condition, and should not be more than 100 feet long. They must not be fastened with staples, hung from nails, or suspended by wire. Extension cords should be suspended off the floor and out of workers' way to protect the cords from damage from traffic, sharp objects, and pinching.

Wherever possible, exhaust units should be vented to the outside of the building. This may involve the use of additional lengths of flexible or rigid duct connected to the air outlet and routed to the nearest outside opening. Windowpanes may have to be removed temporarily.

If exhaust air cannot be vented to the outside of the building or if cold temperatures necessitate measures to conserve heat and minimize cold air infiltration, filtered air that has been exhausted through the barrier may be recirculated into an adjacent area. However, this is not recommended.

Additional makeup air may be necessary to avoid creating too high of a pressure differential, which could cause the plastic coverings and temporary barriers to "blow in. " Additional makeup air also may be needed to move air most effectively through the work area. Supplemental makeup air inlets may be made by making openings in the plastic sheeting that allow air from outside the building into the work area. Auxiliary makeup air inlets should be as far as possible from the exhaust unit(s) (e.g., on an opposite wall), off the floor (preferably near the ceiling), and away from barriers that separate the work area from occupied clean areas. They should be resealed whenever the negative pressure system is turned off after removal has started. Because the pressure differential (and ultimately the effectiveness of the system) is affected by the adequacy of makeup air, the number of auxiliary air inlets should be kept to a minimum to maintain negative pressure. Figure J-2 presents examples of negative pressure systems denoting the location of HEPA-filtered exhaust units and the direction of air flow.

J.3.2 Use of the Negative Pressure System

J.3.2.1 Testing the System

The negative pressure system should be tested before any asbestos-containing material is wetted or removed. After the work area has been prepared, the decontamination facility set up, and the exhaust unit(s) installed, the unit(s) should be started (one at a time). Observe the barriers and plastic sheeting. The plastic curtains of the decontamination facility should move slightly in toward the work area. The use of ventilation smoke tubes and a rubber bulb is another easy and inexpensive way to visually check system performance and direction of air flow through openings in the barrier. Another test is to use a Magnehelic gauge (or other instrument) to measure the static pressure differential across the barrier. The measuring device must be sensitive enough to detect a relatively low pressure drop. A Magnehelic gauge with a scale of O to 0.25 or 0.50 inch of H_2O and 0.005 or 0.01 inch graduations is generally adequate. The pressure drop across the barrier is measured from the outside by punching a small hole in the plastic barrier and inserting one end of a piece of rubber or Tygon tubing. The other end of the tubing is connected to the "low pressure" tap of the instrument. The "high pressure" tap must be open to the atmosphere. The pressure is read directly from the scale. After the test is completed, the hole in the barrier must be patched.

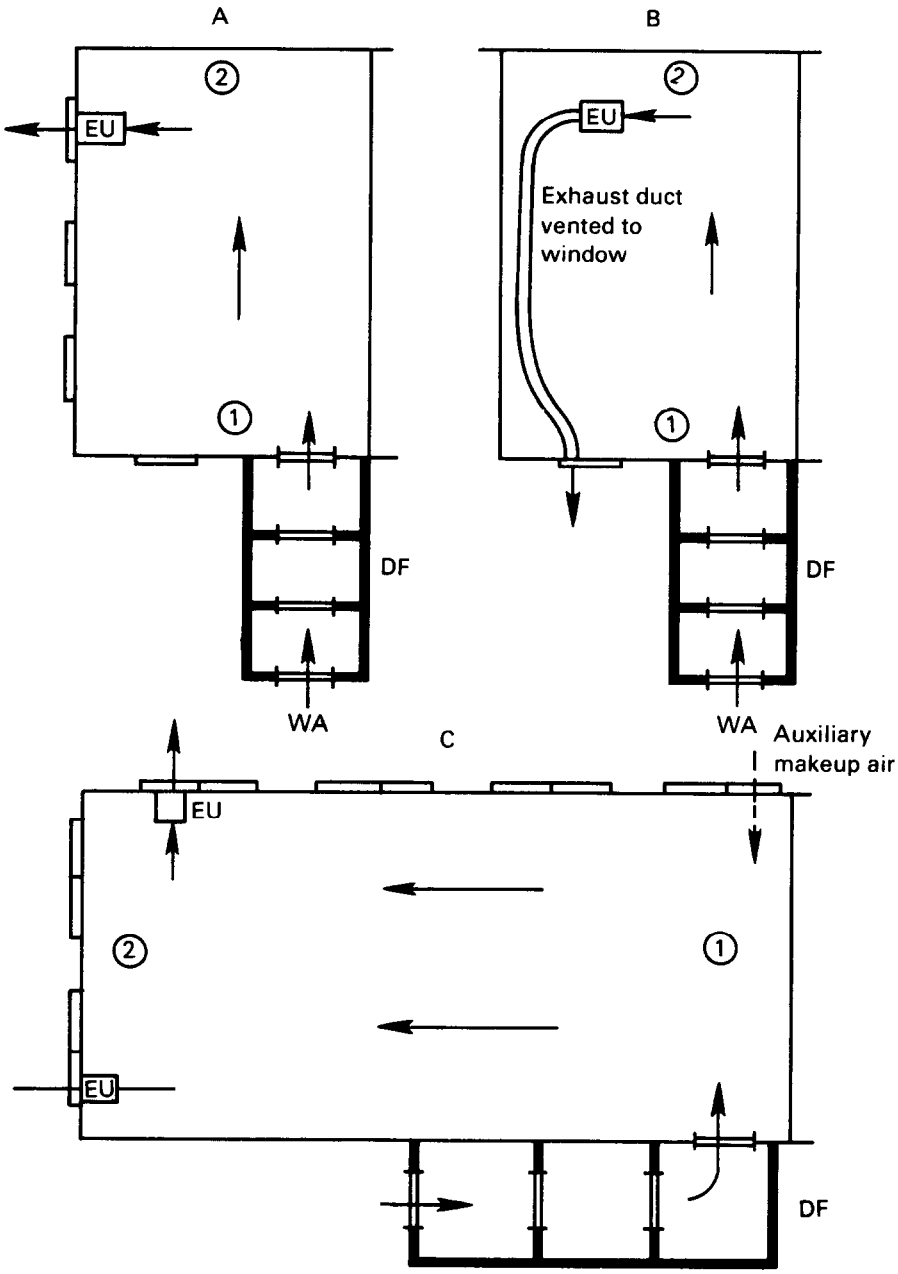

Figure J-2. Examples of negative pressure systems. DF, Decontamination Facility; EU, Exhaust Unit; WA, Worker Access; A, Single-room work area with multiple windows; B, Single-room work area with single window near entrance; C, Large single-room work area with windows and auxiliary makeup air source (dotted arrow). Arrows denote direction of air flow. Circled numbers indicate progression of removal sequence.

J.3.2.2 Use of System During Removal Operations

The exhaust units should be started just before beginning removal (i.e., before any asbestos-containing material is disturbed). After removal has begun, the units should run continuously to maintain a constant negative pressure until decontamination of the work area is complete. The units should not be turned off at the end of the work shift or when removal operations temporarily stop.

Employees should start removing the asbestos material at a location farthest from the exhaust units and work toward them. If an electric power failure occurs, removal must stop immediately and should not resume until power is restored and exhaust units are operating again.

Because airborne asbestos fibers are microscopic in size and tend to remain in suspension for a long time, the exhaust units must keep operating throughout the entire removal and decontamination processes. To ensure continuous operation, a spare unit should be available.

After asbestos removal equipment has been moved from the work area, the plastic sheeting has been cleaned, and all surfaces in the work area have been wet-cleaned, the exhaust units can be allowed to run for at least another 4 hours to remove airborne fibers that may have been generated during wet removal and cleanup and to purge the work area with clean makeup air. The units may be allowed to run for a longer time after decontamination, particularly if dry or only partially wetted asbestos material was encountered during removal.

J.3.2.2.1 Filter Replacement

All filters must be accessible from the work area or “contaminated” side of the barrier. Thus, personnel responsible for changing filters while the negative pressure system is in use should wear approved respirators and other protective equipment. The operating life of a HEPA filter depends on the level of particulate contamination in the environment in which it is used. During use, filters will become loaded with dust, which increases resistance to air flow and diminishes the air-handling capacity of the unit. The difference in pressure drop across the filters between “clean” and “loaded” conditions (Δ P) is a convenient means of estimating the extent of air-flow resistance and determining when the filters should be replaced.

When Δ P across the filters (as determined by the Magnehelic gauge or manometer on the unit) exceeds 1.0 inch of H_2O, the prefilter should be replaced first. The prefilter, which fan suction will generally hold in place on the intake grill, should be removed with the unit running by carefully rolling or folding in its sides. Any dust dislodged from the prefilter during removal will be collected on the intermediate filter. The used prefilter should be placed inside a plastic bag, sealed and labeled, and disposed of as asbestos waste. A new prefilter is then placed on the intake grill. Filters for prefiltration applications may be purchased as individual precut panels or in a roll of specified width that must be cut to size.

If the Δ P still exceeds 1.0 inch of H_2O after the prefilter has been replaced, the intermediate filter is replaced. With the unit operating, the prefilter should be removed, the intake grill or filter access opened, and the intermediate filter removed. Any dust dislodged from the intermediate filter during removal will be collected on the HEPA filter. The used intermediate filter should be placed in a sealable plastic bag (appropriately labeled) and disposed of as asbestos waste. A new replacement filter is then installed and the grill or access closed, Finally, the prefilter on the intake grill should be replaced.

The HEPA filter should be replaced if prefilter and/or intermediate filter replacement does not restore the pressure drop across the filters to its original clean resistance reading or if the HEPA filter becomes damaged. The exhaust unit is shut off to replace the HEPA filter, which requires removing the prefilter first, then opening the intake grill or filter access, and finally removing the HEPA filter from the unit. Used HEPA filters should be placed in a sealable plastic bag (appropriately labeled) and disposed of as asbestos waste. A new HEPA filter (structurally identical to the original filter) should then be installed. The intake grill and intermediate filter should be put back in place, the unit turned on, and the prefilter positioned on the intake grill. Whenever the HEPA filter is replaced, the prefilter and intermediate filter should also be replaced.

When several exhaust units are used to ventilate a work area, any air movement through an inactive unit during the HEPA filter replacement will be into the work area. Thus, the risk of asbestos fiber release to the outside environment is controlled.

Any filters used in the system maybe replaced more frequently than the pressure drop across the filters indicates is necessary. Prefilters, for example, may be replaced two to four times a day or when accumulations of particulate matter become visible. Intermediate filters must be replaced once every day or so, and the HEPA filter may be replaced at the beginning of each new project. (Used HEPA filters must be disposed of as asbestos-containing waste.) Conditions in the work area dictate the frequency of filter changes. In a work area where fiber release is effectively controlled by thorough wetting and good work practices, fewer filter changes may be required than in work areas where the removal process is not well controlled. It should also be noted that the collection efficiency of a filter generally improves as particulate accumulates on it. Thus, filters can be used effectively until resistance (as a result of excessive particulate loading) diminishes the exhaust capacity of the unit.

J.3.2.3 Dismantling the System

When a final inspection and the results of final air tests indicate that the area has been decontaminated, all filters of the exhaust units should be removed and disposed of properly and the units shut off. The remaining barriers between contaminated and clean areas and all seals on openings into the work area and fixtures may be removed and disposed of as contaminated waste. A final check should be made to be sure that no dust or debris remain on surfaces as a result of dismantling operations.

Appendix K. Checklist for Determining Contractor Qualifications

a. Contractors shall demonstrate reliability in performance of general contracting activities through the submission of a list of references of persons who can attest to the quality of work performed by the contractor.

b, Contractors must demonstrate ability to perform asbestos abatement activities by submitting evidence of the successful completion of training courses covering asbestos abatement. At a minimum, the contractor shall furnish proof that employees have had instruction on the dangers of asbestos exposure, on respirator use, decontamination, and OSHA regulations.

c. Contractors must be able to demonstrate prior experience in performing previous abatement projects through the submission of a list of prior contracts, including: the names, addresses, and telephone numbers of building owners for whom the projects were performed. In rare circumstances inexperienced contractors may be qualified if they can demonstrate exceptional qualifications in the other contractor standards.

d. Additional evidence of successful completion of prior abatement projects should be demonstrated by contractors through the submission of air monitoring data, if any, taken during and after completion of previous projects in accordance with 29 CFR 1910.1001 (e).

e. Contractors must possess written standard operating procedures and employee protection plans which include specific reference to OSHA medical monitoring and respirator training programs. In addition, the contractor must be prepared to make available for viewing at the job site a copy of OSHA regulations at 29 CFR 1910.1001 governing asbestos controls, and Environmental Protection Agency regulations at 40 CFR Part 61, Subpart M, (NESHAPS) governing asbestos stripping work practices. and disposal of asbestos waste.

f. In those States which have contractor certification programs, contractors must possess State certifications for the performance of asbestos abatement projects.

g. Contractors must be able to provide a description of any asbestos abatement projects which have been prematurely terminated, including the circumstances surrounding the termination.

h. Contractors must provide a list of any contractual penalties which the contractor has paid for breach or noncompliance with contract specifications, such as overruns of completion time or liquidated damages.

i. Any citations levied against the contractor by any Federal, State, or local government agencies for violations related to asbestos abatement, shall be identified by contractors, including the name or location of the project, the date(s), and how the allegations were resolved.

j Contractors must submit a description detailing all legal proceedings, lawsuits or claims which have been filed or levied against the contractor or any of his pastor present employees for asbestos-related activities.

k. Contractors must supply a list of equipment that they have available for asbestos work. This should include negative air machines, type “C” supplied air systems, scaffolding, decontamination facilities, disposable clothing, etc.

Appendix L. Guide Specifications for Abatement Projects

The following organizations have developed contract specifications that can be used as a guide for abatement projects:

Association of the Wall/Ceiling Industries—International, Inc.
Guide Specifications for the Abatement of Asbestos Release from Spray-or Trowel-Applied Materials in Buildings and Other Structures. December 1981. The Foundation of the Wall and Ceiling Industry, 25 K Street, N. E., Washington, DC 20002 USA.

Maryland State Department of Health and Mental Hygiene
Recommended Contract Specifications for Asbestos Abatement Projects.

Federal Construction Guide Specifications (FCGS): 02085. Asbestos Abatement Procedures.

GSA Guide Specifications PBS (PCD): 02085. Asbestos Abatement Procedures.

Appendix M. Detailed Specifications for Sampling and Analyzing Airborne Asbestos

The following specifications are summarized from "Measuring Airborne Asbestos Following an Abatement Action" (USEPA 1985).

M.1 Sampling

M.1.1 Sampling Equipment

Standard sampling equipment consists of a pump (operated at a 2 to 12 liter per minute flow rate), a filter in a cassette and associated tubing and supports. Three types of filters can be used:

PCM — cellulose ester with 0.8 to 1.2 μm pore size;

TEM — polycarbonate with 0.4 μm pore size (preferred); or cellulose ester with 0.8pm pore size.

M.1.2 Number of Samples

M.1.2.1 TEM

A minimum of five samples inside and five outside the work site is recommended. When a negative air pressure ventilation system has been used during the abatement operation the "outside" samples should be collected outside the work site, but inside the building. This provides a comparison between the work site and the incoming air. If a negative air pressure ventilation system has not been used, the "outside" samples should be collected outdoors. These sample sizes are based on calculations of statistical reliability and on the following characteristics:

- The coefficient of variation for TEM measurements is between 100% and 150% based on data from EPA research studies,
- A false positive rate of .10 (i.e., based on the statistical test comparing inside and outside measurements, 10% of the "clean" work sites will fail and have to be recleaned).
- A false negative rate of at most .10 (i.e., the statistical test comparing inside and outside measurements will identify at least 90% of the sites that must be recleaned).

M.1.2.2 PCM

A minimum of five samples is recommended. A sample size of five controls the false negative error rate. At least 90% of the sites where the actual fiber concentration exceeds 0.01 f/cc will fail the test. If the actual concentration is 0.02 f/cc the probability of failure is 99%.

M.1.3 Location of Samplers

M.1.3.1 Indoors

Indoor samplers should be placed so they are not influenced by unusual air circulation patterns. Avoid corners of rooms and obstructions (like furniture). Within the above constraints, samplers should be placed at random around the work site. For example, if the site is a single room of 1000 or more sq. ft., the five samplers should be distributed in an approximately uniform manner. If the site includes more than five rooms, the rooms to be sampled maybe selected randomly. The companion EPA document (USEPA 1985) describes this procedure in more detail.

When TEM is used for the air test and a negative air pressure ventilation system has been employed during the abatement operation, the five "outside" samplers should be placed outside the work site but inside the building, and the negative air system left running during sampling. These outside samplers should be located to avoid any air that might escape through the containment barriers. Minimum recommendations are at least 50 ft. from the entry portal to the work site, or 25 ft. from the plastic containment barriers.

M.1.3.2 Outdoors

If TEM is to be used for the air test and a negative air pressure ventilation system has not been used during abatement, then five samplers should be placed outdoors. These should be placed at ground level (about 2 meters high), if possible, and away from obstructions that may influence wind patterns. If access to electricity and concerns about security dictate a roof-top site, do not place samplers near vents or other structures on the roof.

M.1.4 Sampling Volumes

M.1.4.1 TEM

The required sampling volume for the TEM air testis calculated from the theoretical detection limit of the TEM analysis procedures, and from typical levels of asbestos against which measurements in the work site will be compared:

$$\text{Volume} = \frac{(1 \text{ f/10 grid squares})}{(0.005 \text{ f/cc})} \times \frac{(855 \text{ mm}^2)}{(0.0056 \text{ mm}^2)} \times \frac{(1 \text{ liter})}{(1000 \text{ cc})} = 3054 \text{ liters}$$

Where:

- 1 f/10 grid squares (the maximum recommended filter counting area) is the smallest number of fibers needed to make a non-zero measurement. (This is below the limit of reliable quantification.)
- 0.005 f/cc is a typical outdoor asbestos level in urban areas, as measured by TEM (Chatfield 1983).
- 855 mm^2 is the collection area of a 37 mm diameter filter.
- 0.0056 mm^2 is the area of each grid square (75 µm per side) in a 200 mesh electron microscope grid. This value will vary from 0.0056 to 0.0081 mm^2 for different grids. Larger grid squares will improve measurement accuracy for the same sampling volume.

This equation is appropriate for TEM analysis using a direct sample transfer technique (see Section M.2.1). If an indirect technique is used, the required sampling volume is increased in proportion to the dilution used. For example, if the sample is diluted by a factor of 10, the required volume is 10 times larger.

M.1.4.2 PCM

The equivalent PCM limit of reliable quantification for a sampling volume of 3000 liters is:

$$\text{Quantification Limit} = \frac{(10\ \text{f/100 fields})}{(3000\ \text{liters})} \times \frac{(855\ \text{mm}^2)}{(0.003\ \text{mm}^2)} \times \frac{(1\ \text{liter})}{(1000\ \text{cc})} = 0.01\ \text{f/cc}$$

Where:
- 10 f/100 fields is the limit of reliable quantification for the P&CAM 239 method.
- 855 mm^2 is the collection area of a 37 mm diameter filter.
- 0.003 mm^2 is the size of a typical field of view for a PCM microscope. This value will vary from 0.003 to 0.006 mm^2 for different microscopes. Larger fields of view will improve (decrease) the limit of reliable quantification.

By increasing the sampling volume, the PCM test criterion can be made proportionally more stringent:

Volume	Quantification Limit
3000 liters	0.01 f/cc
5000	0.006
7500	0.004

If the sampling scheme associated with the new NIOSH 7400 PCM method is used, the limit of reliable quantification will be lower for the same sampling volume.

M.1.5 Aggressive Sampling

Procedures for sampling aggressively are:

- Before starting the sampling pumps, direct the exhaust from forced air equipment (such as a 1 horsepower leaf blower) against all walls, ceilings, floors, ledges and other surfaces in the room. This should take at least 5 minutes per 1000 sq. ft. of floor.
- Place a 20-inch fan in the center of the room. (Use one fan per 10,000 cubic feet of room space.) Place the fan on slow speed and point it toward the ceiling.
- Start the sampling pumps and sample for the required time.
- Turn off the pump and then the fan(s) when sampling is complete.

M.2 Analysis

M.2.1 TEM

Use the update to the EPA provisional method (Yamate 1984). The sample should be transferred directly from the polycarbonate filter to the electron microscope grid. If high levels of organic materials are suspected or found, cellulose ester filters and indirect transfer (involving ashing, sonicating, and refiltering the fibers) is recommended. However, levels of airborne organic particles should be low in a cleaned work site.

M.2.2 PCM

Use the NIOSH P&CAM 239 method (NIOSH 1979). The newer NIOSH 7400 methods can also be used, although OSHA has yet to replace P&CAM 239 with 7400 for workplace compliance monitoring. NIOSH reports that 7400 is at least as accurate as P&CAM 239

M.3 Interpretation of Results

M.3.1 TEM

Use student's "t" test to compare inside and outside levels.

- Compute the natural logarithm of fiber concentration for each sample.
- Compute means of the log transformed data for inside samples and outside samples.
- Form the ratio

$$T = \frac{\overline{y}_1 - \overline{y}_2}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where:

$\overline{y}_1$ = average of log concentrations inside the work site

$\overline{y}_2$ = average of log concentrations outside the work site

$S = [(\Sigma (y_1 j - \overline{y}_1)^2 + \Sigma (y_2 j - \overline{y}_2)^2)/(n_1 + n_2 - 2)]^{1/2}$

n_1 = number of samples collected inside the work site

n_2 = number of samples collected outside the work site

Then compare T to the 95 percentile point of a "t" distribution with $n_1 + n_2 - 2$ degrees of freedom. (When 5 samples are collected inside and outside the 95 percentile point is 1.86.) If T exceeds the 95 percentile point, reclean. Otherwise, release the contractor.

The following two examples illustrate the method:

Example 1

Measurements inside the work site (f/cc)	Measurements outside the work site (f/cc)
0.002	0.001
0.007	0.010
0.030	0.008
0.028	0.001
0.001	0.025
$\overline{y_1} = -5,03$	$\overline{y_2} = -5.39$

S = 1.49

T = 0.38

T is less than 1.86. The contractor is released.

Example 2

Measurements inside the work site (f/cc)	Measurements outside the work site (f/cc)
0.052	0.001
0.130	0.010
0.005	0.008
0.240	0.001
0.375	0.025
$\overline{y_1} = -2.54$	$\overline{y_2} = -5.39$

s = 1.59

T = 2.84

T is greater than 1.86. The site must be recleaned.

The test is based on the assumption that a homogeneous work site has been selected. If one sample has a much higher concentration than the others it is possible that the site is not homogeneous. Common sense should prevail in this case. Irrespective of the result of the “t” test, the high value should be investigated. The sample should be reanalyzed, additional samples collected, or the site recleaned and tested before the contractor is released.

M.3.2 PCM

The measured level of each sample is compared with the PCM limit of reliable quantification for the volume of air sampled (approximately 0.01 f/cc for 3000 liters). If any of the samples exceeds 0.01 f/cc, the work site must be re-cleaned.

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Appendix N. Glossary

Abatement	Asbestos control beyond a special operations and maintenance program.
Asbestos	A group of naturally occurring minerals that separate into fibers. There are six asbestos minerals used commercially: Chrysotile, Amosite, Crocidolite, Anthophyllite, Tremolite, and Actinolite.
Cementitious	Friable materials that are densely packed and nonfibrous.
Containment	Isolation of the work area from the rest of the building to prevent escape of asbestos fibers.
Delaminate	To separate into layers. As used here, to separate from the substrate.
(Human) Exposure	The presence of people in an area where levels of an airborne contaminant are elevated. A more technical definition sometimes found in scientific literature is: The total amount of airborne contaminant inhaled by a person, typically approximated by the product of concentration and duration.
(Material) Exposure	The amount or fraction of material visible.
Fibrous	Spongy, fluffy, composed of long strands of fibers.
Friable	Capable of being crumbled, pulverized, or reduced to powder by hand pressure.
Homogeneous (Material)	Similar in appearance and texture.
Homogeneous (Work Site)	Contains only one type of asbestos-containing material and only one type of abatement method was used.
Peak levels	Levels of airborne contaminant which are much higher than average and occur for short periods of time in response to sudden release of the contaminant.
Prevalent levels	Levels of airborne contaminant occurring under normal conditions.
Resolve	To distinguish different objects with a microscope.
Risk	The likelihood of developing a disease as a result of exposure to a contaminant.

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8. performing Organization Rept. No.

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11. Contract(C) or Grant(G) No.

(C) 68-01-6721

(G)

12. Sponsoring Organization Name I nd Address

ENVIRONMENTAL PROTECTION AGENCY
Office of Toxic Substances
Exposure Evaluation Division
Washington, D.C. 20460

13. Types of Report & Period Covered

14.

15. Supplementary Notes

This report was prepared for the Exposure Evaluation Division of the Office of Toxic Substances. Copies of the document can be obtained by calling toll-free 800-424-9065. (Call 554-1404 in the District of Columbia.)

.16. Abstract (Limit: 200 words)

This revised document provides EPA guidance on controlling asbestos-containing materials found in buildings. The document (1) provides a current summary of data on exposure to airborne asbestos, (2) survey procedures for determining if asbestos-containing material is present in buildings, (3) explains how to establish a special operations and maintenance program in a building found to contain asbestos, (4) reviews technical issues confronted when assessing the potential for exposure to airborne asbestos, in particular indoor settings, (5) suggests a structured process for selecting a particular course of action given information on physical condition of the asbestos, exposure levels, assessment methods, and abatement techniques, (6) summarizes and updates information on applicability, effectiveness, and relative costs of alternative remedial actions, (7) introduces and discusses criteria for determining successful asbestos control. The material presented is a summary of information and experience gained by EPA through its Asbestos in Schools and Buildings Program and by a wide spectrum of experts in the field.

17. Document Analysis a. Descriptors

b. identifiers/Open.Ended Terms

Airborne Asbestos
Asbestos Abatement
Asbestos-Containing Materials
Asbestos Control Program
Asbestos Exposure
Asbestos Special Operations and Maintenance Program

c. COSATI field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Available to the Public	Unclassified	160
	20. Security Class (This Page) Unclassified	22. Price

(See ANSI-239.18)

See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(formerly NTIS-35)
Department of Commerce

APPENDIX J

RESPIRATORY PROTECTION PROGRAM

THIS SECTION IS DESIGNATED TO MAINTAIN A COPY OF THE SCHOOL'S RESPIRATORY PROTECTION PLAN. Should ACPS employees be prohibited from disturbing the identified asbestos-containing materials located within the school, no respiratory protection program will be included in this section. If this policy is amended in the future, any changes will include a written respiratory protection program.

APPENDIX K
MEDICAL SURVEILLANCE REQUIREMENTS

THIS SECTION IS USED FOR MEDICAL SURVELLANCE REQUIREMENT DOCUMENTATION. Should ACPS employees be prohibited from disturbing the identified asbestos-containing materials located within the school, medical surveillance documentation will not be referenced in this section. If this policy is amended in the future, any changes will include available documentation as it pertains to medical surveillance of ACPS employees.

APPENDIX L

TYPICAL PROCEDURES FOR CLASS III WORK

Class III asbestos work includes repair and maintenance operations, where "ACM", including TSI and surfacing ACM and PACM/assumed, is likely to be disturbed. Training is required for employees who will disturb or remove ACM, not to exceed one 60" x 60" bag of generated waste, in order to perform their principal work. Initial training is 16 hours and annual refresher training is 2 hours.

As of the date of this Management Plan, Alexandria City Public School employees are not proposed to be disturbing the identified asbestos-containing materials located within the school. If asbestos-containing materials need to be removed in order to perform repair or maintenance work, the personnel should contact the Asbestos Designee prior to disturbing asbestos-containing materials.

Mr. Derrick Fulcher
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APPENDIX M

DIRECTORY OF LOCAL REGULATORY AGENCIES

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APPENDIX N

EPA REGULATIONS FOR ASBESTOS

40 CFR, Chapter 61, Subpart M
National Emission Standard for Asbestos

§61.140 Applicability.
§61.141 Definitions.
§61.142 Standard for asbestos mills.
§61.143 Standard for roadways.
§61.144 Standard for manufacturing.
§61.145 Standard for demolition and renovation.
§61.146 Standard for spraying.
§61.147 Standard for fabricating.
§61.148 Standard for insulating materials.
§61.149 Standard for waste disposal for asbestos mills.
§61.150 Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations.
§61.151 Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations.
§61.152 Air-cleaning.
§61.153 Reporting.
§61.154 Standard for active waste disposal sites.
§61.155 Standard for operations that convert asbesto-containing waste material into nonasbestos (asbestos-free) material.
§61.156 Cross-reference to other asbestos regulations.
§61.157 Delegation of authority.

61 Subpart M Appendix A Interpretive Rule Governing Roof Removal Operations

61.140 Applicability.

The provisions of this subpart are applicable to those sources specified in 61.142 through 61.151, 61.154, and 61.155.

[55 FR 48414, Nov. 20, 1990]

61.141 Definitions.

All terms that are used in this subpart and are not defined below are given the same meaning as in the Act and in subpart A of this part.

Active waste disposal site means any disposal site other than an inactive site.

Adequately wet means sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from asbestos-containing material, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wet.

Asbestos means the asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.

Asbestos-containing waste materials means mill tailings or any waste that contains commercial asbestos and is generated by a source subject to the provisions of this subpart. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term also includes regulated asbestos-containing material waste and materials contaminated with asbestos including disposable equipment and clothing.

Asbestos mill means any facility engaged in converting, or in any intermediate step in converting, asbestos ore into commercial asbestos. Outside storage of asbestos material is not considered a part of the asbestos mill.

Asbestos tailings means any solid waste that contains asbestos and is a product of asbestos mining or milling operations.

Asbestos waste from control devices means any waste material that contains asbestos and is collected by a pollution control device.

Category I nonfriable asbestos-containing material (ACM) means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy.

Category II nonfriable ACM means any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos as determined using the methods specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Commercial asbestos means any material containing asbestos that is extracted from ore and has value because of its asbestos content.

Cutting means to penetrate with a sharp-edged instrument and includes sawing, but does not include shearing, slicing, or punching.

Demolition means the wrecking or taking out of any load-supporting structural member of a facility together with any related handling operations or the intentional burning of any facility.

Emergency renovation operation means a renovation operation that was not planned but results from a sudden, unexpected event that, if not immediately attended to, presents a safety or public health hazard, is necessary to protect equipment from

damage, or is necessary to avoid imposing an unreasonable financial burden. This term includes operations necessitated by nonroutine failures of equipment.

Fabricating means any processing (e.g., cutting, sawing, drilling) of a manufactured product that contains commercial asbestos, with the exception of processing at temporary sites (field fabricating) for the construction or restoration of facilities. In the case of friction products, fabricating includes bonding, debonding, grinding, sawing, drilling, or other similar operations performed as part of fabricating.

Facility means any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding residential buildings having four or fewer dwelling units); any ship; and any active or inactive waste disposal site. For purposes of this definition, any building, structure, or installation that contains a loft used as a dwelling is not considered a residential structure, installation, or building. Any structure, installation or building that was previously subject to this subpart is not excluded, regardless of its current use or function.

Facility component means any part of a facility including equipment.

Friable asbestos material means any material containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763 section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent as determined by a method other than point counting by polarized light microscopy (PLM), verify the asbestos content by point counting using PLM.

Fugitive source means any source of emissions not controlled by an air pollution control device.

Glove bag means a sealed compartment with attached inner gloves used for the handling of asbestos-containing materials. Properly installed and used, glove bags provide a small work area enclosure typically used for small-scale asbestos stripping operations. Information on glove-bag installation, equipment and supplies, and work practices is contained in the Occupational Safety and Health Administration's (OSHA's) final rule on occupational exposure to asbestos (appendix G to 29 CFR 1926.58).

Grinding means to reduce to powder or small fragments and includes mechanical chipping or drilling.

Inactive waste disposal site means any disposal site or portion of it where additional asbestos-containing waste material has not been deposited within the past year.

In poor condition means the binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material.

Installation means any building or structure or any group of buildings or structures at a single demolition or renovation site that are under the control of the same owner or operator (or owner or operator under common control).
Leak-tight means that solids or liquids cannot escape or spill out. It also means dust-tight.

Malfunction means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of asbestos are increased. Failures of equipment shall not be considered malfunctions if they are caused in any way by poor maintenance, careless operation, or any other preventable upset conditions, equipment breakdown, or process failure.

Manufacturing means the combining of commercial asbestos-or, in the case of woven friction products, the combining of textiles containing commercial asbestos-with any other material(s), including commercial asbestos, and the processing of this combination into a product. Chlorine production is considered a part of manufacturing.

Natural barrier means a natural object that effectively precludes or deters access.

Natural barriers include physical obstacles such as cliffs, lakes or other large bodies of water, deep and wide ravines, and mountains. Remoteness by itself is not a natural barrier.

Nonfriable asbestos-containing material means any material containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Nonscheduled renovation operation means a renovation operation necessitated by the routine failure of equipment, which is expected to occur within a given period based on past operating experience, but for which an exact date cannot be predicted.

Outside air means the air outside buildings and structures, including, but not limited to, the air under a bridge or in an open air ferry dock.

Owner or operator of a demolition or renovation activity means any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Particulate asbestos material means finely divided particles of asbestos or material containing asbestos.

Planned renovation operations means a renovation operation, or a number of such operations, in which some RACM will be removed or stripped within a given period of time and that can be predicted. Individual nonscheduled operations are included if a number of such operations can be predicted to occur during a given period of time based on operating experience.

Regulated asbestos-containing material (RACM) means

(a) Friable asbestos material,
(b) Category I nonfriable ACM that has become friable,
(c) Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or
(d) Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations regulated by this subpart.

Remove means to take out RACM or facility components that contain or are covered with RACM from any facility.

Renovation means altering a facility or one or more facility components in any way, including the stripping or removal of RACM from a facility component. Operations in which load-supporting structural members are wrecked or taken out are demolitions.

Resilient floor covering means asbestos-containing floor tile, including asphalt and vinyl floor tile, and sheet vinyl floor covering containing more than 1 percent asbestos as determined using polarized light microscopy according to the method specified in appendix E, subpart E, 40 CFR part 763, Section 1, Polarized Light Microscopy.

Roadways means surfaces on which vehicles travel. This term includes public and private highways, roads, streets, parking areas, and driveways.

Strip means to take off RACM from any part of a facility or facility components.

Structural member means any load-supporting member of a facility, such as beams and load supporting walls; or any nonload-supporting member, such as ceilings and nonload-supporting walls.

Visible emissions means any emissions, which are visually detectable without the aid of instruments, coming from RACM or asbestos-containing waste material, or from any asbestos milling, manufacturing, or fabricating operation. This does not include condensed, uncombined water vapor.

Waste generator means any owner or operator of a source covered by this subpart whose act or process produces asbestos-containing waste material.

Waste shipment record means the shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Working day means Monday through Friday and includes holidays that fall on any of the days Monday through Friday.

[49 FR 13661, Apr. 5, 1984; 49 FR 25453, June 21, 1984, as amended by 55 FR 48414, Nov. 20, 1990; 56 FR 1669, Jan. 16, 1991; 60 FR 31917, June 19, 1995]

61.142 **Standard for asbestos mills**. (deleted from this document)

61.143 **Standard for roadways.** (deleted from this document)

61.144 **Standard for manufacturing**. (deleted from this document)

61.145 **Standard for demolition and renovation.**

(a) Applicability. To determine which requirements of paragraphs (a), (b), and (c) of this section apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM. The requirements of paragraphs (b) and (c) of this section apply to each owner or operator of a demolition or renovation activity, including the removal of RACM as follows:

(1) In a facility being demolished, all the requirements of paragraphs (b) and (c) of this section apply, except as provided in paragraph (a)(3) of this section, if the combined amount of RACM is

(i) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(ii) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.

(2) In a facility being demolished, only the notification requirements of paragraphs (b)(1), (2), (3)(i) and (iv), and (4)(i) through (vii) and (4)(ix) and (xvi) of this section apply, if the combined amount of RACM is

(i) Less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, and

(ii) Less than one cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously or there is no asbestos.

(3) If the facility is being demolished under an order of a State or local government agency, issued because the facility is structurally unsound and in danger of imminent collapse, only the requirements of paragraphs (b)(1), (b)(2), (b)(3)(iii), (b)(4) (except (b)(4)(viii)), (b)(5), and (c)(4) through (c)(9) of this section apply.

(4) In a facility being renovated, including any individual nonscheduled renovation operation, all the requirements of paragraphs (b) and (c) of this section apply if the combined amount of RACM to be stripped, removed, dislodged, cut, drilled, or similarly disturbed is

(i) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(ii) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.

(iii) To determine whether paragraph (a)(4) of this section applies to planned renovation operations involving individual nonscheduled operations, predict the combined additive amount of RACM to be removed or stripped during a calendar year of January 1 through December 31.

(iv) To determine whether paragraph (a)(4) of this section applies to emergency renovation operations, estimate the combined amount of RACM to be removed or stripped as a result of the sudden, unexpected event that necessitated the renovation.

(5) Owners or operators of demolition and renovation operations are exempt from the requirements of 61.05 (a), 61.07, and 61.09.

(b) Notification requirements. Each owner or operator of a demolition or renovation activity to which this section applies shall:

(1) Provide the Administrator with written notice of intention to demolish or renovate. Delivery of the notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(2) Update notice, as necessary, including when the amount of asbestos affected changes by at least 20 percent.

(3) Postmark or deliver the notice as follows:

(i) At least 10 working days before asbestos stripping or removal work or any other activity begins (such as site preparation that would break up, dislodge or similarly disturb asbestos material), if the operation is described in paragraphs (a) (1) and (4) (except (a)(4)(iii) and (a)(4)(iv)) of this section. If the operation is as described in paragraph (a)(2) of this section, notification is required 10 working days before demolition begins.

(ii) At least 10 working days before the end of the calendar year preceding the year for which notice is being given for renovations described in paragraph (a)(4)(iii) of this section.

(iii) As early as possible before, but not later than, the following working day if the operation is a demolition ordered according to paragraph (a)(3) of this section or, if the operation is a renovation described in paragraph (a)(4)(iv) of this section.

(iv) For asbestos stripping or removal work in a demolition or renovation operation, described in paragraphs (a) (1) and (4) (except (a)(4)(iii) and (a)(4)(iv)) of this section, and for a demolition described in paragraph (a)(2) of this section, that will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Administrator as follows:

(A) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin after the date contained in the notice,

(1) Notify the Administrator of the new start date by telephone as soon as possible before the original start date, and

(2) Provide the Administrator with a written notice of the new start date as soon as possible before, and no later than, the original start date. Delivery of the updated notice by the U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(B) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin on a date earlier than the original start date,

(1) Provide the Administrator with a written notice of the new start date at least 10 working days before asbestos stripping or removal work begins.

(2) For demolitions covered by paragraph (a)(2) of this section, provide the Administrator written notice of a new start date at least 10 working days before commencement of demolition. Delivery of updated notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(C) In no event shall an operation covered by this paragraph begin on a date other than the date contained in the written notice of the new start date.

(4) Include the following in the notice:

(i) An indication of whether the notice is the original or a revised notification.

(ii) Name, address, and telephone number of both the facility owner and operator and the asbestos removal contractor owner or operator.

(iii) Type of operation: demolition or renovation.

(iv) Description of the facility or affected part of the facility including the size (square meters [square feet] and number of floors), age, and present and prior use of the facility.

(v) Procedure, including analytical methods, employed to detect the presence of RACM and Category I and Category II nonfriable ACM.

(vi) Estimate of the approximate amount of RACM to be removed from the facility in terms of length of pipe in linear meters (linear feet), surface area in square meters (square feet) on other facility components, or volume in cubic meters (cubic feet) if off the facility components. Also, estimate the approximate amount of Category I and Category II nonfriable ACM in the affected part of the facility that will not be removed before demolition.

(vii) Location and street address (including building number or name and floor or room number, if appropriate), city, county, and state, of the facility being demolished or renovated.

(viii) Scheduled starting and completion dates of asbestos removal work (or any other activity, such as site preparation that would break up, dislodge, or similarly disturb asbestos material) in a demolition or renovation; planned renovation operations involving individual nonscheduled operations shall only include the beginning and ending dates of the report period as described in paragraph (a)(4)(iii) of this section.

(ix) Scheduled starting and completion dates of demolition or renovation.

(x) Description of planned demolition or renovation work to be performed and method(s) to be employed, including demolition or renovation techniques to be used and description of affected facility components.

(xi) Description of work practices and engineering controls to be used to comply with the requirements of this subpart, including asbestos removal and waste-handling emission control procedures.

(xii) Name and location of the waste disposal site where the asbestos-containing waste material will be deposited.

(xiii) A certification that at least one person trained as required by paragraph (c)(8) of this section will supervise the stripping and removal described by this notification. This requirement shall become effective 1 year after promulgation of this regulation.

(xiv) For facilities described in paragraph (a)(3) of this section, the name, title, and authority of the State or local government representative who has ordered the demolition, the date that the order was issued, and the date on which the demolition was ordered to begin. A copy of the order shall be attached to the notification.

(xv) For emergency renovations described in paragraph (a)(4)(iv) of this section, the date and hour that the emergency occurred, a description of the sudden, unexpected event, and an explanation of how the event caused an unsafe condition, or would cause equipment damage or an unreasonable financial burden.

(xvi) Description of procedures to be followed in the event that unexpected RACM is found or Category II nonfriable ACM becomes crumbled, pulverized, or reduced to powder.

(xvii) Name, address, and telephone number of the waste transporter.

(5) The information required in paragraph (b)(4) of this section must be reported using a form similiar to that shown in Figure 3.

(c) Procedures for asbestos emission control. Each owner or operator of a demolition or renovation activity to whom this paragraph applies, according to paragraph (a) of this section, shall comply with the following procedures:

(1) Remove all RACM from a facility being demolished or renovated before any activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal. RACM need not be removed before demolition if:

(i) It is Category I nonfriable ACM that is not in poor condition and is not friable.

(ii) It is on a facility component that is encased in concrete or other similarly hard material and is adequately wet whenever exposed during demolition; or

(iii) It was not accessible for testing and was, therefore, not discovered until after demolition began and, as a result of the demolition, the material cannot be safely removed. If not removed for safety reasons, the exposed RACM and any asbestos-contaminated debris must be treated as asbestos-containing waste material and adequately wet at all times until disposed of.

(iv) They are Category II nonfriable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.

(2) When a facility component that contains, is covered with, or is coated with RACM is being taken out of the facility as a unit or in sections:

(i) Adequately wet all RACM exposed during cutting or disjoining operations; and

(ii) Carefully lower each unit or section to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the RACM.

(3) When RACM is stripped from a facility component while it remains in place in the facility, adequately wet the RACM during the stripping operation.

(i) In renovation operations, wetting is not required if:

(A) The owner or operator has obtained prior written approval from the Administrator based on a written application that wetting to comply with this paragraph would unavoidably damage equipment or present a safety hazard; and

(B) The owner or operator uses of the following emission control methods:

(1) A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the asbestos materials. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in 61.152.

(2) A glove-bag system designed and operated to contain the particulate asbestos material produced by the stripping of the asbestos materials.

(3) Leak-tight wrapping to contain all RACM prior to dismantlement.

(ii) In renovation operations where wetting would result in equipment damage or a safety hazard, and the methods allowed in paragraph (c)(3)(i) of this section cannot be used, another method may be used after obtaining written approval from the Administrator based upon a determination that it is equivalent to wetting in controlling emissions or to the methods allowed in paragraph (c)(3)(i) of this section.

(iii) A copy of the Administrator's written approval shall be kept at the worksite and made available for inspection.

(4) After a facility component covered with, coated with, or containing RACM has been taken out of the facility as a unit or in sections pursuant to paragraph (c)(2) of this section, it shall be stripped or contained in leak-tight wrapping, except as described in paragraph (c)(5) of this section. If stripped, either:

(i) Adequately wet the RACM during stripping; or

(ii) Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping. The system must exhibit no visible emissions to the

outside air or be designed and operated in accordance with the requirements in 61.152.

(5) For large facility components such as reactor vessels, large tanks, and steam generators, but not beams (which must be handled in accordance with paragraphs (c)(2), (3), and (4) of this section), the RACM is not required to be stripped if the following requirements are met:

(i) The component is removed, transported, stored, disposed of, or reused without disturbing or damaging the RACM.

(ii) The component is encased in a leak-tight wrapping.

(iii) The leak-tight wrapping is labeled according to 61.149 (d)(1)(i), (ii), and (iii) during all loading and unloading operations and during storage.

(6) For all RACM, including material that has been removed or stripped:

(i) Adequately wet the material and ensure that it remains wet until collected and contained or treated in preparation for disposal in accordance with 61.150; and

(ii) Carefully lower the material to the ground and floor, not dropping, throwing, sliding, or otherwise damaging or disturbing the material.

(iii) Transport the material to the ground via leak-tight chutes or containers if it has been removed or stripped more than 50 feet above ground level and was not removed as units or in sections.

(iv) RACM contained in leak-tight wrapping that has been removed in accordance with paragraphs (c)(4) and (c)(3)(i)(B)(3) of this section need not be wetted.

(7) When the temperature at the point of wetting is below 0 °C (32 °F):

(i) The owner or operator need not comply with paragraph (c)(2)(i) and the wetting provisions of paragraph (c)(3) of this section.

(ii) The owner or operator shall remove facility components containing, coated with, or covered with RACM as units or in sections to the maximum extent possible.

(iii) During periods when wetting operations are suspended due to freezing temperatures, the owner or operator must record the temperature in the area containing the facility components at the

beginning, middle, and end of each workday and keep daily temperature records available for inspection by the Administrator during normal business hours at the demolition or renovation site. The owner or operator shall retain the temperature records for at least 2 years.

(8) Effective 1 year after promulgation of this regulation, no RACM shall be stripped, removed, or otherwise handled or disturbed at a facility regulated by this section unless at least one on-site representative, such as a foreman or management-level person or other authorized representative, trained in the provisions of this regulation and the means of complying with them, is present. Every 2 years, the trained on-site individual shall receive refresher training in the provisions of this regulation. The required training shall include as a minimum: applicability; notifications; material identification; control procedures for removals including, at least, wetting, local exhaust ventilation, negative pressure enclosures, glove-bag procedures, and High Efficiency Particulate Air (HEPA) filters; waste disposal work practices; reporting and recordkeeping; and asbestos hazards and worker protection. Evidence that the required training has been completed shall be posted and made available for inspection by the Administrator at the demolition or renovation site.

(9) For facilities described in paragraph (a)(3) of this section, adequately wet the portion of the facility that contains RACM during the wrecking operation.

(10) If a facility is demolished by intentional burning, all RACM including Category I and Category II nonfriable ACM must be removed in accordance with the NESHAP before burning.

(Approved by the Office of Management and Budget under control number 2060-0101)
[55 FR 48419, Nov. 20, 1990; 56 FR 1669, Jan. 16, 1991; 58 FR 18014, Apr. 7, 1993]

61.146 **Standard for spraying.** (deleted from this document)

61.147 **Standard for fabricating.** (deleted from this document)

61.148 **Standard for insulating materials.** (deleted from this document)

61.149 **Standard for waste disposal for asbestos mills.** (deleted from this document)

61.150 Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations.

Each owner or operator of any source covered under the provisions of 61.144, 61.145, 61.146, and 61.147 shall comply with the following provisions:

(a) Discharge no visible emissions to the outside air during the collection, processing (including incineration), packaging, or transporting of any asbestos-containing waste material generated by the source, or use one of the emission control and waste treatment methods specified in paragraphs (a) (1) through (4) of this section.

(1) Adequately wet asbestos-containing waste material as follows:

(i) Mix control device asbestos waste to form a slurry; adequately wet other asbestos-containing waste material; and

(ii) Discharge no visible emissions to the outside air from collection, mixing, wetting, and handling operations, or use the methods specified by 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air; and

(iii) After wetting, seal all asbestos-containing waste material in leak-tight containers while wet; or, for materials that will not fit into containers without additional breaking, put materials into leak-tight wrapping; and

(iv) Label the containers or wrapped materials specified in paragraph (a)(1)(iii) of this section using warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.1001 (j)(2) or 1926.58 (k)(2)(iii). The labels shall be printed in letters of sufficient size and contrast so as to be readily visible and legible.

(v) For asbestos-containing waste material to be transported off the facility site, label containers or wrapped materials with the name of the waste generator and the location at which the waste was generated.

(2) Process asbestos-containing waste material into nonfriable forms as follows:

(i) Form all asbestos-containing waste material into nonfriable pellets or other shapes;

(ii) Discharge no visible emissions to the outside air from collection and processing operations, including incineration, or use the method specified by 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(3) For facilities demolished where the RACM is not removed prior to demolition according to 61.145 (c)(1) (i), (ii), (iii), and (iv) or for facilities demolished according to 61.145 (c)(9), adequately wet asbestos-containing waste material at all times after demolition and keep wet during handling and loading for transport to a disposal site. Asbestos-containing waste materials covered by this paragraph do not have to be sealed in leak-tight containers or wrapping but may be transported and disposed of in bulk.

(4) Use an alternative emission control and waste treatment method that has received prior approval by the Administrator according to the procedure described in 61.149 (c)(2).

(5) As applied to demolition and renovation, the requirements of paragraph (a) of this section do not apply to Category I nonfriable ACM waste and Category II nonfriable ACM waste that did not become crumbled, pulverized, or reduced to powder.

(b) All asbestos-containing waste material shall be deposited as soon as is practical by the waste generator at:

(1) A waste disposal site operated in accordance with the provisions of 61.154, or

(2) An EPA-approved site that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material according to the provisions of 61.155.

(3) The requirements of paragraph (b) of this section do not apply to Category I nonfriable ACM that is not RACM.

(c) Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of waste so that the signs are visible. The markings must conform to the requirements of 61.149 (d)(1) (i), (ii), and (iii).

(d) For all asbestos-containing waste material transported off the facility site:

(1) Maintain waste shipment records, using a form similar to that shown in Figure 4, and include the following information:

(i) The name, address, and telephone number of the waste generator.

(ii) The name and address of the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program.

(iii) The approximate quantity in cubic meters (cubic yards).

(iv) The name and telephone number of the disposal site operator.

(v) The name and physical site location of the disposal site.

(vi) The date transported.

(vii) The name, address, and telephone number of the transporter(s).

(viii) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.

(2) Provide a copy of the waste shipment record, described in paragraph (d)(1) of this section, to the disposal site owners or operators at the same time as the asbestos-containing waste material is delivered to the disposal site.

(3) For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated disposal site, is not received by the waste generator within 35 days of the date the waste was accepted by the initial transporter, contact the transporter and/or the owner or operator of the designated disposal site to determine the status of the waste shipment.

(4) Report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator if a copy of the waste shipment record, signed by the owner or operator of the designated waste disposal site, is not received by the waste generator within 45 days of the date the waste was accepted by the initial transporter. Include in the report the following information:

(i) A copy of the waste shipment record for which a confirmation of delivery was not received, and

(ii) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.

(5) Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.

(e) Furnish upon request, and make available for inspection by the Administrator, all records required under this section.

[55 FR 48429, Nov. 20, 1990; 56 FR 1669, Jan. 16, 1991]

61.151 Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations. (deleted from this document)

61.152 Air-cleaning. (deleted from this document)

61.153 Reporting. (deleted from this document)

61.154 Standard for active waste disposal sites.

Each owner or operator of an active waste disposal site that receives asbestos-containing waste material from a source covered under 61.149, 61.150, or 61.155 shall meet the requirements of this section:

(a) Either there must be no visible emissions to the outside air from any active waste disposal site where asbestos-containing waste material has been deposited, or the requirements of paragraph (c) or (d) of this section must be met.

(b) Unless a natural barrier adequately deters access by the general public, either warning signs and fencing must be installed and maintained as follows, or the requirements of paragraph (c)(1) of this section must be met.

(1) Warning signs must be displayed at all entrances and at intervals of 100 m (330 ft) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material is deposited. The warning signs must:

(i) Be posted in such a manner and location that a person can easily read the legend; and

(ii) Conform to the requirements of 51 cm 36 cm (20" 14") upright format signs specified in 29 CFR 1910.145 (d)(4) and this paragraph; and

(iii) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

Legend	Notation
Asbestos Waste Disposal Site	2.5 cm (1 inch) Sans Serif, Gothic or Block.
Do Not Create Dust	1.9 cm (3/4 inch) Sans Serif, Gothic or Block.
Breathing Asbestos is Hazardous to Your Health	14 Point Gothic.

Spacing between any two lines must be at least equal to the height of the upper of the two lines.

(2) The perimeter of the disposal site must be fenced in a manner adequate to deter access by the general public.

(3) Upon request and supply of appropriate information, the Administrator will determine whether a fence or a natural barrier adequately deters access by the general public.

(c) Rather than meet the no visible emission requirement of paragraph (a) of this section, at the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material that has been deposited at the site during the operating day or previous 24-hour period shall:

(1) Be covered with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, or

(2) Be covered with a resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. Such an agent shall be used in the manner and frequency recommended for the particular dust by the dust suppression agent manufacturer to achieve and maintain dust control. Other equally effective dust suppression agents may be used upon prior approval by the Administrator. For purposes of this paragraph, any used, spent, or other waste oil is not considered a dust suppression agent.

(d) Rather than meet the no visible emission requirement of paragraph (a) of this section, use an alternative emissions control method that has received prior

written approval by the Administrator according to the procedures described in 61.149 (c)(2).

(e) For all asbestos-containing waste material received, the owner or operator of the active waste disposal site shall:

(1) Maintain waste shipment records, using a form similar to that shown in Figure 4, and include the following information:

(i) The name, address, and telephone number of the waste generator.

(ii) The name, address, and telephone number of the transporter(s).

(iii) The quantity of the asbestos-containing waste material in cubic meters (cubic yards).

(iv) The presence of improperly enclosed or uncovered waste, or any asbestos-containing waste material not sealed in leak-tight containers. Report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator (identified in the waste shipment record), and, if different, the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the disposal site, by the following working day, the presence of a significant amount of improperly enclosed or uncovered waste. Submit a copy of the waste shipment record along with the report.

(v) The date of the receipt.

(2) As soon as possible and no longer than 30 days after receipt of the waste, send a copy of the signed waste shipment record to the waste generator.

(3) Upon discovering a discrepancy between the quantity of waste designated on the waste shipment records and the quantity actually received, attempt to reconcile the discrepancy with the waste generator. If the discrepancy is not resolved within 15 days after receiving the waste, immediately report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator (identified in the waste shipment record), and, if different, the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the disposal site. Describe the discrepancy and attempts to reconcile it, and submit a copy of the waste shipment record along with the report.

(4) Retain a copy of all records and reports required by this paragraph for at least 2 years.

(f) Maintain, until closure, records of the location, depth and area, and quantity in cubic meters (cubic yards) of asbestos-containing waste material within the disposal site on a map or diagram of the disposal area.

(g) Upon closure, comply with all the provisions of 61.151.

(h) Submit to the Administrator, upon closure of the facility, a copy of records of asbestos waste disposal locations and quantities.

(i) Furnish upon request, and make available during normal business hours for inspection by the Administrator, all records required under this section.

(j) Notify the Administrator in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site and is covered. If the excavation will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Administrator at least 10 working days before excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:

(1) Scheduled starting and completion dates.

(2) Reason for disturbing the waste.

(3) Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the Administrator may require changes in the emission control procedures to be used.

(4) Location of any temporary storage site and the final disposal site.

(Secs. 112 and 301(a) of the Clean Air Act as amended (42 U.S.C. 7412, 7601(a))
[49 FR 13661, Apr. 5, 1990. Redesignated and amended at 55 FR 48431, Nov. 20, 1990; 56 FR 1669, Jan. 16, 1991]

61.155 Standard for operations that convert asbesto-containing waste material into nonasbestos (asbestos-free) material. (deleted from this document)

61.156 Cross-reference to other asbestos regulations.

In addition to this subpart, the regulations referenced in Table 1 also apply to asbestos and may be applicable to those sources specified in 61.142 through 61.151, 61.154,

and 61.155 of this subpart. These cross-references are presented for the reader's information and to promote compliance with the cited regulations.
Table 1-Cross-reference to Other Asbestos Regulations

Agency	CFR citation	Comment
EPA	40 CFR 763, Subpart E	Requires schools to inspectfor asbestos and implement response actions and submit asbestos management plans to States. Specifies use of accredited inspectors, air sampling methods, and waste disposal procedures.
	40 CFR 427	Effluent standards for asbestos manufacturing source categories.
	40 CFR 763, Subpart G	Protects public employees performing asbestos abatement work in States not covered by OSHA asbestos standard.
OSHA	29 CFR 1910.1001	Worker protection measures-engineering controls, worker training, labeling, respiratory protection, bagging of waste, 0.2 f/cc permissible exposure level.
	29 CFR 1926.58	Worker protection measures for all construction work involving asbestos, including demolition and renovation-work practices, worker training, bagging of waste, 0.2 f/cc permissible exposure level.
MSHA	30 CFR 56, Subpart D	Specifies exposures limits, engineering controls, and respiratory protection measures for workers in surface mines.
	30 CFR 57, Subpart D	Specifies exposure limits, engineering controls, and respiratory protection measures

		for workers in underground mines.
DOT	49 CFR 171 and 172	Regulates the of asbestos-containing material. Requires waste containment and shipping papers.

[55 FR 48432, Nov. 20, 1990; 60 FR 31917, June 19, 1995]

61.157 **Delegation of authority.** (deleted from this document)

App A **Interpretive Rule Governing Roof Removal Operations** (deleted from this document)

contaminated surface used in the validation study. Record and keep the results of the validation study as an appendix to the SOP. Include in this appendix, the solvent used to make the spiking solution, the PCB concentration of the spiking solution used to contaminate the surfaces in the validation study, and all of the validation study testing parameters and experimental conditions.

PART 763—ASBESTOS

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AUTHORITY: 15 U.S.C. 2605, 2607(c), 2643, and 2646.

Subparts A–D [Reserved]

Subpart E—Asbestos-Containing Materials in Schools

SOURCE: 52 FR 41846, Oct. 30, 1987, unless otherwise noted.

§ 763.80 Scope and purpose.

(a) This rule requires local education agencies to identify friable and nonfriable asbestos-containing material (ACM) in public and private elementary and secondary schools by visually inspecting school buildings for such materials, sampling such materials if they are not assumed to be ACM, and having samples analyzed by appropriate techniques referred to in this rule. The rule requires local education agencies to submit management plans to the Governor of their State by October 12, 1988, begin to implement the plans by July 9, 1989, and complete implementation of the plans in a timely fashion. In addition, local education agencies are required to use persons who have been accredited to conduct inspections, reinspections, develop management plans, or perform response actions. The rule also includes recordkeeping requirements. Local education agencies may contractually delegate their duties under this rule, but they remain responsible for the proper performance of those duties.

Local education agencies are encouraged to consult with EPA Regional Asbestos Coordinators, or if applicable, a State's lead agency designated by the State Governor, for assistance in complying with this rule.

(b) Local education agencies must provide for the transportation and disposal of asbestos in accordance with EPA's ''Asbestos Waste Management Guidance.'' For convenience, applicable sections of this guidance are reprinted as Appendix D of this subpart. There are regulations in place, however, that affect transportation and disposal of asbestos waste generated by this rule. The transportation of asbestos waste is covered by the Department of Transportation (49 CFR part 173, subpart J) and disposal is covered by the National Emissions Standards for Hazardous Air Pollutants (NESHAP) (40 CFR part 61, subpart M).

§ 763.83 Definitions.

For purposes of this subpart:

Act means the Toxic Substances Control Act (TSCA), 15 U.S.C. 2601, *et seq.*

Accessible when referring to ACM means that the material is subject to disturbance by school building occupants or custodial or maintenance personnel in the course of their normal activities.

Accredited or *accreditation* when referring to a person or laboratory means that such person or laboratory is accredited in accordance with section 206 of Title II of the Act.

Air erosion means the passage of air over friable ACBM which may result in the release of asbestos fibers.

Asbestos means the asbestiform varieties of: Chrysotile (serpentine); crocidolite (riebeckite); amosite (cummingtonitegrunerite); anthophyllite; tremolite; and actinolite.

Asbestos-containing material (ACM) when referring to school buildings means any material or product which contains more than 1 percent asbestos.

Asbestos-containing building material (ACBM) means surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a school building.

Asbestos debris means pieces of ACBM that can be identified by color, texture, or composition, or means dust, if the dust is determined by an accredited inspector to be ACM.

Damaged friable miscellaneous ACM means friable miscellaneous ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate or which for any other reason lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

Damaged friable surfacing ACM means friable surfacing ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or which has delaminated such that its bond to the substrate (adhesion) is inadequate, or which, for any other reason, lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

Damaged or significantly damaged thermal system insulation ACM means thermal system insulation ACM on pipes, boilers, tanks, ducts, and other thermal system insulation equipment where the insulation has lost its structural integrity, or its covering, in whole or in part, is crushed, waterstained, gouged, punctured, missing, or not intact such that it is not able to contain fibers. Damage may be further illustrated by occasional punctures, gouges or other signs of physical injury to ACM; occasional water damage on

the protective coverings/jackets; or exposed ACM ends or joints. Asbestos debris originating from the ACBM in question may also indicate damage.

Encapsulation means the treatment of ACBM with a material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent the release of fibers, as the encapsulant creates a membrane over the surface (bridging encapsulant) or penetrates the material and binds its components together (penetrating encapsulant).

Enclosure means an airtight, impermeable, permanent barrier around ACBM to prevent the release of asbestos fibers into the air.

Fiber release episode means any uncontrolled or unintentional disturbance of ACBM resulting in visible emission.

Friable when referring to material in a school building means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously nonfriable material after such previously nonfriable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.

Functional space means a room, group of rooms, or homogeneous area (including crawl spaces or the space between a dropped ceiling and the floor or roof deck above), such as classroom(s), a cafeteria, gymnasium, hallway(s), designated by a person accredited to prepare management plans, design abatement projects, or conduct response actions.

High-efficiency particulate air (HEPA) refers to a filtering system capable of trapping and retaining at least 99.97 percent of all monodispersed particles 0.3 μm in diameter or larger.

Homogeneous area means an area of surfacing material, thermal system insulation material, or miscellaneous material that is uniform in color and texture.

Local education agency means:

(1) Any local educational agency as defined in section 198 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 3381).

(2) The owner of any nonpublic, nonprofit elementary, or secondary school building.

(3) The governing authority of any school operated under the defense dependent's education system provided for under the Defense Dependents' Education Act of 1978 (20 U.S.C. 921, et seq.).

Miscellaneous ACM means miscellaneous material that is ACM in a school building.

Miscellaneous material means interior building material on structural components, structural members or fixtures, such as floor and ceiling tiles, and does not include surfacing material or thermal system insulation.

Nonfriable means material in a school building which when dry may not be crumbled, pulverized, or reduced to powder by hand pressure.

Operations and maintenance program means a program of work practices to maintain friable ACBM in good condition, ensure clean up of asbestos fibers previously released, and prevent further release by minimizing and controlling friable ACBM disturbance or damage.

Potential damage means circumstances in which:

(1) Friable ACBM is in an area regularly used by building occupants, including maintenance personnel, in the course of their normal activities.

(2) There are indications that there is a reasonable likelihood that the material or its covering will become damaged, deteriorated, or delaminated due to factors such as changes in building use, changes in operations and maintenance practices, changes in occupancy, or recurrent damage.

Potential significant damage means circumstances in which:

(1) Friable ACBM is in an area regularly used by building occupants, including maintenance personnel, in the course of their normal activities.

(2) There are indications that there is a reasonable likelihood that the material or its covering will become significantly damaged, deteriorated, or delaminated due to factors such as changes in building use, changes in operations and maintenance practices, changes in occupancy, or recurrent damage.

(3) The material is subject to major or continuing disturbance, due to factors including, but not limited to, accessibility or, under certain circumstances, vibration or air erosion.

Preventive measures means actions taken to reduce disturbance of ACBM or otherwise eliminate the reasonable likelihood of the material's becoming damaged or significantly damaged.

Removal means the taking out or the stripping of substantially all ACBM from a damaged area, a functional space, or a homogeneous area in a school building.

Repair means returning damaged ACBM to an undamaged condition or to an intact state so as to prevent fiber release.

Response action means a method, including removal, encapsulation, enclosure, repair, operations and maintenance, that protects human health and the environment from friable ACBM.

Routine maintenance area means an area, such as a boiler room or mechanical room, that is not normally frequented by students and in which maintenance employees or contract workers regularly conduct maintenance activities.

School means any elementary or secondary school as defined in section 198 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 2854).

School building means:

(1) Any structure suitable for use as a classroom, including a school facility such as a laboratory, library, school eating facility, or facility used for the preparation of food.

(2) Any gymnasium or other facility which is specially designed for athletic or recreational activities for an academic course in physical education.

(3) Any other facility used for the instruction or housing of students or for the administration of educational or research programs.

(4) Any maintenance, storage, or utility facility, including any hallway, essential to the operation of any facility described in this definition of ''school building'' under paragraphs (1), (2), or (3).

(5) Any portico or covered exterior hallway or walkway.

(6) Any exterior portion of a mechanical system used to condition interior space.

Significantly damaged friable miscellaneous ACM means damaged friable miscellaneous ACM where the damage is extensive and severe.

Significantly damaged friable surfacing ACM means damaged friable surfacing ACM in a functional space where the damage is extensive and severe.

State means a State, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the Northern Marianas, the Trust Territory of the Pacific Islands, and the Virgin Islands.

Surfacing ACM means surfacing material that is ACM.

Surfacing material means material in a school building that is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

Thermal system insulation means material in a school building applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain, or water condensation, or for other purposes.

Thermal system insulation ACM means thermal system insulation that is ACM.

Vibration means the periodic motion of friable ACBM which may result in the release of asbestos fibers.

§ 763.84 General local education agency responsibilities.

Each local education agency shall:

(a) Ensure that the activities of any persons who perform inspections, reinspections, and periodic surveillance, develop and update management plans, and develop and implement response actions, including operations and maintenance, are carried out in accordance with subpart E of this part.

(b) Ensure that all custodial and maintenance employees are properly trained as required by this subpart E and other applicable Federal and/or

State regulations (e.g., the Occupational Safety and Health Administration asbestos standard for construction, the EPA worker protection rule, or applicable State regulations).

(c) Ensure that workers and building occupants, or their legal guardians, are informed at least once each school year about inspections, response actions, and post-response action activities, including periodic reinspection and surveillance activities that are planned or in progress.

(d) Ensure that short-term workers (e.g., telephone repair workers, utility workers, or exterminators) who may come in contact with asbestos in a school are provided information regarding the locations of ACBM and suspected ACBM assumed to be ACM.

(e) Ensure that warning labels are posted in accordance with § 763.95.

(f) Ensure that management plans are available for inspection and notification of such availability has been provided as specified in the management plan under § 763.93(g).

(g)(1) Designate a person to ensure that requirements under this section are properly implemented.

(2) Ensure that the designated person receives adequate training to perform duties assigned under this section. Such training shall provide, as necessary, basic knowledge of:

(i) Health effects of asbestos.

(ii) Detection, identification, and assessment of ACM.

(iii) Options for controlling ACBM.

(iv) Asbestos management programs.

(v) Relevant Federal and State regulations concerning asbestos, including those in this subpart E and those of the Occupational Safety and Health Administration, U.S. Department of Labor, the U.S. Department of Transportation and the U.S. Environmental Protection Agency.

(h) Consider whether any conflict of interest may arise from the interrelationship among accredited personnel and whether that should influence the selection of accredited personnel to perform activities under this subpart.

§ 763.85 Inspection and reinspections.

(a) *Inspection.* (1) Except as provided in paragraph (a)(2) of this section, before October 12, 1988, local education agencies shall inspect each school building that they lease, own, or otherwise use as a school building to identify all locations of friable and nonfriable ACBM.

(2) Any building leased or acquired on or after October 12, 1988, that is to be used as a school building shall be inspected as described under paragraphs (a) (3) and (4) of this section prior to use as a school building. In the event that emergency use of an uninspected building as a school building is necessitated, such buildings shall be inspected within 30 days after commencement of such use.

(3) Each inspection shall be made by an accredited inspector.

(4) For each area of a school building, except as excluded under § 763.99, each person performing an inspection shall:

(i) Visually inspect the area to identify the locations of all suspected ACBM.

(ii) Touch all suspected ACBM to determine whether they are friable.

(iii) Identify all homogeneous areas of friable suspected ACBM and all homogeneous areas of nonfriable suspected ACBM.

(iv) Assume that some or all of the homogeneous areas are ACM, and, for each homogeneous area that is not assumed to be ACM, collect and submit for analysis bulk samples under §§ 763.86 and 763.87.

(v) Assess, under § 763.88, friable material in areas where samples are collected, friable material in areas that are assumed to be ACBM, and friable ACBM identified during a previous inspection.

(vi) Record the following and submit to the person designated under § 763.84 a copy of such record for inclusion in the management plan within 30 days of the inspection:

(A) An inspection report with the date of the inspection signed by each accredited person making the inspection, State of accreditation, and if applicable, his or her accreditation number.

(B) An inventory of the locations of the homogeneous areas where samples are collected, exact location where each bulk sample is collected, dates

that samples are collected, homogeneous areas where friable suspected ACBM is assumed to be ACM, and homogeneous areas where nonfriable suspected ACBM is assumed to be ACM.

(C) A description of the manner used to determine sampling locations, the name and signature of each accredited inspector who collected the samples, State of accreditation, and, if applicable, his or her accreditation number.

(D) A list of whether the homogeneous areas identified under paragraph (a)(4)(vi)(B) of this section, are surfacing material, thermal system insulation, or miscellaneous material.

(E) Assessments made of friable material, the name and signature of each accredited inspector making the assessment, State of accreditation, and if applicable, his or her accreditation number.

(b) *Reinspection.* (1) At least once every 3 years after a management plan is in effect, each local education agency shall conduct a reinspection of all friable and nonfriable known or assumed ACBM in each school building that they lease, own, or otherwise use as a school building.

(2) Each inspection shall be made by an accredited inspector.

(3) For each area of a school building, each person performing a reinspection shall:

(i) Visually reinspect, and reassess, under §763.88, the condition of all friable known or assumed ACBM.

(ii) Visually inspect material that was previously considered nonfriable ACBM and touch the material to determine whether it has become friable since the last inspection or reinspection.

(iii) Identify any homogeneous areas with material that has become friable since the last inspection or reinspection.

(iv) For each homogeneous area of newly friable material that is already assumed to be ACBM, bulk samples may be collected and submitted for analysis in accordance with §§763.86 and 763.87.

(v) Assess, under §763.88, the condition of the newly friable material in areas where samples are collected, and newly friable materials in areas that are assumed to be ACBM.

(vi) Reassess, under §763.88, the condition of friable known or assumed ACBM previously identified.

(vii) Record the following and submit to the person designated under §763.84 a copy of such record for inclusion in the management plan within 30 days of the reinspection:

(A) The date of the reinspection, the name and signature of the person making the reinspection, State of accreditation, and if applicable, his or her accreditation number, and any changes in the condition of known or assumed ACBM.

(B) The exact locations where samples are collected during the reinspection, a description of the manner used to determine sampling locations, the name and signature of each accredited inspector who collected the samples, State of accreditation, and, if applicable, his or her accreditation number.

(C) Any assessments or reassessments made of friable material, the name and signature of the accredited inspector making the assessments, State of accreditation, and if applicable, his or her accreditation number.

(c) *General.* Thermal system insulation that has retained its structural integrity and that has an undamaged protective jacket or wrap that prevents fiber release shall be treated as nonfriable and therefore is subject only to periodic surveillance and preventive measures as necessary.

§763.86 Sampling.

(a) *Surfacing material.* An accredited inspector shall collect, in a statistically random manner that is representative of the homogeneous area, bulk samples from each homogeneous area of friable surfacing material that is not assumed to be ACM, and shall collect the samples as follows:

(1) At least three bulk samples shall be collected from each homogeneous area that is 1,000 ft^2 or less, except as provided in §763.87(c)(2).

(2) At least five bulk samples shall be collected from each homogeneous area that is greater than 1,000 ft^2 but less than or equal to 5,000 ft^2, except as provided in §763.87(c)(2).

(3) At least seven bulk samples shall be collected from each homogeneous

area that is greater than 5,000 ft², except as provided in § 763.87(c)(2).

(b) *Thermal system insulation.* (1) Except as provided in paragraphs (b) (2) through (4) of this section and § 763.87(c), an accredited inspector shall collect, in a randomly distributed manner, at least three bulk samples from each homogeneous area of thermal system insulation that is not assumed to be ACM.

(2) Collect at least one bulk sample from each homogeneous area of patched thermal system insulation that is not assumed to be ACM if the patched section is less than 6 linear or square feet.

(3) In a manner sufficient to determine whether the material is ACM or not ACM, collect bulk samples from each insulated mechanical system that is not assumed to be ACM where cement or plaster is used on fittings such as tees, elbows, or valves, except as provided under § 763.87(c)(2).

(4) Bulk samples are not required to be collected from any homogeneous area where the accredited inspector has determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-ACBM.

(c) *Miscellaneous material.* In a manner sufficient to determine whether material is ACM or not ACM, an accredited inspector shall collect bulk samples from each homogeneous area of friable miscellaneous material that is not assumed to be ACM.

(d) *Nonfriable suspected ACBM.* If any homogeneous area of nonfriable suspected ACBM is not assumed to be ACM, then an accredited inspector shall collect, in a manner sufficient to determine whether the material is ACM or not ACM, bulk samples from the homogeneous area of nonfriable suspected ACBM that is not assumed to be ACM.

§ 763.87 Analysis.

(a) Local education agencies shall have bulk samples, collected under § 763.86 and submitted for analysis, analyzed for asbestos using laboratories accredited by the National Bureau of Standards (NBS). Local education agencies shall use laboratories which have received interim accreditation for polarized light microscopy (PLM) analysis under the EPA Interim Asbestos Bulk Sample Analysis Quality Assurance Program until the NBS PLM laboratory accreditation program for PLM is operational.

(b) Bulk samples shall not be composited for analysis and shall be analyzed for asbestos content by PLM, using the ''Interim Method for the Determination of Asbestos in Bulk Insulation Samples'' found at appendix E to subpart E of this part.

(c)(1) A homogeneous area is considered not to contain ACM only if the results of all samples required to be collected from the area show asbestos in amounts of 1 percent or less.

(2) A homogeneous area shall be determined to contain ACM based on a finding that the results of at least one sample collected from that area shows that asbestos is present in an amount greater than 1 percent.

(d) The name and address of each laboratory performing an analysis, the date of analysis, and the name and signature of the person performing the analysis shall be submitted to the person designated under § 763.84 for inclusion into the management plan within 30 days of the analysis.

[52 FR 41846, Oct. 30, 1987, as amended at 60 FR 31922, June 19, 1995]

§ 763.88 Assessment.

(a)(1) For each inspection and reinspection conducted under § 763.85 (a) and (c) and previous inspections specified under § 763.99, the local education agency shall have an accredited inspector provide a written assessment of all friable known or assumed ACBM in the school building.

(2) Each accredited inspector providing a written assessment shall sign and date the assessment, provide his or her State of accreditation, and if applicable, accreditation number, and submit a copy of the assessment to the person designated under § 763.84 for inclusion in the management plan within 30 days of the assessment.

(b) The inspector shall classify and give reasons in the written assessment for classifying the ACBM and suspected ACBM assumed to be ACM in the school building into one of the following categories:

(1) Damaged or significantly damaged thermal system insulation ACM.

(2) Damaged friable surfacing ACM.

(3) Significantly damaged friable surfacing ACM.

(4) Damaged or significantly damaged friable miscellaneous ACM.

(5) ACBM with potential for damage.

(6) ACBM with potential for significant damage.

(7) Any remaining friable ACBM or friable suspected ACBM.

(c) Assessment may include the following considerations:

(1) Location and the amount of the material, both in total quantity and as a percentage of the functional space.

(2) Condition of the material, specifying:

(i) Type of damage or significant damage (e.g., flaking, blistering, water damage, or other signs of physical damage).

(ii) Severity of damage (e.g., major flaking, severely torn jackets, as opposed to occasional flaking, minor tears to jackets).

(iii) Extent or spread of damage over large areas or large percentages of the homogeneous area.

(3) Whether the material is accessible.

(4) The material's potential for disturbance.

(5) Known or suspected causes of damage or significant damage (e.g., air erosion, vandalism, vibration, water).

(6) Preventive measures which might eliminate the reasonable likelihood of undamaged ACM from becoming significantly damaged.

(d) The local education agency shall select a person accredited to develop management plans to review the results of each inspection, reinspection, and assessment for the school building and to conduct any other necessary activities in order to recommend in writing to the local education agency appropriate response actions. The accredited person shall sign and date the recommendation, provide his or her State of accreditation, and, if applicable, provide his or her accreditation number, and submit a copy of the recommendation to the person designated under §763.84 for inclusion in the management plan.

§ 763.90 Response actions.

(a) The local education agency shall select and implement in a timely manner the appropriate response actions in this section consistent with the assessment conducted in §763.88. The response actions selected shall be sufficient to protect human health and the environment. The local education agency may then select, from the response actions which protect human health and the environment, that action which is the least burdensome method. Nothing in this section shall be construed to prohibit removal of ACBM from a school building at any time, should removal be the preferred response action of the local education agency.

(b) If damaged or significantly damaged thermal system insulation ACM is present in a building, the local education agency shall:

(1) At least repair the damaged area.

(2) Remove the damaged material if it is not feasible, due to technological factors, to repair the damage.

(3) Maintain all thermal system insulation ACM and its covering in an intact state and undamaged condition.

(c)(1) If damaged friable surfacing ACM or damaged friable miscellaneous ACM is present in a building, the local education agency shall select from among the following response actions: encapsulation, enclosure, removal, or repair of the damaged material.

(2) In selecting the response action from among those which meet the definitional standards in §763.83, the local education agency shall determine which of these response actions protects human health and the environment. For purposes of determining which of these response actions are the least burdensome, the local education agency may then consider local circumstances, including occupancy and use patterns within the school building, and its economic concerns, including short- and long-term costs.

(d) If significantly damaged friable surfacing ACM or significantly damaged friable miscellaneous ACM is present in a building the local education agency shall:

(1) Immediately isolate the functional space and restrict access, unless

isolation is not necessary to protect human health and the environment.

(2) Remove the material in the functional space or, depending upon whether enclosure or encapsulation would be sufficient to protect human health and the environment, enclose or encapsulate.

(e) If any friable surfacing ACM, thermal system insulation ACM, or friable miscellaneous ACM that has potential for damage is present in a building, the local education agency shall at least implement an operations and maintenance (O&M) program, as described under § 763.91.

(f) If any friable surfacing ACM, thermal system insulation ACM, or friable miscellaneous ACM that has potential for significant damage is present in a building, the local education agency shall:

(1) Implement an O&M program, as described under § 763.91.

(2) Institute preventive measures appropriate to eliminate the reasonable likelihood that the ACM or its covering will become significantly damaged, deteriorated, or delaminated.

(3) Remove the material as soon as possible if appropriate preventive measures cannot be effectively implemented, or unless other response actions are determined to protect human health and the environment. Immediately isolate the area and restrict access if necessary to avoid an imminent and substantial endangerment to human health or the environment.

(g) Response actions including removal, encapsulation, enclosure, or repair, other than small-scale, short-duration repairs, shall be designed and conducted by persons accredited to design and conduct response actions.

(h) The requirements of this subpart E in no way supersede the worker protection and work practice requirements under 29 CFR 1926.58 (Occupational Safety and Health Administration (OSHA) asbestos worker protection standards for construction), 40 CFR part 763, subpart G (EPA asbestos worker protection standards for public employees), and 40 CFR part 61, subpart M (National Emission Standards for Hazardous Air Pollutants—Asbestos).

(i) Completion of response actions. (1) At the conclusion of any action to remove, encapsulate, or enclose ACBM or material assumed to be ACBM, a person designated by the local education agency shall visually inspect each functional space where such action was conducted to determine whether the action has been properly completed.

(2)(i) A person designated by the local education agency shall collect air samples using aggressive sampling as described in appendix A to this subpart E to monitor air for clearance after each removal, encapsulation, and enclosure project involving ACBM, except for projects that are of small-scale, short-duration.

(ii) Local education agencies shall have air samples collected under this section analyzed for asbestos using laboratories accredited by the National Bureau of Standards to conduct such analysis using transmission electron microscopy (TEM) or, under circumstances permitted in this section, laboratories enrolled in the American Industrial Hygiene Association Proficiency Analytical Testing Program for phase contrast microscopy (PCM).

(iii) Until the National Bureau of Standards TEM laboratory accreditation program is operational, local educational agencies shall use laboratories that use the protocol described in appendix A to subpart E of this part.

(3) Except as provided in paragraphs (i)(4), and (i)(5), of this section, an action to remove, encapsulate, or enclose ACBM shall be considered complete when the average concentration of asbestos of five air samples collected within the affected functional space and analyzed by the TEM method in appendix A of this subpart E, is not statistically significantly different, as determined by the Z-test calculation found in appendix A of this subpart E, from the average asbestos concentration of five air samples collected at the same time outside the affected functional space and analyzed in the same manner, and the average asbestos concentration of the three field blanks described in appendix A of this subpart E is below the filter background level, as defined in appendix A of this subpart E, of 70 structures per square millimeter (70 s/mm^2).

(4) An action may also be considered complete if the volume of air drawn for each of the five samples collected within the affected functional space is equal to or greater than 1,199 L of air for a 25 mm filter or equal to or greater than 2,799 L of air for a 37 mm filter, and the average concentration of asbestos as analyzed by the TEM method in appendix A of this subpart E, for the five air samples does not exceed the filter background level, as defined in appendix A, of 70 structures per square millimeter (70 s/mm^2). If the average concentration of asbestos of the five air samples within the affected functional space exceeds 70 s/mm^2, or if the volume of air in each of the samples is less than 1,199 L of air for a 25 mm filter or less than 2,799 L of air for a 37 mm filter, the action shall be considered complete only when the requirements of paragraph (i)(3) or (i)(5), of this section are met.

(5) At any time, a local education agency may analyze air monitoring samples collected for clearance purposes by phase contrast microscopy (PCM) to confirm completion of removal, encapsulation, or enclosure of ACBM that is greater than small-scale, short-duration and less than or equal to 160 square feet or 260 linear feet. The action shall be considered complete when the results of samples collected in the affected functional space and analyzed by phase contrast microscopy using the National Institute for Occupational Safety and Health (NIOSH) Method 7400 entitled ''Fibers'' published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987, show that the concentration of fibers for each of the five samples is less than or equal to a limit of quantitation for PCM (0.01 fibers per cubic centimeter (0.01 f/cm^3) of air). The method is available for public inspection at the Non-Confidential Information Center (NCIC) (7407), Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency, Room B–607 NEM, 401 M St., SW., Washington, DC 20460, between the hours of 12 p.m. and 4 p.m. weekdays excluding legal holidays or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.* This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. The method is incorporated as it exists on the effective date of this rule, and a notice of any change to the method will be published in the FEDERAL REGISTER.

(6) To determine the amount of ACBM affected under paragraph (i)(5) of this section, the local education agency shall add the total square or linear footage of ACBM within the containment barriers used to isolate the functional space for the action to remove, encapsulate, or enclose the ACBM. Contiguous portions of material subject to such action conducted concurrently or at approximately the same time within the same school building shall not be separated to qualify under paragraph (i)(5), of this section.

[52 FR 41846, Oct. 30, 1987, as amended at 53 FR 12525, Apr. 15, 1988; 60 FR 31922, June 19, 1995; 60 FR 34465, July 3, 1995; 69 FR 18803, Apr. 9, 2004]

§ 763.91 Operations and maintenance.

(a) *Applicability.* The local education agency shall implement an operations, maintenance, and repair (O&M) program under this section whenever any friable ACBM is present or assumed to be present in a building that it leases, owns, or otherwise uses as a school building. Any material identified as nonfriable ACBM or nonfriable assumed ACBM must be treated as friable ACBM for purposes of this section when the material is about to become friable as a result of activities performed in the school building.

(b) *Worker protection.* Local education agencies must comply with either the OSHA Asbestos Construction Standard at 29 CFR 1926.1101, or the Asbestos Worker Protection Rule at 40 CFR 763.120, whichever is applicable.

(c) *Cleaning*—(1) *Initial cleaning.* Unless the building has been cleaned using equivalent methods within the previous 6 months, all areas of a school building where friable ACBM, damaged

or significantly damaged thermal system insulation ACM, or friable suspected ACBM assumed to be ACM are present shall be cleaned at least once after the completion of the inspection required by § 763.85(a) and before the initiation of any response action, other than O&M activities or repair, according to the following procedures:

(i) HEPA-vacuum or steam-clean all carpets.

(ii) HEPA-vacuum or wet-clean all other floors and all other horizontal surfaces.

(iii) Dispose of all debris, filters, mopheads, and cloths in sealed, leak-tight containers.

(2) *Additional cleaning.* The accredited management planner shall make a written recommendation to the local education agency whether additional cleaning is needed, and if so, the methods and frequency of such cleaning.

(d) *Operations and maintenance activities.* The local education agency shall ensure that the procedures described below to protect building occupants shall be followed for any operations and maintenance activities disturbing friable ACBM:

(1) Restrict entry into the area by persons other than those necessary to perform the maintenance project, either by physically isolating the area or by scheduling.

(2) Post signs to prevent entry by unauthorized persons.

(3) Shut off or temporarily modify the air-handling system and restrict other sources of air movement.

(4) Use work practices or other controls, such as, wet methods, protective clothing, HEPA-vacuums, mini-enclosures, glove bags, as necessary to inhibit the spread of any released fibers.

(5) Clean all fixtures or other components in the immediate work area.

(6) Place the asbestos debris and other cleaning materials in a sealed, leak-tight container.

(e) *Maintenance activities other than small-scale, short-duration.* The response action for any maintenance activities disturbing friable ACBM, other than small-scale, short-duration maintenance activities, shall be designed by persons accredited to design response actions and conducted by persons accredited to conduct response actions.

(f) *Fiber release episodes*—(1) *Minor fiber release episode.* The local education agency shall ensure that the procedures described below are followed in the event of a minor fiber release episode (i.e., the falling or dislodging of 3 square or linear feet or less of friable ACBM): 5

(i) Thoroughly saturate the debris using wet methods.

(ii) Clean the area, as described in paragraph (e) of this section.

(iii) Place the asbestos debris in a sealed, leak-tight container.

(iv) Repair the area of damaged ACM with materials such as asbestos-free spackling, plaster, cement, or insulation, or seal with latex paint or an encapsulant, or immediately have the appropriate response action implemented as required by § 763.90.

(2) *Major fiber release episode.* The local education agency shall ensure that the procedures described below are followed in the event of a major fiber release episode (i.e., the falling or dislodging of more than 3 square or linear feet of friable ACBM):

(i) Restrict entry into the area and post signs to prevent entry into the area by persons other than those necessary to perform the response action.

(ii) Shut off or temporarily modify the air-handling system to prevent the distribution of fibers to other areas in the building.

(iii) The response action for any major fiber release episode must be designed by persons accredited to design response actions and conducted by persons accredited to conduct response actions.

[52 FR 41846, Oct. 30, 1987, as amended at 65 FR 69216, Nov. 15, 2000]

§ 763.92 Training and periodic surveillance.

(a) *Training.* (1) The local education agency shall ensure, prior to the implementation of the O&M provisions of the management plan, that all members of its maintenance and custodial staff (custodians, electricians, heating/air conditioning engineers, plumbers, etc.) who may work in a building that contains ACBM receive awareness training of at least 2 hours, whether or not they are required to work with ACBM. New custodial and maintenance

employees shall be trained within 60 days after commencement of employment. Training shall include, but not be limited to:

(i) Information regarding asbestos and its various uses and forms.

(ii) Information on the health effects associated with asbestos exposure.

(iii) Locations of ACBM identified throughout each school building in which they work.

(iv) Recognition of damage, deterioration, and delamination of ACBM.

(v) Name and telephone number of the person designated to carry out general local education agency responsibilities under §763.84 and the availability and location of the management plan.

(2) The local education agency shall ensure that all members of its maintenance and custodial staff who conduct any activities that will result in the disturbance of ACBM shall receive training described in paragraph (a)(1) of this section and 14 hours of additional training. Additional training shall include, but not be limited to:

(i) Descriptions of the proper methods of handling ACBM.

(ii) Information on the use of respiratory protection as contained in the EPA/NIOSH *Guide to Respiratory Protection for the Asbestos Abatement Industry,* September 1986 (EPA 560/OPPTS–86–001), available from the Director, Environmental Assistance Division (7408), Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency, Room E–543B, 1200 Pennsylvania Ave., NW., Washington, DC 20460, Telephone: (202) 554–1404, TDD: (202) 544–0551 and other personal protection measures.

(iii) The provisions of this section and §763.91, Appendices A, C, and D of this subpart E of this part, EPA regulations contained in 40 CFR part 763, subpart G, and in 40 CFR part 61, subpart M, and OSHA regulations contained in 29 CFR 1926.58.

(iv) Hands-on training in the use of respiratory protection, other personal protection measures, and good work practices.

(3) Local education agency maintenance and custodial staff who have attended EPA-approved asbestos training or received equivalent training for O&M and periodic surveillance activities involving asbestos shall be considered trained for the purposes of this section.

(b) *Periodic surveillance.* (1) At least once every 6 months after a management plan is in effect, each local education agency shall conduct periodic surveillance in each building that it leases, owns, or otherwise uses as a school building that contains ACBM or is assumed to contain ACBM.

(2) Each person performing periodic surveillance shall:

(i) Visually inspect all areas that are identified in the management plan as ACBM or assumed ACBM.

(ii) Record the date of the surveillance, his or her name, and any changes in the condition of the materials.

(iii) Submit to the person designated to carry out general local education agency responsibilities under §763.84 a copy of such record for inclusion in the management plan.

[52 FR 41846, Oct. 30, 1987, as amended at 60 FR 34465, July 3, 1995; 65 FR 69216, Nov. 15, 2000]

§763.93 Management plans.

(a)(1) On or before October 12, 1988, each local education agency shall develop an asbestos management plan for each school, including all buildings that they lease, own, or otherwise use as school buildings, and submit the plan to an Agency designated by the Governor of the State in which the local education agency is located. The plan may be submitted in stages that cover a portion of the school buildings under the authority of the local education agency.

(2) If a building to be used as part of a school is leased or otherwise acquired after October 12, 1988, the local education agency shall include the new building in the management plan for the school prior to its use as a school building. The revised portions of the management plan shall be submitted to the Agency designated by the Governor.

(3) If a local education agency begins to use a building as a school after October 12, 1988, the local education agency shall submit a management plan for the school to the Agency designated by

the Governor prior to its use as a school.

(b) On or before October 17, 1987, the Governor of each State shall notify local education agencies in the State regarding where to submit their management plans. States may establish administrative procedures for reviewing management plans. If the Governor does not disapprove a management plan within 90 days after receipt of the plan, the local education agency shall implement the plan.

(c) Each local education agency must begin implementation of its management plan on or before July 9, 1989, and complete implementation in a timely fashion.

(d) Each local education agency shall maintain and update its management plan to keep it current with ongoing operations and maintenance, periodic surveillance, inspection, reinspection, and response action activities. All provisions required to be included in the management plan under this section shall be retained as part of the management plan, as well as any information that has been revised to bring the plan up-to-date.

(e) The management plan shall be developed by an accredited management planner and shall include:

(1) A list of the name and address of each school building and whether the school building contains friable ACBM, nonfriable ACBM, and friable and nonfriable suspected ACBM assumed to be ACM.

(2) For each inspection conducted before the December 14, 1987:

(i) The date of the inspection.

(ii) A blueprint, diagram, or written description of each school building that identifies clearly each location and approximate square or linear footage of any homogeneous or sampling area where material was sampled for ACM, and, if possible, the exact locations where bulk samples were collected, and the dates of collection.

(iii) A copy of the analyses of any bulk samples, dates of analyses, and a copy of any other laboratory reports pertaining to the analyses.

(iv) A description of any response actions or preventive measures taken to reduce asbestos exposure, including if possible, the names and addresses of all contractors involved, start and completion dates of the work, and results of any air samples analyzed during and upon completion of the work.

(v) A description of assessments, required to be made under § 763.88, of material that was identified before December 14, 1987, as friable ACBM or friable suspected ACBM assumed to be ACM, and the name and signature, State of accreditation, and if applicable, accreditation number of each accredited person making the assessments.

(3) For each inspection and reinspection conducted under § 763.85:

(i) The date of the inspection or reinspection and the name and signature, State of accreditation and, if applicable, the accreditation number of each accredited inspector performing the inspection or reinspection.

(ii) A blueprint, diagram, or written description of each school building that identifies clearly each location and approximate square or linear footage of homogeneous areas where material was sampled for ACM, the exact location where each bulk sample was collected, date of collection, homogeneous areas where friable suspected ACBM is assumed to be ACM, and where nonfriable suspected ACBM is assumed to be ACM.

(iii) A description of the manner used to determine sampling locations, and the name and signature of each accredited inspector collecting samples, the State of accreditation, and if applicable, his or her accreditation number.

(iv) A copy of the analyses of any bulk samples collected and analyzed, the name and address of any laboratory that analyzed bulk samples, a statement that the laboratory meets the applicable requirements of § 763.87(a) the date of analysis, and the name and signature of the person performing the analysis.

(v) A description of assessments, required to be made under § 763.88, of all ACBM and suspected ACBM assumed to be ACM, and the name, signature, State of accreditation, and if applicable, accreditation number of each accredited person making the assessments.

(4) The name, address, and telephone number of the person designated under § 763.84 to ensure that the duties of the

local education agency are carried out, and the course name, and dates and hours of training taken by that person to carry out the duties.

(5) The recommendations made to the local education agency regarding response actions, under §763.88(d), the name, signature, State of accreditation of each person making the recommendations, and if applicable, his or her accreditation number.

(6) A detailed description of preventive measures and response actions to be taken, including methods to be used, for any friable ACBM, the locations where such measures and action will be taken, reasons for selecting the response action or preventive measure, and a schedule for beginning and completing each preventive measure and response action.

(7) With respect to the person or persons who inspected for ACBM and who will design or carry out response actions, except for operations and maintenance, with respect to the ACBM, one of the following statements:

(i) If the State has adopted a contractor accreditation program under section 206(b) of Title II of the Act, a statement that the person(s) is accredited under such plan.

(ii) A statement that the local education agency used (or will use) persons who have been accredited by another State which has adopted a contractor accreditation plan under section 206(b) of Title II of the Act or is accredited by an EPA-approved course under section 206(c) of Title II of the Act.

(8) A detailed description in the form of a blueprint, diagram, or in writing of any ACBM or suspected ACBM assumed to be ACM which remains in the school once response actions are undertaken pursuant to §763.90. This description shall be updated as response actions are completed.

(9) A plan for reinspection under §763.85, a plan for operations and maintenance activities under §763.91, and a plan for periodic surveillance under §763.92, a description of the recommendation made by the management planner regarding additional cleaning under §763.91(c)(2) as part of an operations and maintenance program, and the response of the local education agency to that recommendation.

(10) A description of steps taken to inform workers and building occupants, or their legal guardians, about inspections, reinspections, response actions, and post-response action activities, including periodic reinspection and surveillance activities that are planned or in progress.

(11) An evaluation of the resources needed to complete response actions successfully and carry out reinspection, operations and maintenance activities, periodic surveillance and training.

(12) With respect to each consultant who contributed to the management plan, the name of the consultant and one of the following statements:

(i) If the State has adopted a contractor accreditation plan under section 206(b) of Title II of the Act, a statement that the consultant is accredited under such plan.

(ii) A statement that the contractor is accredited by another State which has adopted a contractor accreditation plan under section 206(b) of Title II of the Act, or is accredited by an EPA-approved course developed under section 206(c) of Title II of the Act.

(f) A local education agency may require each management plan to contain a statement signed by an accredited management plan developer that such person has prepared or assisted in the preparation of such plan or has reviewed such plan, and that such plan is in compliance with this subpart E. Such statement may not be signed by a person who, in addition to preparing or assisting in preparing the management plan, also implements (or will implement) the management plan.

(g)(1) Upon submission of a management plan to the Governor for review, a local education agency shall keep a copy of the plan in its administrative office. The management plans shall be available, without cost or restriction, for inspection by representatives of EPA and the State, the public, including teachers, other school personnel and their representatives, and parents. The local education agency may charge a reasonable cost to make copies of management plans.

(2) Each local education agency shall maintain in its administrative office a complete, updated copy of a management plan for each school under its administrative control or direction. The management plans shall be available, during normal business hours, without cost or restriction, for inspection by representatives of EPA and the State, the public, including teachers, other school personnel and their representatives, and parents. The local education agency may charge a reasonable cost to make copies of management plans.

(3) Each school shall maintain in its administrative office a complete, updated copy of the management plan for that school. Management plans shall be available for inspection, without cost or restriction, to workers before work begins in any area of a school building. The school shall make management plans available for inspection to representatives of EPA and the State, the public, including parents, teachers, and other school personnel and their representatives within 5 working days after receiving a request for inspection. The school may charge a reasonable cost to make copies of the management plan.

(4) Upon submission of its management plan to the Governor and at least once each school year, the local education agency shall notify in writing parent, teacher, and employee organizations of the availability of management plans and shall include in the management plan a description of the steps taken to notify such organizations, and a dated copy of the notification. In the absence of any such organizations for parents, teachers, or employees, the local education agency shall provide written notice to that relevant group of the availability of management plans and shall include in the management plan a description of the steps taken to notify such groups, and a dated copy of the notification.

(h) Records required under § 763.94 shall be made by local education agencies and maintained as part of the management plan.

(i) Each management plan must contain a true and correct statement, signed by the individual designated by the local education agency under § 763.84, which certifies that the general, local education agency responsibilities, as stipulated by § 763.84, have been met or will be met.

§ 763.94 Recordkeeping.

(a) Records required under this section shall be maintained in a centralized location in the administrative office of both the school and the local education agency as part of the management plan. For each homogeneous area where all ACBM has been removed, the local education agency shall ensure that such records are retained for 3 years after the next reinspection required under § 763.85(b)(1), or for an equivalent period.

(b) For each preventive measure and response action taken for friable and nonfriable ACBM and friable and nonfriable suspected ACBM assumed to be ACM, the local education agency shall provide:

(1) A detailed written description of the measure or action, including methods used, the location where the measure or action was taken, reasons for selecting the measure or action, start and completion dates of the work, names and addresses of all contractors involved, and if applicable, their State of accreditation, and accreditation numbers, and if ACBM is removed, the name and location of storage or disposal site of the ACM.

(2) The name and signature of any person collecting any air sample required to be collected at the completion of certain response actions specified by § 763.90(i), the locations where samples were collected, date of collection, the name and address of the laboratory analyzing the samples, the date of analysis, the results of the analysis, the method of analysis, the name and signature of the person performing the analysis, and a statement that the laboratory meets the applicable requirements of § 763.90(i)(2)(ii).

(c) For each person required to be trained under § 763.92(a) (1) and (2), the local education agency shall provide the person's name and job title, the date that training was completed by that person, the location of the training, and the number of hours completed in such training.

(d) For each time that periodic surveillance under § 763.92(b) is performed,

the local education agency shall record the name of each person performing the surveillance, the date of the surveillance, and any changes in the conditions of the materials.

(e) For each time that cleaning under §763.91(c) is performed, the local education agency shall record the name of each person performing the cleaning, the date of such cleaning, the locations cleaned, and the methods used to perform such cleaning.

(f) For each time that operations and maintenance activities under §763.91(d) are performed, the local education agency shall record the name of each person performing the activity, the start and completion dates of the activity, the locations where such activity occurred, a description of the activity including preventive measures used, and if ACBM is removed, the name and location of storage or disposal site of the ACM.

(g) For each time that major asbestos activity under §763.91(e) is performed, the local education agency shall provide the name and signature, State of accreditation, and if applicable, the accreditation number of each person performing the activity, the start and completion dates of the activity, the locations where such activity occurred, a description of the activity including preventive measures used, and if ACBM is removed, the name and location of storage or disposal site of the ACM.

(h) For each fiber release episode under §763.91(f), the local education agency shall provide the date and location of the episode, the method of repair, preventive measures or response action taken, the name of each person performing the work, and if ACBM is removed, the name and location of storage or disposal site of the ACM.

(Approved by the Office of Management and Budget under control number 2070–0091)

§763.95 Warning labels.

(a) The local education agency shall attach a warning label immediately adjacent to any friable and nonfriable ACBM and suspected ACBM assumed to be ACM located in routine maintenance areas (such as boiler rooms) at each school building. This shall include:

(1) Friable ACBM that was responded to by a means other than removal.

(2) ACBM for which no response action was carried out.

(b) All labels shall be prominently displayed in readily visible locations and shall remain posted until the ACBM that is labeled is removed.

(c) The warning label shall read, in print which is readily visible because of large size or bright color, as follows:

CAUTION: ASBESTOS. HAZARDOUS. DO NOT DISTURB WITHOUT PROPER TRAINING AND EQUIPMENT.

§763.97 Compliance and enforcement.

(a) *Compliance with Title II of the Act.* (1) Section 207(a) of Title II of the Act (15 U.S.C. 2647) makes it unlawful for any local education agency to:

(i) Fail to conduct inspections pursuant to section 203(b) of Title II of the Act, including failure to follow procedures and failure to use accredited personnel and laboratories.

(ii) Knowingly submit false information to the Governor regarding any inspection pursuant to regulations under section 203(i) of Title II of the Act.

(iii) Fail to develop a management plan pursuant to regulations under section 203(i) of Title II of the Act.

(2) Section 207(a) of Title II of the Act (15 U.S.C. 2647) also provides that any local education agency which violates any provision of section 207 shall be liable for a civil penalty of not more than $5,000 for each day during which the violation continues. For the purposes of this subpart, a ''violation'' means a failure to comply with respect to a single school building.

(b) *Compliance with Title I of the Act.* (1) Section 15(1)(D) of Title I of the Act (15 U.S.C. 2614) makes it unlawful for any person to fail or refuse to comply with any requirement of Title II or any rule promulgated or order issued under Title II. Therefore, any person who violates any requirement of this subpart is in violation of section 15 of Title I of the Act.

(2) Section 15(3) of Title I of the Act (15 U.S.C. 2614) makes it unlawful for any person to fail or refuse to establish or maintain records, submit reports, notices or other information, or permit access to or copying of records, as required by this Act or a rule thereunder.

(3) Section 15(4) (15 U.S.C. 2614) of Title I of the Act makes it unlawful for any person to fail or refuse to permit entry or inspection as required by section 11 of Title I of the Act.

(4) Section 16(a) of Title I of the Act (15 U.S.C. 2615) provides that any person who violates any provision of section 15 of Title I of the Act shall be liable to the United States for a civil penalty in an amount not to exceed $25,000 for each such violation. Each day such a violation continues shall, for purposes of this paragraph, constitute a separate violation of section 15. A local education agency is not liable for any civil penalty under Title I of the Act for failing or refusing to comply with any rule promulgated or order issued under Title II of the Act.

(c) *Criminal penalties.* If any violation committed by any person (including a local education agency) is knowing or willful, criminal penalties may be assessed under section 16(b) of Title I of the Act.

(d) *Injunctive relief.* The Agency may obtain injunctive relief under section 208(b) of Title II of the Act to respond to a hazard which poses an imminent and substantial endangerment to human health or the environment or section 17 (15 U.S.C. 2616) of Title I of the Act to restrain any violation of section 15 of Title I of the Act or to compel the taking of any action required by or under Title I of the Act.

(e) *Citizen complaints.* Any citizen who wishes to file a complaint pursuant to section 207(d) of Title II of the Act should direct the complaint to the Governor of the State or the EPA Asbestos Ombudsman, 1200 Pennsylvania Ave., NW., Washington, DC 20460. The citizen complaint should be in writing and identified as a citizen complaint pursuant to section 207(d) of Title II of TSCA. The EPA Asbestos Ombudsman or the Governor shall investigate and respond to the complaint within a reasonable period of time if the allegations provide a reasonable basis to believe that a violation of the Act has occurred.

(f) *Inspections.* EPA may conduct inspections and review management plans under section 11 of Title I of the Act (15 U.S.C. 2610) to ensure compliance.

§ 763.98 Waiver; delegation to State.

(a) *General.* (1) Upon request from a state Governor and after notice and comment and an opportunity for a public hearing in accordance with paragraphs (b) and (c) of this section, EPA may waive some or all of the requirements of this subpart E if the state has established and is implementing or intends to implement a program of asbestos inspection and management that contains requirements that are at least as stringent as the requirements of this subpart. In addition, if the state chooses to receive electronic documents, the state program must include, at a minimum, the requirements of 40 CFR part 3—(Electronic reporting).

(2) A waiver from any requirement of this subpart E shall apply only to the specific provision for which a waiver has been granted under this section. All requirements of this subpart E shall apply until a waiver is granted under this section.

(b) *Request.* Each request by a Governor to waive any requirement of this subpart E shall be sent with three complete copies of the request to the Regional Administrator for the EPA Region in which the State is located and shall include:

(1) A copy of the State provisions or proposed provisions relating to its program of asbestos inspection and management in schools for which the request is made.

(2)(i) The name of the State agency that is or will be responsible for administering and enforcing the requirements for which a waiver is requested, the names and job titles of responsible officials in that agency, and phone numbers where the officials can be contacted.

(ii) In the event that more than one agency is or will be responsible for administering and enforcing the requirements for which a waiver is requested, a description of the functions to be performed by each agency, how the program will be coordinated by the lead agency to ensure consistency and effective administration in the asbestos inspection and management program within the State, the names and job titles of responsible officials in the agencies, and phone numbers where the officials can be contacted. The lead agency

will serve as the central contact point for the EPA.

(3) Detailed reasons, supporting papers, and the rationale for concluding that the state's asbestos inspection and management program provisions for which the request is made are at least as stringent as the requirements of Subpart E of this part, and that, if the state chooses to receive electronic documents, the state program includes, at a minimum, the requirements of 40 CFR part 3—(Electronic reporting).

(4) A discussion of any special situations, problems, and needs pertaining to the waiver request accompanied by an explanation of how the State intends to handle them.

(5) A statement of the resources that the State intends to devote to the administration and enforcement of the provisions relating to the waiver request.

(6) Copies of any specific or enabling State laws (enacted and pending enactment) and regulations (promulgated and pending promulgation) relating to the request, including provisions for assessing criminal and/or civil penalties.

(7) Assurance from the Governor, the Attorney General, or the legal counsel of the lead agency that the lead agency or other cooperating agencies have the legal authority necessary to carry out the requirements relating to the request.

(c) *General notice—hearing.* (1) Within 30 days after receipt of a request for a waiver, EPA will determine the completeness of the request. If EPA does not request further information within the 30-day period, the request will be deemed complete.

(2) Within 30 days after EPA determines that a request is complete, EPA will issue for publication in the FEDERAL REGISTER a notice that announces receipt of the request, describes the information submitted under paragraph (b) of this section, and solicits written comment from interested members of the public. Comments must be submitted within 60 days.

(3) If, during the comment period, EPA receives a written objection to a Governor's request and a request for a public hearing detailing specific objections to the granting of a waiver, EPA will schedule a public hearing to be held in the affected State after the close of the comment period and will announce the public hearing date in the FEDERAL REGISTER before the date of the hearing. Each comment shall include the name and address of the person submitting the comment.

(d) *Criteria.* EPA may waive some or all of the requirements of subpart E of this part if:

(1) The State's lead agency and other cooperating agencies have the legal authority necessary to carry out the provisions of asbestos inspection and management in schools relating to the waiver request.

(2) The State's program of asbestos inspection and management in schools relating to the waiver request and implementation of the program are or will be at least as stringent as the requirements of this subpart E.

(3) The state has an enforcement mechanism to allow it to implement the program described in the waiver request and any electronic reporting requirements are at least as stringent as 40 CFR part 3—(Electronic reporting).

(4) The lead agency and any cooperating agencies have or will have qualified personnel to carry out the provisions relating to the waiver request.

(5) The State will devote adequate resources to the administration and enforcement of the asbestos inspection and management provisions relating to the waiver request.

(6) When specified by EPA, the State gives satisfactory assurances that necessary steps, including specific actions it proposes to take and a time schedule for their accomplishment, will be taken within a reasonable time to conform with applicable criteria under paragraphs (d) (2) through (4) of this section.

(e) *Decision.* EPA will issue for publication in the FEDERAL REGISTER a notice announcing its decision to grant or deny, in whole or in part, a Governor's request for a waiver from some or all of the requirements of this subpart E within 30 days after the close of the comment period or within 30 days following a public hearing, whichever is applicable. The notice will include the Agency's reasons and rationale for

granting or denying the Governor's request. The 30-day period may be extended if mutually agreed upon by EPA and the State.

(f) *Modifications.* When any substantial change is made in the administration or enforcement of a State program for which a waiver was granted under this section, a responsible official in the lead agency shall submit such changes to EPA.

(g) *Reports.* The lead agency in each State that has been granted a waiver by EPA from any requirement of subpart E of this part shall submit a report to the Regional Administrator for the Region in which the State is located at least once every 12 months to include the following information:

(1) A summary of the State's implementation and enforcement activities during the last reporting period relating to provisions waived under this section, including enforcement actions taken.

(2) Any changes in the administration or enforcement of the State program implemented during the last reporting period.

(3) Other reports as may be required by EPA to carry out effective oversight of any requirement of this subpart E that was waived under this section.

(h) *Oversight.* EPA may periodically evaluate the adequacy of a State's implementation and enforcement of and resources devoted to carrying out requirements relating to the waiver. This evaluation may include, but is not limited to, site visits to local education agencies without prior notice to the State.

(i) *Informal conference.* (1) EPA may request that an informal conference be held between appropriate State and EPA officials when EPA has reason to believe that a State has failed to:

(i) Substantially comply with the terms of any provision that was waived under this section.

(ii) Meet the criteria under paragraph (d) of this section, including the failure to carry out enforcement activities or act on violations of the State program.

(2) EPA will:

(i) Specify to the State those aspects of the State's program believed to be inadequate.

(ii) Specify to the State the facts that underlie the belief of inadequacy.

(3) If EPA finds, on the basis of information submitted by the State at the conference, that deficiencies did not exist or were corrected by the State, no further action is required.

(4) Where EPA finds that deficiencies in the State program exist, a plan to correct the deficiencies shall be negotiated between the State and EPA. The plan shall detail the deficiencies found in the State program, specify the steps the State has taken or will take to remedy the deficiencies, and establish a schedule for each remedial action to be initiated.

(j) *Rescission.* (1) If the State fails to meet with EPA or fails to correct deficiencies raised at the informal conference, EPA will deliver to the Governor of the State and a responsible official in the lead agency a written notice of its intent to rescind, in whole or part, the waiver.

(2) EPA will issue for publication in the FEDERAL REGISTER a notice that announces the rescission of the waiver, describes those aspects of the State's program determined to be inadequate, and specifies the facts that underlie the findings of inadequacy.

[52 FR 41846, Oct. 30, 1987, as amended at 70 FR 59889, Oct. 13, 2005]

§ 763.99 Exclusions.

(a) A local education agency shall not be required to perform an inspection under § 763.85(a) in any sampling area as defined in 40 CFR 763.103 or homogeneous area of a school building where:

(1) An accredited inspector has determined that, based on sampling records, friable ACBM was identified in that homogeneous or sampling area during an inspection conducted before December 14, 1987. The inspector shall sign and date a statement to that effect with his or her State of accreditation and if applicable, accreditation number and, within 30 days after such determination, submit a copy of the statement to the person designated under § 763.84 for inclusion in the management plan. However, an accredited inspector shall assess the friable ACBM under § 763.88.

(2) An accredited inspector has determined that, based on sampling records,

nonfriable ACBM was identified in that homogeneous or sampling area during an inspection conducted before December 14, 1987. The inspector shall sign and date a statement to that effect with his or her State of accreditation and if applicable, accreditation number and, within 30 days after such determination, submit a copy of the statement to the person designated under §763.84 for inclusion in the management plan. However, an accredited inspector shall identify whether material that was nonfriable has become friable since that previous inspection and shall assess the newly-friable ACBM under §763.88.

(3) Based on sampling records and inspection records, an accredited inspector has determined that no ACBM is present in the homogeneous or sampling area and the records show that the area was sampled, before December 14, 1987 in substantial compliance with §763.85(a), which for purposes of this section means in a random manner and with a sufficient number of samples to reasonably ensure that the area is not ACBM.

(i) The accredited inspector shall sign and date a statement, with his or her State of accreditation and if applicable, accreditation number that the homogeneous or sampling area determined not to be ACBM was sampled in substantial compliance with §763.85(a).

(ii) Within 30 days after the inspector's determination, the local education agency shall submit a copy of the inspector's statement to the EPA Regional Office and shall include the statement in the management plan for that school.

(4) The lead agency responsible for asbestos inspection in a State that has been granted a waiver from §763.85(a) has determined that, based on sampling records and inspection records, no ACBM is present in the homogeneous or sampling area and the records show that the area was sampled before December 14, 1987, in substantial compliance with §763.85(a). Such determination shall be included in the management plan for that school.

(5) An accredited inspector has determined that, based on records of an inspection conducted before December 14, 1987, suspected ACBM identified in that homogeneous or sampling area is assumed to be ACM. The inspector shall sign and date a statement to that effect, with his or her State of accreditation and if applicable, accreditation number and, within 30 days of such determination, submit a copy of the statement to the person designated under §763.84 for inclusion in the management plan. However, an accredited inspector shall identify whether material that was nonfriable suspected ACBM assumed to be ACM has become friable since the previous inspection and shall assess the newly friable material and previously identified friable suspected ACBM assumed to be ACM under §763.88.

(6) Based on inspection records and contractor and clearance records, an accredited inspector has determined that no ACBM is present in the homogeneous or sampling area where asbestos removal operations have been conducted before December 14, 1987, and shall sign and date a statement to that effect and include his or her State of accreditation and, if applicable, accreditation number. The local education agency shall submit a copy of the statement to the EPA Regional Office and shall include the statement in the management plan for that school.

(7) An architect or project engineer responsible for the construction of a new school building built after October 12, 1988, or an accredited inspector signs a statement that no ACBM was specified as a building material in any construction document for the building, or, to the best of his or her knowledge, no ACBM was used as a building material in the building. The local education agency shall submit a copy of the signed statement of the architect, project engineer, or accredited inspector to the EPA Regional Office and shall include the statement in the management plan for that school.

(b) The exclusion, under paragraphs (a) (1) through (4) of this section, from conducting the inspection under §763.85(a) shall apply only to homogeneous or sampling areas of a school building that were inspected and sampled before October 17, 1987. The local

education agency shall conduct an inspection under §763.85(a) of all areas inspected before October 17, 1987, that were not sampled or were not assumed to be ACM.

(c) If ACBM is subsequently found in a homogeneous or sampling area of a local education agency that had been identified as receiving an exclusion by an accredited inspector under paragraphs (a) (3), (4), (5) of this section, or an architect, project engineer or accredited inspector under paragraph (a)(7) of this section, the local education agency shall have 180 days following the date of identification of ACBM to comply with this subpart E.

APPENDIX A TO SUBPART E OF PART 763—INTERIM TRANSMISSION ELECTRON MICROSCOPY ANALYTICAL METHODS—MANDATORY AND NON-MANDATORY—AND MANDATORY SECTION TO DETERMINE COMPLETION OF RESPONSE ACTIONS

I. Introduction

The following appendix contains three units. The first unit is the mandatory transmission electron microscopy (TEM) method which all laboratories must follow; it is the minimum requirement for analysis of air samples for asbestos by TEM. The mandatory method contains the essential elements of the TEM method. The second unit contains the complete non-mandatory method. The non-mandatory method supplements the mandatory method by including additional steps to improve the analysis. EPA recommends that the non-mandatory method be employed for analyzing air filters; however, the laboratory may choose to employ the mandatory method. The non-mandatory method contains the same minimum requirements as are outlined in the mandatory method. Hence, laboratories may choose either of the two methods for analyzing air samples by TEM.

The final unit of this Appendix A to subpart E defines the steps which must be taken to determine completion of response actions. This unit is mandatory.

II. Mandatory Transmission Electron Microscopy Method

A. Definitions of Terms

1. *Analytical sensitivity*—Airborne asbestos concentration represented by each fiber counted under the electron microscope. It is determined by the air volume collected and the proportion of the filter examined. This method requires that the analytical sensitivity be no greater than 0.005 structures/cm^3.

2. *Asbestiform*—A specific type of mineral fibrosity in which the fibers and fibrils possess high tensile strength and flexibility.

3. *Aspect ratio*—A ratio of the length to the width of a particle. Minimum aspect ratio as defined by this method is equal to or greater than 5:1.

4. *Bundle*—A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

5. *Clean area*—A controlled environment which is maintained and monitored to assure a low probability of asbestos contamination to materials in that space. Clean areas used in this method have HEPA filtered air under positive pressure and are capable of sustained operation with an open laboratory blank which on subsequent analysis has an average of less than 18 structures/mm^2 in an area of 0.057 mm^2 (nominally 10 200-mesh grid openings) and a maximum of 53 structures/mm^2 for any single preparation for that same area.

6. *Cluster*—A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

7. *ED*—Electron diffraction.

8. *EDXA*—Energy dispersive X-ray analysis.

9. *Fiber*—A structure greater than or equal to 0.5 μm in length with an aspect ratio (length to width) of 5:1 or greater and having substantially parallel sides.

10. *Grid*—An open structure for mounting on the sample to aid in its examination in the TEM. The term is used here to denote a 200-mesh copper lattice approximately 3 mm in diameter.

11. *Intersection*—Nonparallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater.

12. *Laboratory sample coordinator*—That person responsible for the conduct of sample handling and the certification of the testing procedures.

13. *Filter background level*—The concentration of structures per square millimeter of filter that is considered indistinguishable from the concentration measured on a blank (filters through which no air has been drawn). For this method the filter background level is defined as 70 structures/mm^2.

14. *Matrix*—Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

15. *NSD*—No structure detected.

16. *Operator*—A person responsible for the TEM instrumental analysis of the sample.

17. *PCM*—Phase contrast microscopy.

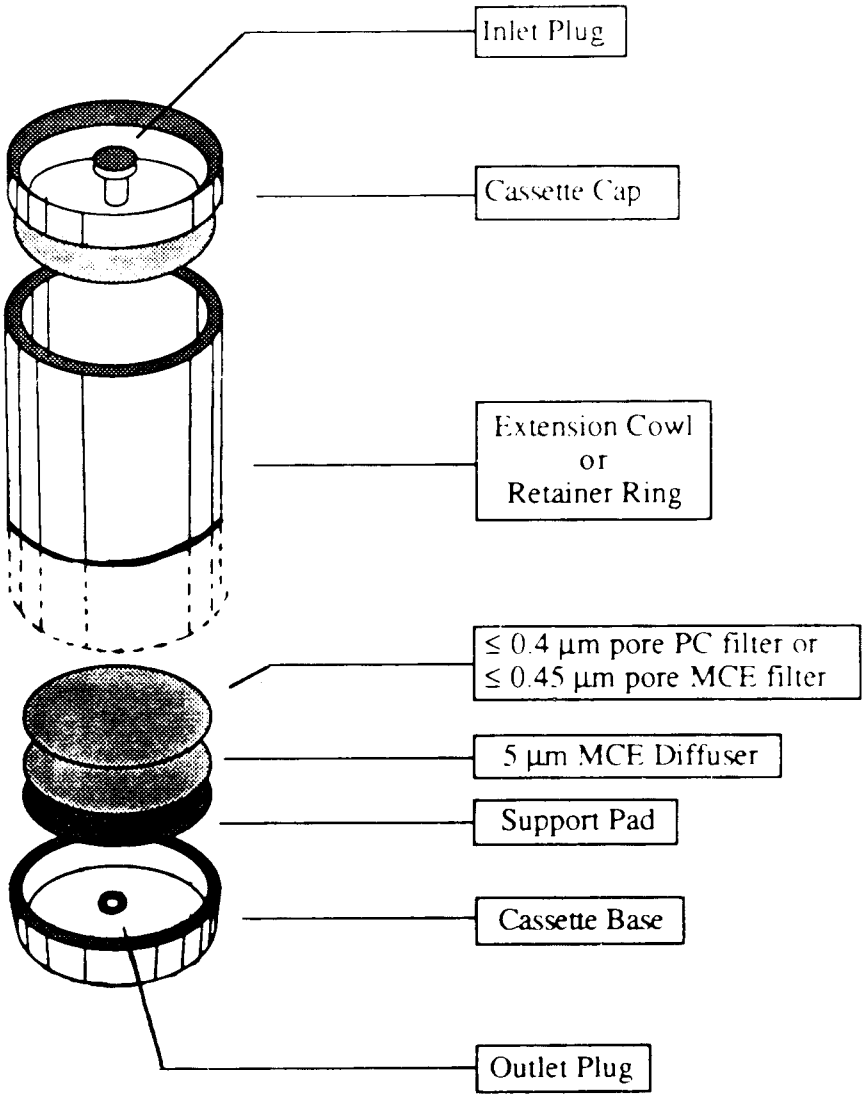
18. *SAED*—Selected area electron diffraction.

19. *SEM*—Scanning electron microscope.
20. *STEM*—Scanning transmission electron microscope.
21. *Structure*—a microscopic bundle, cluster, fiber, or matrix which may contain asbestos.
22. *S/cm³*—Structures per cubic centimeter.
23. *S/mm²*—Structures per square millimeter.
24. *TEM*—Transmission electron microscope.

B. Sampling

1. The sampling agency must have written quality control procedures and documents which verify compliance.
2. Sampling operations must be performed by qualified individuals completely independent of the abatement contractor to avoid possible conflict of interest (References 1, 2, 3, and 5 of Unit II.J.).
3. Sampling for airborne asbestos following an abatement action must use commercially available cassettes.
4. Prescreen the loaded cassette collection filters to assure that they do not contain concentrations of asbestos which may interfere with the analysis of the sample. A filter blank average of less than 18 s/mm² in an area of 0.057 mm² (nominally 10 200-mesh grid openings) and a single preparation with a maximum of 53 s/mm² for that same area is acceptable for this method.
5. Use sample collection filters which are either polycarbonate having a pore size less than or equal to 0.4 μm or mixed cellulose ester having a pore size less than or equal to 0.45 μm.
6. Place these filters in series with a 5.0 μm backup filter (to serve as a diffuser) and a support pad. See the following Figure 1:

FIGURE I--SAMPLING CASSETTE CONFIGURATION



7. Reloading of used cassettes is not permitted.

8. Orient the cassette downward at approximately 45 degrees from the horizontal.

9. Maintain a log of all pertinent sampling information.

10. Calibrate sampling pumps and their flow indicators over the range of their intended use with a recognized standard. Assemble the sampling system with a representative filter (not the filter which will be used in sampling) before and after the sampling operation.

11. Record all calibration information.

12. Ensure that the mechanical vibrations from the pump will be minimized to prevent transferral of vibration to the cassette.

13. Ensure that a continuous smooth flow of negative pressure is delivered by the pump by damping out any pump action fluctuations if necessary.

14. The final plastic barrier around the abatement area remains in place for the sampling period.

15. After the area has passed a thorough visual inspection, use aggressive sampling conditions to dislodge any remaining dust. (See suggested protocol in Unit III.B.7.d.)

16. Select an appropriate flow rate equal to or greater than 1 liter per minute (L/min) or less than 10 L/min for 25 mm cassettes. Larger filters may be operated at proportionally higher flow rates.

17. A minimum of 13 samples are to be collected for each testing site consisting of the following:

a. A minimum of five samples per abatement area.

b. A minimum of five samples per ambient area positioned at locations representative of the air entering the abatement site.

c. Two field blanks are to be taken by removing the cap for not more than 30 seconds and replacing it at the time of sampling before sampling is initiated at the following places:

i. Near the entrance to each abatement area.

ii. At one of the ambient sites. (DO NOT leave the field blanks open during the sampling period.)

d. A sealed blank is to be carried with each sample set. This representative cassette is not to be opened in the field.

18. Perform a leak check of the sampling system at each indoor and outdoor sampling site by activating the pump with the closed sampling cassette in line. Any flow indicates a leak which must be eliminated before initiating the sampling operation.

19. The following Table I specifies volume ranges to be used:

TABLE 1--NUMBER OF 200 MESH EM GRID OPENINGS ($0.0057\ MM^2$) THAT NEED TO BE ANALYZED TO MAINTAIN SENSITIVITY OF 0.005 STRUCTURES/CC BASED ON VOLUME AND EFFECTIVE FILTER AREA

	Effective Filter Area 385 sq mm		Effective Filter Area 855 sq mm	
	Volume (liters)	# of grid openings	Volume (liters)	# of grid openings
	560	*24*	*1,250*	*24*
	600	23	1,300	23
	700	19	1,400	21
	800	17	1,600	19
	900	15	1,800	17
	1,000	14	2,000	15
	1,100	12	2,200	14
	1,200	**11**	2,400	13
	1,300	**10**	2,600	12
Recommended Volume Range	**1,400**	**10**	**2,800**	**11**
	1,500	**9**	**3,000**	**10**
	1,600	**8**	**3,200**	**9**
	1,700	**8**	**3,400**	**9**
	1,800	**8**	**3,600**	**8**
	1,900	7	**3,800**	**8**
	2,000	7	**4,000**	**8**
	2,100	6	4,200	7
	2,200	6	4,400	7
	2,300	6	4,600	7
	2,400	6	4,800	6
	2,500	5	5,000	6
	2,600	5	5,200	6
	2,700	5	5,400	6
	2,800	5	5,600	5
	2,900	5	5,800	5
	3,000	5	6,000	5
	3,100	4	6,200	5
	3,200	4	6,400	5
	3,300	4	6,600	5
	3,400	4	6,800	4
	3,500	4	7,000	4
	3,600	4	7,200	4
	3,700	4	7,400	4
	3,800	4	7,600	4
				Recommended Volume Range

Note minimum volumes required:
25 mm : 560 liters
37 mm : 1250 liters

Filter diameter of 25 mm = effective area of 385 sq mm
Filter diameter of 37 mm = effective area of 855 sq mm

20. Ensure that the sampler is turned upright before interrupting the pump flow.

21. Check that all samples are clearly labeled and that all pertinent information has been enclosed before transfer of the samples to the laboratory.

22. Ensure that the samples are stored in a secure and representative location.

23. Do not change containers if portions of these filters are taken for other purposes.

24. A summary of Sample Data Quality Objectives is shown in the following Table II:

TABLE II--SUMMARY OF SAMPLING AGENCY DATA QUALITY OBJECTIVES

This table summarizes the data quality objectives from the performance of this method in terms of precision, accuracy, completeness, representativeness, and comparability. These objectives are assured by the periodic control checks and reference checks listed here and described in the text of the method.

Unit Operation	QC Check	Frequency	Conformance Expectation
Sampling materials	Sealed blank	1 per I/O site	95%
Sample procedures	Field blanks	2 per I/O site	95%
	Pump calibration	Before and after each field series	90%
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample shipment	Review of sending report	Each sample	95% complete

C. Sample Shipment

Ship bulk samples to the analytical laboratory in a separate container from air samples.

D. Sample Receiving

1. Designate one individual as sample coordinator at the laboratory. While that individual will normally be available to receive samples, the coordinator may train and supervise others in receiving procedures for those times when he/she is not available.

2. Bulk samples and air samples delivered to the analytical laboratory in the same container shall be rejected.

E. Sample Preparation

1. All sample preparation and analysis shall be performed by a laboratory independent of the abatement contractor.

2. Wet-wipe the exterior of the cassettes to minimize contamination possibilities before taking them into the clean room facility.

3. Perform sample preparation in a well-equipped clean facility.

NOTE: The clean area is required to have the following minimum characteristics. The area or hood must be capable of maintaining a positive pressure with make-up air being HEPA-filtered. The cumulative analytical blank concentration must average less than 18 s/mm^2 in an area of 0.057 mm^2 (nominally 10 200-mesh grid openings) and a single preparation with a maximum of 53 s/mm^2 for that same area.

4. Preparation areas for air samples must not only be separated from preparation areas for bulk samples, but they must be prepared in separate rooms.

5. Direct preparation techniques are required. The object is to produce an intact film containing the particulates of the filter surface which is sufficiently clear for TEM analysis.

a. TEM Grid Opening Area measurement must be done as follows:

i. The filter portion being used for sample preparation must have the surface collapsed using an acetone vapor technique.

ii. Measure 20 grid openings on each of 20 random 200-mesh copper grids by placing a grid on a glass and examining it under the PCM. Use a calibrated graticule to measure the average field diameters. From the data, calculate the field area for an average grid opening.

iii. Measurements can also be made on the TEM at a properly calibrated low magnification or on an optical microscope at a magnification of approximately 400X by using an eyepiece fitted with a scale that has been calibrated against a stage micrometer. Optical microscopy utilizing manual or automated procedures may be used providing instrument calibration can be verified.

b. TEM specimen preparation from polycarbonate (PC) filters. Procedures as described in Unit III.G. or other equivalent methods may be used.

c. TEM specimen preparation from mixed cellulose ester (MCE) filters.

i. Filter portion being used for sample preparation must have the surface collapsed using an acetone vapor technique or the Burdette procedure (Ref. 7 of Unit II.J.)

ii. Plasma etching of the collapsed filter is required. The microscope slide to which the collapsed filter pieces are attached is placed in a plasma asher. Because plasma ashers vary greatly in their performance, both from unit to unit and between different positions in the asher chamber, it is difficult to specify the conditions that should be used. Insufficient etching will result in a failure to expose embedded filters, and too much etching may result in loss of particulate from the surface. As an interim measure, it is recommended that the time for ashing of a

known weight of a collapsed filter be established and that the etching rate be calculated in terms of micrometers per second. The actual etching time used for the particulate asher and operating conditions will then be set such that a 1–2 μm (10 percent) layer of collapsed surface will be removed.

iii. Procedures as described in Unit III. or other equivalent methods may be used to prepare samples.

F. TEM Method

1. An 80–120 kV TEM capable of performing electron diffraction with a fluorescent screen inscribed with calibrated gradations is required. If the TEM is equipped with EDXA it must either have a STEM attachment or be capable of producing a spot less than 250 nm in diameter at crossover. The microscope shall be calibrated routinely for magnification and camera constant.

2. *Determination of Camera Constant and ED Pattern Analysis.* The camera length of the TEM in ED operating mode must be calibrated before ED patterns on unknown samples are observed. This can be achieved by using a carbon-coated grid on which a thin film of gold has been sputtered or evaporated. A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis ED patterns superimposed with a ring pattern from the polycrystalline gold film. In practice, it is desirable to optimize the thickness of the gold film so that only one or two sharp rings are obtained on the superimposed ED pattern. Thicker gold film would normally give multiple gold rings, but it will tend to mask weaker diffraction spots from the unknown fibrous particulate. Since the unknown d-spacings of most interest in asbestos analysis are those which lie closest to the transmitted beam, multiple gold rings are unnecessary on zone-axis ED patterns. An average camera constant using multiple gold rings can be determined. The camera constant is one-half the diameter of the rings times the interplanar spacing of the ring being measured.

3. *Magnification Calibration.* The magnification calibration must be done at the fluorescent screen. The TEM must be calibrated at the grid opening magnification (if used) and also at the magnification used for fiber counting. This is performed with a cross grating replica (e.g., one containing 2,160 lines/mm). Define a field of view on the fluorescent screen either by markings or physical boundaries. The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric). A logbook must be maintained, and the dates of calibration and the values obtained must be recorded. The frequency of calibration depends on the past history of the particular microscope. After any maintenance of the microscope that involved adjustment of the power supplied to the lenses or the high-voltage system or the mechanical disassembly of the electron optical column apart from filament exchange, the magnification must be recalibrated. Before the TEM calibration is performed, the analyst must ensure that the cross grating replica is placed at the same distance from the objective lens as the specimens are. For instruments that incorporate a eucentric tilting specimen stage, all specimens and the cross grating replica must be placed at the eucentric position.

4. While not required on every microscope in the laboratory, the laboratory must have either one microscope equipped with energy dispersive X-ray analysis or access to an equivalent system on a TEM in another laboratory.

5. Microscope settings: 80–120 kV, grid assessment 250–1,000X, then 15,000–20,000X screen magnification for analysis.

6. Approximately one-half (0.5) of the predetermined sample area to be analyzed shall be performed on one sample grid preparation and the remaining half on a second sample grid preparation.

7. Individual grid openings with greater than 5 percent openings (holes) or covered with greater than 25 percent particulate matter or obviously having nonuniform loading must not be analyzed.

8. Reject the grid if:

a. Less than 50 percent of the grid openings covered by the replica are intact.

b. The replica is doubled or folded.

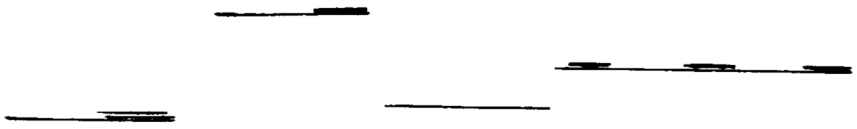
c. The replica is too dark because of incomplete dissolution of the filter.

9. *Recording Rules.*

a. Any continuous grouping of particles in which an asbestos fiber with an aspect ratio greater than or equal to 5:1 and a length greater than or equal to 0.5 μm is detected shall be recorded on the count sheet. These will be designated asbestos structures and will be classified as fibers, bundles, clusters, or matrices. Record as individual fibers any contiguous grouping having 0, 1, or 2 definable intersections. Groupings having more than 2 intersections are to be described as cluster or matrix. An intersection is a nonparallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater. See the following Figure 2:

FIGURE 2--COUNTING GUIDELINES USED IN DETERMINING ASBESTOS STRUCTURES

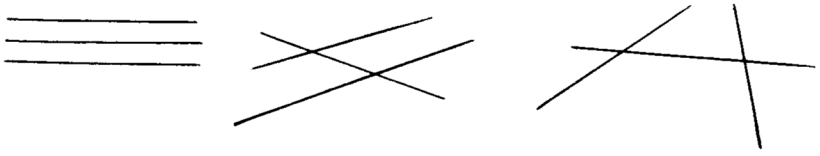
Count as 1 fiber; 1 Structure; no intersections.



Count as 2 fibers if space between fibers is greater than width of 1 fiber diameter or number of intersections is equal to or less than 1.

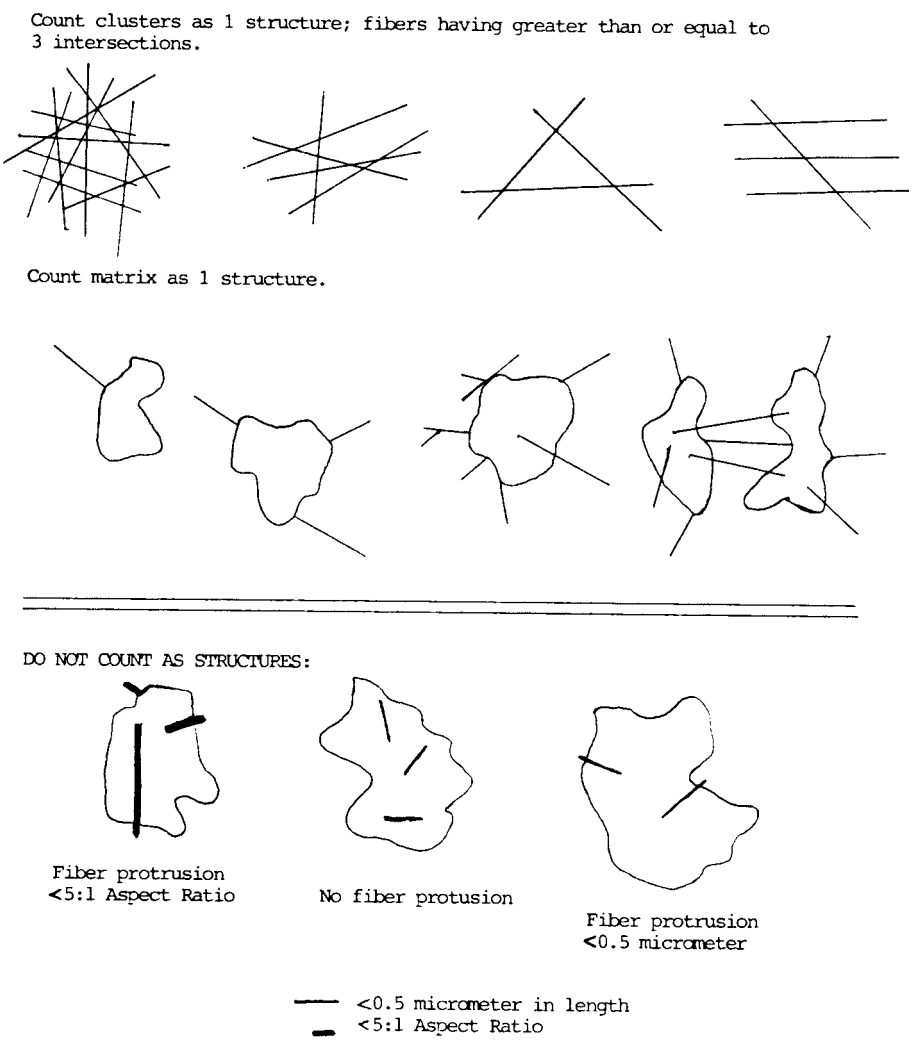


Count as 3 structures if space between fibers is greater than width of 1 fiber diameter or if the number of intersections is equal to or less than 2.



Count bundles as 1 structure; 3 or more parallel fibrils less than 1 fiber diameter separation.





i. *Fiber.* A structure having a minimum length greater than or equal to 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

ii. *Bundle.* A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

iii. *Cluster.* A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

iv. *Matrix.* Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

b. Separate categories will be maintained for fibers less than 5 μm and for fibers equal to or greater than 5 μm in length.

c. Record NSD when no structures are detected in the field.

d. Visual identification of electron diffraction (ED) patterns is required for each asbestos structure counted which would cause the

analysis to exceed the 70 s/mm² concentration. (Generally this means the first four fibers identified as asbestos must exhibit an identifiable diffraction pattern for chrysotile or amphibole.)

e. The micrograph number of the recorded diffraction patterns must be reported to the client and maintained in the laboratory's quality assurance records. In the event that examination of the pattern by a qualified individual indicates that the pattern has been misidentified visually, the client shall be contacted.

f. Energy Dispersive X-ray Analysis (EDXA) is required of all amphiboles which would cause the analysis results to exceed the 70 s/mm² concentration. (Generally speaking, the first 4 amphiboles would require EDXA.)

g. If the number of fibers in the non-asbestos class would cause the analysis to exceed the 70 s/mm² concentration, the fact that they are not asbestos must be confirmed by EDXA or measurement of a zone axis diffraction pattern.

h. Fibers classified as chrysotile must be identified by diffraction or X-ray analysis and recorded on a count sheet. X-ray analysis alone can be used only after 70 s/mm² have been exceeded for a particular sample.

i. Fibers classified as amphiboles must be identified by X-ray analysis and electron diffraction and recorded on the count sheet. (X-ray analysis alone can be used only after 70 s/mm² have been exceeded for a particular sample.)

j. If a diffraction pattern was recorded on film, record the micrograph number on the count sheet.

k. If an electron diffraction was attempted but no pattern was observed, record N on the count sheet.

l. If an EDXA spectrum was attempted but not observed, record N on the count sheet.

m. If an X-ray analysis spectrum is stored, record the file and disk number on the count sheet.

10. Classification Rules.

a. *Fiber.* A structure having a minimum length greater than or equal to 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

b. *Bundle.* A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

c. *Cluster.* A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

d. *Matrix.* Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

11. After finishing with a grid, remove it from the microscope, and replace it in the appropriate grid holder. Sample grids must be stored for a minimum of 1 year from the date of the analysis; the sample cassette must be retained for a minimum of 30 days by the laboratory or returned at the client's request.

G. Sample Analytical Sequence

1. Under the present sampling requirements a minimum of 13 samples is to be collected for the clearance testing of an abatement site. These include five abatement area samples, five ambient samples, two field blanks, and one sealed blank.

2. Carry out visual inspection of work site prior to air monitoring.

3. Collect a minimum of 5 air samples inside the work site and 5 samples outside the work site. The indoor and outdoor samples shall be taken during the same time period.

4. Remaining steps in the analytical sequence are contained in Unit IV of this Appendix.

H. Reporting

1. The following information must be reported to the client for each sample analyzed:

a. Concentration in structures per square millimeter and structures per cubic centimeter.

b. Analytical sensitivity used for the analysis.

c. Number of asbestos structures.

d. Area analyzed.

e. Volume of air sampled (which must be initially supplied to lab by client).

f. Copy of the count sheet must be included with the report.

g. Signature of laboratory official to indicate that the laboratory met specifications of the method.

h. Report form must contain official laboratory identification (e.g., letterhead).

i. Type of asbestos.

I. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of sensitive sampling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filter and the actual examination of this grid in the microscope. Each of these unit operations must produce a product of defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards are to be performed along with the sample analysis as indicators that the materials used are adequate and the

operations are within acceptable limits. In this way, the quality of the data is defined and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the following Table III:

TABLE III--SUMMARY OF LABORATORY DATA QUALITY OBJECTIVES

Unit Operation	QC Check	Frequency	Conformance Expectation
Sample receiving	Review of receiving report	Each sample	95% complete
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample preparation	Supplies and reagents	On receipt	Meet specs. or reject
	Grid opening size	20 openings/20 grids/lot of 1000 or 1 opening/sample	100%
	Special clean area monitoring	After cleaning or service	Meet specs or reclean
	Laboratory blank	1 per prep series or 10%	Meet specs. or reanalyze series
	Plasma etch blank	1 per 20 samples	75%
	Multiple preps (3 per sample)	Each sample	One with cover of 15 complete grid sqs.
Sample analysis	System check	Each day	Each day
	Alignment check	Each day	Each day
	Magnification calibration with low and high standards	Each month or after service	95%
	ED calibration by gold standard	Weekly	95%
	EDS calibration by copper line	Daily	95%
Performance check	Laboratory blank (measure of cleanliness)	Prep 1 per series or 10% read 1 per 25 samples	Meet specs or reanalyze series
	Replicate counting (measure of precision)	1 per 100 samples	1.5 x Poisson Std. Dev.
	Duplicate analysis (measure of reproducibility)	1 per 100 samples	2 x Poisson Std. Dev.
	Known samples of typical materials (working standards)	Training and for comparison with unknowns	100%
	Analysis of NBS SRM 1876 and/or RM 8410 (measure of accuracy and comparability)	1 per analyst per year	1.5 x Poisson Std. Dev.
	Data entry review (data validation and measure of completeness)	Each sample	95%
	Record and verify ID electron diffraction pattern of structure	1 per 5 samples	80% accuracy
Calculations and data reduction	Hand calculation of automated data reduction procedure or independent recalculation of hand-calculated data	1 per 100 samples	85%

1. When the samples arrive at the laboratory, check the samples and documentation for completeness and requirements before initiating the analysis.

2. Check all laboratory reagents and supplies for acceptable asbestos background levels.

3. Conduct all sample preparation in a clean room environment monitored by laboratory blanks. Testing with blanks must also be done after cleaning or servicing the room.

4. Prepare multiple grids of each sample.

5. Provide laboratory blanks with each sample batch. Maintain a cumulative average of these results. If there are more than 53 fibers/mm² per 10 200-mesh grid openings, the system must be checked for possible sources of contamination.

6. Perform a system check on the transmission electron microscope daily.

7. Make periodic performance checks of magnification, electron diffraction and energy dispersive X-ray systems as set forth in Table III under Unit II.I.

8. Ensure qualified operator performance by evaluation of replicate analysis and standard sample comparisons as set forth in Table III under Unit II.I.

9. Validate all data entries.

10. Recalculate a percentage of all computations and automatic data reduction steps as specified in Table III under Unit II.I.

11. Record an electron diffraction pattern of one asbestos structure from every five samples that contain asbestos. Verify the identification of the pattern by measurement or comparison of the pattern with patterns collected from standards under the same conditions. The records must also demonstrate that the identification of the pattern has been verified by a qualified individual and that the operator who made the identification is maintaining at least an 80 percent correct visual identification based on his measured patterns.

12. Appropriate logs or records must be maintained by the analytical laboratory verifying that it is in compliance with the mandatory quality assurance procedures.

J. References

For additional background information on this method, the following references should be consulted.

1. ''Guidance for Controlling Asbestos-Containing Materials in Buildings,'' EPA 560/5–85–024, June 1985.

2. ''Measuring Airborne Asbestos Following an Abatement Action,'' USEPA, Office of Pollution Prevention and Toxics, EPA 600/4–85–049, 1985.

3. Small, John and E. Steel. Asbestos Standards: Materials and Analytical Methods. N.B.S. Special Publication 619, 1982.

4. Campbell, W.J., R.L. Blake, L.L. Brown, E.E. Cather, and J.J. Sjoberg. Selected Silicate Minerals and Their Asbestiform Varieties. Information Circular 8751, U.S. Bureau of Mines, 1977.

5. Quality Assurance Handbook for Air Pollution Measurement System. Ambient Air Methods, EPA 600/4–77–027a, USEPA, Office of Research and Development, 1977.

6. Method 2A: Direct Measurement of Gas Volume through Pipes and Small Ducts. 40 CFR Part 60 Appendix A.

7. Burdette, G.J., Health & Safety Exec. Research & Lab. Services Div., London, ''Proposed Analytical Method for Determination of Asbestos in Air.''

8. Chatfield, E.J., Chatfield Tech. Cons., Ltd., Clark, T., PEI Assoc., ''Standard Operating Procedure for Determination of Airborne Asbestos Fibers by Transmission Electron Microscopy Using Polycarbonate Membrane Filters,'' WERL SOP 87–1, March 5, 1987.

9. NIOSH Method 7402 for Asbestos Fibers, 12–11–86 Draft.

10. Yamate, G., Agarwall, S.C., Gibbons, R.D., IIT Research Institute, ''Methodology for the Measurement of Airborne Asbestos by Electron Microscopy,'' Draft report, USEPA Contract 68–02–3266, July 1984.

11. ''Guidance to the Preparation of Quality Assurance Project Plans,'' USEPA, Office of Pollution Prevention and Toxics, 1984.

III. Nonmandatory Transmission Electron Microscopy Method

A. Definitions of Terms

1. *Analytical sensitivity*—Airborne asbestos concentration represented by each fiber counted under the electron microscope. It is determined by the air volume collected and the proportion of the filter examined. This method requires that the analytical sensitivity be no greater than 0.005 s/cm³.

2. *Asbestiform*—A specific type of mineral fibrosity in which the fibers and fibrils possess high tensile strength and flexibility.

3. *Aspect ratio*—A ratio of the length to the width of a particle. Minimum aspect ratio as defined by this method is equal to or greater than 5:1.

4. *Bundle*—A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

5. *Clean area*—A controlled environment which is maintained and monitored to assure a low probability of asbestos contamination to materials in that space. Clean areas used in this method have HEPA filtered air under positive pressure and are capable of sustained operation with an open laboratory blank which on subsequent analysis has an average of less than 18 structures/mm² in an area of 0.057 mm² (nominally 10 200 mesh grid openings) and a maximum of 53 structures/mm² for no more than one single preparation for that same area.

6. *Cluster*—A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

7. *ED*—Electron diffraction.

8. *EDXA*—Energy dispersive X-ray analysis.

9. *Fiber*—A structure greater than or equal to 0.5 μm in length with an aspect ratio (length to width) of 5:1 or greater and having substantially parallel sides.

10. *Grid*—An open structure for mounting on the sample to aid in its examination in the TEM. The term is used here to denote a 200-mesh copper lattice approximately 3 mm in diameter.

11. *Intersection*—Nonparallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater.

12. *Laboratory sample coordinator*—That person responsible for the conduct of sample handling and the certification of the testing procedures.

13. *Filter background level*—The concentration of structures per square millimeter of filter that is considered indistinguishable from the concentration measured on blanks (filters through which no air has been drawn). For this method the filter background level is defined as 70 structures/mm^2.

14. *Matrix*—Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

15. *NSD*—No structure detected.

16. *Operator*—A person responsible for the TEM instrumental analysis of the sample.

17. *PCM*—Phase contrast microscopy.

18. *SAED*—Selected area electron diffraction.

19. *SEM*—Scanning electron microscope.

20. *STEM*—Scanning transmission electron microscope.

21. *Structure*—a microscopic bundle, cluster, fiber, or matrix which may contain asbestos.

22. *S/cm^3*—Structures per cubic centimeter.

23. *S/mm^2*—Structures per square millimeter.

24. *TEM*—Transmission electron microscope.

B. Sampling

1. Sampling operations must be performed by qualified individuals completely independent of the abatement contractor to avoid possible conflict of interest (See References 1, 2, and 5 of Unit III.L.) Special precautions should be taken to avoid contamination of the sample. For example, materials that have not been prescreened for their asbestos background content should not be used; also, sample handling procedures which do not take cross contamination possibilities into account should not be used.

2. Material and supply checks for asbestos contamination should be made on all critical supplies, reagents, and procedures before their use in a monitoring study.

3. Quality control and quality assurance steps are needed to identify problem areas and isolate the cause of the contamination (see Reference 5 of Unit III.L.). Control checks shall be permanently recorded to document the quality of the information produced. The sampling firm must have written quality control procedures and documents which verify compliance. Independent audits by a qualified consultant or firm should be performed once a year. All documentation of compliance should be retained indefinitely to provide a guarantee of quality. A summary of Sample Data Quality Objectives is shown in Table II of Unit II.B.

4. Sampling materials.

a. Sample for airborne asbestos following an abatement action using commercially available cassettes.

b. Use either a cowling or a filter-retaining middle piece. Conductive material may reduce the potential for particulates to adhere to the walls of the cowl.

c. Cassettes must be verified as ''clean'' prior to use in the field. If packaged filters are used for loading or preloaded cassettes are purchased from the manufacturer or a distributor, the manufacturer's name and lot number should be entered on all field data sheets provided to the laboratory, and are required to be listed on all reports from the laboratory.

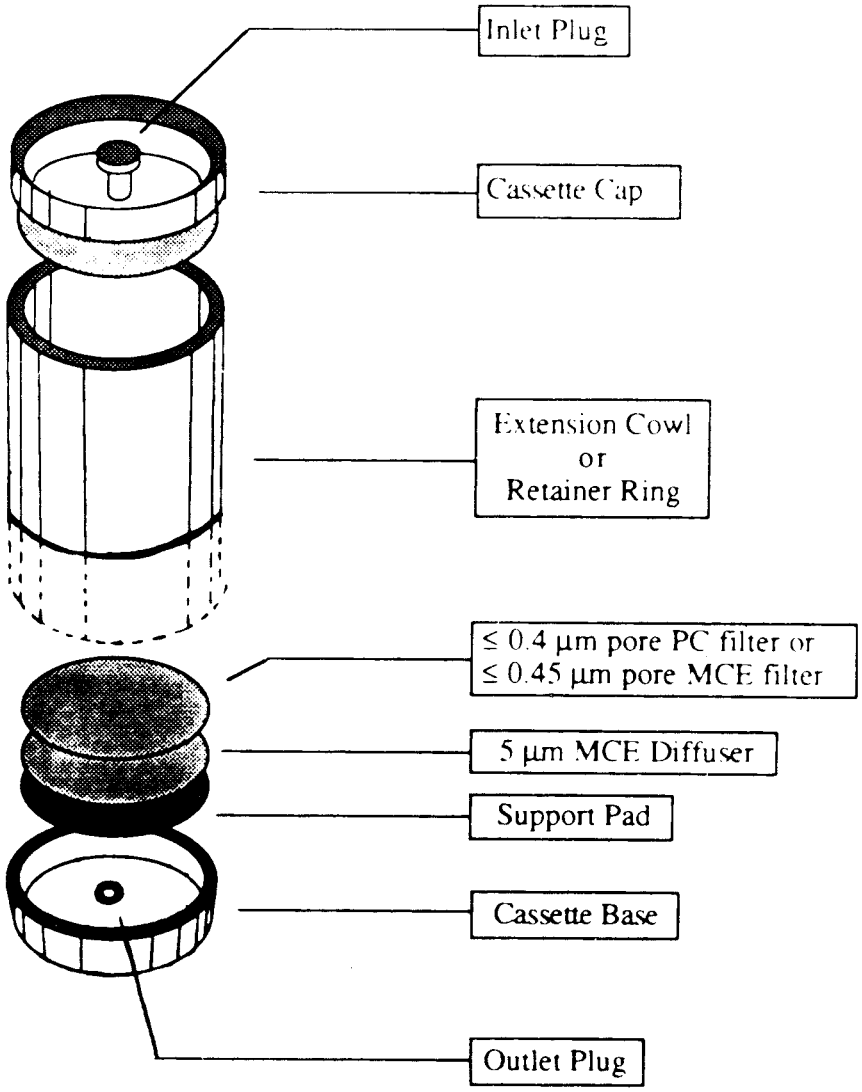
d. Assemble the cassettes in a clean facility (See definition of clean area under Unit III.A.).

e. Reloading of used cassettes is not permitted.

f. Use sample collection filters which are either polycarbonate having a pore size of less than or equal to 0.4 μm or mixed cellulose ester having a pore size of less than or equal to 0.45 μm.

g. Place these filters in series with a backup filter with a pore size of 5.0 μm (to serve as a diffuser) and a support pad. See the following Figure 1:

FIGURE I--SAMPLING CASSETTE CONFIGURATION



h. When polycarbonate filters are used, position the highly reflective face such that the incoming particulate is received on this surface.

i. Seal the cassettes to prevent leakage around the filter edges or between cassette part joints. A mechanical press may be useful to achieve a reproducible leak-free seal.

Shrink fit gel-bands may be used for this purpose and are available from filter manufacturers and their authorized distributors.

j. Use wrinkle-free loaded cassettes in the sampling operation.

5. Pump setup.

a. Calibrate the sampling pump over the range of flow rates and loads anticipated for the monitoring period with this flow measuring device in series. Perform this calibration using guidance from EPA Method 2A each time the unit is sent to the field (See Reference 6 of Unit III.L.).

b. Configure the sampling system to preclude pump vibrations from being transmitted to the cassette by using a sampling stand separate from the pump station and making connections with flexible tubing.

c. Maintain continuous smooth flow conditions by damping out any pump action fluctuations if necessary.

d. Check the sampling system for leaks with the end cap still in place and the pump operating before initiating sample collection. Trace and stop the source of any flow indicated by the flowmeter under these conditions.

e. Select an appropriate flow rate equal to or greater than 1 L/min or less than 10 L/min for 25 mm cassettes. Larger filters may be operated at proportionally higher flow rates.

f. Orient the cassette downward at approximately 45 degrees from the horizontal.

g. Maintain a log of all pertinent sampling information, such as pump identification number, calibration data, sample location, date, sample identification number, flow rates at the beginning, middle, and end, start and stop times, and other useful information or comments. Use of a sampling log form is recommended. See the following Figure 2:

FIGURE 2--SAMPLING LOG FORM

Sample Number	Location of Sample	Pump I.D.	Start Time	Middle Time	End Time	Flow Rate

Inspector: _____ Date: _____

h. Initiate a chain of custody procedure at the start of each sampling, if this is requested by the client.

i. Maintain a close check of all aspects of the sampling operation on a regular basis.

j. Continue sampling until at least the minimum volume is collected, as specified in the following Table I:

TABLE 1--NUMBER OF 200 MESH EM GRID OPENINGS ($0.0057\ MM^2$) THAT NEED TO BE ANALYZED TO MAINTAIN SENSITIVITY OF 0.005 STRUCTURES/CC BASED ON VOLUME AND EFFECTIVE FILTER AREA

	Effective Filter Area 385 sq mm		Effective Filter Area 855 sq mm	
	Volume (liters)	# of grid openings	Volume (liters)	# of grid openings
	560	*24*	*1,250*	*24*
	600	23	1,300	23
	700	19	1,400	21
	800	17	1,600	19
	900	15	1,800	17
	1,000	14	2,000	15
	1,100	12	2,200	14
Recommended Volume Range	**1,200**	**11**	2,400	13
	1,300	**10**	2,600	12
	1,400	**10**	**2,800**	**11**
	1,500	**9**	**3,000**	**10**
	1,600	**8**	**3,200**	**9**
	1,700	**8**	**3,400**	**9**
	1,800	**8**	**3,600**	**8**
	1,900	7	**3,800**	**8**
	2,000	7	**4,000**	**8**
	2,100	6	4,200	7
	2,200	6	4,400	7
	2,300	6	4,600	7
	2,400	6	4,800	6
	2,500	5	5,000	6
	2,600	5	5,200	6
	2,700	5	5,400	6
	2,800	5	5,600	5
	2,900	5	5,800	5
	3,000	5	6,000	5
	3,100	4	6,200	5
	3,200	4	6,400	5
	3,300	4	6,600	5
	3,400	4	6,800	4
	3,500	4	7,000	4
	3,600	4	7,200	4
	3,700	4	7,400	4
	3,800	4	7,600	4

Recommended Volume Range

Note minimum volumes required:
25 mm : 560 liters
37 mm : 1250 liters

Filter diameter of 25 mm = effective area of 385 sq mm
Filter diameter of 37 mm = effective area of 855 sq mm

k. At the conclusion of sampling, turn the cassette upward before stopping the flow to minimize possible particle loss. If the sampling is resumed, restart the flow before reorienting the cassette downward. Note the condition of the filter at the conclusion of sampling.

l. Double check to see that all information has been recorded on the data collection forms and that the cassette is securely closed and appropriately identified using a waterproof label. Protect cassettes in individual clean resealed polyethylene bags. Bags are to be used for storing cassette caps when they are removed for sampling purposes. Caps and plugs should only be removed or replaced using clean hands or clean disposable plastic gloves.

m. Do not change containers if portions of these filters are taken for other purposes.

6. Minimum sample number per site. A minimum of 13 samples are to be collected for each testing consisting of the following:

a. A minimum of five samples per abatement area.

b. A minimum of five samples per ambient area positioned at locations representative of the air entering the abatement site.

c. Two field blanks are to be taken by removing the cap for not more than 30 sec and replacing it at the time of sampling before sampling is initiated at the following places:

i. Near the entrance to each ambient area.

ii. At one of the ambient sites.

(NOTE: Do not leave the blank open during the sampling period.)

d. A sealed blank is to be carried with each sample set. This representative cassette is not to be opened in the field.

7. Abatement area sampling.

a. Conduct final clearance sampling only after the primary containment barriers have been removed; the abatement area has been thoroughly dried; and, it has passed visual inspection tests by qualified personnel. (See Reference 1 of Unit III.L.)

b. Containment barriers over windows, doors, and air passageways must remain in place until the TEM clearance sampling and analysis is completed and results meet clearance test criteria. The final plastic barrier remains in place for the sampling period.

c. Select sampling sites in the abatement area on a random basis to provide unbiased and representative samples.

d. After the area has passed a thorough visual inspection, use aggressive sampling conditions to dislodge any remaining dust.

i. Equipment used in aggressive sampling such as a leaf blower and/or fan should be properly cleaned and decontaminated before use.

ii. Air filtration units shall remain on during the air monitoring period.

iii. Prior to air monitoring, floors, ceiling and walls shall be swept with the exhaust of a minimum one (1) horsepower leaf blower.

iv. Stationary fans are placed in locations which will not interfere with air monitoring equipment. Fan air is directed toward the ceiling. One fan shall be used for each 10,000 ft^3 of worksite.

v. Monitoring of an abatement work area with high-volume pumps and the use of circulating fans will require electrical power. Electrical outlets in the abatement area may be used if available. If no such outlets are available, the equipment must be supplied with electricity by the use of extension cords and strip plug units. All electrical power supply equipment of this type must be approved Underwriter Laboratory equipment that has not been modified. All wiring must be grounded. Ground fault interrupters should be used. Extreme care must be taken to clean up any residual water and ensure that electrical equipment does not become wet while operational.

vi. Low volume pumps may be carefully wrapped in 6-mil polyethylene to insulate the pump from the air. High volume pumps cannot be sealed in this manner since the heat of the motor may melt the plastic. The pump exhausts should be kept free.

vii. If recleaning is necessary, removal of this equipment from the work area must be handled with care. It is not possible to completely decontaminate the pump motor and parts since these areas cannot be wetted. To minimize any problems in this area, all equipment such as fans and pumps should be carefully wet wiped prior to removal from the abatement area. Wrapping and sealing low volume pumps in 6-mil polyethylene will provide easier decontamination of this equipment. Use of clean water and disposable wipes should be available for this purpose.

e. Pump flow rate equal to or greater than 1 L/min or less than 10 L/min may be used for 25 mm cassettes. The larger cassette diameters may have comparably increased flow.

f. Sample a volume of air sufficient to ensure the minimum quantitation limits. (See Table I of Unit III.B.5.j.)

8. Ambient sampling.

a. Position ambient samplers at locations representative of the air entering the abatement site. If makeup air entering the abatement site is drawn from another area of the building which is outside of the abatement area, place the pumps in the building, pumps should be placed out of doors located near the building and away from any obstructions that may influence wind patterns. If construction is in progress immediately outside the enclosure, it may be necessary to select another ambient site. Samples should be representative of any air entering the work site.

b. Locate the ambient samplers at least 3 ft apart and protect them from adverse weather conditions.

c. Sample same volume of air as samples taken inside the abatement site.

C. Sample Shipment

1. Ship bulk samples in a separate container from air samples. Bulk samples and air samples delivered to the analytical laboratory in the same container shall be rejected.

2. Select a rigid shipping container and pack the cassettes upright in a noncontaminating nonfibrous medium such as a bubble pack. The use of resealable polyethylene bags may help to prevent jostling of individual cassettes.

3. Avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials because of possible contamination.

4. Include a shipping bill and a detailed listing of samples shipped, their descriptions

and all identifying numbers or marks, sampling data, shipper's name, and contact information. For each sample set, designate which are the ambient samples, which are the abatement area samples, which are the field blanks, and which is the sealed blank if sequential analysis is to be performed.

5. Hand-carry samples to the laboratory in an upright position if possible; otherwise choose that mode of transportation least likely to jar the samples in transit.

6. Address the package to the laboratory sample coordinator by name when known and alert him or her of the package description, shipment mode, and anticipated arrival as part of the chain of custody and sample tracking procedures. This will also help the laboratory schedule timely analysis for the samples when they are received.

D. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of sensitive sampling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filter and the actual examination of this grid in the microscope. Each of these unit operations must produce a product of defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards is performed along with the sample analysis as indicators that the materials used are adequate and the operations are within acceptable limits. In this way, the quality of the data is defined, and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the text below.

1. Prescreen the loaded cassette collection filters to assure that they do not contain concentrations of asbestos which may interfere with the analysis of the sample. A filter blank average of less than 18 s/mm^2 in an area of 0.057 mm^2 (nominally 10 200-mesh grid openings) and a maximum of 53 s/mm^2 for that same area for any single preparation is acceptable for this method.

2. Calibrate sampling pumps and their flow indicators over the range of their intended use with a recognized standard. Assemble the sampling system with a representative filter—not the filter which will be used in sampling—before and after the sampling operation.

3. Record all calibration information with the data to be used on a standard sampling form.

4. Ensure that the samples are stored in a secure and representative location.

5. Ensure that mechanical calibrations from the pump will be minimized to prevent transferral of vibration to the cassette.

6. Ensure that a continuous smooth flow of negative pressure is delivered by the pump by installing a damping chamber if necessary.

7. Open a loaded cassette momentarily at one of the indoor sampling sites when sampling is initiated. This sample will serve as an indoor field blank.

8. Open a loaded cassette momentarily at one of the outdoor sampling sites when sampling is initiated. This sample will serve as an outdoor field blank.

9. Carry a sealed blank into the field with each sample series. Do not open this cassette in the field.

10. Perform a leak check of the sampling system at each indoor and outdoor sampling site by activating the pump with the closed sampling cassette in line. Any flow indicates a leak which must be eliminated before initiating the sampling operation.

11. Ensure that the sampler is turned upright before interrupting the pump flow.

12. Check that all samples are clearly labeled and that all pertinent information has been enclosed before transfer of the samples to the laboratory.

E. Sample Receiving

1. Designate one individual as sample coordinator at the laboratory. While that individual will normally be available to receive samples, the coordinator may train and supervise others in receiving procedures for those times when he/she is not available.

2. Adhere to the following procedures to ensure both the continued chain-of-custody and the accountability of all samples passing through the laboratory:

a. Note the condition of the shipping package and data written on it upon receipt.

b. Retain all bills of lading or shipping slips to document the shipper and delivery time.

c. Examine the chain-of-custody seal, if any, and the package for its integrity.

d. If there has been a break in the seal or substantive damage to the package, the sample coordinator shall immediately notify the shipper and a responsible laboratory manager before any action is taken to unpack the shipment.

e. Packages with significant damage shall be accepted only by the responsible laboratory manager after discussions with the client.

3. Unwrap the shipment in a clean, uncluttered facility. The sample coordinator or his or her designee will record the contents, including a description of each item and all identifying numbers or marks. A

Sample Receiving Form to document this information is attached for use when necessary. (See the following Figure 3.)

FIGURE 3--SAMPLE RECEIVING FORM

Date of package delivery _____ Package shipped from _____

Carrier _____ Shipping bill retained _____

*Condition of package on receipt _____

*Condition of custody seal _____

Number of samples received _____ Shipping manifest attached _____

Purchase Order No. _____ Project I.D. _____

Comments _____

No.	Description	Sampling Medium PC	Sampling Medium MCE	Sampled Volume Liters	Receiving ID #	Assigned #
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

(Use as many additional sheets as needed.)

Comments _____

Date of acceptance into sample bank _____

Signature of chain-of-custody recipient _____

Disposition of samples _____

*Note: If the package has sustained substantial damage or the custody seal is broken, stop and contact the project manager and the shipper.

NOTE: The person breaking the chain-of-custody seal and itemizing the contents assumes responsibility for the shipment and signs documents accordingly.

4. Assign a laboratory number and schedule an analysis sequence.

5. Manage all chain-of-custody samples within the laboratory such that their integrity can be ensured and documented.

F. Sample Preparation

1. Personnel not affiliated with the Abatement Contractor shall be used to prepare samples and conduct TEM analysis. Wet-wipe the exterior of the cassettes to minimize contamination possibilities before taking them to the clean sample preparation facility.

2. Perform sample preparation in a well-equipped clean facility.

NOTE: The clean area is required to have the following minimum characteristics. The area or hood must be capable of maintaining a positive pressure with make-up air being HEPA filtered. The cumulative analytical blank concentration must average less than 18 s/mm^2 in an area of 0.057 s/mm^2 (nominally 10 200-mesh grid openings) with no more than one single preparation to exceed 53 s/mm^2 for that same area.

3. Preparation areas for air samples must be separated from preparation areas for bulk samples. Personnel must not prepare air samples if they have previously been preparing bulk samples without performing appropriate personal hygiene procedures, i.e., clothing change, showering, etc.

4. *Preparation.* Direct preparation techniques are required. The objective is to produce an intact carbon film containing the particulates from the filter surface which is sufficiently clear for TEM analysis. Currently recommended direct preparation procedures for polycarbonate (PC) and mixed cellulose ester (MCE) filters are described in Unit III.F.7. and 8. Sample preparation is a subject requiring additional research. Variation on those steps which do not substantively change the procedure, which improve filter clearing or which reduce contamination problems in a laboratory are permitted.

a. Use only TEM grids that have had grid opening areas measured according to directions in Unit III.J.

b. Remove the inlet and outlet plugs prior to opening the cassette to minimize any pressure differential that may be present.

c. Examples of techniques used to prepare polycarbonate filters are described in Unit III.F.7.

d. Examples of techniques used to prepare mixed cellulose ester filters are described in Unit III.F.8.

e. Prepare multiple grids for each sample.

f. Store the three grids to be measured in appropriately labeled grid holders or polyethylene capsules.

5. Equipment.

a. Clean area.

b. Tweezers. Fine-point tweezers for handling of filters and TEM grids.

c. Scalpel Holder and Curved No. 10 Surgical Blades.

d. Microscope slides.

e. Double-coated adhesive tape.

f. Gummed page reinforcements.

g. Micro-pipet with disposal tips 10 to 100 µL variable volume.

h. Vacuum coating unit with facilities for evaporation of carbon. Use of a liquid nitrogen cold trap above the diffusion pump will minimize the possibility of contamination of the filter surface by oil from the pumping system. The vacuum-coating unit can also be used for deposition of a thin film of gold.

i. *Carbon rod electrodes.* Spectrochemically pure carbon rods are required for use in the vacuum evaporator for carbon coating of filters.

j. *Carbon rod sharpener.* This is used to sharpen carbon rods to a neck. The use of necked carbon rods (or equivalent) allows the carbon to be applied to the filters with a minimum of heating.

k. *Low-temperature plasma asher.* This is used to etch the surface of collapsed mixed cellulose ester (MCE) filters. The asher should be supplied with oxygen, and should be modified as necessary to provide a throttle or bleed valve to control the speed of the vacuum to minimize disturbance of the filter. Some early models of ashers admit air too rapidly, which may disturb particulates on the surface of the filter during the etching step.

l. *Glass petri dishes, 10 cm in diameter, 1 cm high.* For prevention of excessive evaporation of solvent when these are in use, a good seal must be provided between the base and the lid. The seal can be improved by grinding the base and lid together with an abrasive grinding material.

m. Stainless steel mesh.

n. Lens tissue.

o. Copper 200-mesh TEM grids, 3 mm in diameter, or equivalent.

p. Gold 200-mesh TEM grids, 3 mm in diameter, or equivalent.

q. Condensation washer.

r. Carbon-coated, 200-mesh TEM grids, or equivalent.

s. Analytical balance, 0.1 mg sensitivity.

t. Filter paper, 9 cm in diameter.

u. Oven or slide warmer. Must be capable of maintaining a temperature of 65–70 °C.

v. Polyurethane foam, 6 mm thickness.

w. Gold wire for evaporation.

6. Reagents.

a. *General.* A supply of ultra-clean, fiber-free water must be available for washing of all components used in the analysis. Water

that has been distilled in glass or filtered or deionized water is satisfactory for this purpose. Reagents must be fiber-free.

b. Polycarbonate preparation method—chloroform.

c. Mixed Cellulose Ester (MCE) preparation method—acetone or the Burdette procedure (Ref. 7 of Unit III.L.).

7. TEM specimen preparation from polycarbonate filters.

a. *Specimen preparation laboratory.* It is most important to ensure that contamination of TEM specimens by extraneous asbestos fibers is minimized during preparation.

b. Cleaning of sample cassettes. Upon receipt at the analytical laboratory and before they are taken into the clean facility or laminar flow hood, the sample cassettes must be cleaned of any contamination adhering to the outside surfaces.

c. Preparation of the carbon evaporator. If the polycarbonate filter has already been carbon-coated prior to receipt, the carbon coating step will be omitted, unless the analyst believes the carbon film is too thin. If there is a need to apply more carbon, the filter will be treated in the same way as an uncoated filter. Carbon coating must be performed with a high-vacuum coating unit. Units that are based on evaporation of carbon filaments in a vacuum generated only by an oil rotary pump have not been evaluated for this application, and must not be used. The carbon rods should be sharpened by a carbon rod sharpener to necks of about 4 mm long and 1 mm in diameter. The rods are installed in the evaporator in such a manner that the points are approximately 10 to 12 cm from the surface of a microscope slide held in the rotating and tilting device.

d. Selection of filter area for carbon coating. Before preparation of the filters, a 75 mm×50 mm microscope slide is washed and dried. This slide is used to support strips of filter during the carbon evaporation. Two parallel strips of double-sided adhesive tape are applied along the length of the slide. Polycarbonate filters are easily stretched during handling, and cutting of areas for further preparation must be performed with great care. The filter and the MCE backing filter are removed together from the cassette and placed on a cleaned glass microscope slide. The filter can be cut with a curved scalpel blade by rocking the blade from the point placed in contact with the filter. The process can be repeated to cut a strip approximately 3 mm wide across the diameter of the filter. The strip of polycarbonate filter is separated from the corresponding strip of backing filter and carefully placed so that it bridges the gap between the adhesive tape strips on the microscope slide. The filter strip can be held with fine-point tweezers and supported underneath by the scalpel blade during placement on the microscope slide. The analyst can place several such strips on the same microscope slide, taking care to rinse and wet-wipe the scalpel blade and tweezers before handling a new sample. The filter strips should be identified by etching the glass slide or marking the slide using a marker insoluble in water and solvents. After the filter strip has been cut from each filter, the residual parts of the filter must be returned to the cassette and held in position by reassembly of the cassette. The cassette will then be archived for a period of 30 days or returned to the client upon request.

e. Carbon coating of filter strips. The glass slide holding the filter strips is placed on the rotation-tilting device, and the evaporator chamber is evacuated. The evaporation must be performed in very short bursts, separated by some seconds to allow the electrodes to cool. If evaporation is too rapid, the strips of polycarbonate filter will begin to curl, which will lead to cross-linking of the surface material and make it relatively insoluble in chloroform. An experienced analyst can judge the thickness of carbon film to be applied, and some test should be made first on unused filters. If the film is too thin, large particles will be lost from the TEM specimen, and there will be few complete and undamaged grid openings on the specimen. If the coating is too thick, the filter will tend to curl when exposed to chloroform vapor and the carbon film may not adhere to the support mesh. Too thick a carbon film will also lead to a TEM image that is lacking in contrast, and the ability to obtain ED patterns will be compromised. The carbon film should be as thin as possible and remain intact on most of the grid openings of the TEM specimen intact.

f. Preparation of the Jaffe washer. The precise design of the Jaffe washer is not considered important, so any one of the published designs may be used. A washer consisting of a simple stainless steel bridge is recommended. Several pieces of lens tissue approximately 1.0 cm×0.5 cm are placed on the stainless steel bridge, and the washer is filled with chloroform to a level where the meniscus contacts the underside of the mesh, which results in saturation of the lens tissue. See References 8 and 10 of Unit III.L.

g. Placing of specimens into the Jaffe washer. The TEM grids are first placed on a piece of lens tissue so that individual grids can be picked up with tweezers. Using a curved scalpel blade, the analyst excises three 3 mm square pieces of the carbon-coated polycarbonate filter from the filter strip. The three squares are selected from the center of the strip and from two points between the outer periphery of the active surface and the center. The piece of filter is placed on a TEM specimen grid with the shiny side of the TEM grid facing upwards, and the whole assembly is placed boldly onto the saturated lens tissue in the Jaffe washer. If carbon-coated grids are used, the filter should be

placed carbon-coated side down. The three excised squares of filters are placed on the same piece of lens tissue. Any number of separate pieces of lens tissue may be placed in the same Jaffe washer. The lid is then placed on the Jaffe washer, and the system is allowed to stand for several hours, preferably overnight.

h. *Condensation washing.* It has been found that many polycarbonate filters will not dissolve completely in the Jaffe washer, even after being exposed to chloroform for as long as 3 days. This problem becomes more serious if the surface of the filter was overheated during the carbon evaporation. The presence of undissolved filter medium on the TEM preparation leads to partial or complete obscuration of areas of the sample, and fibers that may be present in these areas of the specimen will be overlooked; this will lead to a low result. Undissolved filter medium also compromises the ability to obtain ED patterns. Before they are counted, TEM grids must be examined critically to determine whether they are adequately cleared of residual filter medium. It has been found that condensation washing of the grids after the initial Jaffe washer treatment, with chloroform as the solvent, clears all residual filter medium in a period of approximately 1 hour. In practice, the piece of lens tissue supporting the specimen grids is transferred to the cold finger of the condensation washer, and the washer is operated for about 1 hour. If the specimens are cleared satisfactorily by the Jaffe washer alone, the condensation washer step may be unnecessary.

8. TEM specimen preparation from MCE filters.

a. This method of preparing TEM specimens from MCE filters is similar to that specified in NIOSH Method 7402. See References 7, 8, and 9 of Unit III.L.

b. Upon receipt at the analytical laboratory, the sample cassettes must be cleaned of any contamination adhering to the outside surfaces before entering the clean sample preparation area.

c. Remove a section from any quadrant of the sample and blank filters.

d. Place the section on a clean microscope slide. Affix the filter section to the slide with a gummed paged reinforcement or other suitable means. Label the slide with a water and solvent-proof marking pen.

e. Place the slide in a petri dish which contains several paper filters soaked with 2 to 3 mL acetone. Cover the dish. Wait 2 to 4 minutes for the sample filter to fuse and clear.

f. Plasma etching of the collapsed filter is required.

i. The microscope slide to which the collapsed filter pieces are attached is placed in a plasma asher. Because plasma ashers vary greatly in their performance, both from unit to unit and between different positions in the asher chamber, it is difficult to specify the conditions that should be used. This is one area of the method that requires further evaluation. Insufficient etching will result in a failure to expose embedded filters, and too much etching may result in loss of particulate from the surface. As an interim measure, it is recommended that the time for ashing of a known weight of a collapsed filter be established and that the etching rate be calculated in terms of micrometers per second. The actual etching time used for a particular asher and operating conditions will then be set such that a 1–2 μm (10 percent) layer of collapsed surface will be removed.

ii. Place the slide containing the collapsed filters into a low-temperature plasma asher, and etch the filter.

g. Transfer the slide to a rotating stage inside the bell jar of a vacuum evaporator. Evaporate a 1 mm×5 mm section of graphite rod onto the cleared filter. Remove the slide to a clean, dry, covered petri dish.

h. Prepare a second petri dish as a Jaffe washer with the wicking substrate prepared from filter or lens paper placed on top of a 6 mm thick disk of clean spongy polyurethane foam. Cut a V-notch on the edge of the foam and filter paper. Use the V-notch as a reservoir for adding solvent. The wicking substrate should be thin enough to fit into the petri dish without touching the lid.

i. Place carbon-coated TEM grids face up on the filter or lens paper. Label the grids by marking with a pencil on the filter paper or by putting registration marks on the petri dish lid and marking with a waterproof marker on the dish lid. In a fume hood, fill the dish with acetone until the wicking substrate is saturated. The level of acetone should be just high enough to saturate the filter paper without creating puddles.

j. Remove about a quarter section of the carbon-coated filter samples from the glass slides using a surgical knife and tweezers. Carefully place the section of the filter, carbon side down, on the appropriately labeled grid in the acetone-saturated petri dish. When all filter sections have been transferred, slowly add more solvent to the wedge-shaped trough to bring the acetone level up to the highest possible level without disturbing the sample preparations. Cover the petri dish. Elevate one side of the petri dish by placing a slide under it. This allows drops of condensed solvent vapors to form near the edge rather than in the center where they would drip onto the grid preparation.

G. TEM Method

1. *Instrumentation.*

a. Use an 80–120 kV TEM capable of performing electron diffraction with a fluorescent screen inscribed with calibrated gradations. If the TEM is equipped with EDXA it must either have a STEM attachment or be capable of producing a spot less than 250 nm

in diameter at crossover. The microscope shall be calibrated routinely (see Unit III.J.) for magnification and camera constant.

b. While not required on every microscope in the laboratory, the laboratory must have either one microscope equipped with energy dispersive X-ray analysis or access to an equivalent system on a TEM in another laboratory. This must be an Energy Dispersive X-ray Detector mounted on TEM column and associated hardware/software to collect, save, and read out spectral information. Calibration of Multi-Channel Analyzer shall be checked regularly for A1 at 1.48 KeV and Cu at 8.04 KeV, as well as the manufacturer's procedures.

i. Standard replica grating may be used to determine magnification (e.g., 2160 lines/mm).

ii. Gold standard may be used to determine camera constant.

c. Use a specimen holder with single tilt and/or double tilt capabilities.

2. Procedure.

a. Start a new Count Sheet for each sample to be analyzed. Record on count sheet: analyst's initials and date; lab sample number; client sample number microscope identification; magnification for analysis; number of predetermined grid openings to be analyzed; and grid identification. See the following Figure 4:

FIGURE 4--COUNT SHEET

Lab Sample No. _____ Filter Type _____ Operator _____
Client Sample No. _____ Filter Area _____ Date _____
Instrument I.D. _____ Grid I.D. _____ Comments _____
Magnification _____ Grid Opening (GO) Area _____ _____
Acc. Voltage _____ No. GO to be Analyzed _____ _____

GO	Structure No.	Structure Type*	Length		ED Observation				EDAX
			< 5μm	≥ 5 μm	Chrys.	Amph.	Nonasb.	Neg. ID	

GO	Structure No.	Structure Type*	Length		ED Observation				EDAX
			< 5μm	≥ 5 μm	Chrys.	Amph.	Nonasb.	Neg. ID	

*B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD = No fibers detected
N = No diffraction obtained

b. Check that the microscope is properly aligned and calibrated according to the manufacturer's specifications and instructions.

c. Microscope settings: 80–120 kV, grid assessment 250–1000X, then 15,000–20,000X screen magnification for analysis.

d. Approximately one-half (0.5) of the predetermined sample area to be analyzed shall be performed on one sample grid preparation and the remaining half on a second sample grid preparation.

e. Determine the suitability of the grid.

i. Individual grid openings with greater than 5 percent openings (holes) or covered with greater than 25 percent particulate matter or obviously having nonuniform loading shall not be analyzed.

ii. Examine the grid at low magnification (<1000X) to determine its suitability for detailed study at higher magnifications.

iii. Reject the grid if:

(1) Less than 50 percent of the grid openings covered by the replica are intact.

(2) It is doubled or folded.

(3) It is too dark because of incomplete dissolution of the filter.

iv. If the grid is rejected, load the next sample grid.

v. If the grid is acceptable, continue on to Step 6 if mapping is to be used; otherwise proceed to Step 7.

f. Grid Map (Optional).

i. Set the TEM to the low magnification mode.

ii. Use flat edge or finder grids for mapping.

iii. Index the grid openings (fields) to be counted by marking the acceptable fields for one-half (0.5) of the area needed for analysis on each of the two grids to be analyzed. These may be marked just before examining each grid opening (field), if desired.

iv. Draw in any details which will allow the grid to be properly oriented if it is reloaded into the microscope and a particular field is to be reliably identified.

g. Scan the grid.

i. Select a field to start the examination.

ii. Choose the appropriate magnification (15,000 to 20,000X screen magnification).

iii. Scan the grid as follows.

(1) At the selected magnification, make a series of parallel traverses across the field. On reaching the end of one traverse, move the image one window and reverse the traverse.

NOTE: A slight overlap should be used so as not to miss any part of the grid opening (field).

(2) Make parallel traverses until the entire grid opening (field) has been scanned.

h. Identify each structure for appearance and size.

i. Appearance and size: Any continuous grouping of particles in which an asbestos fiber within aspect ratio greater than or equal to 5:1 and a length greater than or equal to 0.5 μm is detected shall be recorded on the count sheet. These will be designated asbestos structures and will be classified as fibers, bundles, clusters, or matrices. Record as individual fibers any contiguous grouping having 0, 1, or 2 definable intersections. Groupings having more than 2 intersections are to be described as cluster or matrix. See the following Figure 5:

FIGURE 5--COUNTING GUIDELINES USED IN DETERMINING ASBESTOS STRUCTURES

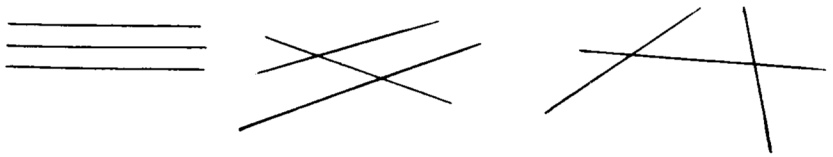
Count as 1 fiber; 1 Structure; no intersections.



Count as 2 fibers if space between fibers is greater than width of 1 fiber diameter or number of intersections is equal to or less than 1.

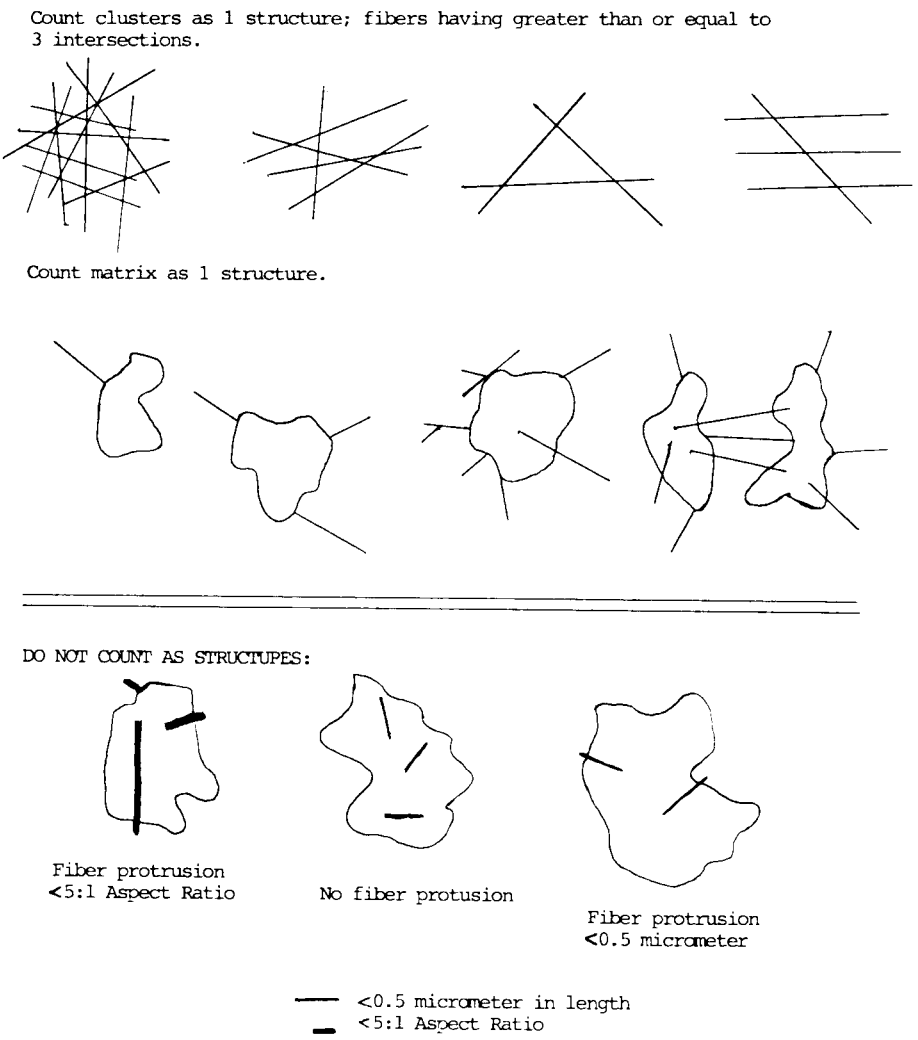


Count as 3 structures if space between fibers is greater than width of 1 fiber diameter or if the number of intersections is equal to or less than 2.



Count bundles as 1 structure; 3 or more parallel fibrils less than 1 fiber diameter separation.





An intersection is a non-parallel touching or crossing of fibers, with the projection having an aspect ratio of 5:1 or greater. Combinations such as a matrix and cluster, matrix and bundle, or bundle and cluster are categorized by the dominant fiber quality—cluster, bundle, and matrix, respectively. Separate categories will be maintained for fibers less than 5 μm and for fibers greater than or equal to 5 μm in length. Not required, but useful, may be to record the fiber length in 1 μm intervals. (Identify each structure morphologically and analyze it as it enters the ''window''.)

(1) *Fiber.* A structure having a minimum length greater than 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed, no intersections.

(2) *Bundle.* A structure composed of 3 or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

(3) *Cluster.* A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group; groupings must have more than 2 intersections.

(4) *Matrix.* Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

(5) *NSD.* Record NSD when no structures are detected in the field.

(6) *Intersection.* Non-parallel touching or crossing of fibers, with the projection having an aspect ratio 5:1 or greater.

ii. Structure Measurement.

(1) Recognize the structure that is to be sized.

(2) Memorize its location in the ''window'' relative to the sides, inscribed square and to other particulates in the field so this exact location can be found again when scanning is resumed.

(3) Measure the structure using the scale on the screen.

(4) Record the length category and structure type classification on the count sheet after the field number and fiber number.

(5) Return the fiber to its original location in the window and scan the rest of the field for other fibers; if the direction of travel is not remembered, return to the right side of the field and begin the traverse again.

i. Visual identification of Electron Diffraction (ED) patterns is required for each asbestos structure counted which would cause the analysis to exceed the 70 s/mm² concentration. (Generally this means the first four fibers identified as asbestos must exhibit an identifiable diffraction pattern for chrysotile or amphibole.)

i. Center the structure, focus, and obtain an ED pattern. (See Microscope Instruction Manual for more detailed instructions.)

ii. From a visual examination of the ED pattern, obtained with a short camera length, classify the observed structure as belonging to one of the following classifications: chrysotile, amphibole, or nonasbestos.

(1) Chrysotile: The chrysotile asbestos pattern has characteristic streaks on the layer lines other than the central line and some streaking also on the central line. There will be spots of normal sharpness on the central layer line and on alternate lines (2nd, 4th, etc.). The repeat distance between layer lines is 0.53 nm and the center doublet is at 0.73 nm. The pattern should display (002), (110), (130) diffraction maxima; distances and geometry should match a chrysotile pattern and be measured semiquantitatively.

(2) Amphibole Group [includes grunerite (amosite), crocidolite, anthophyllite, tremolite, and actinolite]: Amphibole asbestos fiber patterns show layer lines formed by very closely spaced dots, and the repeat distance between layer lines is also about 0.53 nm. Streaking in layer lines is occasionally present due to crystal structure defects.

(3) Nonasbestos: Incomplete or unobtainable ED patterns, a nonasbestos EDXA, or a nonasbestos morphology.

iii. The micrograph number of the recorded diffraction patterns must be reported to the client and maintained in the laboratory's quality assurance records. The records must also demonstrate that the identification of the pattern has been verified by a qualified individual and that the operator who made the identification is maintaining at least an 80 percent correct visual identification based on his measured patterns. In the event that examination of the pattern by the qualified individual indicates that the pattern had been misidentified visually, the client shall be contacted. If the pattern is a suspected chrysotile, take a photograph of the diffraction pattern at 0 degrees tilt. If the structure is suspected to be amphibole, the sample may have to be tilted to obtain a simple geometric array of spots.

j. Energy Dispersive X-Ray Analysis (EDXA).

i. Required of all amphiboles which would cause the analysis results to exceed the 70 s/mm² concentration. (Generally speaking, the first 4 amphiboles would require EDXA.)

ii. Can be used alone to confirm chrysotile after the 70 s/mm² concentration has been exceeded.

iii. Can be used alone to confirm all nonasbestos.

iv. Compare spectrum profiles with profiles obtained from asbestos standards. The closest match identifies and categorizes the structure.

v. If the EDXA is used for confirmation, record the properly labeled spectrum on a computer disk, or if a hard copy, file with analysis data.

vi. If the number of fibers in the nonasbestos class would cause the analysis to exceed the 70 s/mm² concentration, their identities must be confirmed by EDXA or measurement of a zone axis diffraction pattern to establish that the particles are nonasbestos.

k. Stopping Rules.

i. If more than 50 asbestiform structures are counted in a particular grid opening, the analysis may be terminated.

ii. After having counted 50 asbestiform structures in a minimum of 4 grid openings, the analysis may be terminated. The grid opening in which the 50th fiber was counted must be completed.

iii. For blank samples, the analysis is always continued until 10 grid openings have been analyzed.

iv. In all other samples the analysis shall be continued until an analytical sensitivity of 0.005 s/cm³ is reached.

l. Recording Rules. The count sheet should contain the following information:

i. Field (grid opening): List field number.

ii. Record ''NSD'' if no structures are detected.

iii. Structure information.

(1) If fibers, bundles, clusters, and/or matrices are found, list them in consecutive numerical order, starting over with each field.

(2) Length. Record length category of asbestos fibers examined. Indicate if less than 5 μm or greater than or equal to 5 μm.

(3) Structure Type. Positive identification of asbestos fibers is required by the method. At least one diffraction pattern of each fiber type from every five samples must be recorded and compared with a standard diffraction pattern. For each asbestos fiber reported, both a morphological descriptor and an identification descriptor shall be specified on the count sheet.

(4) Fibers classified as chrysotile must be identified by diffraction and/or X-ray analysis and recorded on the count sheet. X-ray analysis alone can be used as sole identification only after 70s/mm² have been exceeded for a particular sample.

(5) Fibers classified as amphiboles must be identified by X-ray analysis and electron diffraction and recorded on the count sheet. (X-ray analysis alone can be used as sole identification only after 70s/mm² have been exceeded for a particular sample.)

(6) If a diffraction pattern was recorded on film, the micrograph number must be indicated on the count sheet.

(7) If an electron diffraction was attempted and an appropriate spectra is not observed, N should be recorded on the count sheet.

(8) If an X-ray analysis is attempted but not observed, N should be recorded on the count sheet.

(9) If an X-ray analysis spectrum is stored, the file and disk number must be recorded on the count sheet.

m. Classification Rules.

i. *Fiber.* A structure having a minimum length greater than or equal to 0.5 μm and an aspect ratio (length to width) of 5:1 or greater and substantially parallel sides. Note the appearance of the end of the fiber, i.e., whether it is flat, rounded or dovetailed.

ii. *Bundle.* A structure composed of three or more fibers in a parallel arrangement with each fiber closer than one fiber diameter.

iii. *Cluster.* A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group. Groupings must have more than two intersections.

iv. *Matrix.* Fiber or fibers with one end free and the other end embedded in or hidden by a particulate. The exposed fiber must meet the fiber definition.

v. *NSD.* Record NSD when no structures are detected in the field.

n. After all necessary analyses of a particle structure have been completed, return the goniometer stage to 0 degrees, and return the structure to its original location by recall of the original location.

o. Continue scanning until all the structures are identified, classified and sized in the field.

p. Select additional fields (grid openings) at low magnification; scan at a chosen magnification (15,000 to 20,000X screen magnification); and analyze until the stopping rule becomes applicable.

q. Carefully record all data as they are being collected, and check for accuracy.

r. After finishing with a grid, remove it from the microscope, and replace it in the appropriate grid hold. Sample grids must be stored for a minimum of 1 year from the date of the analysis; the sample cassette must be retained for a minimum of 30 days by the laboratory or returned at the client's request.

H. Sample Analytical Sequence

1. Carry out visual inspection of work site prior to air monitoring.

2. Collect a minimum of five air samples inside the work site and five samples outside the work site. The indoor and outdoor samples shall be taken during the same time period.

3. Analyze the abatement area samples according to this protocol. The analysis must meet the 0.005 s/cm³ analytical sensitivity.

4. Remaining steps in the analytical sequence are contained in Unit IV. of this Appendix.

I. Reporting

The following information must be reported to the client. See the following Table II:

TABLE II--EXAMPLE LABORATORY LETTERHEAD

Laboratory I.D.	Client I.D.	FILTER MEDIA DATA				Analyzed Area, mm^2	Sample Volume, cc
		Type	Diameter, mm	Effective Area, mm^2	Pore Size, µm		

INDIVIDUAL ANALYTICAL RESULTS

Laboratory I.D.	Client I.D.	# Asbestos Structures	Analytical Sensitivity, s/cc	CONCENTRATION	
				Structures/mm^2	Structures/cc

The analysis was carried out to the approved TEM method. This laboratory is in compliance with the quality specified by the method.

Authorized Signature

1. Concentration in structures per square millimeter and structures per cubic centimeter.
2. Analytical sensitivity used for the analysis.
3. Number of asbestos structures.
4. Area analyzed.
5. Volume of air samples (which was initially provided by client).
6. Average grid size opening.
7. Number of grids analyzed.
8. Copy of the count sheet must be included with the report.

9. Signature of laboratory official to indicate that the laboratory met specifications of the AHERA method.

10. Report form must contain official laboratory identification (e.g., letterhead).

11. Type of asbestos.

J. Calibration Methodology

NOTE: Appropriate implementation of the method requires a person knowledgeable in electron diffraction and mineral identification by ED and EDXA. Those inexperienced laboratories wishing to develop capabilities may acquire necessary knowledge through analysis of appropriate standards and by following detailed methods as described in References 8 and 10 of Unit III.L.

1. *Equipment Calibration.* In this method, calibration is required for the air-sampling equipment and the transmission electron microscope (TEM).

a. *TEM Magnification.* The magnification at the fluorescent screen of the TEM must be calibrated at the grid opening magnification (if used) and also at the magnification used for fiber counting. This is performed with a cross grating replica. A logbook must be maintained, and the dates of calibration depend on the past history of the particular microscope; no frequency is specified. After any maintenance of the microscope that involved adjustment of the power supplied to the lenses or the high-voltage system or the mechanical disassembly of the electron optical column apart from filament exchange, the magnification must be recalibrated. Before the TEM calibration is performed, the analyst must ensure that the cross grating replica is placed at the same distance from the objective lens as the specimens are. For instruments that incorporate an eucentric tilting specimen stage, all speciments and the cross grating replica must be placed at the eucentric position.

b. Determination of the TEM magnification on the fluorescent screen.

i. Define a field of view on the fluorescent screen either by markings or physical boundaries. The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric).

ii. Insert a diffraction grating replica (for example a grating containing 2,160 lines/mm) into the specimen holder and place into the microscope. Orient the replica so that the grating lines fall perpendicular to the scale on the TEM fluorescent screen. Ensure that the goniometer stage tilt is 0 degrees.

iii. Adjust microscope magnification to 10,000X or 20,000X. Measure the distance (mm) between two widely separated lines on the grating replica. Note the number of spaces between the lines. Take care to measure between the same relative positions on the lines (e.g., between left edges of lines).

NOTE: The more spaces included in the measurement, the more accurate the final calculation. On most microscopes, however, the magnification is substantially constant only within the central 8–10 cm diameter region of the fluorescent screen.

iv. Calculate the true magnification (M) on the fluorescent screen:

$$M=XG/Y$$

where:

X=total distance (mm) between the designated grating lines;

G=calibration constant of the grating replica (lines/mm):

Y=number of grating replica spaces counted along X.

c. Calibration of the EDXA System. Initially, the EDXA system must be calibrated by using two reference elements to calibrate the energy scale of the instrument. When this has been completed in accordance with the manufacturer's instructions, calibration in terms of the different types of asbestos can proceed. The EDXA detectors vary in both solid angle of detection and in window thickness. Therefore, at a particular accelerating voltage in use on the TEM, the count rate obtained from specific dimensions of fiber will vary both in absolute X-ray count rate and in the relative X-ray peak heights for different elements. Only a few minerals are relevant for asbestos abatement work, and in this procedure the calibration is specified in terms of a ''fingerprint'' technique. The EDXA spectra must be recorded from individual fibers of the relevant minerals, and identifications are made on the basis of semiquantitative comparisons with these reference spectra.

d. Calibration of Grid Openings.

i. Measure 20 grid openings on each of 20 random 200-mesh copper grids by placing a grid on a glass slide and examining it under the PCM. Use a calibrated graticule to measure the average field diameter and use this number to calculate the field area for an average grid opening. Grids are to be randomly selected from batches up to 1,000.

NOTE: A grid opening is considered as one field.

ii. The mean grid opening area must be measured for the type of specimen grids in use. This can be accomplished on the TEM at a properly calibrated low magnification or on an optical microscope at a magnification of approximately 400X by using an eyepiece fitted with a scale that has been calibrated against a stage micrometer. Optical microscopy utilizing manual or automated procedures may be used providing instrument calibration can be verified.

e. Determination of Camera Constant and ED Pattern Analysis.

i. The camera length of the TEM in ED operating mode must be calibrated before ED patterns on unknown samples are observed. This can be achieved by using a carbon-coated grid on which a thin film of gold has been

sputtered or evaporated. A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis ED patterns superimposed with a ring pattern from the polycrystalline gold film.

ii. In practice, it is desirable to optimize the thickness of the gold film so that only one or two sharp rings are obtained on the superimposed ED pattern. Thicker gold film would normally give multiple gold rings, but it will tend to mask weaker diffraction spots from the unknown fibrous particulates. Since the unknown d-spacings of most interest in asbestos analysis are those which lie closest to the transmitted beam, multiple gold rings are unnecessary on zone-axis ED patterns. An average camera constant using multiple gold rings can be determined. The camera constant is one-half the diameter, D, of the rings times the interplanar spacing, d, of the ring being measured.

K. Quality Control/Quality Assurance Procedures (Data Quality Indicators)

Monitoring the environment for airborne asbestos requires the use of sensitive sampling and analysis procedures. Because the test is sensitive, it may be influenced by a variety of factors. These include the supplies used in the sampling operation, the performance of the sampling, the preparation of the grid from the filter and the actual examination of this grid in the microscope. Each of these unit operations must produce a product of defined quality if the analytical result is to be a reliable and meaningful test result. Accordingly, a series of control checks and reference standards is performed along with the sample analysis as indicators that the materials used are adequate and the operations are within acceptable limits. In this way, the quality of the data is defined and the results are of known value. These checks and tests also provide timely and specific warning of any problems which might develop within the sampling and analysis operations. A description of these quality control/quality assurance procedures is summarized in the following Table III:

TABLE III--SUMMARY OF LABORATORY DATA QUALITY OBJECTIVES

Unit Operation	QC Check	Frequency	Conformance Expectation
Sample receiving	Review of receiving report	Each sample	95% complete
Sample custody	Review of chain-of-custody record	Each sample	95% complete
Sample preparation	Supplies and reagents	On receipt	Meet specs. or reject
	Grid opening size	20 openings/20 grids/lot of 1000 or 1 opening/sample	100%
	Special clean area monitoring	After cleaning or service	Meet specs or reclean
	Laboratory blank	1 per prep series or 10%	Meet specs. or reanalyze series
	Plasma etch blank	1 per 20 samples	75%
	Multiple preps (3 per sample)	Each sample	One with cover of 15 complete grid sqs.
Sample analysis	System check	Each day	Each day
	Alignment check	Each day	Each day
	Magnification calibration with low and high standards	Each month or after service	95%
	ED calibration by gold standard	Weekly	95%
	EDS calibration by copper line	Daily	95%
Performance check	Laboratory blank (measure of cleanliness)	Prep 1 per series or 10% read 1 per 25 samples	Meet specs or reanalyze series
	Replicate counting (measure of precision)	1 per 100 samples	1.5 x Poisson Std. Dev.
	Duplicate analysis (measure of reproducibility)	1 per 100 samples	2 x Poisson Std. Dev.
	Known samples of typical materials (working standards)	Training and for comparison with unknowns	100%
	Analysis of NBS SRM 1876 and/or RM 8410 (measure of accuracy and comparability)	1 per analyst per year	1.5 x Poisson Std. Dev.
	Data entry review (data validation and measure of completeness)	Each sample	95%
	Record and verify ID electron diffraction pattern of structure	1 per 5 samples	80% accuracy
Calculations and data reduction	Hand calculation of automated data reduction procedure or independent recalculation of hand-calculated data	1 per 100 samples	85%

1. When the samples arrive at the laboratory, check the samples and documentation for completeness and requirements before initiating the analysis.

2. Check all laboratory reagents and supplies for acceptable asbestos background levels.

3. Conduct all sample preparation in a clean room environment monitored by laboratory blanks and special testing after cleaning or servicing the room.

4. Prepare multiple grids of each sample.

5. Provide laboratory blanks with each sample batch. Maintain a cumulative average of these results. If this average is greater than 53 f/mm^2 per 10 200-mesh grid openings, check the system for possible sources of contamination.

6. Check for recovery of asbestos from cellulose ester filters submitted to plasma asher.

7. Check for asbestos carryover in the plasma asher by including a blank alongside the positive control sample.

8. Perform a systems check on the transmission electron microscope daily.

9. Make periodic performance checks of magnification, electron diffraction and energy dispersive X-ray systems as set forth in Table III of Unit III.K.

10. Ensure qualified operator performance by evaluation of replicate counting, duplicate analysis, and standard sample comparisons as set forth in Table III of Unit III.K.

11. Validate all data entries.

12. Recalculate a percentage of all computations and automatic data reduction steps as specified in Table III.

13. Record an electron diffraction pattern of one asbestos structure from every five samples that contain asbestos. Verify the identification of the pattern by measurement or comparison of the pattern with patterns collected from standards under the same conditions.

The outline of quality control procedures presented above is viewed as the minimum required to assure that quality data is produced for clearance testing of an asbestos abated area. Additional information may be gained by other control tests. Specifics on those control procedures and options available for environmental testing can be obtained by consulting References 6, 7, and 11 of Unit III.L.

L. References

For additional background information on this method the following references should be consulted.

1. ''Guidelines for Controlling Asbestos-Containing Materials in Buildings,'' EPA 560/5–85–024, June 1985.

2. ''Measuring Airborne Asbestos Following an Abatement Action,'' USEP/Office of Pollution Prevention and Toxics, EPA 600/4–85–049, 1985.

3. Small, John and E. Steel. Asbestos Standards: Materials and Analytical Methods. N.B.S. Special Publication 619, 1982.

4. Campbell, W.J., R.L. Blake, L.L. Brown, E.E. Cather, and J.J. Sjoberg. Selected Silicate Minerals and Their Asbestiform Varieties. Information Circular 8751, U.S. Bureau of Mines, 1977.

5. Quality Assurance Handbook for Air Pollution Measurement System. Ambient Air Methods, EPA 600/4–77–027a, USEPA, Office of Research and Development, 1977.

6. Method 2A: Direct Measurement of Gas Volume Through Pipes and Small Ducts. 40 CFR Part 60 Appendix A.

7. Burdette, G.J. Health & Safety Exec., Research & Lab. Services Div., London, ''Proposed Analytical Method for Determination of Asbestos in Air.''

8. Chatfield, E.J., Chatfield Tech. Cons., Ltd., Clark, T., PEI Assoc. ''Standard Operating Procedure for Determination of Airborne Asbestos Fibers by Transmission Electron Microscopy Using Polycarbonate Membrane Filters.'' WERL SOP 87–1, March 5, 1987.

9. NIOSH. Method 7402 for Asbestos Fibers, December 11, 1986 Draft.

10. Yamate, G., S.C. Agarwall, R.D. Gibbons, IIT Research Institute, ''Methodology for the Measurement of Airborne Asbestos by Electron Microscopy.'' Draft report, USEPA Contract 68–02–3266, July 1984.

11. Guidance to the Preparation of Quality Assurance Project Plans. USEPA, Office of Pollution Prevention and Toxics, 1984.

IV. Mandatory Interpretation of Transmission Electron Microscopy Results To Determine Completion of Response Actions

A. Introduction

A response action is determined to be completed by TEM when the abatement area has been cleaned and the airborne asbestos concentration inside the abatement area is no higher than concentrations at locations outside the abatement area. ''Outside'' means outside the abatement area, but not necessarily outside the building. EPA reasons that an asbestos removal contractor cannot be expected to clean an abatement area to an airborne asbestos concentration that is lower than the concentration of air entering the abatement area from outdoors or from other parts of the building. After the abatement area has passed a thorough visual inspection, and before the outer containment barrier is removed, a minimum of five air samples inside the abatement area and a minimum of five air samples outside the abatement area must be collected. Hence, the response action is determined to be completed when the average airborne asbestos concentration measured inside the abatement area is not statistically different from the average airborne asbestos concentration measured outside the abatement area.

The inside and outside concentrations are compared by the Z-test, a statistical test that takes into account the variability in the measurement process. A minimum of five samples inside the abatement area and five samples outside the abatement area are required to control the false negative error rate, i.e., the probability of declaring the removal complete when, in fact, the air concentration inside the abatement area is significantly higher than outside the abatement area. Additional quality control is provided by requiring three blanks (filters through which no air has been drawn) to be analyzed to check for unusually high filter contamination that would distort the test results.

When volumes greater than or equal to 1,199 L for a 25 mm filter and 2,799 L for a 37 mm filter have been collected and the average number of asbestos structures on samples inside the abatement area is no greater than 70 s/mm^2 of filter, the response action

may be considered complete without comparing the inside samples to the outside samples. EPA is permitting this initial screening test to save analysis costs in situations where the airborne asbestos concentration is sufficiently low so that it cannot be distinguished from the filter contamination/background level (fibers deposited on the filter that are unrelated to the air being sampled). The screening test cannot be used when volumes of less than 1,199 L for 25 mm filter or 2,799 L for a 37 mm filter are collected because the ability to distinguish levels significantly different from filter background is reduced at low volumes.

The initial screening test is expressed in structures per square millimeter of filter because filter background levels come from sources other than the air being sampled and cannot be meaningfully expressed as a concentration per cubic centimeter of air. The value of 70 s/mm^2 is based on the experience of the panel of microscopists who consider one structure in 10 grid openings (each grid opening with an area of 0.0057 mm^2) to be comparable with contamination/background levels of blank filters. The decision is based, in part, on Poisson statistics which indicate that four structures must be counted on a filter before the fiber count is statistically distinguishable from the count for one structure. As more information on the performance of the method is collected, this criterion may be modified. Since different combinations of the number and size of grid openings are permitted under the TEM protocol, the criterion is expressed in structures per square millimeter of filter to be consistent across all combinations. Four structures per 10 grid openings corresponds to approximately 70 s/mm^2.

B. Sample Collection and Analysis

1. A minimum of 13 samples is required: five samples collected inside the abatement area, five samples collected outside the abatement area, two field blanks, and one sealed blank.

2. Sampling and TEM analysis must be done according to either the mandatory or nonmandatory protocols in Appendix A. At least 0.057 mm^2 of filter must be examined on blank filters.

C. Interpretation of Results

1. The response action shall be considered complete if either:

a. Each sample collected inside the abatement area consists of at least 1,199 L of air for a 25 mm filter, or 2,799 L of air for a 37 mm filter, and the arithmetic mean of their asbestos structure concentrations per square millimeter of filter is less than or equal to 70 s/mm^2; or

b. The three blank samples have an arithmetic mean of the asbestos structure concentration on the blank filters that is less than or equal to 70 s/mm^2 and the average airborne asbestos concentration measured inside the abatement area is not statistically higher than the average airborne asbestos concentration measured outside the abatement area as determined by the Z-test. The Z-test is carried out by calculating

$$Z = \frac{\bar{Y}_I - \bar{Y}_O}{0.8(1/n_I + 1/n_O)^{1/2}}$$

where Y_I is the average of the natural logarithms of the inside samples and Y_O is the average of the natural logarithms of the outside samples, n_I is the number of inside samples and n_O is the number of outside samples. The response action is considered complete if Z is less than or equal to 1.65.

NOTE: When no fibers are counted, the calculated detection limit for that analysis is inserted for the concentration.

2. If the abatement site does not satisfy either (1) or (2) of this Section C, the site must be recleaned and a new set of samples collected.

D. Sequence for Analyzing Samples

It is possible to determine completion of the response action without analyzing all samples. Also, at any point in the process, a decision may be made to terminate the analysis of existing samples, reclean the abatement site, and collect a new set of samples. The following sequence is outlined to minimize the number of analyses needed to reach a decision.

1. Analyze the inside samples.

2. If at least 1,199 L of air for a 25 mm filter or 2,799 L of air for a 37 mm filter is collected for each inside sample and the arithmetic mean concentration of structures per square millimeter of filter is less than or equal to 70 s/mm^2, the response action is complete and no further analysis is needed.

3. If less than 1,199 L of air for a 25 mm filter or 2,799 L of air for a 37 mm filter is collected for any of the inside samples, or the arithmetic mean concentration of structures per square millimeter of filter is greater than 70 s/mm^2, analyze the three blanks.

4. If the arithmetic mean concentration of structures per square millimeter on the blank filters is greater than 70 s/mm^2, terminate the analysis, identify and correct the source of blank contamination, and collect a new set of samples.

5. If the arithmetic mean concentration of structures per square millimeter on the blank filters is less than or equal to 70 s/mm^2, analyze the outside samples and perform the Z-test.

6. If the Z-statistic is less than or equal to 1.65, the response action is complete. If the Z-statistic is greater than 1.65, reclean the abatement site and collect a new set of samples.

[52 FR 41857, Oct. 30, 1987]

APPENDIX B TO SUBPART E OF PART 763 [RESERVED]

APPENDIX C TO SUBPART E OF PART 763—ASBESTOS MODEL ACCREDITATION PLAN

I. Asbestos Model Accreditation Plan for States

The Asbestos Model Accreditation Plan (MAP) for States has eight components:

(A) Definitions
(B) Initial Training
(C) Examinations
(D) Continuing Education
(E) Qualifications
(F) Recordkeeping Requirements for Training Providers
(G) Deaccreditation
(H) Reciprocity
(I) Electronic reporting

A. Definitions

For purposes of Appendix C:

1. ''Friable asbestos-containing material (ACM)'' means any material containing more than one percent asbestos which has been applied on ceilings, walls, structural members, piping, duct work, or any other part of a building, which when dry, may be crumbled, pulverized, or reduced to powder by hand pressure. The term includes non-friable asbestos-containing material after such previously non-friable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.

2. ''Friable asbestos-containing building material (ACBM)'' means any friable ACM that is in or on interior structural members or other parts of a school or public and commercial building.

3. ''Inspection'' means an activity undertaken in a school building, or a public and commercial building, to determine the presence or location, or to assess the condition of, friable or non-friable asbestos-containing building material (ACBM) or suspected ACBM, whether by visual or physical examination, or by collecting samples of such material. This term includes reinspections of friable and non-friable known or assumed ACBM which has been previously identified. The term does not include the following:

a. Periodic surveillance of the type described in 40 CFR 763.92(b) solely for the purpose of recording or reporting a change in the condition of known or assumed ACBM;

b. Inspections performed by employees or agents of Federal, State, or local government solely for the purpose of determining compliance with applicable statutes or regulations; or

c. visual inspections of the type described in 40 CFR 763.90(i) solely for the purpose of determining completion of response actions.

4. ''Major fiber release episode'' means any uncontrolled or unintentional disturbance of ACBM, resulting in a visible emission, which involves the falling or dislodging of more than 3 square or linear feet of friable ACBM.

5. ''Minor fiber release episode'' means any uncontrolled or unintentional disturbance of ACBM, resulting in a visible emission, which involves the falling or dislodging of 3 square or linear feet or less of friable ACBM.

6. ''Public and commercial building'' means the interior space of any building which is not a school building, except that the term does not include any residential apartment building of fewer than 10 units or detached single-family homes. The term includes, but is not limited to: industrial and office buildings, residential apartment buildings and condominiums of 10 or more dwelling units, government-owned buildings, colleges, museums, airports, hospitals, churches, preschools, stores, warehouses and factories. Interior space includes exterior hallways connecting buildings, porticos, and mechanical systems used to condition interior space.

7. ''Response action'' means a method, including removal, encapsulation, enclosure, repair, and operation and maintenance, that protects human health and the environment from friable ACBM.

8. ''Small-scale, short-duration activities (SSSD)'' are tasks such as, but not limited to:

a. Removal of asbestos-containing insulation on pipes.

b. Removal of small quantities of asbestos-containing insulation on beams or above ceilings.

c. Replacement of an asbestos-containing gasket on a valve.

d. Installation or removal of a small section of drywall.

e. Installation of electrical conduits through or proximate to asbestos-containing materials.

SSSD can be further defined by the following considerations:

f. Removal of small quantities of ACM only if required in the performance of another maintenance activity not intended as asbestos abatement.

g. Removal of asbestos-containing thermal system insulation not to exceed amounts greater than those which can be contained in a single glove bag.

h. Minor repairs to damaged thermal system insulation which do not require removal.

i. Repairs to a piece of asbestos-containing wallboard.

j. Repairs, involving encapsulation, enclosure, or removal, to small amounts of friable ACM only if required in the performance of emergency or routine maintenance activity and not intended solely as asbestos abatement. Such work may not exceed amounts greater than those which can be contained in a single prefabricated mini-enclosure. Such an enclosure shall conform spatially and geometrically to the localized work area, in order to perform its intended containment function.

B. Initial Training

Training requirements for purposes of accreditation are specified both in terms of required subjects of instruction and in terms of length of training. Each initial training course has a prescribed curriculum and number of days of training. One day of training equals 8 hours, including breaks and lunch. Course instruction must be provided by EPA or State-approved instructors. EPA or State instructor approval shall be based upon a review of the instructor's academic credentials and/or field experience in asbestos abatement.

Beyond the initial training requirements, individual States may wish to consider requiring additional days of training for purposes of supplementing hands-on activities or for reviewing relevant state regulations. States also may wish to consider the relative merits of a worker apprenticeship program. Further, they might consider more stringent minimum qualification standards for the approval of training instructors. EPA recommends that the enrollment in any given course be limited to 25 students so that adequate opportunities exist for individual hands-on experience.

States have the option to provide initial training directly or approve other entities to offer training. The following requirements are for the initial training of persons required to have accreditation under TSCA Title II.

Training requirements for each of the five accredited disciplines are outlined below. Persons in each discipline perform a different job function and distinct role. Inspectors identify and assess the condition of ACBM, or suspect ACBM. Management planners use data gathered by inspectors to assess the degree of hazard posed by ACBM in schools to determine the scope and timing of appropriate response actions needed for schools. Project designers determine how asbestos abatement work should be conducted. Lastly, workers and contractor/supervisors carry out and oversee abatement work. In addition, a recommended training curriculum is also presented for a sixth discipline, which is not federally-accredited, that of ''Project Monitor.'' Each accredited discipline and training curriculum is separate and distinct from the others. A person seeking accreditation in any of the five accredited MAP disciplines cannot attend two or more courses concurrently, but may attend such courses sequentially.

In several instances, initial training courses for a specific discipline (e.g., workers, inspectors) require hands-on training. For asbestos abatement contractor/supervisors and workers, hands-on training should include working with asbestos-substitute materials, fitting and using respirators, use of glovebags, donning protective clothing, and constructing a decontamination unit as well as other abatement work activities.

1. WORKERS

A person must be accredited as a worker to carry out any of the following activities with respect to friable ACBM in a school or public and commercial building: (1) A response action other than a SSSD activity, (2) a maintenance activity that disturbs friable ACBM other than a SSSD activity, or (3) a response action for a major fiber release episode. All persons seeking accreditation as asbestos abatement workers shall complete at least a 4–day training course as outlined below. The 4–day worker training course shall include lectures, demonstrations, at least 14 hours of hands-on training, individual respirator fit testing, course review, and an examination. Hands-on training must permit workers to have actual experience performing tasks associated with asbestos abatement. A person who is otherwise accredited as a contractor/supervisor may perform in the role of a worker without possessing separate accreditation as a worker.

Because of cultural diversity associated with the asbestos workforce, EPA recommends that States adopt specific standards for the approval of foreign language courses for abatement workers. EPA further recommends the use of audio-visual materials to complement lectures, where appropriate.

The training course shall adequately address the following topics:

(a) *Physical characteristics of asbestos.* Identification of asbestos, aerodynamic characteristics, typical uses, and physical appearance, and a summary of abatement control options.

(b) *Potential health effects related to asbestos exposure.* The nature of asbestos-related diseases; routes of exposure; dose-response relationships and the lack of a safe exposure level; the synergistic effect between cigarette smoking and asbestos exposure; the latency periods for asbestos-related diseases; a discussion of the relationship of asbestos exposure to asbestosis, lung cancer, mesothelioma, and cancers of other organs.

(c) *Employee personal protective equipment.* Classes and characteristics of respirator

types; limitations of respirators; proper selection, inspection; donning, use, maintenance, and storage procedures for respirators; methods for field testing of the facepiece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit (e.g., facial hair); the components of a proper respiratory protection program; selection and use of personal protective clothing; use, storage, and handling of non-disposable clothing; and regulations covering personal protective equipment.

(d) *State-of-the-art work practices.* Proper work practices for asbestos abatement activities, including descriptions of proper construction; maintenance of barriers and decontamination enclosure systems; positioning of warning signs; lock-out of electrical and ventilation systems; proper working techniques for minimizing fiber release; use of wet methods; use of negative pressure exhaust ventilation equipment; use of high-efficiency particulate air (HEPA) vacuums; proper clean-up and disposal procedures; work practices for removal, encapsulation, enclosure, and repair of ACM; emergency procedures for sudden releases; potential exposure situations; transport and disposal procedures; and recommended and prohibited work practices.

(e) *Personal hygiene.* Entry and exit procedures for the work area; use of showers; avoidance of eating, drinking, smoking, and chewing (gum or tobacco) in the work area; and potential exposures, such as family exposure.

(f) *Additional safety hazards.* Hazards encountered during abatement activities and how to deal with them, including electrical hazards, heat stress, air contaminants other than asbestos, fire and explosion hazards, scaffold and ladder hazards, slips, trips, and falls, and confined spaces.

(g) *Medical monitoring.* OSHA and EPA Worker Protection Rule requirements for physical examinations, including a pulmonary function test, chest X-rays, and a medical history for each employee.

(h) *Air monitoring.* Procedures to determine airborne concentrations of asbestos fibers, focusing on how personal air sampling is performed and the reasons for it.

(i) *Relevant Federal, State, and local regulatory requirements, procedures, and standards.* With particular attention directed at relevant EPA, OSHA, and State regulations concerning asbestos abatement workers.

(j) *Establishment of respiratory protection programs.*

(k) *Course review.* A review of key aspects of the training course.

2. CONTRACTOR/SUPERVISORS

A person must be accredited as a contractor/supervisor to supervise any of the following activities with respect to friable ACBM in a school or public and commercial building: (1) A response action other than a SSSD activity, (2) a maintenance activity that disturbs friable ACBM other than a SSSD activity, or (3) a response action for a major fiber release episode. All persons seeking accreditation as asbestos abatement contractor/supervisors shall complete at least a 5–day training course as outlined below. The training course must include lectures, demonstrations, at least 14 hours of hands-on training, individual respirator fit testing, course review, and a written examination. Hands-on training must permit supervisors to have actual experience performing tasks associated with asbestos abatement.

EPA recommends the use of audiovisual materials to complement lectures, where appropriate.

Asbestos abatement supervisors include those persons who provide supervision and direction to workers performing response actions. Supervisors may include those individuals with the position title of foreman, working foreman, or leadman pursuant to collective bargaining agreements. At least one supervisor is required to be at the worksite at all times while response actions are being conducted. Asbestos workers must have access to accredited supervisors throughout the duration of the project.

The contractor/supervisor training course shall adequately address the following topics:

(a) *The physical characteristics of asbestos and asbestos-containing materials.* Identification of asbestos, aerodynamic characteristics, typical uses, physical appearance, a review of hazard assessment considerations, and a summary of abatement control options.

(b) *Potential health effects related to asbestos exposure.* The nature of asbestos-related diseases; routes of exposure; dose-response relationships and the lack of a safe exposure level; synergism between cigarette smoking and asbestos exposure; and latency period for diseases.

(c) *Employee personal protective equipment.* Classes and characteristics of respirator types; limitations of respirators; proper selection, inspection, donning, use, maintenance, and storage procedures for respirators; methods for field testing of the facepiece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit (e.g., facial hair); the components of a proper respiratory protection program; selection and use of personal protective clothing; and use, storage,

and handling of non-disposable clothing; and regulations covering personal protective equipment.

(d) *State-of-the-art work practices.* Proper work practices for asbestos abatement activities, including descriptions of proper construction and maintenance of barriers and decontamination enclosure systems; positioning of warning signs; lock-out of electrical and ventilation systems; proper working techniques for minimizing fiber release; use of wet methods; use of negative pressure exhaust ventilation equipment; use of HEPA vacuums; and proper clean-up and disposal procedures. Work practices for removal, encapsulation, enclosure, and repair of ACM; emergency procedures for unplanned releases; potential exposure situations; transport and disposal procedures; and recommended and prohibited work practices. New abatement-related techniques and methodologies may be discussed.

(e) *Personal hygiene.* Entry and exit procedures for the work area; use of showers; and avoidance of eating, drinking, smoking, and chewing (gum or tobacco) in the work area. Potential exposures, such as family exposure, shall also be included.

(f) *Additional safety hazards.* Hazards encountered during abatement activities and how to deal with them, including electrical hazards, heat stress, air contaminants other than asbestos, fire and explosion hazards, scaffold and ladder hazards, slips, trips, and falls, and confined spaces.

(g) *Medical monitoring.* OSHA and EPA Worker Protection Rule requirements for physical examinations, including a pulmonary function test, chest X-rays and a medical history for each employee.

(h) *Air monitoring.* Procedures to determine airborne concentrations of asbestos fibers, including descriptions of aggressive air sampling, sampling equipment and methods, reasons for air monitoring, types of samples and interpretation of results.

EPA recommends that transmission electron microscopy (TEM) be used for analysis of final air clearance samples, and that sample analyses be performed by laboratories accredited by the National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program (NVLAP).

(i) *Relevant Federal, State, and local regulatory requirements, procedures, and standards, including:*

(i) Requirements of TSCA Title II.

(ii) National Emission Standards for Hazardous Air Pollutants (40 CFR part 61), Subparts A (General Provisions) and M (National Emission Standard for Asbestos).

(iii) OSHA standards for permissible exposure to airborne concentrations of asbestos fibers and respiratory protection (29 CFR 1910.134).

(iv) OSHA Asbestos Construction Standard (29 CFR 1926.58). (v)EPA Worker Protection Rule, (40 CFR part 763, Subpart G).

(j) *Respiratory Protection Programs and Medical Monitoring Programs.*

(k) *Insurance and liability issues.* Contractor issues; worker's compensation coverage and exclusions; third-party liabilities and defenses; insurance coverage and exclusions.

(l) *Recordkeeping for asbestos abatement projects.* Records required by Federal, State, and local regulations; records recommended for legal and insurance purposes.

(m) *Supervisory techniques for asbestos abatement activities.* Supervisory practices to enforce and reinforce the required work practices and discourage unsafe work practices.

(n) *Contract specifications.* Discussions of key elements that are included in contract specifications.

(o) *Course review.* A review of key aspects of the training course.

3. INSPECTOR

All persons who inspect for ACBM in schools or public and commercial buildings must be accredited. All persons seeking accreditation as an inspector shall complete at least a 3-day training course as outlined below. The course shall include lectures, demonstrations, 4 hours of hands-on training, individual respirator fit-testing, course review, and a written examination.

EPA recommends the use of audiovisual materials to complement lectures, where appropriate. Hands-on training should include conducting a simulated building walk-through inspection and respirator fit testing. The inspector training course shall adequately address the following topics:

(a) *Background information on asbestos.* Identification of asbestos, and examples and discussion of the uses and locations of asbestos in buildings; physical appearance of asbestos.

(b) *Potential health effects related to asbestos exposure.* The nature of asbestos-related diseases; routes of exposure; dose-response relationships and the lack of a safe exposure level; the synergistic effect between cigarette smoking and asbestos exposure; the latency periods for asbestos-related diseases; a discussion of the relationship of asbestos exposure to asbestosis, lung cancer, mesothelioma, and cancers of other organs.

(c) *Functions/qualifications and role of inspectors.* Discussions of prior experience and qualifications for inspectors and management planners; discussions of the functions of an accredited inspector as compared to those of an accredited management planner; discussion of inspection process including inventory of ACM and physical assessment.

(d) *Legal liabilities and defenses.* Responsibilities of the inspector and management

planner; a discussion of comprehensive general liability policies, claims-made, and occurrence policies, environmental and pollution liability policy clauses; state liability insurance requirements; bonding and the relationship of insurance availability to bond availability.

(e) *Understanding building systems.* The interrelationship between building systems, including: an overview of common building physical plan layout; heat, ventilation, and air conditioning (HVAC) system types, physical organization, and where asbestos is found on HVAC components; building mechanical systems, their types and organization, and where to look for asbestos on such systems; inspecting electrical systems, including appropriate safety precautions; reading blueprints and as-built drawings.

(f) *Public/employee/building occupant relations.* Notifying employee organizations about the inspection; signs to warn building occupants; tact in dealing with occupants and the press; scheduling of inspections to minimize disruptions; and education of building occupants about actions being taken.

(g) *Pre-inspection planning and review of previous inspection records.* Scheduling the inspection and obtaining access; building record review; identification of probable homogeneous areas from blueprints or as-built drawings; consultation with maintenance or building personnel; review of previous inspection, sampling, and abatement records of a building; the role of the inspector in exclusions for previously performed inspections.

(h) *Inspecting for friable and non-friable ACM and assessing the condition of friable ACM.* Procedures to follow in conducting visual inspections for friable and non-friable ACM; types of building materials that may contain asbestos; touching materials to determine friability; open return air plenums and their importance in HVAC systems; assessing damage, significant damage, potential damage, and potential significant damage; amount of suspected ACM, both in total quantity and as a percentage of the total area; type of damage; accessibility; material's potential for disturbance; known or suspected causes of damage or significant damage; and deterioration as assessment factors.

(i) *Bulk sampling/documentation of asbestos.* Detailed discussion of the ''Simplified Sampling Scheme for Friable Surfacing Materials (EPA 560/5-85-030a October 1985)''; techniques to ensure sampling in a randomly distributed manner for other than friable surfacing materials; sampling of non-friable materials; techniques for bulk sampling; inspector's sampling and repair equipment; patching or repair of damage from sampling; discussion of polarized light microscopy; choosing an accredited laboratory to analyze bulk samples; quality control and quality assurance procedures. EPA's recommendation that all bulk samples collected from school or public and commercial buildings be analyzed by a laboratory accredited under the NVLAP administered by NIST.

(j) *Inspector respiratory protection and personal protective equipment.* Classes and characteristics of respirator types; limitations of respirators; proper selection, inspection; donning, use, maintenance, and storage procedures for respirators; methods for field testing of the facepiece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit (e.g., facial hair); the components of a proper respiratory protection program; selection and use of personal protective clothing; use, storage, and handling of non-disposable clothing.

(k) *Recordkeeping and writing the inspection report.* Labeling of samples and keying sample identification to sampling location; recommendations on sample labeling; detailing of ACM inventory; photographs of selected sampling areas and examples of ACM condition; information required for inclusion in the management plan required for school buildings under TSCA Title II, section 203 (i)(1). EPA recommends that States develop and require the use of standardized forms for recording the results of inspections in schools or public or commercial buildings, and that the use of these forms be incorporated into the curriculum of training conducted for accreditation.

(l) *Regulatory review.* The following topics should be covered: National Emission Standards for Hazardous Air Pollutants (NESHAP; 40 CFR part 61, Subparts A and M); EPA Worker Protection Rule (40 CFR part 763, Subpart G); OSHA Asbestos Construction Standard (29 CFR 1926.58); OSHA respirator requirements (29 CFR 1910.134); the Asbestos-Containing Materials in School Rule (40 CFR part 763, Subpart E; applicable State and local regulations, and differences between Federal and State requirements where they apply, and the effects, if any, on public and nonpublic schools or commercial or public buildings.

(m) *Field trip.* This includes a field exercise, including a walk-through inspection; on-site discussion about information gathering and the determination of sampling locations; on-site practice in physical assessment; classroom discussion of field exercise.

(n) *Course review.* A review of key aspects of the training course.

4. MANAGEMENT PLANNER

All persons who prepare management plans for schools must be accredited. All persons seeking accreditation as management planners shall complete a 3-day inspector training course as outlined above and a 2-day

management planner training course. Possession of current and valid inspector accreditation shall be a prerequisite for admission to the management planner training course. The management planner course shall include lectures, demonstrations, course review, and a written examination.

EPA recommends the use of audiovisual materials to complement lectures, where appropriate.

TSCA Title II does not require accreditation for persons performing the management planner role in public and commercial buildings. Nevertheless, such persons may find this training and accreditation helpful in preparing them to design or administer asbestos operations and maintenance programs for public and commercial buildings.

The management planner training course shall adequately address the following topics:

(a) *Course overview.* The role and responsibilities of the management planner; operations and maintenance programs; setting work priorities; protection of building occupants.

(b) *Evaluation/interpretation of survey results.* Review of TSCA Title II requirements for inspection and management plans for school buildings as given in section 203(i)(1) of TSCA Title II; interpretation of field data and laboratory results; comparison of field inspector's data sheet with laboratory results and site survey.

(c) *Hazard assessment.* Amplification of the difference between physical assessment and hazard assessment; the role of the management planner in hazard assessment; explanation of significant damage, damage, potential damage, and potential significant damage; use of a description (or decision tree) code for assessment of ACM; assessment of friable ACM; relationship of accessibility, vibration sources, use of adjoining space, and air plenums and other factors to hazard assessment.

(d) *Legal implications.* Liability; insurance issues specific to planners; liabilities associated with interim control measures, in-house maintenance, repair, and removal; use of results from previously performed inspections.

(e) *Evaluation and selection of control options.* Overview of encapsulation, enclosure, interim operations and maintenance, and removal; advantages and disadvantages of each method; response actions described via a decision tree or other appropriate method; work practices for each response action; staging and prioritizing of work in both vacant and occupied buildings; the need for containment barriers and decontamination in response actions.

(f) *Role of other professionals.* Use of industrial hygienists, engineers, and architects in developing technical specifications for response actions; any requirements that may exist for architect sign-off of plans; team approach to design of high-quality job specifications.

(g) *Developing an operations and maintenance (O&M) plan.* Purpose of the plan; discussion of applicable EPA guidance documents; what actions should be taken by custodial staff; proper cleaning procedures; steam cleaning and HEPA vacuuming; reducing disturbance of ACM; scheduling O&M for off-hours; rescheduling or canceling renovation in areas with ACM; boiler room maintenance; disposal of ACM; in-house procedures for ACM—bridging and penetrating encapsulants; pipe fittings; metal sleeves; polyvinyl chloride (PVC), canvas, and wet wraps; muslin with straps, fiber mesh cloth; mineral wool, and insulating cement; discussion of employee protection programs and staff training; case study in developing an O&M plan (development, implementation process, and problems that have been experienced).

(h) *Regulatory review.* Focusing on the OSHA Asbestos Construction Standard found at 29 CFR 1926.58; the National Emission Standard for Hazardous Air Pollutants (NESHAP) found at 40 CFR part 61, Subparts A (General Provisions) and M (National Emission Standard for Asbestos); EPA Worker Protection Rule found at 40 CFR part 763, Subpart G; TSCA Title II; applicable State regulations.

(i) *Recordkeeping for the management planner.* Use of field inspector's data sheet along with laboratory results; on-going recordkeeping as a means to track asbestos disturbance; procedures for recordkeeping. EPA recommends that States require the use of standardized forms for purposes of management plans and incorporate the use of such forms into the initial training course for management planners.

(j) *Assembling and submitting the management plan.* Plan requirements for schools in TSCA Title II section 203(i)(1); the management plan as a planning tool.

(k) *Financing abatement actions.* Economic analysis and cost estimates; development of cost estimates; present costs of abatement versus future operation and maintenance costs; Asbestos School Hazard Abatement Act grants and loans.

(l) *Course review.* A review of key aspects of the training course.

5. PROJECT DESIGNER

A person must be accredited as a project designer to design any of the following activities with respect to friable ACBM in a school or public and commercial building: (1) A response action other than a SSSD maintenance activity, (2) a maintenance activity that disturbs friable ACBM other than a SSSD maintenance activity, or (3) a response action for a major fiber release episode. All persons seeking accreditation as a project designer shall complete at least a minimum

3–day training course as outlined below. The project designer course shall include lectures, demonstrations, a field trip, course review and a written examination.

EPA recommends the use of audiovisual materials to complement lectures, where appropriate.

The abatement project designer training course shall adequately address the following topics:

(a) *Background information on asbestos.* Identification of asbestos; examples and discussion of the uses and locations of asbestos in buildings; physical appearance of asbestos.

(b) *Potential health effects related to asbestos exposure.* Nature of asbestos-related diseases; routes of exposure; dose-response relationships and the lack of a safe exposure level; the synergistic effect between cigarette smoking and asbestos exposure; the latency period of asbestos-related diseases; a discussion of the relationship between asbestos exposure and asbestosis, lung cancer, mesothelioma, and cancers of other organs.

(c) *Overview of abatement construction projects.* Abatement as a portion of a renovation project; OSHA requirements for notification of other contractors on a multi-employer site (29 CFR 1926.58).

(d) *Safety system design specifications.* Design, construction, and maintenance of containment barriers and decontamination enclosure systems; positioning of warning signs; electrical and ventilation system lockout; proper working techniques for minimizing fiber release; entry and exit procedures for the work area; use of wet methods; proper techniques for initial cleaning; use of negative-pressure exhaust ventilation equipment; use of HEPA vacuums; proper clean-up and disposal of asbestos; work practices as they apply to encapsulation, enclosure, and repair; use of glove bags and a demonstration of glove bag use.

(e) *Field trip.* A visit to an abatement site or other suitable building site, including on-site discussions of abatement design and building walk-through inspection. Include discussion of rationale for the concept of functional spaces during the walk-through.

(f) *Employee personal protective equipment.* Classes and characteristics of respirator types; limitations of respirators; proper selection, inspection; donning, use, maintenance, and storage procedures for respirators; methods for field testing of the facepiece-to-face seal (positive and negative-pressure fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit (e.g., facial hair); the components of a proper respiratory protection program; selection and use of personal protective clothing; use, storage, and handling of non-disposable clothing.

(g) *Additional safety hazards.* Hazards encountered during abatement activities and how to deal with them, including electrical hazards, heat stress, air contaminants other than asbestos, fire, and explosion hazards.

(h) *Fiber aerodynamics and control.* Aerodynamic characteristics of asbestos fibers; importance of proper containment barriers; settling time for asbestos fibers; wet methods in abatement; aggressive air monitoring following abatement; aggressive air movement and negative-pressure exhaust ventilation as a clean-up method.

(i) *Designing abatement solutions.* Discussions of removal, enclosure, and encapsulation methods; asbestos waste disposal.

(j) *Final clearance process.* Discussion of the need for a written sampling rationale for aggressive final air clearance; requirements of a complete visual inspection; and the relationship of the visual inspection to final air clearance.

EPA recommends the use of TEM for analysis of final air clearance samples. These samples should be analyzed by laboratories accredited under the NIST NVLAP.

(k) *Budgeting/cost estimating.* Development of cost estimates; present costs of abatement versus future operation and maintenance costs; setting priorities for abatement jobs to reduce costs.

(l) *Writing abatement specifications.* Preparation of and need for a written project design; means and methods specifications versus performance specifications; design of abatement in occupied buildings; modification of guide specifications for a particular building; worker and building occupant health/medical considerations; replacement of ACM with non-asbestos substitutes.

(m) *Preparing abatement drawings.* Significance and need for drawings, use of as-built drawings as base drawings; use of inspection photographs and on-site reports; methods of preparing abatement drawings; diagramming containment barriers; relationship of drawings to design specifications; particular problems related to abatement drawings.

(n) *Contract preparation and administration.*

(o) *Legal/liabilities/defenses.* Insurance considerations; bonding; hold-harmless clauses; use of abatement contractor's liability insurance; claims made versus occurrence policies.

(p) *Replacement.* Replacement of asbestos with asbestos-free substitutes.

(q) *Role of other consultants.* Development of technical specification sections by industrial hygienists or engineers; the multi-disciplinary team approach to abatement design.

(r) *Occupied buildings.* Special design procedures required in occupied buildings; education of occupants; extra monitoring recommendations; staging of work to minimize occupant exposure; scheduling of renovation to minimize exposure.

(s) *Relevant Federal, State, and local regulatory requirements, procedures and standards, including, but not limited to:*

(i) Requirements of TSCA Title II.

(ii) National Emission Standards for Hazardous Air Pollutants, (40 CFR part 61) subparts A (General Provisions) and M (National Emission Standard for Asbestos).

(iii) OSHA Respirator Standard found at 29 CFR 1910.134.

(iv) EPA Worker Protection Rule found at 40 CFR part 763, subpart G.

(v) OSHA Asbestos Construction Standard found at 29 CFR 1926.58.

(vi) OSHA Hazard Communication Standard found at 29 CFR 1926.59.

(t) *Course review.* A review of key aspects of the training course.

6. PROJECT MONITOR

EPA recommends that States adopt training and accreditation requirements for persons seeking to perform work as project monitors. Project monitors observe abatement activities performed by contractors and generally serve as a building owner's representative to ensure that abatement work is completed according to specification and in compliance with all relevant statutes and regulations. They may also perform the vital role of air monitoring for purposes of determining final clearance. EPA recommends that a State seeking to accredit individuals as project monitors consider adopting a minimum 5–day training course covering the topics outlined below. The course outlined below consists of lectures and demonstrations, at least 6 hours of hands-on training, course review, and a written examination. The hands-on training component might be satisfied by having the student simulate participation in or performance of any of the relevant job functions or activities (or by incorporation of the workshop component described in item ''n'' below of this unit).

EPA recommends that the project monitor training course adequately address the following topics:

(a) *Roles and responsibilities of the project monitor.* Definition and responsibilities of the project monitor, including regulatory/specification compliance monitoring, air monitoring, conducting visual inspections, and final clearance monitoring.

(b) *Characteristics of asbestos and asbestos-containing materials.* Typical uses of asbestos; physical appearance of asbestos; review of asbestos abatement and control techniques; presentation of the health effects of asbestos exposure, including routes of exposure, dose-response relationships, and latency periods for asbestos-related diseases.

(c) *Federal asbestos regulations.* Overview of pertinent EPA regulations, including: NESHAP, 40 CFR part 61, subparts A and M; AHERA, 40 CFR part 763, subpart E; and the EPA Worker Protection Rule, 40 CFR part 763, subpart G. Overview of pertinent OSHA regulations, including: Construction Industry Standard for Asbestos, 29 CFR 1926.58; Respirator Standard, 29 CFR 1910.134; and the Hazard Communication Standard, 29 CFR 1926.59. Applicable State and local asbestos regulations; regulatory interrelationships.

(d) *Understanding building construction and building systems.* Building construction basics, building physical plan layout; understanding building systems (HVAC, electrical, etc.); layout and organization, where asbestos is likely to be found on building systems; renovations and the effect of asbestos abatement on building systems.

(e) *Asbestos abatement contracts, specifications, and drawings.* Basic provisions of the contract; relationships between principle parties, establishing chain of command; types of specifications, including means and methods, performance, and proprietary and nonproprietary; reading and interpreting records and abatement drawings; discussion of change orders; common enforcement responsibilities and authority of project monitor.

(f) *Response actions and abatement practices.* Pre-work inspections; pre-work considerations, precleaning of the work area, removal of furniture, fixtures, and equipment; shutdown/modification of building systems; construction and maintenance of containment barriers, proper demarcation of work areas; work area entry/exit, hygiene practices; determining the effectiveness of air filtration equipment; techniques for minimizing fiber release, wet methods, continuous cleaning; abatement methods other than removal; abatement area clean-up procedures; waste transport and disposal procedures; contingency planning for emergency response.

(g) *Asbestos abatement equipment.* Typical equipment found on an abatement project; air filtration devices, vacuum systems, negative pressure differential monitoring; HEPA filtration units, theory of filtration, design/construction of HEPA filtration units, qualitative and quantitative performance of HEPA filtration units, sizing the ventilation requirements, location of HEPA filtration units, qualitative and quantitative tests of containment barrier integrity; best available technology.

(h) *Personal protective equipment.* Proper selection of respiratory protection; classes and characteristics of respirator types, limitations of respirators; proper use of other safety equipment, protective clothing selection, use, and proper handling, hard/bump hats, safety shoes; breathing air systems, high pressure v. low pressure, testing for Grade D air, determining proper backup air volumes.

(i) *Air monitoring strategies.* Sampling equipment, sampling pumps (low v. high volume), flow regulating devices (critical and

limiting orifices), use of fibrous aerosol monitors on abatement projects; sampling media, types of filters, types of cassettes, filter orientation, storage and shipment of filters; calibration techniques, primary calibration standards, secondary calibration standards, temperature/pressure effects, frequency of calibration, recordkeeping and field work documentation, calculations; air sample analysis, techniques available and limitations of AHERA on their use, transmission electron microscopy (background to sample preparation and analysis, air sample conditions which prohibit analysis, EPA's recommended technique for analysis of final air clearance samples), phase contrast microscopy (background to sample preparation, and AHERA's limits on the use of phase contrast microscopy), what each technique measures; analytical methodologies, AHERA TEM protocol, NIOSH 7400, OSHA reference method (non clearance), EPA recommendation for clearance (TEM); sampling strategies for clearance monitoring, types of air samples (personal breathing zone v. fixed-station area) sampling location and objectives (pre-abatement, during abatement, and clearance monitoring), number of samples to be collected, minimum and maximum air volumes, clearance monitoring (post-visual-inspection) (number of samples required, selection of sampling locations, period of sampling, aggressive sampling, interpretations of sampling results, calculations), quality assurance; special sampling problems, crawl spaces, acceptable samples for laboratory analysis, sampling in occupied buildings (barrier monitoring).

(j) *Safety and health issues other than asbestos.* Confined-space entry, electrical hazards, fire and explosion concerns, ladders and scaffolding, heat stress, air contaminants other than asbestos, fall hazards, hazardous materials on abatement projects.

(k) *Conducting visual inspections.* Inspections during abatement, visual inspections using the ASTM E1368 document; conducting inspections for completeness of removal; discussion of ''how clean is clean?''

(l) *Legal responsibilities and liabilities of project monitors.* Specification enforcement capabilities; regulatory enforcement; licensing; powers delegated to project monitors through contract documents.

(m) *Recordkeeping and report writing.* Developing project logs/daily logs (what should be included, who sees them); final report preparation; recordkeeping under Federal regulations.

(n) *Workshops (6 hours spread over 3 days).* Contracts, specifications, and drawings: This workshop could consist of each participant being issued a set of contracts, specifications, and drawings and then being asked to answer questions and make recommendations to a project architect, engineer or to the building owner based on given conditions and these documents.

Air monitoring strategies/asbestos abatement equipment: This workshop could consist of simulated abatement sites for which sampling strategies would have to be developed (i.e., occupied buildings, industrial situations). Through demonstrations and exhibition, the project monitor may also be able to gain a better understanding of the function of various pieces of equipment used on abatement projects (air filtration units, water filtration units, negative pressure monitoring devices, sampling pump calibration devices, etc.).

Conducting visual inspections: This workshop could consist, ideally, of an interactive video in which a participant is ''taken through'' a work area and asked to make notes of what is seen. A series of questions will be asked which are designed to stimulate a person's recall of the area. This workshop could consist of a series of two or three videos with different site conditions and different degrees of cleanliness.

C. Examinations

1. Each State shall administer a closed book examination or designate other entities such as State-approved providers of training courses to administer the closed-book examination to persons seeking accreditation who have completed an initial training course. Demonstration testing may also be included as part of the examination. A person seeking initial accreditation in a specific discipline must pass the examination for that discipline in order to receive accreditation. For example, a person seeking accreditation as an abatement project designer must pass the State's examination for abatement project designer.

States may develop their own examinations, have providers of training courses develop examinations, or use standardized examinations developed for purposes of accreditation under TSCA Title II. In addition, States may supplement standardized examinations with questions about State regulations. States may obtain commercially developed standardized examinations, develop standardized examinations independently, or do so in cooperation with other States, or with commercial or non-profit providers on a regional or national basis. EPA recommends the use of standardized, scientifically-validated testing instruments, which may be beneficial in terms of both promoting competency and in fostering accreditation reciprocity between States.

Each examination shall adequately cover the topics included in the training course for that discipline. Each person who completes a

training course, passes the required examination, and fulfills whatever other requirements the State imposes must receive an accreditation certificate in a specific discipline. Whether a State directly issues accreditation certificates, or authorizes training providers to issue accreditation certificates, each certificate issued to an accredited person must contain the following minimum information:

a. A unique certificate number

b. Name of accredited person

c. Discipline of the training course completed.

d. Dates of the training course.

e. Date of the examination.

f. An expiration date of 1 year after the date upon which the person successfully completed the course and examination.

g. The name, address, and telephone number of the training provider that issued the certificate.

h. A statement that the person receiving the certificate has completed the requisite training for asbestos accreditation under TSCA Title II.

States or training providers who reaccredit persons based upon completion of required refresher training must also provide accreditation certificates with all of the above information, except the examination date may be omitted if a State does not require a refresher examination for reaccreditation.

Where a State licenses accredited persons but has authorized training providers to issue accreditation certificates, the State may issue licenses in the form of photo-identification cards. Where this applies, EPA recommends that the State licenses should include all of the same information required for the accreditation certificates. A State may also choose to issue photo-identification cards in addition to the required accreditation certificates.

Accredited persons must have their initial and current accreditation certificates at the location where they are conducting work.

2. The following are the requirements for examination in each discipline:

a. Worker:

i. 50 multiple-choice questions

ii. Passing score: 70 percent correct

b. Contractor/Supervisor:

i. 100 multiple-choice questions

ii. Passing score: 70 percent correct

c. Inspector:

i. 50 Multiple-choice questions

ii. Passing score: 70 percent correct

d. Management Planner:

i. 50 Multiple-choice questions

ii. Passing score: 70 percent correct

e. Project Designer:

i. 100 multiple-choice questions

ii. Passing score: 70 percent correct

D. Continuing Education

For all disciplines, a State's accreditation program shall include annual refresher training as a requirement for reaccreditation as indicated below:

1. Workers: One full day of refresher training.

2. Contractor/Supervisors: One full day of refresher training.

3. Inspectors: One half-day of refresher training.

4. Management Planners: One half-day of inspector refresher training and one half-day of refresher training for management planners.

5. Project Designers: One full day of refresher training.

The refresher courses shall be specific to each discipline. Refresher courses shall be conducted as separate and distinct courses and not combined with any other training during the period of the refresher course. For each discipline, the refresher course shall review and discuss changes in Federal, State, and local regulations, developments in state-of-the-art procedures, and a review of key aspects of the initial training course as determined by the State. After completing the annual refresher course, persons shall have their accreditation extended for an additional year from the date of the refresher course. A State may consider requiring persons to pass reaccreditation examinations at specific intervals (for example, every 3 years).

EPA recommends that States formally establish a 12-month grace period to enable formerly accredited persons with expired certificates to complete refresher training and have their accreditation status reinstated without having to re-take the initial training course.

E. Qualifications

In addition to requiring training and an examination, a State may require candidates for accreditation to meet other qualification and/or experience standards that the State considers appropriate for some or all disciplines. States may choose to consider requiring qualifications similar to the examples outlined below for inspectors, management planners and project designers. States may modify these examples as appropriate. In addition, States may want to include some requirements based on experience in performing a task directly as a part of a job or in an apprenticeship role. They may also wish to consider additional criteria for the approval of training course instructors beyond those prescribed by EPA.

1. Inspectors: Qualifications - possess a high school diploma. States may want to require an Associate's Degree in specific fields (e.g., environmental or physical sciences).

2. Management Planners: Qualifications - Registered architect, engineer, or certified industrial hygienist or related scientific field.

3. Project Designers: Qualifications - registered architect, engineer, or certified industrial hygienist.

4. Asbestos Training Course Instructor: Qualifications - academic credentials and/or field experience in asbestos abatement.

EPA recommends that States prescribe minimum qualification standards for training instructors employed by training providers.

F. Recordkeeping Requirements for Training Providers

All approved providers of accredited asbestos training courses must comply with the following minimum recordkeeping requirements.

1. Training course materials. A training provider must retain copies of all instructional materials used in the delivery of the classroom training such as student manuals, instructor notebooks and handouts.

2. Instructor qualifications. A training provider must retain copies of all instructors' resumes, and the documents approving each instructor issued by either EPA or a State. Instructors must be approved by either EPA or a State before teaching courses for accreditation purposes. A training provider must notify EPA or the State, as appropriate, in advance whenever it changes course instructors. Records must accurately identify the instructors that taught each particular course for each date that a course is offered.

3. Examinations. A training provider must document that each person who receives an accreditation certificate for an initial training course has achieved a passing score on the examination. These records must clearly indicate the date upon which the exam was administered, the training course and discipline for which the exam was given, the name of the person who proctored the exam, a copy of the exam, and the name and test score of each person taking the exam. The topic and dates of the training course must correspond to those listed on that person's accreditation certificate. States may choose to apply these same requirements to examinations for refresher training courses.

4. Accreditation certificates. The training providers or States, whichever issues the accreditation certificate, shall maintain records that document the names of all persons who have been awarded certificates, their certificate numbers, the disciplines for which accreditation was conferred, training and expiration dates, and the training location. The training provider or State shall maintain the records in a manner that allows verification by telephone of the required information.

5. Verification of certificate information. EPA recommends that training providers of refresher training courses confirm that their students possess valid accreditation before granting course admission. EPA further recommends that training providers offering the initial management planner training course verify that students have met the prerequisite of possessing valid inspector accreditation at the time of course admission.

6. Records retention and access. (a) The training provider shall maintain all required records for a minimum of 3 years. The training provider, however, may find it advantageous to retain these records for a longer period of time.

(b) The training provider must allow reasonable access to all of the records required by the MAP, and to any other records which may be required by States for the approval of asbestos training providers or the accreditation of asbestos training courses, to both EPA and to State Agencies, on request. EPA encourages training providers to make this information equally accessible to the general public.

(c) If a training provider ceases to conduct training, the training provider shall notify the approving government body (EPA or the State) and give it the opportunity to take possession of that providers asbestos training records.

G. Deaccreditation

1. States must establish criteria and procedures for deaccrediting persons accredited as workers, contractor/supervisors, inspectors, management planners, and project designers. States must follow their own administrative procedures in pursuing deaccreditation actions. At a minimum, the criteria shall include:

(a) Performing work requiring accreditation at a job site without being in physical possession of initial and current accreditation certificates;

(b) Permitting the duplication or use of one's own accreditation certificate by another;

(c) Performing work for which accreditation has not been received; or

(d) Obtaining accreditation from a training provider that does not have approval to offer training for the particular discipline from either EPA or from a State that has a contractor accreditation plan at least as stringent as the EPA MAP.

EPA may directly pursue deaccreditation actions without reliance on State deaccreditation or enforcement authority or actions. In addition to the above-listed situations, the Administrator may suspend or revoke the accreditation of persons who have been subject to a final order imposing a civil penalty or convicted under section 16 of TSCA, 15 U.S.C. 2615 or 2647, for violations of 40 CFR part 763, or section 113 of the Clean

Air Act, 42 U.S.C. 7413, for violations of 40 CFR part 61, subpart M.

2. Any person who performs asbestos work requiring accreditation under section 206(a) of TSCA, 15 U.S.C. 2646(a), without such accreditation is in violation of TSCA. The following persons are not accredited for purposes of section 206(a) of TSCA:

(a) Any person who obtains accreditation through fraudulent representation of training or examination documents;

(b) Any person who obtains training documentation through fraudulent means;

(c) Any person who gains admission to and completes refresher training through fraudulent representation of initial or previous refresher training documentation; or

(d) Any person who obtains accreditation through fraudulent representation of accreditation requirements such as education, training, professional registration, or experience.

H. Reciprocity

EPA recommends that each State establish reciprocal arrangements with other States that have established accreditation programs that meet or exceed the requirements of the MAP. Such arrangements might address cooperation in licensing determinations, the review and approval of training programs and/or instructors, candidate testing and exam administration, curriculum development, policy formulation, compliance monitoring, and the exchange of information and data. The benefits to be derived from these arrangements include a potential cost-savings from the reduction of duplicative activity and the attainment of a more professional accredited workforce as States are able to refine and improve the effectiveness of their programs based upon the experience and methods of other States.

I. Electronic Reporting

States that choose to receive electronic documents must include, at a minimum, the requirements of 40 CFR Part 3—(Electronic reporting) in their programs.

II. EPA Approval Process for State Accreditation Programs

A. States may seek approval for a single discipline or all disciplines as specified in the MAP. For example, a State that currently only requires worker accreditation may receive EPA approval for that discipline alone. EPA encourages States that currently do not have accreditation requirements for all disciplines required under section 206(b)(2) of TSCA, 15 U.S.C. 2646(b)(2), to seek EPA approval for those disciplines the State does accredit. As States establish accreditation requirements for the remaining disciplines, the requested information outlined below should be submitted to EPA as soon as possible. Any State that had an accreditation program approved by EPA under an earlier version of the MAP may follow the same procedures to obtain EPA approval of their accreditation program under this MAP.

B. Partial approval of a State Program for the accreditation of one or more disciplines does not mean that the State is in full compliance with TSCA where the deadline for that State to have adopted a State Plan no less stringent than the MAP has already passed. State Programs which are at least as stringent as the MAP for one or more of the accredited disciplines may, however, accredit persons in those disciplines only.

C. States seeking EPA approval or reapproval of accreditation programs shall submit the following information to the Regional Asbestos Coordinator at their EPA Regional office:

1. A copy of the legislation establishing or upgrading the State's accreditation program (if applicable).

2. A copy of the State's accreditation regulations or revised regulations.

3. A letter to the Regional Asbestos Coordinator that clearly indicates how the State meets the program requirements of this MAP. Addresses for each of the Regional Asbestos Coordinators are shown below:

EPA, Region I, (ATC-111) Asbestos Coordinator, JFK Federal Bldg., Boston, MA 02203-2211, (617) 565-3836.

EPA, Region II, (MS-500), Asbestos Coordinator, 2890 Woodbridge Ave., Edison, NJ 08837-3679, (908) 321-6671.

EPA, Region III, (3AT-33), Asbestos Coordinator, 841 Chestnut Bldg., Philadelphia, PA 19107, (215) 597-3160.

EPA, Region IV, Asbestos Coordinator, 345 Courtland St., N.E., Atlanta, GA 30365, (404) 347-5014.

EPA, Region V, (SP-14J), Asbestos Coordinator, 77 W. Jackson Blvd., Chicago, IL 60604-3590, (312) 886-6003.

EPA, Region VI, (6T-PT), Asbestos Coordinator, 1445 Ross Ave. Dallas, TX 75202-2744, (214) 655-7244.

EPA, Region VII, (ARTX/ASBS), Asbestos Coordinator, 726 Minnesota Ave., Kansas City, KS 66101, (913) 551-7020.

EPA, Region VIII, (8AT-TS), Asbestos Coordinator, 1 Denver Place, Suite 500 999 - 18th St., Denver, CO 80202-2405, (303) 293-1442.

EPA, Region IX, (A-4-4), Asbestos Coordinator, 75 Hawthorne St., San Francisco, CA 94105, (415) 744-1128.

EPA, Region X, (AT-083), Asbestos Coordinator, 1200 Sixth Ave., Seattle, WA 98101, (206) 553-4762.

EPA maintains a listing of all those States that have applied for and received EPA approval for having accreditation requirements that are at least as stringent as the MAP for one or more disciplines. Any training courses

approved by an EPA-approved State Program are considered to be EPA-approved for purposes of accreditation.

III. Approval of Training Courses

Individuals or groups wishing to sponsor training courses for disciplines required to be accredited under section 206(b)(1)(A) of TSCA, 15 U.S.C. 2646(b)(1)(A), may apply for approval from States that have accreditation program requirements that are at least as stringent as this MAP. For a course to receive approval, it must meet the requirements for the course as outlined in this MAP, and any other requirements imposed by the State from which approval is being sought. Courses that have been approved by a State with an accreditation program at least as stringent as this MAP are approved under section 206(a) of TSCA, 15 U.S.C. 2646(a), for that particular State, and also for any other State that does not have an accreditation program as stringent as this MAP.

A. Initial Training Course Approval

A training provider must submit the following minimum information to a State as part of its application for the approval of each training course:

1. The course provider's name, address, and telephone number.
2. A list of any other States that currently approve the training course.
3. The course curriculum.
4. A letter from the provider of the training course that clearly indicates how the course meets the MAP requirements for:
a. Length of training in days.
b. Amount and type of hands-on training.
c. Examination (length, format, and passing score).
d. Topics covered in the course.
5. A copy of all course materials (student manuals, instructor notebooks, handouts, etc.).
6. A detailed statement about the development of the examination used in the course.
7. Names and qualifications of all course instructors. Instructors must have academic and/or field experience in asbestos abatement.
8. A description of and an example of the numbered certificates issued to students who attend the course and pass the examination.

B. Refresher Training Course Approval

The following minimum information is required for approval of refresher training courses by States:

1. The length of training in half-days or days.
2. The topics covered in the course.
3. A copy of all course materials (student manuals, instructor notebooks, handouts, etc.).
4. The names and qualifications of all course instructors. Instructors must have academic and/or field experience in asbestos abatement.
5. A description of and an example of the numbered certificates issued to students who complete the refresher course and pass the examination, if required.

C. Withdrawal of Training Course Approval

States must establish criteria and procedures for suspending or withdrawing approval from accredited training programs. States should follow their own administrative procedures in pursuing actions for suspension or withdrawal of approval of training programs. At a minimum, the criteria shall include:

(1) Misrepresentation of the extent of a training course's approval by a State or EPA;
(2) Failure to submit required information or notifications in a timely manner;
(3) Failure to maintain requisite records;
(4) Falsification of accreditation records, instructor qualifications, or other accreditation information; or
(5) Failure to adhere to the training standards and requirements of the EPA MAP or State Accreditation Program, as appropriate.

In addition to the criteria listed above, EPA may also suspend or withdraw a training course's approval where an approved training course instructor, or other person with supervisory authority over the delivery of training has been found in violation of other asbestos regulations administered by EPA. An administrative or judicial finding of violation, or execution of a consent agreement and order under 40 CFR 22.18, constitutes evidence of a failure to comply with relevant statutes or regulations. States may wish to adopt this criterion modified to include their own asbestos statutes or regulations. EPA may also suspend or withdraw approval of training programs where a training provider has submitted false information as a part of the self-certification required under Unit V.B. of the revised MAP.

Training course providers shall permit representatives of EPA or the State which approved their training courses to attend, evaluate, and monitor any training course without charge. EPA or State compliance inspection staff are not required to give advance notice of their inspections. EPA may suspend or withdraw State or EPA approval of a training course based upon the criteria specified in this Unit III.C.

IV. EPA Procedures for Suspension or Revocation of Accreditation or Training Course Approval.

A. If the Administrator decides to suspend or revoke the accreditation of any person or

suspend or withdraw the approval of a training course, the Administrator will notify the affected entity of the following:

1. The grounds upon which the suspension, revocation, or withdrawal is based.

2. The time period during which the suspension, revocation, or withdrawal is effective, whether permanent or otherwise.

3. The conditions, if any, under which the affected entity may receive accreditation or approval in the future.

4. Any additional conditions which the Administrator may impose.

5. The opportunity to request a hearing prior to final Agency action to suspend or revoke accreditation or suspend or withdraw approval.

B. If a hearing is requested by the accredited person or training course provider pursuant to the preceding paragraph, the Administrator will:

1. Notify the affected entity of those assertions of law and fact upon which the action to suspend, revoke, or withdraw is based.

2. Provide the affected entity an opportunity to offer written statements of facts, explanations, comments, and arguments relevant to the proposed action.

3. Provide the affected entity such other procedural opportunities as the Administrator may deem appropriate to ensure a fair and impartial hearing.

4. Appoint an EPA attorney as Presiding Officer to conduct the hearing. No person shall serve as Presiding Officer if he or she has had any prior connection with the specific case.

C. The Presiding Officer appointed pursuant to the preceding paragraph shall:

1. Conduct a fair, orderly, and impartial hearing, without unnecessary delay.

2. Consider all relevant evidence, explanation, comment, and argument submitted pursuant to the preceding paragraph.

3. Promptly notify the affected entity of his or her decision and order. Such an order is a final Agency action.

D. If the Administrator determines that the public health, interest, or welfare warrants immediate action to suspend the accreditation of any person or the approval of any training course provider, the Administrator will:

1. Notify the affected entity of the grounds upon which the emergency suspension is based;

2. Notify the affected entity of the time period during which the emergency suspension is effective.

3. Notify the affected entity of the Administrator's intent to suspend or revoke accreditation or suspend or withdraw training course approval, as appropriate, in accordance with Unit IV.A. above. If such suspension, revocation, or withdrawal notice has not previously been issued, it will be issued at the same time the emergency suspension notice is issued.

E. Any notice, decision, or order issued by the Administrator under this section, and any documents filed by an accredited person or approved training course provider in a hearing under this section, shall be available to the public except as otherwise provided by section 14 of TSCA or by 40 CFR part 2. Any such hearing at which oral testimony is presented shall be open to the public, except that the Presiding Officer may exclude the public to the extent necessary to allow presentation of information which may be entitled to confidential treatment under section 14 of TSCA or 40 CFR part 2.

V. Implementation Schedule

The various requirements of this MAP become effective in accordance with the following schedules:

A. Requirements applicable to State Programs

1. Each State shall adopt an accreditation plan that is at least as stringent as this MAP within 180 days after the commencement of the first regular session of the legislature of the State that is convened on or after April 4, 1994.

2. If a State has adopted an accreditation plan at least as stringent as this MAP as of April 4, 1994, the State may continue to:

a. Conduct TSCA training pursuant to this MAP.

b. Approve training course providers to conduct training and to issue accreditation that satisfies the requirements for TSCA accreditation under this MAP.

c. Issue accreditation that satisfies the requirements for TSCA accreditation under this MAP.

3. A State that had complied with an earlier version of the MAP, but has not adopted an accreditation plan at least as stringent as this MAP by April 4, 1994, may:

a. Conduct TSCA training which remains in compliance with the requirements of Unit V.B. of this MAP. After such training has been self-certified in accordance with Unit V.B. of this MAP, the State may issue accreditation that satisfies the requirement for TSCA accreditation under this MAP.

b. Sustain its approval for any training course providers to conduct training and issue TSCA accreditation that the State had approved before April 4, 1994, and that remain in compliance with Unit V.B. of this MAP.

c. Issue accreditation pursuant to an earlier version of the MAP that provisionally satisfies the requirement for TSCA accreditation until October 4, 1994.

Such a State may not approve new TSCA training course providers to conduct training or to issue TSCA accreditation that satisfies

the requirements of this MAP until the State adopts an accreditation plan that is at least as stringent as this MAP.

4. A State that had complied with an earlier version of the MAP, but fails to adopt a plan as stringent as this MAP by the deadline established in Unit V.A.1., is subject to the following after that deadline date:

a. The State loses any status it may have held as an EPA-approved State for accreditation purposes under section 206 of TSCA, 15 U.S.C. 2646.

b. All training course providers approved by the State lose State approval to conduct training and issue accreditation that satisfies the requirements for TSCA accreditation under this MAP.

c. The State may not:

i. Conduct training for accreditation purposes under section 206 of TSCA, 15 U.S.C. 2646.

ii. Approve training course providers to conduct training or issue accreditation that satisfies the requirements for TSCA accreditation; or

iii. Issue accreditation that satisfies the requirement for TSCA accreditation.

EPA will extend EPA-approval to any training course provider that loses State approval because the State does not comply with the deadline, so long as the provider is in compliance with Unit V.B. of this MAP, and the provider is approved by a State that had complied with an earlier version of the MAP as of the day before the State loses its EPA approval.

5. A State that does not have an accreditation program that satisfies the requirements for TSCA accreditation under either an earlier version of the MAP or this MAP, may not:

a. Conduct training for accreditation purposes under section 206 of TSCA, 15 U.S.C. 2646;

b. Approve training course providers to conduct training or issue accreditation that satisfies the requirements for TSCA accreditation; or

c. Issue accreditation that satisfies the requirement for TSCA accreditation.

B. Requirements applicable to Training Courses and Providers

As of October 4, 1994, an approved training provider must certify to EPA and to any State that has approved the provider for TSCA accreditation, that each of the provider's training courses complies with the requirements of this MAP. The written submission must document in specific detail the changes made to each training course in order to comply with the requirements of this MAP and clearly state that the provider is also in compliance with all other requirements of this MAP, including the new recordkeeping and certificate provisions. Each submission must include the following statement signed by an authorized representative of the training provider: ''Under civil and criminal penalties of law for the making or submission of false or fraudulent statements or representations (18 U.S.C. 1001 and 15 U.S.C. 2615), I certify that the training described in this submission complies with all applicable requirements of Title II of TSCA, 40 CFR part 763, Appendix C to Subpart E, as revised, and any other applicable Federal, state, or local requirements.'' A consolidated self-certification submission from each training provider that addresses all of its approved training courses is permissible and encouraged.

The self-certification must be sent via registered mail, to EPA Headquarters at the following address: Attn. Self-Certification Program, Field Programs Branch, Chemical Management Division (7404), Office of Pollution Prevention and Toxics, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460. A duplicate copy of the complete submission must also be sent to any States from which approval had been obtained.

The timely receipt of a complete self-certification by EPA and all approving States shall have the effect of extending approval under this MAP to the training courses offered by the submitting provider. If a self-certification is not received by the approving government bodies on or before the due date, the affected training course is not approved under this MAP. Such training providers must then reapply for approval of these training courses pursuant to the procedures outlined in Unit III.

C. Requirements applicable to Accredited Persons.

Persons accredited by a State with an accreditation program no less stringent than an earlier version of the MAP or by an EPA-approved training provider as of April 3, 1994, are accredited in accordance with the requirements of this MAP, and are not required to retake initial training. They must continue to comply with the requirements for annual refresher training in Unit I.D. of the revised MAP.

D. Requirements applicable to Non-Accredited Persons.

In order to perform work requiring accreditation under TSCA Title II, persons who are not accredited by a State with an accreditation program no less stringent than an earlier version of the MAP or by an EPA-approved training provider as of April 3, 1994, must comply with the upgraded training requirements of this MAP by no later than October 4, 1994. Non-accredited persons may obtain initial accreditation on a provisional basis by successfully completing any of the training programs approved under an earlier

version of the MAP, and thereby perform work during the first 6 months after this MAP takes effect. However, by October 4, 1994, these persons must have successfully completed an upgraded training program that fully complies with the requirements of this MAP in order to continue to perform work requiring accreditation under section 206 of TSCA, 15 U.S.C. 2646.

[59 FR 5251, Feb. 3, 1994, as amended at 60 FR 31922, June 19, 1995; 70 FR 59889, Oct. 13, 2005]

APPENDIX D TO SUBPART E OF PART 763—TRANSPORT AND DISPOSAL OF ASBESTOS WASTE

For the purposes of this appendix, transport is defined as all activities from receipt of the containerized asbestos waste at the generation site until it has been unloaded at the disposal site. Current EPA regulations state that there must be no visible emissions to the outside air during waste transport. However, recognizing the potential hazards and subsequent liabilities associated with exposure, the following additional precautions are recommended.

Recordkeeping. Before accepting wastes, a transporter should determine if the waste is properly wetted and containerized. The transporter should then require a chain-of-custody form signed by the generator. A chain-of-custody form may include the name and address of the generator, the name and address of the pickup site, the estimated quantity of asbestos waste, types of containers used, and the destination of the waste. The chain-of-custody form should then be signed over to a disposal site operator to transfer responsibility for the asbestos waste. A copy of the form signed by the disposal site operator should be maintained by the transporter as evidence of receipt at the disposal site.

Waste handling. A transporter should ensure that the asbestos waste is properly contained in leak-tight containers with appropriate labels, and that the outside surfaces of the containers are not contaminated with asbestos debris adhering to the containers. If there is reason to believe that the condition of the asbestos waste may allow significant fiber release, the transporter should not accept the waste. Improper containerization of wastes is a violation of the NESHAPs regulation and should be reported to the appropriate EPA Regional Asbestos NESHAPs contact below:

Region I

Asbestos NESHAPs Contact, Air Management Division, USEPA, Region I, JFK Federal Building, Boston, MA 02203, (617) 223–3266.

Region II

Asbestos NESHAPs Contact, Air & Waste Management Division, USEPA, Region II, 26 Federal Plaza, New York, NY 10007, (212) 264–6770.

Region III

Asbestos NESHAPs Contact, Air Management Division, USEPA, Region III, 841 Chestnut Street, Philadelphia, PA 19107, (215) 597–9325.

Region IV

Asbestos NESHAPs Contact, Air, Pesticide & Toxic Management, USEPA, Region IV, 345 Courtland Street, NE., Atlanta, GA 30365, (404) 347–4298.

Region V

Asbestos NESHAPs Contact, Air Management Division, USEPA, Region V, 77 West Jackson Boulevard, Chicago, IL 60604, (312) 353–6793.

Region VI

Asbestos NESHAPs Contact, Air & Waste Management Division, USEPA, Region VI, 1445 Ross Avenue, Dallas, TX 75202, (214) 655–7229.

Region VII

Asbestos NESHAPs Contact, Air & Waste Management Division, USEPA, Region VII, 726 Minnesota Avenue, Kansas City, KS 66101, (913) 236–2896.

Region VIII

Asbestos NESHAPs Contact, Air & Waste Management Division, USEPA, Region VIII, 999 18th Street, Suite 500, Denver, CO 80202, (303) 293–1814.

Region IX

Asbestos NESHAPs Contact, Air Management Division, USEPA, Region IX, 215 Fremont Street, San Francisco, CA 94105, (415) 974–7633.

Region X

Asbestos NESHAPs Contact, Air & Toxics Management Division, USEPA, Region X, 1200 Sixth Avenue, Seattle, WA 98101, (206) 442–2724.

Once the transporter is satisfied with the condition of the asbestos waste and agrees to handle it, the containers should be loaded into the transport vehicle in a careful manner to prevent breaking of the containers. Similarly, at the disposal site, the asbestos waste containers should be transferred carefully to avoid fiber release.

Waste transport. Although there are no regulatory specifications regarding the transport vehicle, it is recommended that vehicles

used for transport of containerized asbestos waste have an enclosed carrying compartment or utilize a canvas covering sufficient to contain the transported waste, prevent damage to containers, and prevent fiber release. Transport of large quantities of asbestos waste is commonly conducted in a 20-cubic-yard ''roll off'' box, which should also be covered. Vehicles that use compactors to reduce waste volume should not be used because these will cause the waste containers to rupture. Vacuum trucks used to transport waste slurry must be inspected to ensure that water is not leaking from the truck.

Disposal involves the isolation of asbestos waste material in order to prevent fiber release to air or water. Landfilling is recommended as an environmentally sound isolation method because asbestos fibers are virtually immobile in soil. Other disposal techniques such as incineration or chemical treatment are not feasible due to the unique properties of asbestos. EPA has established asbestos disposal requirements for active and inactive disposal sites under NESHAPs (40 CFR Part 61, subpart M) and specifies general requirements for solid waste disposal under RCRA (40 CFR Part 257). Advance EPA notification of the intended disposal site is required by NESHAPs.

Selecting a disposal facility. An acceptable disposal facility for asbestos wastes must adhere to EPA's requirements of no visible emissions to the air during disposal, or minimizing emissions by covering the waste within 24 hours. The minimum required cover is 6 inches of nonasbestos material, normally soil, or a dust-suppressing chemical. In addition to these Federal requirements, many state or local government agencies require more stringent handling procedures. These agencies usually supply a list of ''approved'' or licensed asbestos disposal sites upon request. Solid waste control agencies are listed in local telephone directories under state, county, or city headings. A list of state solid waste agencies may be obtained by calling the RCRA hotline: 1–800–424–9346 (382–3000 in Washington, DC). Some landfill owners or operators place special requirements on asbestos waste, such as placing all bagged waste into 55-gallon metal drums. Therefore, asbestos removal contractors should contact the intended landfill before arriving with the waste.

Receiving asbestos waste. A landfill approved for receipt of asbestos waste should require notification by the waste hauler that the load contains asbestos. The landfill operator should inspect the loads to verify that asbestos waste is properly contained in leak-tight containers and labeled appropriately. The appropriate EPA Regional Asbestos NESHAPs Contact should be notified if the landfill operator believes that the asbestos waste is in a condition that may cause significant fiber release during disposal. In situations when the wastes are not properly containerized, the landfill operator should thoroughly soak the asbestos with a water spray prior to unloading, rinse out the truck, and immediately cover the wastes with nonasbestos material prior to compacting the waste in the landfill.

Waste deposition and covering. Recognizing the health dangers associated with asbestos exposure, the following procedures are recommended to augment current federal requirements:

• Designate a separate area for asbestos waste disposal. Provide a record for future landowners that asbestos waste has been buried there and that it would be hazardous to attempt to excavate that area. (Future regulations may require property deeds to identify the location of any asbestos wastes and warn against excavation.)

• Prepare a separate trench to receive asbestos wastes. The size of the trench will depend upon the quantity and frequency of asbestos waste delivered to the disposal site. The trenching technique allows application of soil cover without disturbing the asbestos waste containers. The trench should be ramped to allow the transport vehicle to back into it, and the trench should be as narrow as possible to reduce the amount of cover required. If possible, the trench should be aligned perpendicular to prevailing winds.

• Place the asbestos waste containers into the trench carefully to avoid breaking them. Be particularly careful with plastic bags because when they break under pressure asbestos particles can be emitted.

• Completely cover the containerized waste within 24 hours with a minimum of 6 inches of nonasbestos material. Improperly containerized waste is a violation of the NESHAPs and EPA should be notified.

However, if improperly containerized waste is received at the disposal site, it should be covered immediately after unloading. Only after the wastes, including properly containerized wastes, are completely covered, can the wastes be compacted or other heavy equipment run over it. During compacting, avoid exposing wastes to the air or tracking asbestos material away from the trench.

• For final closure of an area containing asbestos waste, cover with at least an additional 30 inches of compacted nonasbestos material to provide a 36-inch final cover. To control erosion of the final cover, it should be properly graded and vegetated. In areas of the United States where excessive soil erosion may occur or the frost line exceeds 3 feet, additional final cover is recommended. In desert areas where vegetation would be difficult to maintain, 3–6 inches of well graded crushed rock is recommended for placement on top of the final cover.

Controlling public access. Under the current NESHAPs regulation, EPA does not require

that a landfill used for asbestos disposal use warning signs or fencing if it meets the requirement to cover asbestos wastes. However, under RCRA, EPA requires that access be controlled to prevent exposure of the public to potential health and safety hazards at the disposal site. Therefore, for liability protection of operators of landfills that handle asbestos, fencing and warning signs are recommended to control public access when natural barriers do not exist. Access to a landfill should be limited to one or two entrances with gates that can be locked when left unattended. Fencing should be installed around the perimeter of the disposal site in a manner adequate to deter access by the general public. Chain-link fencing, 6-ft high and topped with a barbed wire guard, should be used. More specific fencing requirements may be specified by local regulations. Warning signs should be displayed at all entrances and at intervals of 330 feet or less along the property line of the landfill or perimeter of the sections where asbestos waste is deposited. The sign should read as follows:

ASBESTOS WASTE DISPOSAL SITE
BREATHING ASBESTOS DUST MAY CAUSE LUNG DISEASE AND CANCER

Recordkeeping. For protection from liability, and considering possible future requirements for notification on disposal site deeds, a landfill owner should maintain documentation of the specific location and quantity of the buried asbestos wastes. In addition, the estimated depth of the waste below the surface should be recorded whenever a landfill section is closed. As mentioned previously, such information should be recorded in the land deed or other record along with a notice warning against excavation of the area.

[52 FR 41897, Oct. 30, 1987, as amended at 62 FR 1834, Jan. 14, 1997]

APPENDIX E TO SUBPART E OF PART 763—INTERIM METHOD OF THE DETERMINATION OF ASBESTOS IN BULK INSULATION SAMPLES

SECTION 1. POLARIZED LIGHT MICROSCOPY

1.1 Principle and Applicability

Bulk samples of building materials taken for asbestos identification are first examined for homogeneity and preliminary fiber identification at low magnification. Positive identification of suspect fibers is made by analysis of subsamples with the polarized light microscope.

The principles of optical mineralogy are well established.[1,2] A light microscope equipped with two polarizing filters is used to observe specific optical characteristics of a sample. The use of plane polarized light allows the determination of refractive indices along specific crystallographic axes. Morphology and color are also observed. A retardation plate is placed in the polarized light path for determination of the sign of elongation using orthoscopic illumination. Orientation of the two filters such that their vibration planes are perpendicular (crossed polars) allows observation of the birefringence and extinction characteristics of anisotropic particles.

Quantitative analysis involves the use of point counting. Point counting is a standard technique in petrography for determining the relative areas occupied by separate minerals in thin sections of rock. Background information on the use of point counting[2] and the interpretation of point count data[3] is available.

This method is applicable to all bulk samples of friable insulation materials submitted for identification and quantitation of asbestos components.

1.2 Range

The point counting method may be used for analysis of samples containing from 0 to 100 percent asbestos. The upper detection limit is 100 percent. The lower detection limit is less than 1 percent.

1.3 Interferences

Fibrous organic and inorganic constituents of bulk samples may interfere with the identification and quantitation of the asbestos mineral content. Spray-on binder materials may coat fibers and affect color or obscure optical characteristics to the extent of masking fiber identity. Fine particles of other materials may also adhere to fibers to an extent sufficient to cause confusion in identification. Procedures that may be used for the removal of interferences are presented in Section 1.7.2.2.

1.4 Precision and Accuracy

Adequate data for measuring the accuracy and precision of the method for samples with various matrices are not currently available. Data obtained for samples containing a single asbestos type in a simple matrix are available in the EPA report *Bulk Sample Analysis for Asbestos Content: Evaluation of the Tentative Method.*[4]

1.5 Apparatus

1.5.1 Sample Analysis

A low-power binocular microscope, preferably stereoscopic, is used to examine the bulk insulation sample as received.

- *Microscope:* binocular, 10–45X (approximate).
- *Light Source:* incandescent or fluorescent.
- *Forceps, Dissecting Needles, and Probes*
- *Glassine Paper or Clean Glass Plate*

Compound microscope requirements: A polarized light microscope complete with polarizer, analyzer, port for wave retardation plate, 360° graduated rotating stage, substage condenser, lamp, and lamp iris.

- *Polarized Light Microscope:* described above.
- *Objective Lenses:* 10X, 20X, and 40X or near equivalent.
- *Dispersion Staining Objective Lens* (optional)
- *Ocular Lens:* 10X minimum.
- *Eyepiece Reticle:* cross hair or 25 point Chalkley Point Array.
- *Compensator Plate:* 550 millimicron retardation.

1.5.2 Sample Preparation

Sample preparation apparatus requirements will depend upon the type of insulation sample under consideration. Various physical and/or chemical means may be employed for an adequate sample assessment.

- *Ventilated Hood* or negative pressure glove box.
- *Microscope Slides*
- *Coverslips*
- *Mortar and Pestle:* agate or porcelain. (optional)
- *Wylie Mill* (optional)
- *Beakers and Assorted Glassware* (optional)
- *Certrifuge* (optional)
- *Filtration apparatus* (optional)
- *Low temperature asher* (optional)

1.6 Reagents

1.6.1 Sample Preparation

- *Distilled Water (optional)*
- *Dilute CH_3COOH:* ACS reagent grade (optional)
- *Dilute HCl:* ACS reagent grade (optional)
- *Sodium metaphosphate* $(NaPO_3)_6$ (optional)

1.6.2 Analytical Reagents

Refractive Index Liquids: 1.490–1.570, 1.590–1.720 in increments of 0.002 or 0.004.

- *Refractive Index Liquids for Dispersion Staining:* high-dispersion series, 1.550, 1.605, 1.630 (optional).
- *UICC Asbestos Reference Sample Set:* Available from: UICC MRC Pneumoconiosis Unit, Llandough Hospital, Penarth, Glamorgan CF6 1XW, UK, and commercial distributors.
- *Tremolite-asbestos* (source to be determined)
- *Actinolite-asbestos* (source to be determined)

1.7 Procedures

NOTE: Exposure to airborne asbestos fibers is a health hazard. Bulk samples submitted for analysis are usually friable and may release fibers during handling or matrix reduction steps. All sample and slide preparations should be carried out in a ventilated hood or glove box with continuous airflow (negative pressure). Handling of samples without these precautions may result in exposure of the analyst and contamination of samples by airborne fibers.

1.7.1 Sampling

Samples for analysis of asbestos content shall be taken in the manner prescribed in Reference 5 and information on design of sampling and analysis programs may be found in Reference 6. If there are any questions about the representative nature of the sample, another sample should be requested before proceeding with the analysis.

1.7.2 Analysis

1.7.2.1 Gross Examination

Bulk samples of building materials taken for the identification and quantitation of asbestos are first examined for homogeneity at low magnification with the aid of a stereomicroscope. The core sample may be examined in its container or carefully removed from the container onto a glassine transfer paper or clean glass plate. If possible, note is made of the top and bottom orientation. When discrete strata are identified, each is treated as a separate material so that fibers are first identified and quantified in that layer only, and then the results for each layer are combined to yield an estimate of asbestos content for the whole sample.

1.7.2.2 Sample Preparation

Bulk materials submitted for asbestos analysis involve a wide variety of matrix materials. Representative subsamples may not be readily obtainable by simple means in heterogeneous materials, and various steps may be required to alleviate the difficulties encountered. In most cases, however, the best preparation is made by using forceps to sample at several places from the bulk material. Forcep samples are immersed in a refractive index liquid on a microscope slide, teased apart, covered with a cover glass, and observed with the polarized light microscope.

Alternatively, attempts may be made to homogenize the sample or eliminate interferences before further characterization. The selection of appropriate procedures is dependent upon the samples encountered and personal preference. The following are presented as possible sample preparation steps.

A mortar and pestle can sometimes be used in the size reduction of soft or loosely bound materials though this may cause matting of some samples. Such samples may be reduced in a Wylie mill. Apparatus should be clean and extreme care exercised to avoid cross-contamination of samples. Periodic checks of the particle sizes should be made during the grinding operation so as to preserve any fiber bundles present in an identifiable form. These procedures are not recommended for samples that contain amphibole minerals or

vermiculite. Grinding of amphiboles may result in the separation of fiber bundles or the production of cleavage fragments with aspect ratios greater than 3:1. Grinding of vermiculite may also produce fragments with aspect ratios greater than 3:1.

Acid treatment may occasionally be required to eliminate interferences. Calcium carbonate, gypsum, and bassanite (plaster) are frequently present in sprayed or trowelled insulations. These materials may be removed by treatment with warm dilute acetic acid. Warm dilute hydrochloric acid may also be used to remove the above materials. If acid treatment is required, wash the sample at least twice with distilled water, being careful not to lose the particulates during decanting steps. Centrifugation or filtration of the suspension will prevent significant fiber loss. The pore size of the filter should be 0.45 micron or less. Caution: prolonged acid contact with the sample may alter the optical characteristics of chrysotile fibers and should be avoided.

Coatings and binding materials adhering to fiber surfaces may also be removed by treatment with sodium metaphosphate.[7] Add 10 mL of 10g/L sodium metaphosphate solution to a small (0.1 to 0.5 mL) sample of bulk material in a 15-mL glass centrifuge tube. For approximately 15 seconds each, stir the mixture on a vortex mixer, place in an ultrasonic bath and then shake by hand. Repeat the series. Collect the dispersed solids by centrifugation at 1000 rpm for 5 minutes. Wash the sample three times by suspending in 10 mL distilled water and recentrifuging. After washing, resuspend the pellet in 5 mL distilled water, place a drop of the suspension on a microscope slide, and dry the slide at 110 °C.

In samples with a large portion of cellulosic or other organic fibers, it may be useful to ash part of the sample and view the residue. Ashing should be performed in a low temperature asher. Ashing may also be performed in a muffle furnace at temperatures of 500 °C or lower. Temperatures of 550 °C or higher will cause dehydroxylation of the asbestos minerals, resulting in changes of the refractive index and other key parameters. If a muffle furnace is to be used, the furnace thermostat should be checked and calibrated to ensure that samples will not be heated at temperatures greater than 550 °C.

Ashing and acid treatment of samples should not be used as standard procedures. In order to monitor possible changes in fiber characteristics, the material should be viewed microscopically before and after any sample preparation procedure. Use of these procedures on samples to be used for quantitation requires a correction for percent weight loss.

1.7.2.3 Fiber Identification

Positive identification of asbestos requires the determination of the following optical properties.

- Morphology
- Color and pleochroism
- Refractive indices
- Birefringence
- Extinction characteristics
- Sign of elongation

Table 1–1 lists the above properties for commercial asbestos fibers. Figure 1–1 presents a flow diagram of the examination procedure. Natural variations in the conditions under which deposits of asbestiform minerals are formed will occasionally produce exceptions to the published values and differences from the UICC standards. The sign of elongation is determined by use of the compensator plate and crossed polars. Refractive indices may be determined by the Becke line test. Alternatively, dispersion staining may be used. Inexperienced operators may find that the dispersion staining technique is more easily learned, and should consult Reference 9 for guidance. Central stop dispersion staining colors are presented in Table 1–2. Available high-dispersion (HD) liquids should be used.

TABLE 1–1—OPTICAL PROPERTIES OF ASBESTOC FIBERS

Mineral	Morphology, color [a]	Refrac- tive indices [b]		Birefring- ence	Extinction	Sign of elonation
		α	γ			
Chrysotile (asbestiform serpentine).	Wavy fibers. Fiber bundles have splayed ends and "kinks". Aspect ratio typically >10:1. Colorless [3], nonpleochroic.	1.493–1.560	1.517–1.562 [f] (normally 1.556).	.008	∥ to fiber length.	+ (length slow)
Amosite (asbestiform grunerite).	Straight, rigid fibers. Aspect ratio typically >10:1. Colorless to brown, nonpleochroic or weakly so. Opaque inclusions may be present.	1.635–1.696	1.655–1.729 [f] (normally 1.696–1.710.	.020–.033	∥ to fiber length.	+ (length slow)

TABLE 1–1—OPTICAL PROPERTIES OF ASBESTOC FIBERS—Continued

Mineral	Morphology, color [a]	Refrac- tive indices [b]		Birefring- ence	Extinction	Sign of elonation
		α	γ			
Crocidolite (asbestiform Riebeckite).	Straight, rigid fibers. Thick fibers and bundles common, blue to purple-blue in color. Pleochroic. Birefringence is generally masked by blue color.	1.654–1.701	1.668–1.717[3e] (normally close to 1.700).	.014–.016	| to fiber length.	– (length fast)
Anthophyllite-asbestos.	Straight fibers and acicular cleavage fragments.[d] Some composite fibers. Aspect ratio <10:1. Colorless to light brown.	1.596–1.652	1.615–1.676[f].	.019–.024	| to fiber length.	+ (length slow)
Tremolite-actinolite-asbestos.	Normally present as acicular or prismatic cleavage fragments.[d] Single crystals predominate, aspect ratio <10:1. Colorless to pale green.	1.599–1.668	1.622–1.688[f].	.023–.020	Oblique extinction, 10–20° for fragments. Composite fibers show | extinction.	+ (length slow)

[a] From reference 5; colors cited are seen by observation with plane polarized light.
[b] From references 5 and 8.
[c] Fibers subjected to heating may be brownish.
[d] Fibers defined as having aspect ratio >3:1.
[e] to fiber length.
[f] |To fiber length.

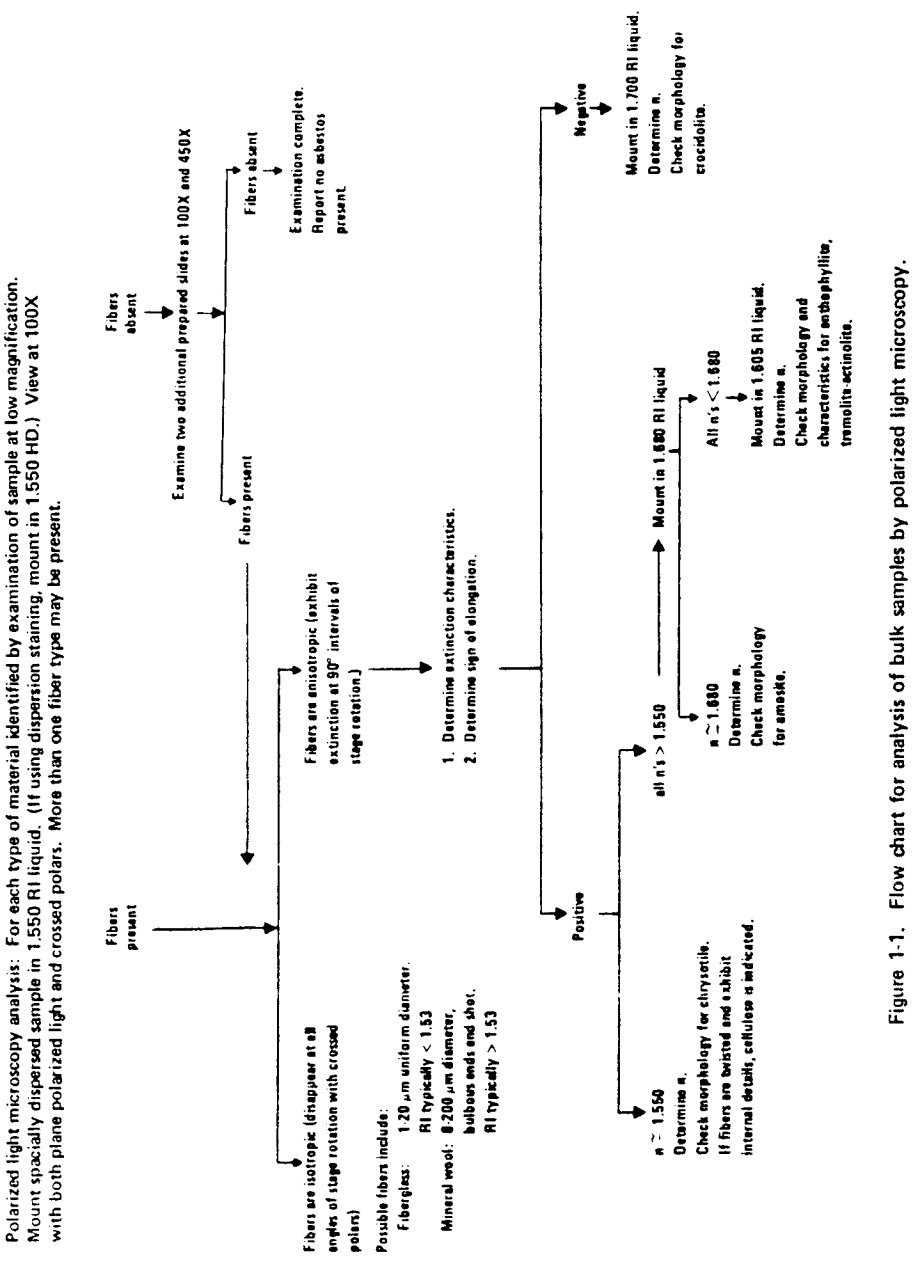


Figure 1-1. Flow chart for analysis of bulk samples by polarized light microscopy.

TABLE 1–2—CENTRAL STOP DISPERSION STAINING COLORS [A]

Mineral	RI Liquid	η	η|
Chrysotile	1.550 HD	Blue	Blue-magenta
Amosite	1.680	Blue-magenta to pale blue.	Golden-yellow
	1.550HD	Yellow to white.	Yellow to white
Crocidolite [b] ..	1.700	Red magenta	Blue-magenta
	1.550HD	Yellow to white.	Yellow to white
Anthophyllite	1.605HD	Blue	Gold to gold-magenta
Tremolite	1.605HD [c]	Pale blue	Gold
Actinolite	1.605HD	Gold-magenta to blue.	Gold
	1.630HD [c]	Magenta	Golden-yellow

[a] From reference 9.
[b] Blue absorption color.
[c] Oblique extinction view.

1.7.2.4 Quantitation of Asbestos Content

Asbestos quantitation is performed by a point-counting procedure or an equivalent estimation method. An ocular reticle (cross-hair or point array) is used to visually superimpose a point or points on the microscope field of view. Record the number of points positioned directly above each kind of particle or fiber of interest. Score only points directly over asbestos fibers or nonasbestos matrix material. Do not score empty points for the closest particle. If an asbestos fiber and a matrix particle overlap so that a point is superimposed on their visual intersection, a point is scored for both categories. Point counting provides a determination of the area percent asbestos. Reliable conversion of area percent to percent of dry weight is not currently feasible unless the specific gravities and relative volumes of the materials are known.

For the purpose of this method, ''asbestos fibers'' are defined as having an aspect ratio greater than 3:1 and being positively identified as one of the minerals in Table 1–1.

A total of 400 points superimposed on either asbestos fibers or nonasbestos matrix material must be counted over at least eight different preparations of representative subsamples. Take eight forcep samples and mount each separately with the appropriate refractive index liquid. The preparation should not be heavily loaded. The sample should be uniformly dispersed to avoid overlapping particles and allow 25–50 percent empty area within the fields of view. Count 50 nonempty points on each preparation, using either

- A cross-hair reticle and mechanical stage; or
- A reticle with 25 points (Chalkley Point Array) and counting at least 2 randomly selected fields.

For samples with mixtures of isotropic and anisotropic materials present, viewing the sample with slightly uncrossed polars or the addition of the compensator plate to the polarized light path will allow simultaneous discrimination of both particle types. Quantitation should be performed at 100X or at the lowest magnification of the polarized light microscope that can effectively distinguish the sample components. Confirmation of the quantitation result by a second analyst on some percentage of analyzed samples should be used as standard quality control procedure.

The percent asbestos is calculated as follows:

% asbestos=(a/n) 100%

where

a=number of asbestos counts,
n=number of nonempty points counted (400).

If a=0, report ''No asbestos detected.'' If 0< a≤3, report ''<1% asbestos''.

The value reported should be rounded to the nearest percent.

1.8 References

1. Paul F. Kerr, *Optical Mineralogy,* 4th ed., New York, McGraw-Hill, 1977.

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3. F. Chayes, *Petrographic Modal Analysis: An Elementary Statistical Appraisal,* New York: John Wiley & Sons, 1956.

4. E. P. Brantly, Jr., K. W. Gold, L. E. Myers, and D. E. Lentzen, *Bulk Sample Analysis for Asbestos Content: Evaluation of the Tentative Method,* U.S. Environmental Protection Agency, October 1981.

5. U.S. Environmental Protection Agency, *Asbestos-Containing Materials in School Buildings: A Guidance Document,* Parts 1 and 2, EPA/OPPT No. C00090, March 1979.

6. D. Lucas, T. Hartwell, and A. V. Rao, *Asbestos-Containing Materials in School Buildings: Guidance for Asbestos Analytical Programs,* EPA 560/13–80–017A, U.S. Environmental Protection Agency, December 1980, 96 pp.

7. D. H. Taylor and J. S. Bloom, Hexametaphosphate pretreatment of insulation samples for identification of fibrous constituents, *Microscope, 28,* 1980.

8. W. J. Campbell, R. L. Blake, L. L. Brown, E. E. Cather, and J. J. Sjoberg. *Selected Silicate Minerals and Their Asbestiform Varieties: Mineralogical Definitions and Identification-Characterization,* U.S. Bureau of Mines Information Circular 8751, 1977.

9. Walter C. McCrone, *Asbestos Particle Atlas,* Ann Arbor: Ann Arbor Science Publishers, June 1980.

SECTION 2. X-RAY POWDER DIFFRACTION

2.1 Principle and Applicability

The principle of X-ray powder diffraction (XRD) analysis is well established.[1,2] Any solid, crystalline material will diffract an impingent beam of parallel, monochromatic X-rays whenever Bragg's Law,

$\lambda = 2d \sin \theta$,

is satisfied for a particular set of planes in the crystal lattice, where

λ = the X-ray wavelength, Å;
d = the interplanar spacing of the set of reflecting lattice planes, Å; and
θ = the angle of incidence between the X-ray beam and the reflecting lattice planes.

By appropriate orientation of a sample relative to the incident X-ray beam, a diffraction pattern can be generated that, in most cases, will be uniquely characteristic of both the chemical composition and structure of the crystalline phases present.

Unlike optical methods of analysis, however, XRD cannot determine crystal morphology. Therefore, in asbestos analysis, XRD does not distinguish between fibrous and nonfibrous forms of the serpentine and amphibole minerals (Table 2–1). However, when used in conjunction with optical methods such as polarized light microscopy (PLM), XRD techniques can provide a reliable analytical method for the identification and characterization of asbestiform minerals in bulk materials.

For *qualitative analysis* by XRD methods, samples are initially scanned over limited diagnostic peak regions for the serpentine (~7.4 Å) and amphibole (8.2–8.5 Å) minerals (Table 2–2). Standard slow-scanning methods for bulk sample analysis may be used for materials shown by PLM to contain significant amounts of asbestos (>5–10 percent). Detection of minor or trace amounts of asbestos may require special sample preparation and step-scanning analysis. All samples that exhibit diffraction peaks in the diagnostic regions for asbestiform minerals are submitted to a full (5°–60° 2θ; 1° 2θ/min) qualitative XRD scan, and their diffraction patterns are compared with standard reference powder diffraction patterns[3] to verify initial peak assignments and to identify possible matrix interferences when subsequent quantitative analysis will be performed.

TABLE 2–1—THE ASBESTOS MINERALS AND THEIR NONASBESTIFORM ANALOGS

Asbestiform	Nonasbestiform
SERPENTINE	
Chrysotile	Antigorite, lizardite
AMPHIBOLE	
Anthophyllite asbestos	Anthophyllite
Cummingtonite-grunerite asbestos (''Amosite'')	Cummingtonite-grunerite
Crocidolite	Riebeckite
Tremolite asbestos	Tremolite
Actinolite asbestos	Actinolite

TABLE 2–2—PRINCIPAL LATTICE SPACINGS OF ASBESTIFORM MINERALS[a]

Minerals	Principal d-spacings (Å) and relative intensities			JCPDS Powder diffraction file[3] number
Chrysotile	7.37_{100}	3.65_{70}	4.57_{50}	21–543[b]
	7.36_{100} ..	3.66_{80}	2.45_{65}	25–645
	7.10_{100} ..	2.33_{80}	3.55_{70}	22–1162 (theoretical)
''Amosite''	8.33_{100}	3.06_{70}	2.756_{70}	17–745 (nonfibrous)
	8.22_{100} ..	3.060_{85}	3.25_{70}	27–1170 (UICC)
Anthophyllite	3.05_{100}	3.24_{60}	8.26_{55}	9–455
	3.06_{100} ..	8.33_{70}	3.23_{50}	16–401 (synthetic)
Anthophyllite	2.72_{100}	2.54_{100}	3.480_{80}	25–157
Crocidolite	8.35_{100}	3.10_{55}	2.720_{35}	27–1415 (UICC)
Tremolite	8.38_{100}	3.12_{100}	2.705_{90}	13–437[b]
	2.706_{100}	3.14_{95}	8.43_{40}	20–1310[b] (synthetic)
	3.13_{100} ..	2.706_{60}	8.44_{40}	23–666 (synthetic mixture with richterite)

[a] This information is intended as a guide, only. Complete powder diffraction data, including mineral type and source, should be referred to, to ensure comparability of sample and reference materials where possible. Additional precision XRD data on amosite, crocidolite, tremolite, and chrysotile are available from the U.S. Bureaus of Mines.[4]
[b] Fibrosity questionable.

Accurate *quantitative analysis* of asbestos in bulk samples by XRD is critically dependent on particle size distribution, crystallite size, preferred orientation and matrix absorption effects, and comparability of standard reference and sample materials. The most intense diffraction peak that has been shown to be free from interference by prior qualitative XRD analysis is selected for quantitation of each asbestiform mineral. A ''thin-layer'' method of analysis[5,6] is recommended in which, subsequent to comminution of the bulk material to ~10 μm by suitable cryogenic milling techniques, an accurately known amount of the sample is deposited on a silver membrane filter. The

mass of asbestiform material is determined by measuring the integrated area of the selected diffraction peak using a step-scanning mode, correcting for matrix absorption effects, and comparing with suitable calibration standards. Alternative ''thick-layer'' or bulk methods,[7,8] may be used for *semi-quantitative analysis.*

This XRD method is applicable as a confirmatory method for identification and quantitation of asbestos in bulk material samples that have undergone prior analysis by PLM or other optical methods.

2.2 Range and Sensitivity

The range of the method has not been determined.

The sensitivity of the method has not been determined. It will be variable and dependent upon many factors, including matrix effects (absoprtion and interferences), diagnostic reflections selected, and their relative intensities.

2.3 Limitations

2.3.1 Interferences

Since the fibrous and nonfibrous forms of the serpentine and amphibole minerals (Table 2–1) are indistinguishable by XRD techniques unless special sample preparation techniques and instrumentation are used,[9] the presence of nonasbestiform serpentines and amphiboles in a sample will pose severe interference problems in the identification and quantitative analysis of their asbestiform analogs.

The use of XRD for identification and quantitation of asbestiform minerals in bulk samples may also be limited by the presence of other interfering materials in the sample. For naturally occurring materials the commonly associated asbestos-related mineral interferences can usually be anticipated. However, for fabricated materials the nature of the interferences may vary greatly (Table 2–3) and present more serious problems in identification and quantitation.[10] Potential interferences are summarized in Table 2–4 and include the following:

- *Chlorite* has major peaks at 7.19 Å and 3.58 Å That interfere with both the primary (7.36 Å) and secondary (3.66 Å) peaks for chrysotile. Resolution of the primary peak to give good quantitative results may be possible when a step-scanning mode of operation is employed.
- *Halloysite* has a peak at 3.63 Å that interferes with the secondary (3.66 Å) peak for chrysotile.
- *Kaolinite* has a major peak at 7.15 Å that may interfere with the primary peak of chrysotile at 7.36 Å when present at concentrations of >10 percent. However, the secondary chrysotile peak at 3.66 Å may be used for quantitation.
- *Gypsum* has a major peak at 7.5 Å that overlaps the 7.36 Å peak of chrysotile when present as a major sample constituent. This may be removed by careful washing with distilled water, or be heating to 300 °C to convert gypsum to plaster of paris.
- *Cellulose* has a broad peak that partially overlaps the secondary (3.66 Å) chrysotile peak.[8]
- Overlap of major diagnostic peaks of the amphibole asbestos minerals, amosite, anthophyllite, crocidolite, and tremolite, at approximately 8.3 Å and 3.1 Å causes mutual interference when these minerals occur in the presence of one another. In some instances, adquate resolution may be attained by using step-scanning methods and/or by decreasing the collimator slit width at the X-ray port.

TABLE 2–3—COMMON CONSTITUENTS IN INSULATION AND WALL MATERIALS

A. Insulation materials

Chrysotile
''Amosite''
Crocidolite
*Rock wool
*Slag wool
*Fiber glass
Gypsum ($CaSO_4 \cdot 2H_2O$)
Vermiculite (micas)
*Perlite
Clays (kaolin)
*Wood pulp
*Paper fibers (talc, clay, carbonate fillers)
Calcium silicates (synthetic)
Opaques (chromite, magnetite inclusions in serpentine)
Hematite (inclusions in ''amosite'')
Magnesite
*Diatomaceous earth

B. Spray finishes or paints

Bassanite
Carbonate minerals (calcite, dolomite, vaterite)
Talc
Tremolite
Anthophyllite
Serpentine (including chrysotile)
Amosite
Crocidolite
*Mineral wool
*Rock wool
*Slag wool
*Fiber glass
Clays (kaolin)
Micas
Chlorite
Gypsum ($CaSO_4 \cdot 2H_2O$)
Quartz
*Organic binders and thickeners
Hyrdomagnesite
Wollastonite
Opaques (chromite, magnetite inclusions in serpentine)
Hematite (inclusions in ''amosite'')

*Amorphous materials___contribute only to overall scattered radiation and increased background radiation.

TABLE 2–4—INTERFERENCES IN XRD ANALYSIS ASBESTIFORM MINERALS

Asbestiform mineral	Primary diagnostic peaks (approximate d-spacings, in A)	Interference
Serpentine		
Chrysotile	7.4	Nonasbestiform serpentines (antigorite, lizardite)
		Chlorite
		Kaolinite
		Gypsum
	3.7	Chlorite
		Halloysite
		Cellulose
Amphibole		
"Amosite" Anthophyllite Crocidolite Tremolite	3.1	Nonasbestiform amphiboles (cummingtonite-grunerite, anthophyllite, riebeckite, tremolite)
		Mutual interferences
		Carbonates
		Talc
	8.3	Mutual interferences

- *Carbonates* may also interfere with quantitative analysis of the amphibole asbestos minerals, amosite, anthophyllite, crocidolite, and tremolite. Calcium carbonate ($CaCO_3$) has a peak at 3.035 Å that overlaps major amphibole peaks at approximately 3.1 Å when present in concentrations of >5 percent. Removal of carbonates with a dilute acid wash is possible; however, if present, chrysotile may be partially dissolved by this treatment.[11]
- A major *talc* peak at 3.12 Å interferes with the primary tremolite peak at this same position and with secondary peaks of crocidolite (3.10 Å), amosite (3.06 Å), and anthophyllite (3.05 Å). In the presence of talc, the major diagnostic peak at approximately 8.3 Å should be used for quantitation of these asbestiform minerals.

The problem of intraspecies and matrix interferences is further aggravated by the variability of the silicate mineral powder diffraction patterns themselves, which often makes definitive identification of the asbestos minerals by comparison with standard reference diffraction patterns difficult. This variability results from alterations in the crystal lattice associated with differences in isomorphous substitution and degree of crystallinity. This is especially true for the amphiboles. These minerals exhibit a wide variety of very similar chemical compositions, with the result being that their diffraction patterns are chracterized by having major (110) reflections of the monoclinic amphiboles and (210) reflections of the orthorhombic anthophyllite separated by less than 0.2 Å.[12]

2.3.2 Matrix Effects

If a copper X-ray source is used, the presence of iron at high concentrations in a sample will result in significant X-ray fluorescence, leading to loss of peak intensity along with increased background intensity and an overall decrease in sensitivity. This situation may be corrected by choosing an X-ray source other than copper; however, this is often accompanied both by loss of intensity and by decreased resolution of closely spaced reflections. Alternatively, use of a diffracted beam monochromator will reduce background fluorescent raditation, enabling weaker diffraction peaks to be detected.

X-ray absorption by the sample matrix will result in overall attenuation of the diffracted beam and may seriously interfere with quantitative analysis. Absorption effects may be minimized by using sufficiently "thin" samples for analysis.[5,13,14] However, unless absorption effects are known to be the same for both samples and standards, appropriate corrections should be made by referencing diagnostic peak areas to an internal standard[7,8] or filter substrate (Ag) peak.[5,6]

2.3.3 Particle Size Dependence

Because the intensity of diffracted X-radiation is particle-size dependent, it is essential for accurate quantitative analysis that both sample and standard reference materials have similar particle size distributions. The optimum particle size range for quantitative analysis of asbestos by XRD has been reported to be 1 to 10 μm.[15] Comparability of sample and standard reference material particle size distributions should be verified by optical microscopy (or another suitable method) prior to analysis.

2.3.4 Preferred Orientation Effects

Preferred orientation of asbestiform minerals during sample preparation often poses a serious problem in quantitative analysis by XRD. A number of techniques have been developed for reducing preferred orientation effects in "thick layer" samples.[7,8,15] However, for "thin" samples on membrane filters, the preferred orientation effects seem to be both reproducible and favorable to enhancement of the principal diagnostic reflections of asbestos minerals, actually increasing the overall sensitivity of the method.[12,14] (Further investigation into preferred orientation effects in both thin layer and bulk samples is required.)

2.3.5 Lack of Suitably Characterized Standard Materials

The problem of obtaining and characterizing suitable reference materials for asbestos analysis is clearly recognized. NIOSH has

recently directed a major research effort toward the preparation and characterization of analytical reference materials, including asbestos standards;[16,17] however, these are not available in large quantities for routine analysis.

In addition, the problem of ensuring the comparability of standard reference and sample materials, particularly regarding crystallite size, particle size distribution, and degree of crystallinity, has yet to be adequately addressed. For example, Langer et al.[18] have observed that in insulating matrices, chrysotile tends to break open into bundles more frequently than amphiboles. This results in a line-broadening effect with a resultant decrease in sensitivity. Unless this effect is the same for both standard and sample materials, the amount of chrysotile in the sample will be underestimated by XRD analysis. To minimize this problem, it is recommended that standardized matrix reduction procedures be used for both sample and standard materials.

2.4 Precision and Accuracy

Precision of the method has not been determined.

Accuracy of the method has not been determined.

2.5 Apparatus

2.5.1 Sample Preparation

Sample preparation apparatus requirements will depend upon the sample type under consideration and the kind of XRD analysis to be performed.

- *Mortar and Pestle:* Agate or porcelain.
- *Razor Blades*
- *Sample Mill:* SPEX, Inc., freezer mill or equivalent.
- *Bulk Sample Holders*
- *Silver Membrane Filters:* 25-mm diameter, 0.45-μm pore size. Selas Corp. of America, Flotronics Div., 1957 Pioneer Road, Huntington Valley, PA 19006.
- *Microscope Slides*
- *Vacuum Filtration Apparatus:* Gelman No. 1107 or equivalent, and side-arm vacuum flask.
- *Microbalance*
- *Ultrasonic Bath or Probe:* Model W140, Ultrasonics, Inc., operated at a power density of approximately 0.1 W/mL, or equivalent.
- *Volumetric Flasks:* 1–L volume.
- *Assorted Pipettes*
- *Pipette Bulb*
- *Nonserrated Forceps*
- *Polyethylene Wash Bottle*
- *Pyrex Beakers:* 50-mL volume.
- *Desiccator*
- *Filter Storage Cassettes*
- *Magnetic Stirring Plate and Bars*
- *Porcelain Crucibles*
- *Muffle Furnace or Low Temperature Asher*

2.5.2 Sample Analysis

Sample analysis requirements include an X-ray diffraction unit, equipped with:

- *Constant Potential Generator; Voltage and mA Stabilizers*
- *Automated Diffractometer with Step-Scanning Mode*
- *Copper Target X-Ray Tube:* High intensity, fine focus, preferably.
- *X-Ray Pulse Height Selector*
- *X-Ray Detector* (with high voltage power supply): Scintillation or proportional counter.
- *Focusing Graphite Crystal Monochromator;* or *Nickel Filter* (if copper source is used, and iron fluorescence is not a serious problem).
- *Data Output Accessories:*
  - *Strip Chart Recorder*
  - *Decade Scaler/Timer*
  - *Digital Printer*
- *Sample Spinner* (optional).
- *Instrument Calibration Reference Specimen:* α-quartz reference crystal (Arkansas quartz standard, #180–147–00, Philips Electronics Instruments, Inc., 85 McKee Drive, Mahwah, NJ 07430) or equivalent.

2.6 Reagents

2.6.1 Standard Reference Materials

The reference materials listed below are intended to serve as a guide. Every attempt should be made to acquire pure reference materials that are comparable to sample materials being analyzed.

- *Chrysotile:* UICC Canadian, or NIEHS Plastibest. (UICC reference materials available from: UICC, MRC Pneumoconiosis Unit, Llandough Hospital, Penarth, Glamorgan, CF61XW, UK).
- *Crocidolite:* UICC
- *Amosite:* UICC
- *Anthophyllite:* UICC
- *Tremolite Asbestos:* Wards Natural Science Establishment, Rochester, N.Y.; Cyprus Research Standard, Cyprus Research, 2435 Military Ave., Los Angeles, CA 90064 (washed with dilute HCl to remove small amount of calcite impurity); India tremolite, Rajasthan State, India.
- *Actinolite Asbestos*

2.6.2 Adhesive

Tape, petroleum jelly, etc. (for attaching silver membrane filters to sample holders).

2.6.3 Surfactant

1 percent aerosol OT aqueous solution or equivalent.

2.6.4 Isopropanol

ACS Reagent Grade.

2.7 Procedure

2.7.1 Sampling

Samples for analysis of asbestos content shall be collected as specified in EPA Guidance Document #C0090, *Asbestos-Containing Materials in School Buildings.*[10]

2.7.2 Analysis

All samples must be analyzed initially for asbestos content by PLM. XRD should be used as an auxiliary method when a second, independent analysis is requested.

NOTE: Asbestos is a toxic substance. All handling of dry materials should be performed in an operating fume hood.

2.7.2.1 Sample Preparation

The method of sample preparation required for XRD analysis will depend on: (1) The condition of the sample received (sample size, homogeneity, particle size distribution, and overall composition as determined by PLM); and (2) the type of XRD analysis to be performed (qualitative, quantitative, thin layer or bulk).

Bulk materials are usually received as inhomogeneous mixtures of complex composition with very wide particle size distributions. Preparation of a homogeneous, representative sample from asbestos-containing materials is particularly difficult because the fibrous nature of the asbestos minerals inhibits mechanical mixing and stirring, and because milling procedures may cause adverse lattice alterations.

A discussion of specific matrix reduction procedures is given below. Complete methods of sample preparation are detailed in Sections 2.7.2.2 and 2.7.2.3.

NOTE: All samples should be examined microscopically before and after each matrix reduction step to monitor changes in sample particle size, composition, and crystallinity, and to ensure sample representativeness and homogeneity for analysis.

2.7.2.1.1 *Milling*— Mechanical milling of asbestos materials has been shown to decrease fiber crystallinity, with a resultant decrease in diffraction intensity of the specimen; the degree of lattice alteration is related to the duration and type of milling process.[19,22] Therefore, all milling times should be kept to a minimum.

For *qualitative analysis,* particle size is not usually of critical importance and initial characterization of the material with a minimum of matrix reduction is often desirable to document the composition of the sample as received. Bulk samples of very large particle size (>2–3 mm) should be comminuted to ~100 μm. A mortar and pestle can sometimes be used in size reduction of soft or loosely bound materials though this may cause matting of some samples. Such samples may be reduced by cutting with a razor blade in a mortar, or by grinding in a suitable mill (e.g., a microhammer mill or equivalent). When using a mortar for grinding or cutting, the sample should be moistened with ethanol, or some other suitable wetting agent, to minimize exposures.

For accurate, reproducible *quantitative analysis,* the particle size of both sample and standard materials should be reduced to ~10 μm (see Section 2.3.3). Dry ball milling at liquid nitrogen temperatures (e.g., Spex Freezer Mill, or equivalent) for a maximum time of 10 min. is recommended to obtain satisfactory particle size distributions while protecting the integrity of the crystal lattice.[5] Bulk samples of very large particle size may require grinding in two stages for full matrix reduction to <10 μm.[8,16]

Final particle size distributions should always be verified by optical microscopy or another suitable method.

2.7.2.1.2 *Low temperature ashing*—For materials shown by PLM to contain large amounts of gypsum, cellulosic, or other organic materials, it may be desirable to ash the samples prior to analysis to reduce background radiation or matrix interference. Since chrysotile undergoes dehydroxylation at temperatures between 550 °C and 650 °C, with subsequent transformation to forsterite,[23,24] ashing temperatures should be kept below 500 °C. Use of a low temperature asher is recommended. In all cases, calibration of the oven is essential to ensure that a maximum ashing temperature of 500 °C is not exceeded.

2.7.2.1.3 *Acid leaching*—Because of the interference caused by gypsum and some carbonates in the detection of asbestiform minerals by XRD (see Section 2.3.1), it may be necessary to remove these interferents by a simple acid leaching procedure prior to analysis (see Section 1.7.2.2).

2.7.2.2 Qualitative Analysis

2.7.2.2.1 *Initial screening of bulk material*—Qualitative analysis should be performed on a representative, homogeneous portion of the sample with a minimum of sample treatment.

1. Grind and mix the sample with a mortar and pestle (or equivalent method, see Section 2.7.2.1.1.) to a final particle size sufficiently small (~100 μm) to allow adequate packing into the sample holder.

2. Pack the sample into a standard bulk sample holder. Care should be taken to ensure that a representative portion of the milled sample is selected for analysis. Particular care should be taken to avoid possible size segregation of the sample. (Note: Use of a back-packing method[25] of bulk sample preparation may reduce preferred orientation effects.)

3. Mount the sample on the diffractometer and scan over the diagnostic peak regions for

the serpentine (~67.4 Å) and amphibole (8.2–8.5 Å) minerals (see Table 2–2). The X-ray diffraction equipment should be optimized for intensity. A slow scanning speed of 1° 2θ/min is recommended for adequate resolution. Use of a sample spinner is recommended.

4. Submit all samples that exhibit diffraction peaks in the diagnostic regions for asbestiform minerals to a full qualitative XRD scan (5°–60° 2θ; 1°2θ/min) to verify initial peak assignments and to identify potential matrix interferences when subsequent quantitative analysis is to be performed.

5. Compare the sample XRD pattern with standard reference powder diffraction patterns (i.e., JCPDS powder diffraction data[3] or those of other well-characterized reference materials). Principal lattice spacings of asbestiform minerals are given in Table 2–2; common constituents of bulk insulation and wall materials are listed in Table 2–3.

2.7.2.2.2 *Detection of minor or trace constituents*— Routine screening of bulk materials by XRD may fail to detect small concentrations (<5 percent) of asbestos. The limits of detection will, in general, be improved if matrix absorption effects are minimized, and if the sample particle size is reduced to the optimal 1 to 10 μm range, provided that the crystal lattice is not degraded in the milling process. Therefore, in those instances where confirmation of the presence of an asbestiform mineral at very low levels is required, or where a negative result from initial screening of the bulk material by XRD (see Section 2.7.2.2.1) is in conflict with previous PLM results, it may be desirable to prepare the sample as described for quantitative analysis (see Section 2.7.2.3) and step-scan over appropriate 2θ ranges of selected diagnostic peaks (Table 2–2). Accurate transfer of the sample to the silver membrane filter is not necessary unless subsequent quantitative analysis is to be performed.

2.7.2.3 Quantitative Analysis

The proposed method for quantitation of asbestos in bulk samples is a modification of the NIOSH-recommended thin-layer method for chrysotile in air.[5] A thick-layer or bulk method involving pelletizing the sample may be used for semiquantitative analysis;[7,8] however, this method requires the addition of an internal standard, use of a specially fabricated sample press, and relatively large amounts of standard reference materials. Additional research is required to evaluate the comparability of thin- and thick-layer methods for quantitative asbestos analysis.

For quantitative analysis by thin-layer methods, the following procedure is recommended:

1. Mill and size all or a substantial representative portion of the sample as outlined in Section 2.7.2.1.1.

2. Dry at 100 °C for 2 hr; cool in a desiccator.

3. Weigh accurately to the nearest 0.01 mg.

4. Samples shown by PLM to contain large amounts of cellulosic or other organic materials, gypsum, or carbonates, should be submitted to appropriate matrix reduction procedures described in Sections 2.7.2.1.2 and 2.7.2.1.3. After ashing and/or acid treatment, repeat the drying and weighing procedures described above, and determine the percent weight loss; L.

5. Quantitatively transfer an accurately weighed amount (50–100 mg) of the sample to a 1–L volumetric flask with approximately 200 mL isopropanol to which 3 to 4 drops of surfactant have been added.

6. Ultrasonicate for 10 min at a power density of approximately 0.1 W/mL, to disperse the sample material.

7. Dilute to volume with isopropanol.

8. Place flask on a magnetic stirring plate. Stir.

9. Place a silver membrane filter on the filtration apparatus, apply a vacuum, and attach the reservoir. Release the vacuum and add several milliliters of isopropanol to the reservoir. Vigorously hand shake the asbestos suspension and immediately withdraw an aliquot from the center of the suspension so that total sample weight, W_T, on the filter will be approximately 1 mg. Do not adjust the volume in the pipet by expelling part of the suspension; if more than the desired aliquot is withdrawn, discard the aliquot and resume the procedure with a clean pipet. Transfer the aliquot to the reservoir. Filter rapidly under vacuum. Do not wash the reservoir walls. Leave the filter apparatus under vacuum until dry. Remove the reservoir, release the vacuum, and remove the filter with forceps. (Note: Water-soluble matrix interferences such as gypsum may be removed at this time by careful washing of the filtrate with distilled water. Extreme care should be taken not to disturb the sample.)

10. Attach the filter to a flat holder with a suitable adhesive and place on the diffractometer. Use of a sample spinner is recommended.

11. For each asbestos mineral to be quantitated select a reflection (or reflections) that has been shown to be free from interferences by prior PLM or qualitative XRD analysis and that can be used unambiguously as an index of the amount of material present in the sample (see Table 2–2).

12. Analyze the selected diagnostic reflection(s) by step scanning in increments of 0.02° 2θ for an appropriate fixed time and integrating the counts. (A fixed count scan may be used alternatively; however, the method chosen should be used consistently for all samples and standards.) An appropriate scanning interval should be selected for each peak, and background corrections made. For a fixed time scan, measure the

background on each side of the peak for one-half the peak-scanning time. The net intensity, I_a, is the difference between the peak integrated count and the total background count.

13. Determine the net count, I_{Ag}, of the filter 2.36 Å silver peak following the procedure in step 12. Remove the filter from the holder, reverse it, and reattach it to the holder. Determine the net count for the unattenuated silver peak, $I_{\mathring{A}g}$. Scan times may be *less* for measurement of silver peaks than for sample peaks; however, they should be *constant* throughout the analysis.

14. Normalize all raw, net intensities (to correct for instrument instabilities) by referencing them to an external standard (e.g., the 3.34 Å peak of an α-quartz reference crystal). After each unknown is scanned, determine the net count, I_r, of the reference specimen following the procedure in step 12. Determine the normalized intensities by dividing the peak intensities by I_r:

$$\hat{I}_a = \frac{I_a}{I^\circ_r}, \quad \hat{I}_{Ag} = \frac{I_{Ag}}{I^\circ_r}, \quad \text{and} \quad \hat{I}^\circ_{Ag} = \frac{I^\circ_{Ag}}{I^\circ_r}$$

2.8 Calibration

2.8.1 Preparation of Calibration Standards

1. Mill and size standard asbestos materials according to the procedure outlined in Section 2.7.2.1.1. *Equivalent, standardized matrix reduction and sizing techniques should be used for both standard and sample materials.*

2. Dry at 100 °C for 2 hr; cool in a desiccator.

3. Prepare two suspensions of each standard in isopropanol by weighing approximately 10 and 50 mg of the dry material to the nearest 0.01 mg. Quantitatively transfer each to a 1–L volumetric flask with approximately 200 mL isopropanol to which a few drops of surfactant have been added.

4. Ultrasonicate for 10 min at a power density of approximately 0.1 W/mL, to disperse the asbestos material.

5. Dilute to volume with isopropanol.

6. Place the flask on a magnetic stirring plate. Stir.

7. Prepare, in triplicate, a series of at least five standard filters to cover the desired analytical range, using appropriate aliquots of the 10 and 50 mg/L suspensions and the following procedure.

Mount a silver membrane filter on the filtration apparatus. Place a few milliliters of isopropanol in the reservoir. Vigorously hand shake the asbestos suspension and immediately withdraw an aliquot from the center of the suspension. Do not adjust the volume in the pipet by expelling part of the suspension; if more than the desired aliquot is withdrawn, discard the aliquot and resume the procedure with a clean pipet. Transfer the aliquot to the reservoir. Keep the tip of the pipet near the surface of the isopropanol. Filter rapidly under vacuum. Do not wash the sides of the reservoir. Leave the vacuum on for a time sufficient to dry the filter. Release the vacuum and remove the filter with forceps.

2.8.2 Analysis of Calibration Standards

1. Mount each filter on a flat holder. Perform step scans on selected diagnostic reflections of the standards and reference specimen using the procedure outlined in Section 2.7.2.3, step 12, and the same conditions as those used for the samples.

2. Determine the normalized intensity for each peak measured, $\hat{I}_{std}$, as outlined in Section 2.7.2.3, step 14.

2.9 Calculations

For each asbestos reference material, calculate the exact weight deposited on each standard filter from the concentrations of the standard suspensions and aliquot volumes. Record the weight, w, of each standard. Prepare a calibration curve by regressing $\hat{I}2_{std}$ on w. Poor reproducibility (±15 percent RSD) at any given level indicates problems in the sample preparation technique, and a need for new standards. The data should fit a straight line equation.

Determine the slope, m, of the calibration curve in counts/microgram. The intercept, b, of the line with the I_{std} axis should be approximately zero. A large negative intercept indicates an error in determining the background. This may arise from incorrectly measuring the baseline or from interference by another phase at the angle of background measurement. A large positive intercept indicates an error in determining the baseline or that an impurity is included in the measured peak.

Using the normalized intensity, $\hat{I}_{Ag}$, for the attenuated silver peak of a sample, and the corresponding normalized intensity from the unattenuated silver peak, $\hat{I}_{\mathring{A}g}$, of the sample filter, calculate the transmittance, T, for each sample as follows:[26,27]

$$T = \frac{\hat{I}_{Ag}}{\hat{I}^\circ_{Ag}}$$

Determine the correction factor, f(T), for each sample according to the formula:

$$f(T) = \frac{-R\,(\ln T)}{1-T^R}$$

where

$$R = \frac{\sin \Theta_{Ag}}{\sin \Theta_a}$$

θ_{Ag}=angular position of the measured silver peak (from Bragg's Law), and

θ_a=angular position of the diagnostic asbestos peak.

Calculate the weight, W_a, in micrograms, of the asbestos material analyzed for in each sample, using the appropriate calibration data and absorption corrections:

$$W_a = \frac{\hat{I}_a f(t) - b}{m}$$

Calculate the percent composition, P_a, of each asbestos mineral analyzed for in the parent material, from the total sample weight, W_T, on the filter:

$$P_a = \frac{W_a(1-.01L)}{W_T} \times 100$$

where

P_a=percent asbestos mineral in parent material;

W_a=mass of asbestos mineral on filter, in µg;

W_T=total sample weight on filter, in µg;

L=percent weight loss of parent material on ashing and/or acid treatment (see Section 2.7.2.3).

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[47 FR 23369, May 27, 1982; 47 FR 38535, Sept. 1, 1982; Redesignated at 60 FR 31922, June 19, 1995]

Subpart F [Reserved]

Subpart G—Asbestos Worker Protection

SOURCE: 65 FR 69216, Nov. 15, 2000, unless otherwise noted.

§ 763.120 What is the purpose of this subpart?

This subpart protects certain State and local government employees who are not protected by the Asbestos Standards of the Occupational Safety and Health Administration (OSHA). This subpart applies the OSHA Asbestos Standards in 29 CFR 1910.1001 and 29 CFR 1926.1101 to these employees.

§ 763.121 Does this subpart apply to me?

If you are a State or local government employer and you are not subject to a State asbestos standard that OSHA has approved under section 18 of the Occupational Safety and Health Act or a State asbestos plan that EPA has exempted from the requirements of this subpart under § 763.123, you must follow the requirements of this subpart to protect your employees from occupational exposure to asbestos.

§ 763.122 What does this subpart require me to do?

If you are a State or local government employer whose employees perform:

(a) Construction activities identified in 29 CFR 1926.1101(a), you must:

(1) Comply with the OSHA standards in 29 CFR 1926.1101.

(2) Submit notifications required for alternative control methods to the Director, National Program Chemicals Division (7404), Office of Pollution Prevention and Toxics, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460.

(b) Custodial activities not associated with the construction activities identified in 29 CFR 1926.1101(a), you must comply with the OSHA standards in 29 CFR 1910.1001.

(c) Repair, cleaning, or replacement of asbestos-containing clutch plates and brake pads, shoes, and linings, or removal of asbestos-containing residue from brake drums or clutch housings, you must comply with the OSHA standards in 29 CFR 1910.1001.

§ 763.123 May a State implement its own asbestos worker protection plan?

This section describes the process under which a State may be exempted from the requirements of this subpart.

(a) *States seeking an exemption.* If your State wishes to implement its own asbestos worker protection plan, rather than complying with the requirements of this subpart, your State must apply for and receive an exemption from EPA.

(1) *What must my State do to apply for an exemption?* To apply for an exemption from the requirements of this subpart, your State must send to the Director of EPA's Office of Pollution Prevention and Toxics (OPPT) a copy of its asbestos worker protection regulations and a detailed explanation of how your State's asbestos worker protection plan meets the requirements of TSCA section 18 (15 U.S.C. 2617).

(2) *What action will EPA take on my State's application for an exemption?* EPA will review your State's application and make a preliminary determination whether your State's asbestos worker protection plan meets the requirements of TSCA section 18.

(i) If EPA's preliminary determination is that your State's plan does meet the requirements of TSCA section 18, EPA will initiate a rulemaking, including an opportunity for public comment, to exempt your State from the requirements of this subpart. After considering any comments, EPA will issue a final rule granting or denying the exemption.

(ii) If EPA's preliminary determination is that the State plan does not meet the requirements of TSCA section 18, EPA will notify your State in writing and will give your State a reasonable opportunity to respond to that determination.

(iii) If EPA does not grant your State an exemption, then the State and local government employers in your State are subject to the requirements of this subpart.

(b) *States that have been granted an exemption.* If EPA has exempted your State from the requirements of this subpart, your State must update its asbestos worker protection regulations as necessary to implement changes to meet the requirements of this subpart, and must apply to EPA for an amendment to its exemption.

(1) *What must my State do to apply for an amendment to its exemption?* To apply for an amendment to its exemption, your State must send to the Director of OPPT a copy of its updated asbestos worker protection regulations and a detailed explanation of how your State's updated asbestos worker protection plan meets the requirements of TSCA section 18. Your State must submit its application for an amendment within 6 months of the effective date of any changes to the requirements of this subpart, or within a reasonable time agreed upon by your State and OPPT.

(2) *What action will EPA take on my State's application for an amendment?* EPA will review your State's application for an amendment and make a preliminary determination whether your State's updated asbestos worker protection plan meets the requirements of TSCA section 18.

(i) If EPA determines that the updated State plan does meet the requirements of TSCA section 18, EPA will issue your State an amended exemption.

(ii) If EPA determines that the updated State plan does not meet the requirements of TSCA section 18, EPA will notify your State in writing and will give your State a reasonable opportunity to respond to that determination.

(iii) If EPA does not grant your State an amended exemption, or if your State does not submit a timely request for amended exemption, then the State and local government employers in your State are subject to the requirements of this subpart.

Subpart H [Reserved]

Subpart I—Prohibition of the Manufacture, Importation, Processing, and Distribution in Commerce of Certain Asbestos-Containing Products; Labeling Requirements

SOURCE: 54 FR 29507, July 12, 1989, unless otherwise noted.

§ 763.160 Scope.

This subpart prohibits the manufacture, importation, processing, and distribution in commerce of the asbestos-containing products identified and at the dates indicated in §§ 763.165, 763.167, and 763.169. This subpart requires that products subject to this rule's bans, but not yet subject to a ban on distribution in commerce, be labeled. This subpart also includes general exemptions and procedures for requesting exemptions from the provisions of this subpart.

§ 763.163 Definitions.

For purposes of this subpart:

Act means the Toxic Substances Control Act, 15 U.S.C. 2601 *et seq.*

Agency means the United States Environmental Protection Agency.

Asbestos means the asbestiform varieties of: chrysotile (serpentine); crocidolite (riebeckite); amosite (cummingtonite-grunerite); tremolite; anthophyllite; and actinolite.

Asbestos-containing product means any product to which asbestos is deliberately added in any concentration or which contains more than 1.0 percent asbestos by weight or area.

Chemical substance, has the same meaning as in section 3 of the Act.

Commerce has the same meaning as in section 3 of the Act.

Commercial paper means an asbestos-containing product which is made of paper intended for use as general insulation paper or muffler paper. Major applications of commercial papers are insulation against fire, heat transfer, and corrosion in circumstances that require a thin, but durable, barrier.

Corrugated paper means an asbestos-containing product made of corrugated paper, which is often cemented to a flat backing, may be laminated with foils or other materials, and has a corrugated surface. Major applications of asbestos corrugated paper include: thermal insulation for pipe coverings; block insulation; panel insulation in elevators; insulation in appliances; and insulation in low-pressure steam, hot water, and process lines.

Customs territory of the United States means the 50 States, Puerto Rico, and the District of Columbia.

Distribute in commerce has the same meaning as in section 3 of the Act, but the term does not include actions taken with respect to an asbestos-containing product (to sell, resale, deliver, or hold) in connection with the end use of the product by persons who are users (persons who use the product for its intended purpose after it is manufactured or processed). The term also does not include distribution by manufacturers, importers, and processors, and other persons solely for purposes of disposal of an asbestos-containing product.

Flooring felt means an asbestos-containing product which is made of paper felt intended for use as an underlayer for floor coverings, or to be bonded to the underside of vinyl sheet flooring.

Import means to bring into the customs territory of the United States, except for: (1) Shipment through the customs territory of the United States for export without any use, processing, or disposal within the customs territory of the United States; or (2) entering the customs territory of the United States as a component of a product during normal personal or business activities involving use of the product.

Importer means anyone who imports a chemical substance, including a chemical substance as part of a mixture or article, into the customs territory of the United States. *Importer* includes the person primarily liable for the payment of any duties on the merchandise or an authorized agent acting on his or her behalf. The term includes as appropriate:

(1) The consignee.

(2) The importer of record.

(3) The actual owner if an actual owner's declaration and superseding bond has been filed in accordance with 19 CFR 141.20.

(4) The transferee, if the right to withdraw merchandise in a bonded warehouse has been transferred in accordance with subpart C of 19 CFR part 144.

Manufacture means to produce or manufacture in the United States.

Manufacturer means a person who produces or manufactures in the United States.

New uses of asbestos means commercial uses of asbestos not identified in § 763.165 the manufacture, importation or processing of which would be initiated for the first time after August 25, 1989.

Person means any natural person, firm, company, corporation, joint-venture, partnership, sole proprietorship, association, or any other business entity; any State or political subdivision thereof, or any municipality; any interstate body and any department, agency, or instrumentality of the Federal Government.

Process has the same meaning as in section 3 of the Act.

Processor has the same meaning as in section 3 of the Act.

Rollboard means an asbestos-containing product made of paper that is produced in a continuous sheet, is flexible, and is rolled to achieve a desired thickness. Asbestos rollboard consists of two sheets of asbestos paper

laminated together. Major applications of this product include: office partitioning; garage paneling; linings for stoves and electric switch boxes; and fire-proofing agent for security boxes, safes, and files.

Specialty paper means an asbestos-containing product that is made of paper intended for use as filters for beverages or other fluids or as paper fill for cooling towers. Cooling tower fill consists of asbestos paper that is used as a cooling agent for liquids from industrial processes and air conditioning systems.

State has the same meaning as in section 3 of the Act.

Stock-on-hand means the products which are in the possession, direction, or control of a person and are intended for distribution in commerce.

United States has the same meaning as in section 3 of the Act.

[59 FR 33208, June 28, 1994]

§ 763.165 Manufacture and importation prohibitions.

(a) After August 27, 1990, no person shall manufacture or import the following asbestos-containing products, either for use in the United States or for export: flooring felt and new uses of asbestos.

(b) After August 26, 1996, no person shall manufacture or import the following asbestos-containing products, either for use in the United States or for export: commercial paper, corrugated paper, rollboard, and specialty paper.

(c) The import prohibitions of this subpart do not prohibit:

(1) The import into the customs territory of the United States of products imported solely for shipment outside the customs territory of the United States, unless further repackaging or processing of the product is performed in the United States; or

(2) Activities involving purchases or acquisitions of small quantities of products made outside the customs territory of the United States for personal use in the United States.

[59 FR 33209, June 28, 1994]

§ 763.167 Processing prohibitions.

(a) After August 27, 1990, no person shall process for any use, either in the United States or for export, any of the asbestos-containing products listed at § 763.165(a).

(b) After August 26, 1996, no person shall process for any use, either in the United States or for export, any of the asbestos-containing products listed at § 763.165(b).

[59 FR 33209, June 28, 1994]

§ 763.169 Distribution in commerce prohibitions.

(a) After August 25, 1992, no person shall distribute in commerce, either for use in the United States or for export, any of the asbestos-containing products listed at § 763.165(a).

(b) After August 25, 1997, no person shall distribute in commerce, either for use in the United States or for export, any of the asbestos-containing products listed at § 763.165(b).

(c) A manufacturer, importer, processor, or any other person who is subject to a ban on distribution in commerce in paragraph (a) or (b) of this section must, within 6 months of the effective date of the ban of a specific asbestos-containing product from distribution in commerce, dispose of all their remaining stock-on-hand of that product, by means that are in compliance with applicable local, State, and Federal restrictions which are current at that time.

[59 FR 33209, June 28, 1994]

§ 763.171 Labeling requirements.

(a) After August 27, 1990, manufacturers, importers, and processors of all asbestos-containing products that are identified in § 763.165(a) shall label the products as specified in this subpart at the time of manufacture, import, or processing. This requirement includes labeling all manufacturers', importers', and processors' stock-on-hand as of August 27, 1990.

(b) After August 25, 1995, manufacturers, importers, and processors of all asbestos-containing products that are identified in § 763.165(b), shall label the products as specified in this subpart at the time of manufacture, import, or processing. This requirement includes

labeling all manufacturers', importers', and processors' stock-on-hand as of August 25, 1995.

(c) The label shall be placed directly on the visible exterior of the wrappings and packaging in which the product is placed for sale, shipment, or storage. If the product has more than one layer of external wrapping or packaging, the label must be attached to the innermost layer adjacent to the product. If the innermost layer of product wrapping or packaging does not have a visible exterior surface larger than 5 square inches, either a tag meeting the requirements of paragraph (d) of this section must be securely attached to the product's innermost layer of product wrapping or packaging, or a label must be attached to the next outer layer of product packaging or wrapping. Any products that are distributed in commerce to someone other than the end user, shipped, or stored without packaging or wrapping must be labeled or tagged directly on a visible exterior surface of the product as described in paragraph (d) of this section.

(d)(1) Labels must be either printed directly on product packaging or in the form of a sticker or tag made of plastic, paper, metal, or other durable substances. Labels must be attached in such a manner that they cannot be removed without defacing or destroying them. Product labels shall appear as in paragraph (d)(2) of this section and consist of block letters and numerals of color that contrasts with the background of the label or tag. Labels shall be sufficiently durable to equal or exceed the life, including storage and disposal, of the product packaging or wrapping. The size of the label or tag must be at least 15.25 cm (6 inches) on each side. If the product packaging is too small to accommodate a label of this size, the label may be reduced in size proportionately to the size of the product packaging or wrapping down to a minimum 2.5 cm (1 inch) on each side if the product wrapping or packaging has a visible exterior surface larger than 5 square inches.

(2) Products subject to this subpart shall be labeled in English as follows:

NOTICE

This product contains *ASBESTOS*. The U.S. Environmental Protection Agency has banned the distribution in U.S. commerce of this product under section 6 of the Toxic Substances Control Act (15 U.S.C. 2605) as of (insert effective date of ban on distribution in commerce). Distribution of this product in commerce after this date and intentionally removing or tampering with this label are *violations of Federal law.*

(e) No one may intentionally remove, deface, cover, or otherwise obscure or tamper with a label or sticker that has been applied in compliance with this section, except when the product is used or disposed of.

[59 FR 33209, June 28, 1994]

§ 763.173 Exemptions.

(a) Persons who are subject to the prohibitions imposed by §§ 763.165, 763.167, or 763.169 may file an application for an exemption. Persons whose exemption applications are approved by the Agency may manufacture, import, process, or distribute in commerce the banned product as specified in the Agency's approval of the application. No applicant for an exemption may continue the banned activity that is the subject of an exemption application after the effective date of the ban unless the Agency has granted the exemption or the applicant receives an extension under paragraph (b)(4) or (5) of this section.

(b) Application filing dates. (1) Applications for products affected by the prohibitions under §§ 763.165(a) and 763.167(a) may be submitted at any time and will be either granted or denied by EPA as soon as is feasible.

(2) Applications for products affected by the ban under § 763.169(a) may be submitted at any time and will be either granted or denied by EPA as soon as is feasible.

(3) Applications for products affected by the ban under §§ 763.165(b) and 763.167(b) may not be submitted prior to February 27, 1995. Complete applications received after that date, but before August 25, 1995, will be either granted or denied by the Agency prior to the effective date of the ban for the product. Applications received after August 25, 1995, will be either granted or denied by EPA as soon as is feasible.

(4) Applications for products affected by the ban under § 763.169(b) may not be submitted prior to February 26, 1996. Complete applications received after that date, but before August 26, 1996, will be either granted or denied by the Agency prior to the effective date of the ban for the product. Applications received after August 26, 1996, will be either granted or denied by EPA as soon as is feasible.

(5) The Agency will consider an application for an exemption from a ban under § 763.169 for a product at the same time the applicant submits an application for an exemption from a ban under § 763.165 or § 763.167 for that product. EPA will grant an exemption at that time from a ban under § 763.169 if the Agency determines it appropriate to do so.

(6) If the Agency denies an application less than 30 days before the effective date of a ban for a product, the applicant can continue the activity for 30 days after receipt of the denial from the Agency.

(7) If the Agency fails to meet the deadlines stated in paragraphs (b)(3) and (b)(4) of this section for granting or denying a complete application in instances in which the deadline is before the effective date of the ban to which the application applies, the applicant will be granted an extension of 1 year from the Agency's deadline date. During this extension period the applicant may continue the activity that is the subject of the exemption application. The Agency will either grant or deny the application during the extension period. The extension period will terminate either on the date the Agency grants the application or 30 days after the applicant receives the Agency's denial of the application. However, no extension will be granted if the Agency is scheduled to grant or deny an application at some date after the effective date of the ban, pursuant to the deadlines stated in paragraphs (b)(3) and (b)(4) of this section.

(c) Where to file. All applications must be submitted to the following location: TSCA Docket Receipts Office (7407), Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency, Rm E-G99, 1200 Pennsylvania Ave., NW., Washington, DC 20460, ATTENTION: Asbestos Exemption. For information regarding the submission of exemptions containing information claimed as confidential business information (CBI), see § 763.179.

(d) Content of application and criteria for decisionmaking.

(1) Content of application. Each application must contain the following:

(i) Name, address, and telephone number of the applicant.

(ii) Description of the manufacturing, import, processing, and/or distribution in commerce activity for which an exemption is requested, including a description of the asbestos-containing product to be manufactured, imported, processed, or distributed in commerce.

(iii) Identification of locations at which the exempted activity would take place.

(iv) Length of time requested for exemption (maximum length of an exemption is 4 years).

(v) Estimated amount of asbestos to be used in the activity that is the subject of the exemption application.

(vi) Data demonstrating the exposure level over the life cycle of the product that is the subject of the application.

(vii) Data concerning:

(A) The extent to which non-asbestos substitutes for the product that is the subject of the application fall significantly short in performance under necessary product standards or requirements, including laws or ordinances mandating product safety standards.

(B) The costs of non-asbestos substitutes relative to the costs of the asbestos-containing product and, in the case in which the product is a component of another product, the effect on the cost of the end use product of using the substitute component.

(C) The extent to which the product or use serves a high-valued use.

(viii) Evidence of demonstrable good faith attempts by the applicant to develop and use a non-asbestos substance or product which may be substituted for the asbestos-containing product or the asbestos in the product or use that is the subject to the application.

(ix) Evidence, in addition to that provided in the other information required with the application, showing that the continued manufacture, importation,

processing, distribution in commerce, and use, as applicable, of the product will not present an unreasonable risk of injury to human health.

(2) Criteria for decision (existing products). After considering all the information provided by an applicant under paragraphs (d)(1) and (e) of this section, and any other information available to EPA, EPA will grant an exemption from the prohibitions in §§ 763.165, 763.167, or 763.169 for an applicant's asbestos-containing product only if EPA determines both of the following:

(i) The applicant has made good faith attempts to develop and use a non-asbestos substance or product which may be substituted for the asbestos-containing product or the asbestos in the product or use, and those attempts have failed to produce a substitute or a substitute that results in a product that can be economically produced.

(ii) Continued manufacturing, processing, distribution in commerce, and use, as applicable, of the product will not present an unreasonable risk of injury to human health.

(3) Criteria for decision (new products). Requests to develop and use an asbestos substance or product will be treated as a petition pursuant to section 21 of TSCA.

(e) The Agency reserves the right to request further information from an exemption applicant if necessary to complete the Agency's evaluation of an application.

(f) Upon receipt of a complete application, the Agency will issue a notice in the FEDERAL REGISTER announcing its receipt and invite public comments on the merits of the application.

(g) If the application does not include all of the information required in paragraph (d) of this section, the Agency will return it to the applicant as incomplete and any resubmission of the application will be considered a new application for purposes of the availability of any extension period. If the application is substantially inadequate to allow the Agency to make a reasoned judgment on any of the information required in paragraph (d) of this section and the Agency chooses to request additional information from the applicant, the Agency may also determine that an extension period provided for in paragraph (b)(5) of this section is unavailable to the applicant.

(h) When denying an application, the Agency will notify the applicant by registered mail of its decision and rationale. Whenever possible, the Agency will send this letter prior to the appropriate ban. This letter will be considered a final Agency action for purposes of judicial review. A notice announcing the Agency's denial of the application will be published in the FEDERAL REGISTER.

(i) If the Agency proposes to approve an exemption, it will issue a notice in the FEDERAL REGISTER announcing this intent and invite public comments. If, after considering any timely comments received, the Agency approves an exemption, its decision will be published in the FEDERAL REGISTER. This notice will be considered a final Agency action for purposes of judicial review.

(j) The length of an exemption period will be specified by the agency when it approves the exemption. To extend an exemption period beyond the period stipulated by EPA, applicants must submit a new application to the Agency, following the application procedures described in this section. Applications may not be submitted prior to 15 months before the expiration of the exemption period, unless stated otherwise in the notice granting the exemption. Applications received between 15 months and 1 year before the end of the exemption period will be either granted or denied by the Agency before the end of the exemption period. Applications received after the date 1 year prior to the end of the exemption period will be either granted or denied by the Agency as soon as is feasible. Applicants may not continue the activity that is the subject of the renewal application after the date of the end of the exemption period.

[54 FR 29507, July 12, 1989; 54 FR 37531, Sept. 11, 1989, as amended at 54 FR 46898, Nov. 8, 1989; 59 FR 33210, June 28, 1994]

§ 763.175 Enforcement.

(a) Failure to comply with any provision of this subpart is a violation of section 15 of the Act (15 U.S.C. 2614).

(b) Failure or refusal to establish and maintain records, or to permit access

to or copying of records as required by section 11 of the Act (15 U.S.C. 2610) is a violation of section 15 of the Act (15 U.S.C. 2614).

(c) Failure or refusal to permit entry or inspection as required by section 11 of the Act (15 U.S.C. 2610) is a violation of section 15 of the Act (15 U.S.C. 2614).

(d) Violators may be subject to the civil and criminal penalties in section 16 of the Act (15 U.S.C. 2615) for each violation.

(e) The Agency may seek to enjoin the manufacture, import, processing, or distribution in commerce of asbestos-containing products in violation of this subpart, or act to seize any asbestos-containing products manufactured, imported, processed, or distributed in commerce in violation of this subpart, or take any other actions under the authority of section 7 or 17 of the Act (15 U.S.C. 2606 or 2616) that are appropriate.

§ 763.176 Inspections.

The Agency will conduct inspections under section 11 of the Act (15 U.S.C. 2610) to ensure compliance with this subpart.

§ 763.178 Recordkeeping.

(a) *Inventory.* (1) Each person who is subject to the prohibitions imposed by §§ 763.165 and 763.167 must perform an inventory of the stock-on-hand of each banned product as of the effective date of the ban for that product for the applicable activity.

(2) The inventory shall be in writing and shall include the type of product, the number of product units currently in the stock-on-hand of the person performing the inventory, and the location of the stock.

(3) Results of the inventory for a banned product must be maintained by the person for 3 years after the effective date of the § 763.165 or § 763.167 ban on the product.

(b) *Records.* (1) Each person whose activities are subject to the bans imposed by §§ 763.165, 763.167, and 763.169 for a product must, between the effective date of the § 763.165 or § 763.167 ban on the product and the § 763.169 ban on the product, keep records of all commercial transactions regarding the product, including the dates of purchases and sales and the quantities purchased or sold. These records must be maintained for 3 years after the effective date of the § 763.169 ban for the product.

(2) Each person who is subject to the requirements of § 763.171 must, for each product required to be labeled, maintain a copy of the label used in compliance with § 763.171. These records must be maintained for 3 years after the effective date of the ban on distribution in commerce for the product for which the § 763.171 requirements apply.

[54 FR 29507, July 12, 1989, as amended by 54 FR 46898, Nov. 8, 1989; 58 FR 34205, June 23, 1993]

§ 763.179 Confidential business information claims.

(a) Applicants for exemptions under § 763.173 may assert a Confidential Business Information (CBI) claim for information in an exemption application or supplement submitted to the Agency under this subpart only if the claim is asserted in accordance with this section, and release of the information would reveal trade secrets or confidential commercial or financial information, as provided in section 14(a) of the Act. Information covered by a CBI claim will be treated in accordance with the procedures set forth in 40 CFR part 2, subpart B. The Agency will place all information not claimed as CBI in the manner described in this section in a public file without further notice to the applicant.

(b) Applicants may assert CBI claims only at the time they submit a completed exemption application and only in the specified manner. If no such claim accompanies the information when it is received by the Agency, the information may be made available to the public without further notice to the applicant. Submitters that claim information as business confidential must do so by writing the word ''Confidential'' at the top of the page on which the information appears and by underlining, circling, or placing brackets ([ ]) around the information claimed CBI.

(c) Applicants who assert a CBI claim for submitted information must provide the Agency with two copies of their exemption application. The first copy must be complete and contain all

information being claimed as CBI. The second copy must contain only information not claimed as CBI. The Agency will place the second copy of the submission in a public file. Failure to furnish a second copy of the submission when information is claimed as CBI in the first copy will be considered a presumptive waiver of the claim of confidentiality. The Agency will notify the applicant by certified mail that a finding of a presumptive waiver of the claim of confidentiality has been made. The applicant has 30 days from the date of receipt of notification to submit the required second copy. Failure to submit the second copy will cause the Agency to place the first copy in a public file.

(d) Applicants must substantiate all claims of CBI at the time the applicant asserts the claim, i.e., when the exemption application or supplement is submitted, by responding to the questions in paragraph (e) of this section. Failure to provide substantiation of a claim at the time the applicant submits the application will result in a waiver of the CBI claim, and the information may be disclosed to the public without further notice to the applicant.

(e) Applicants who assert any CBI claims must substantiate all claims by providing detailed responses to the following:

(1) Is this information subject to a patent or patent application in the United States or elsewhere? If so, why is confidentiality necessary?

(2) For what period do you assert a claim of confidentiality? If the claim is to extend until a certain event or point in time, please indicate that event or time period. Explain why such information should remain confidential until such point.

(3) Has the information that you are claiming as confidential been disclosed to persons outside of your company? Will it be disclosed to such persons in the future? If so, what restrictions, if any, apply to use or further disclosure of the information?

(4) Briefly describe measures taken by your company to guard against undesired disclosure of the information you are claiming as confidential to others.

(5) Does the information claimed as confidential appear or is it referred to in advertising or promotional materials for the product or the resulting end product, safety data sheets or other similar materials for the product or the resulting end product, professional or trade publications, or any other media available to the public or to your competitors? If you answered yes, indicate where the information appears.

(6) If the Agency disclosed the information you are claiming as confidential to the public, how difficult would it be for the competitor to enter the market for your product? Consider in your answer such constraints as capital and marketing cost, specialized technical expertise, or unusual processes.

(7) Has the Agency, another Federal agency, or a Federal court made any confidentiality determination regarding this information? If so, provide copies of such determinations.

(8) How would your company's competitive position be harmed if the Agency disclosed this information? Why should such harm be considered substantial? Describe the causal relationship between the disclosure and harm.

(9) In light of section 14(b) of TSCA, if you have claimed information from a health and safety study as confidential, do you assert that disclosure of this information would disclose a process used in the manufacturing or processing of a product or information unrelated to the effects of asbestos on human health and the environment? If your answer is yes, explain.

PART 766—DIBENZO-PARA-DIOXINS/DIBENZOFURANS

Subpart A—General Provisions

Sec.

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APPENDIX O

OSHA ASBESTOS REGULATIONS

UNITED STATES
DEPARTMENT OF LABOR

OSHA English | Spanish

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ABOUT OSHA WORKERS EMPLOYERS REGULATIONS ENFORCEMENT TOPICS NEWS & PUBLICATIONS DATA TRAINING

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- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** I
- **Subpart Title:** Personal Protective Equipment
- **Standard Number:** 1910.134
- **Title:** Respiratory Protection.
- **Appendix:** A , B-1 , B-2 , C , D
- **GPO Source:** e-CFR

This section applies to General Industry (part 1910), Shipyards (part 1915), Marine Terminals (part 1917), Longshoring (part 1918), and Construction (part 1926).

1910.134(a)

Permissible practice.

1910.134(a)(1)

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.

1910.134(a)(2)

A respirator shall be provided to each employee when such equipment is necessary to protect the health of such employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program, which shall include the requirements outlined in paragraph (c) of this section. The program shall cover each employee required by this section to use a respirator.

1910.134(b)

Definitions. The following definitions are important terms used in the respiratory protection standard in this section.

Air-purifying respirator means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Assigned protection factor (APF) means the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified by this section.

Atmosphere-supplying respirator means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Canister or cartridge means a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Demand respirator means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Emergency situation means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Employee exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

End-of-service-life indicator (ESLI) means a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

Escape-only respirator means a respirator intended to be used only for emergency exit.

Filter or air purifying element means a component used in respirators to remove solid or liquid aerosols from the inspired air.

Filtering facepiece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit factor means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit test means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

Helmet means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

High efficiency particulate air (HEPA) filter means a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

Hood means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Interior structural firefighting means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. (See 29 CFR 1910.155)

Loose-fitting facepiece means a respiratory inlet covering that is designed to form a partial seal with the face.

Maximum use concentration (MUC) means the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the required OSHA permissible exposure limit, short-term exposure limit, or ceiling limit. When no OSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment.

Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere means an atmosphere with an oxygen content below 19.5% by volume.

Physician or other licensed health care professional (PLHCP) means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section.

Positive pressure respirator means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator (PAPR) means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Pressure demand respirator means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative fit test (QLFT) means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Quantitative fit test (QNFT) means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respiratory inlet covering means that portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

Self-contained breathing apparatus (SCBA) means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

Service life means the period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Supplied-air respirator (SAR) or airline respirator means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

This section means this respiratory protection standard.

Tight-fitting facepiece means a respiratory inlet covering that forms a complete seal with the face.

User seal check means an action conducted by the respirator user to determine if the respirator is properly seated to the face.

1910.134(c)

Respiratory protection program. This paragraph requires the employer to develop and implement a written respiratory protection program with required worksite-specific procedures and elements for required respirator use. The program must be administered by a suitably trained program administrator. In addition, certain program elements may be required for voluntary use to prevent potential hazards associated with the use of the respirator. The Small Entity Compliance Guide contains criteria for the selection of a program administrator and a sample program that meets the requirements of this paragraph. Copies of the Small Entity Compliance Guide will be available on or about April 8, 1998 from the Occupational Safety and Health Administration's Office of Publications, Room N 3101, 200 Constitution Avenue, NW, Washington, DC, 20210 (202-219-4667).

1910.134(c)(1)

In any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required by the employer, the employer shall establish and implement a written respiratory protection program with worksite-specific procedures. The program shall be updated as necessary to reflect those changes in workplace conditions that affect respirator use. The employer shall include in the program the following provisions of this section, as applicable:

1910.134(c)(1)(i)

Procedures for selecting respirators for use in the workplace;

1910.134(c)(1)(ii)

Medical evaluations of employees required to use respirators;

1910.134(c)(1)(iii)

Fit testing procedures for tight-fitting respirators;

1910.134(c)(1)(iv)

Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

1910.134(c)(1)(v)

Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

1910.134(c)(1)(vi)

Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

1910.134(c)(1)(vii)

Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

1910.134(c)(1)(viii)

Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

1910.134(c)(1)(ix)

Procedures for regularly evaluating the effectiveness of the program.

1910.134(c)(2)

Where respirator use is not required:

1910.134(c)(2)(i)

An employer may provide respirators at the request of employees or permit employees to use their own respirators, if the employer determines that such respirator use will not in itself create a hazard. If the employer determines that any voluntary respirator use is permissible, the employer shall provide the respirator users with the information contained in Appendix D to this section ("Information for Employees Using Respirators When Not Required Under the Standard"); and

1910.134(c)(2)(ii)

In addition, the employer must establish and implement those elements of a written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user. Exception: Employers are not required to include in a written respiratory protection program those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).

1910.134(c)(3)

The employer shall designate a program administrator who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of program effectiveness.

1910.134(c)(4)

The employer shall provide respirators, training, and medical evaluations at no cost to the employee.

1910.134(d)

Selection of respirators. This paragraph requires the employer to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors. The paragraph also specifies appropriately protective respirators for use in IDLH atmospheres, and limits the selection and use of air-purifying respirators.

1910.134(d)(1)

General requirements.

1910.134(d)(1)(i)

The employer shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.

1910.134(d)(1)(ii)

The employer shall select a NIOSH-certified respirator. The respirator shall be used in compliance with the conditions of its certification.

1910.134(d)(1)(iii)

The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.

1910.134(d)(1)(iv)

The employer shall select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

1910.134(d)(2)

Respirators for IDLH atmospheres.

1910.134(d)(2)(i)

The employer shall provide the following respirators for employee use in IDLH atmospheres:

1910.134(d)(2)(i)(A)

A full facepiece pressure demand SCBA certified by NIOSH for a minimum service life of thirty minutes, or

1910.134(d)(2)(i)(B)

A combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.

1910.134(d)(2)(ii)

Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

1910.134(d)(2)(iii)

All oxygen-deficient atmospheres shall be considered IDLH. Exception: If the employer demonstrates that, under all foreseeable conditions, the oxygen concentration can be maintained within the ranges specified in Table II of this section (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

1910.134(d)(3)

Respirators for atmospheres that are not IDLH.

1910.134(d)(3)(i)

The employer shall provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

1910.134(d)(3)(i)(A)

Assigned Protection Factors (APFs) Employers must use the assigned protection factors listed in Table 1 to select a respirator that meets or exceeds the required level of employee protection. When using a combination respirator (e.g., airline respirators with an air-purifying filter), employers must ensure that the assigned protection factor is appropriate to the mode of operation in which the respirator is being used.

Table 1. -- Assigned Protection Factors[5]

Type of respirator[1], [2]	Quarter mask	Half mask	Full facepiece	Helmet/ hood	Loose-fitting facepiece
1. Air-Purifying Respirator	5	[3]10	50	.....	.....
2. Powered Air-Purifying Respirator (PAPR)	.....	50	1,000	[4]25/1,000	25
3. Supplied-Air Respirator (SAR) or Airline Respirator					
• Demand mode	.....	10	50	.....	.....
• Continuous flow mode	.....	50	1,000	[4]25/1,000	25
• Pressure-demand or other positive-pressure mode	.....	50	1,000	.....	.....
4. Self-Contained Breathing Apparatus (SCBA)					
• Demand mode	.....	10	50	50	.....
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)	.....	.....	10,000	10,000	.....

Notes:

[1]Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.

[2]The assigned protection factors in Table 1 are only effective when the employer implements a continuing, effective respirator program as required by this section (29 CFR 1910.134), including training, fit testing, maintenance, and use requirements.

[3]This APF category includes filtering facepieces, and half masks with elastomeric facepieces.

[4]The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a WPF or SWPF study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting facepiece respirators, and receive an APF of 25.

[5]These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by 29 CFR 1910 subpart Z, employers must refer to the appropriate substance-specific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by 29 CFR 1910.134 (d)(2)(ii).

1910.134(d)(3)(i)(B)

Maximum Use Concentration (MUC)

1910.134(d)(3)(i)(B)(1)

The employer must select a respirator for employee use that maintains the employee's exposure to the hazardous substance, when measured outside the respirator, at or below the MUC.

1910.134(d)(3)(i)(B)(2)

Employers must not apply MUCs to conditions that are immediately dangerous to life or health (IDLH); instead, they must use respirators listed for IDLH conditions in paragraph (d)(2) of this standard.

1910.134(d)(3)(i)(B)(3)

When the calculated MUC exceeds the IDLH level for a hazardous substance, or the performance limits of the cartridge or canister, then employers must set the maximum MUC at that lower limit.

1910.134(d)(3)(ii)

The respirator selected shall be appropriate for the chemical state and physical form of the contaminant.

1910.134(d)(3)(iii)

For protection against gases and vapors, the employer shall provide:

1910.134(d)(3)(iii)(A)

An atmosphere-supplying respirator, or

1910.134(d)(3)(iii)(B)

An air-purifying respirator, provided that:

1910.134(d)(3)(iii)(B)(1)

The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or

1910.134(d)(3)(iii)(B)(2)

If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. The employer shall describe in the respirator program the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

1910.134(d)(3)(iv)

For protection against particulates, the employer shall provide:

1910.134(d)(3)(iv)(A)

An atmosphere-supplying respirator; or

1910.134(d)(3)(iv)(B)

An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR part 84; or

1910.134(d)(3)(iv)(C)

For contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

TABLE I. -- ASSIGNED PROTECTION FACTORS
[RESERVED]

TABLE II

Altitude (ft.)	Oxygen deficient Atmospheres (% 0_2) for which the employer atmosphere-may rely on supplying respirators
Less than 3,001	16.0-19.5
3,001-4,000	16.4-19.5
4,001-5,000	17.1-19.5
5,001-6,000	17.8-19.5
6,001-7,000	18.5-19.5
7,001-8,000[1]	19.3-19.5.

[1]Above 8,000 feet the exception does not apply. Oxygen-enriched breathing air must be supplied above 14,000 feet.

1910.134(e)

Medical evaluation. Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee. Accordingly, this paragraph specifies the minimum requirements for medical evaluation that employers must implement to determine the employee's ability to use a respirator.

1910.134(e)(1)

General. The employer shall provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. The employer may discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

1910.134(e)(2)

Medical evaluation procedures.

1910.134(e)(2)(i)

The employer shall identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.

1910.134(e)(2)(ii)

The medical evaluation shall obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix C of this section.

1910.134(e)(3)

Follow-up medical examination.

1910.134(e)(3)(i)

The employer shall ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C or whose initial medical examination demonstrates the need for a follow-up medical examination.

1910.134(e)(3)(ii)

The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination.

1910.134(e)(4)

Administration of the medical questionnaire and examinations.

1910.134(e)(4)(i)

The medical questionnaire and examinations shall be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. The medical questionnaire shall be administered in a manner that ensures that the employee understands its content.

1910.134(e)(4)(ii)

The employer shall provide the employee with an opportunity to discuss the questionnaire and examination results with the PLHCP.

1910.134(e)(5)

Supplemental information for the PLHCP.

1910.134(e)(5)(i)

The following information must be provided to the PLHCP before the PLHCP makes a recommendation concerning an employee's ability to use a respirator:

1910.134(e)(5)(i)(A)

(A) The type and weight of the respirator to be used by the employee;

1910.134(e)(5)(i)(B)

The duration and frequency of respirator use (including use for rescue and escape);

1910.134(e)(5)(i)(C)

The expected physical work effort;

1910.134(e)(5)(i)(D)

Additional protective clothing and equipment to be worn; and

1910.134(e)(5)(i)(E)

Temperature and humidity extremes that may be encountered.

1910.134(e)(5)(ii)

Any supplemental information provided previously to the PLHCP regarding an employee need not be provided for a subsequent medical evaluation if the information and the PLHCP remain the same.

1910.134(e)(5)(iii)

The employer shall provide the PLHCP with a copy of the written respiratory protection program and a copy of this section.

Note to Paragraph (e)(5)(iii): When the employer replaces a PLHCP, the employer must ensure that the new PLHCP obtains this information, either by providing the documents directly to the PLHCP or having the documents transferred from the former PLHCP to the new PLHCP. However, OSHA does not expect employers to have employees medically reevaluated solely because a new PLHCP has been selected.

1910.134(e)(6)

Medical determination. In determining the employee's ability to use a respirator, the employer shall:

1910.134(e)(6)(i)

Obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP. The recommendation shall provide only the following information:

1910.134(e)(6)(i)(A)

Any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator;

1910.134(e)(6)(i)(B)

The need, if any, for follow-up medical evaluations; and

1910.134(e)(6)(i)(C)

A statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.

1910.134(e)(6)(ii)

If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer shall provide a PAPR if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the employee is medically able to use a negative pressure respirator, then the employer is no longer required to provide a PAPR.

1910.134(e)(7)

Additional medical evaluations. At a minimum, the employer shall provide additional medical evaluations that comply with the requirements of this section if:

1910.134(e)(7)(i)

An employee reports medical signs or symptoms that are related to ability to use a respirator;

1910.134(e)(7)(ii)

A PLHCP, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;

1910.134(e)(7)(iii)

Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or

1910.134(e)(7)(iv)

A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

1910.134(f)

Fit testing. This paragraph requires that, before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. This paragraph specifies the kinds of fit tests allowed, the procedures for conducting them, and how the results of the fit tests must be used.

1910.134(f)(1)

The employer shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT) as stated in this paragraph.

1910.134(f)(2)

The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter.

1910.134(f)(3)

The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of, changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

1910.134(f)(4)

If after passing a QLFT or QNFT, the employee subsequently notifies the employer, program administrator, supervisor, or PLHCP that the fit of the respirator is unacceptable, the employee shall be given a reasonable opportunity to select a different respirator facepiece and to be retested.

1910.134(f)(5)

The fit test shall be administered using an OSHA-accepted QLFT or QNFT protocol. The OSHA-accepted QLFT and QNFT protocols and procedures are contained in Appendix A of this section.

1910.134(f)(6)

QLFT may only be used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less.

1910.134(f)(7)

If the fit factor, as determined through an OSHA-accepted QNFT protocol, is equal to or greater than 100 for tight-fitting half facepieces, or equal to or greater than 500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

1910.134(f)(8)

Fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators shall be accomplished by performing quantitative or qualitative fit testing in the negative pressure mode, regardless of the mode of operation (negative or positive pressure) that is used for respiratory protection.

1910.134(f)(8)(i)

Qualitative fit testing of these respirators shall be accomplished by temporarily converting the respirator user's actual facepiece into a negative pressure respirator with appropriate filters, or by using an identical negative pressure air-purifying respirator facepiece with the same sealing surfaces as a surrogate for the atmosphere-supplying or powered air-purifying respirator facepiece.

1910.134(f)(8)(ii)

Quantitative fit testing of these respirators shall be accomplished by modifying the facepiece to allow sampling inside the facepiece in the breathing zone of the user, midway between the nose and mouth. This requirement shall be accomplished by installing a permanent sampling probe onto a surrogate facepiece, or by using a sampling adapter designed to temporarily provide a means of sampling air from inside the facepiece.

1910.134(f)(8)(iii)

Any modifications to the respirator facepiece for fit testing shall be completely removed, and the facepiece restored to NIOSH-approved configuration, before that facepiece can be used in the workplace.

1910.134(g)

Use of respirators. This paragraph requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in facepiece seal leakage, preventing employees from removing respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the work shift, and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

1910.134(g)(1)

Facepiece seal protection.

1910.134(g)(1)(i)

The employer shall not permit respirators with tight-fitting facepieces to be worn by employees who have:

1910.134(g)(1)(i)(A)

Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or

1910.134(g)(1)(i)(B)

Any condition that interferes with the face-to-facepiece seal or valve function.

1910.134(g)(1)(ii)

If an employee wears corrective glasses or goggles or other personal protective equipment, the employer shall ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.

1910.134(g)(1)(iii)

For all tight-fitting respirators, the employer shall ensure that employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1 of this section.

1910.134(g)(2)

Continuing respirator effectiveness.

1910.134(g)(2)(i)

Appropriate surveillance shall be maintained of work area conditions and degree of employee exposure or stress. When there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, the employer shall reevaluate the continued effectiveness of the respirator.

1910.134(g)(2)(ii)

The employer shall ensure that employees leave the respirator use area:

1910.134(g)(2)(ii)(A)

To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with respirator use; or

1910.134(g)(2)(ii)(B)

If they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece; or

1910.134(g)(2)(ii)(C)

To replace the respirator or the filter, cartridge, or canister elements.

1910.134(g)(2)(iii)

If the employee detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, the employer must replace or repair the respirator before allowing the employee to return to the work area.

1910.134(g)(3)

Procedures for IDLH atmospheres. For all IDLH atmospheres, the employer shall ensure that:

1910.134(g)(3)(i)

One employee or, when needed, more than one employee is located outside the IDLH atmosphere;

1910.134(g)(3)(ii)

Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere;

1910.134(g)(3)(iii)

The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue;

1910.134(g)(3)(iv)

The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue;

1910.134(g)(3)(v)

The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation;

1910.134(g)(3)(vi)

Employee(s) located outside the IDLH atmospheres are equipped with:

1910.134(g)(3)(vi)(A)

Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either

1910.134(g)(3)(vi)(B)

Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or

1910.134(g)(3)(vi)(C)

Equivalent means for rescue where retrieval equipment is not required under paragraph (g)(3)(vi)(B).

1910.134(g)(4)

Procedures for interior structural firefighting. In addition to the requirements set forth under paragraph (g)(3), in interior structural fires, the employer shall ensure that:

1910.134(g)(4)(i)

At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

1910.134(g)(4)(ii)

At least two employees are located outside the IDLH atmosphere; and

1910.134(g)(4)(iii)

All employees engaged in interior structural firefighting use SCBAs.

Note 1 to paragraph (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to paragraph (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

1910.134(h)

Maintenance and care of respirators. This paragraph requires the employer to provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees.

1910.134(h)(1)

Cleaning and disinfecting. The employer shall provide each respirator user with a respirator that is clean, sanitary, and in good working order. The employer shall ensure that respirators are cleaned and disinfected using the procedures in Appendix B-2 of this section, or procedures recommended by the respirator manufacturer, provided that such procedures are of equivalent effectiveness. The respirators shall be cleaned and disinfected at the following intervals:

1910.134(h)(1)(i)

Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;

1910.134(h)(1)(ii)

Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals;

1910.134(h)(1)(iii)

Respirators maintained for emergency use shall be cleaned and disinfected after each use; and

1910.134(h)(1)(iv)

Respirators used in fit testing and training shall be cleaned and disinfected after each use.

1910.134(h)(2)

Storage. The employer shall ensure that respirators are stored as follows:

1910.134(h)(2)(i)

All respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they shall be packed or stored to prevent deformation of the facepiece and exhalation valve.

1910.134(h)(2)(ii)

In addition to the requirements of paragraph (h)(2)(i) of this section, emergency respirators shall be:

1910.134(h)(2)(ii)(A)

Kept accessible to the work area;

1910.134(h)(2)(ii)(B)

Stored in compartments or in covers that are clearly marked as containing emergency respirators; and

1910.134(h)(2)(ii)(C)

Stored in accordance with any applicable manufacturer instructions.

1910.134(h)(3)

Inspection.

1910.134(h)(3)(i)

The employer shall ensure that respirators are inspected as follows:

1910.134(h)(3)(i)(A)

All respirators used in routine situations shall be inspected before each use and during cleaning;

1910.134(h)(3)(i)(B)

All respirators maintained for use in emergency situations shall be inspected at least monthly and in accordance with the manufacturer's recommendations, and shall be checked for proper function before and after each use; and

1910.134(h)(3)(i)(C)

Emergency escape-only respirators shall be inspected before being carried into the workplace for use.

1910.134(h)(3)(ii)

The employer shall ensure that respirator inspections include the following:

1910.134(h)(3)(ii)(A)

A check of respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters; and

1910.134(h)(3)(ii)(B)

A check of elastomeric parts for pliability and signs of deterioration.

1910.134(h)(3)(iii)

In addition to the requirements of paragraphs (h)(3)(i) and (ii) of this section, self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be maintained in a fully charged state and shall be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level. The employer shall determine that the regulator and warning devices function properly.

1910.134(h)(3)(iv)

For respirators maintained for emergency use, the employer shall:

1910.134(h)(3)(iv)(A)

Certify the respirator by documenting the date the inspection was performed, the name (or signature) of the person who made the inspection, the findings, required remedial action, and a serial number or other means of identifying the inspected respirator; and

1910.134(h)(3)(iv)(B)

Provide this information on a tag or label that is attached to the storage compartment for the respirator, is kept with the respirator, or is included in inspection reports stored as paper or electronic files. This information shall be maintained until replaced following a subsequent certification.

1910.134(h)(4)

Repairs. The employer shall ensure that respirators that fail an inspection or are otherwise found to be defective are removed from service, and are discarded or repaired or adjusted in accordance with the following procedures:

1910.134(h)(4)(i)

Repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and shall use only the respirator manufacturer's NIOSH-approved parts designed for the respirator;

1910.134(h)(4)(ii)

Repairs shall be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed; and

1910.134(h)(4)(iii)

Reducing and admission valves, regulators, and alarms shall be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

1910.134(i)

Breathing air quality and use. This paragraph requires the employer to provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity.

1910.134(i)(1)

The employer shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:

1910.134(i)(1)(i)

Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and

1910.134(i)(1)(ii)

Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

1910.134(i)(1)(ii)(A)

Oxygen content (v/v) of 19.5-23.5%;

1910.134(i)(1)(ii)(B)

Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

1910.134(i)(1)(ii)(C)

Carbon monoxide (CO) content of 10 ppm or less;

1910.134(i)(1)(ii)(D)

Carbon dioxide content of 1,000 ppm or less; and

1910.134(i)(1)(ii)(E)

Lack of noticeable odor.

1910.134(i)(2)

The employer shall ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.

1910.134(i)(3)

The employer shall ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

1910.134(i)(4)

The employer shall ensure that cylinders used to supply breathing air to respirators meet the following requirements:

1910.134(i)(4)(i)

Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 180);

1910.134(i)(4)(ii)

Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air; and

1910.134(i)(4)(iii)

The moisture content in the cylinder does not exceed a dew point of -50 deg.F (-45.6 deg.C) at 1 atmosphere pressure.

1910.134(i)(5)

The employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

1910.134(i)(5)(i)

Prevent entry of contaminated air into the air-supply system;

1910.134(i)(5)(ii)

Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 deg.C) below the ambient temperature;

1910.134(i)(5)(iii)

Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

1910.134(i)(5)(iv)

Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

1910.134(i)(6)

For compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

1910.134(i)(7)

For oil-lubricated compressors, the employer shall use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

1910.134(i)(8)

The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

1910.134(i)(9)

The employer shall use only the respirator manufacturer's NIOSH-approved breathing-gas containers,marked and maintained in accordance with the Quality Assurance provisions of the NIOSH approval for the SCBA as issued in accordance with the NIOSH respirator-certification standard at 42 CFR part 84.

1910.134(j)

Identification of filters, cartridges, and canisters. The employer shall ensure that all filters, cartridges and canisters used in the workplace are labeled and color coded with the NIOSH approval label and that the label is not removed and remains legible.

1910.134(k)

Training and information. This paragraph requires the employer to provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary. This paragraph also requires the employer to provide the basic information on respirators in Appendix D of this section to employees who wear respirators when not required by this section or by the employer to do so.

1910.134(k)(1)

The employer shall ensure that each employee can demonstrate knowledge of at least the following:

1910.134(k)(1)(i)

Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;

1910.134(k)(1)(ii)

What the limitations and capabilities of the respirator are;

1910.134(k)(1)(iii)

How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;

1910.134(k)(1)(iv)

How to inspect, put on and remove, use, and check the seals of the respirator;

1910.134(k)(1)(v)

What the procedures are for maintenance and storage of the respirator;

1910.134(k)(1)(vi)

How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and

1910.134(k)(1)(vii)

The general requirements of this section.

1910.134(k)(2)

The training shall be conducted in a manner that is understandable to the employee.

1910.134(k)(3)

The employer shall provide the training prior to requiring the employee to use a respirator in the workplace.

1910.134(k)(4)

An employer who is able to demonstrate that a new employee has received training within the last 12 months that addresses the elements specified in paragraph (k)(1)(i) through (vii) is not required to repeat such training provided that, as required by paragraph (k)(1), the employee can demonstrate knowledge of those element(s). Previous training not repeated initially by the employer must be provided no later than 12 months from the date of the previous training.

1910.134(k)(5)

Retraining shall be administered annually, and when the following situations occur:

1910.134(k)(5)(i)

Changes in the workplace or the type of respirator render previous training obsolete;

1910.134(k)(5)(ii)

Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or

1910.134(k)(5)(iii)

Any other situation arises in which retraining appears necessary to ensure safe respirator use.

1910.134(k)(6)

The basic advisory information on respirators, as presented in Appendix D of this section, shall be provided by the employer in any written or oral format, to employees who wear respirators when such use is not required by this section or by the employer.

1910.134(l)

Program evaluation. This section requires the employer to conduct evaluations of the workplace to ensure that the written respiratory protection program is being properly implemented, and to consult employees to ensure that they are using the respirators properly.

1910.134(l)(1)

The employer shall conduct evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective.

1910.134(l)(2)

The employer shall regularly consult employees required to use respirators to assess the employees' views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include, but are not limited to:

1910.134(l)(2)(i)

Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);

1910.134(l)(2)(ii)

Appropriate respirator selection for the hazards to which the employee is exposed;

1910.134(l)(2)(iii)

Proper respirator use under the workplace conditions the employee encounters; and

1910.134(l)(2)(iv)

Proper respirator maintenance.

1910.134(m)

Recordkeeping. This section requires the employer to establish and retain written information regarding medical evaluations, fit testing, and the respirator program. This information will facilitate employee involvement in the respirator program, assist the employer in auditing the adequacy of the program, and provide a record for compliance determinations by OSHA.

1910.134(m)(1)

Medical evaluation. Records of medical evaluations required by this section must be retained and made available in accordance with 29 CFR 1910.1020.

1910.134(m)(2)

Fit testing.

1910.134(m)(2)(i)

The employer shall establish a record of the qualitative and quantitative fit tests administered to an employee including:

1910.134(m)(2)(i)(A)

The name or identification of the employee tested;

1910.134(m)(2)(i)(B)

Type of fit test performed;

1910.134(m)(2)(i)(C)

Specific make, model, style, and size of respirator tested;

1910.134(m)(2)(i)(D)

Date of test; and

1910.134(m)(2)(i)(E)

The pass/fail results for QLFTs or the fit factor and strip chart recording or other recording of the test results for QNFTs.

1910.134(m)(2)(ii)

Fit test records shall be retained for respirator users until the next fit test is administered.

1910.134(m)(3)

A written copy of the current respirator program shall be retained by the employer.

1910.134(m)(4)

Written materials required to be retained under this paragraph shall be made available upon request to affected employees and to the Assistant Secretary or designee for examination and copying.

1910.134(n)

Effective date. Paragraphs (d)(3)(i)(A) and (d)(3)(i)(B) of this section become effective November 22, 2006.

1910.134(o)

Appendices. Compliance with Appendix A, Appendix B-1, Appendix B-2, Appendix C, and Appendix D to this section are mandatory.

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998; 71 FR 16672, April 3, 2006; 71 FR 50187, August 24, 2006; 73 FR 75584, Dec. 12, 2008; 76 FR 33606, June 8, 2011]

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- **Part Title:** Safety and Health Regulations for Construction
- **Subpart:** Z
- **Subpart Title:** Toxic and Hazardous Substances
- **Standard Number:** 1926.1101
- **Title:** Asbestos
- **Appendix:** A, B, C, D, E, F, G, H, I, J, K
- **GPO Source:** e-CFR

1926.1101(a)

Scope and application. This section regulates asbestos exposure in all work as defined in 29 CFR 1910.12(b), including but not limited to the following:

1926.1101(a)(1)

Demolition or salvage of structures where asbestos is present;

1926.1101(a)(2)

Removal or encapsulation of materials containing asbestos;

1926.1101(a)(3)

Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos;

1926.1101(a)(4)

Installation of products containing asbestos;

1926.1101(a)(5)

Asbestos spill/emergency cleanup; and

1926.1101(a)(6)

Transportation, disposal, storage, containment of and housekeeping activities involving asbestos or products containing asbestos, on the site or location at which construction activities are performed.

1926.1101(a)(7)

Coverage under this standard shall be based on the nature of the work operation involving asbestos exposure.

1926.1101(a)(8)

This section does not apply to asbestos-containing asphalt roof coatings, cements and mastics.

1926.1101(b)

Definitions.

Aggressive method means removal or disturbance of building material by sanding, abrading, grinding or other method that breaks, crumbles, or disintegrates intact ACM.

Amended water means water to which surfactant (wetting agent) has been added to increase the ability of the liquid to penetrate ACM.

Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered. For purposes of this standard, "asbestos" includes PACM, as defined below.

Asbestos-containing material (ACM), means any material containing more than one percent asbestos.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Authorized person means any person authorized by the employer and required by work duties to be present in regulated areas.

Building/facility owner is the legal entity, including a lessee, which exercises control over management and record keeping functions relating to a building and/or facility in which activities covered by this standard take place.

Certified Industrial Hygienist (CIH) means one certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work means activities involving the removal of TSI and surfacing ACM and PACM.

Class II asbestos work means activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

Class III asbestos work means repair and maintenance operations, where "ACM", including TSI and surfacing ACM and PACM, is likely to be disturbed.

Class IV asbestos work means maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities to clean up dust, waste and debris resulting from Class I, II, and III activities.

Clean room means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

Closely resemble means that the major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person means, in addition to the definition in 29 CFR 1926.32 (f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f): in addition, for Class I and Class II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor, or its equivalent and, for Class III and Class IV work, who is trained in a manner consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92 (a)(2).

Critical barrier means one or more layers of plastic sealed over all openings into a work area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a work area from migrating to an adjacent area.

Decontamination area means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

Director means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Disturbance means activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM and PACM, no greater than the amount which can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or waste bag which shall not exceed 60 inches in length and width.

Employee exposure means that exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.

Equipment room (change room) means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber means a particulate form of asbestos, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

Glovebag means not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

High-efficiency particulate air (HEPA) filter means a filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

Homogeneous area means an area of surfacing material or thermal system insulation that is uniform in color and texture.

Industrial hygienist means a professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards.

Intact means that the ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Modification for purposes of paragraph (g)(6)(ii), means a changed or altered procedure, material or component of a control system, which replaces a procedure, material or component of a required system. Omitting a procedure or component, or reducing or diminishing the stringency or strength of a material or component of the control system is not a "modification" for purposes of paragraph (g)(6) of this section.

Negative Initial Exposure Assessment means a demonstration by the employer, which complies with the criteria in paragraph (f)(2)(iii) of this section, that employee exposure during an operation is expected to be consistently below the PELs.

PACM means "presumed asbestos containing material".

Presumed Asbestos Containing Material means thermal system insulation and surfacing material found in buildings constructed no later than 1980. The designation of a material as "PACM" may be rebutted pursuant to paragraph (k)(5) of this section.

Project Designer means a person who has successfully completed the training requirements for an abatement project designer established by 40 U.S.C. Sec. 763.90(g).

Regulated area means: an area established by the employer to demarcate areas where Class I, II, and III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable possibility they may exceed the permissible exposure limit. Requirements for regulated areas are set out in paragraph (e) of this section.

Removal means all operations where ACM and/or PACM is taken out or stripped from structures or substrates, and includes demolition operations.

Renovation means the modifying of any existing structure, or portion thereof.

Repair means overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Surfacing material means material that is sprayed, troweled-on or otherwise applied to surfaces (such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, and other purposes).

Surfacing ACM means surfacing material which contains more than 1% asbestos.

Thermal system insulation (TSI) means ACM applied to pipes, fittings, boilers, breeching, tanks, ducts or other structural components to prevent heat loss or gain.

Thermal system insulation ACM is thermal system insulation which contains more than 1% asbestos.

1926.1101(c)

Permissible exposure limits (PELS).

1926.1101(c)(1)

Time-weighted average limit (TWA). The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Appendix A to this section, or by an equivalent method.

1926.1101(c)(2)

Excursion limit. The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air (1 f/cc) as averaged over a sampling period of thirty (30) minutes, as determined by the method prescribed in Appendix A to this section, or by an equivalent method.

1926.1101(d)

Multi-employer worksites.

1926.1101(d)(1)

On multi-employer worksites, an employer performing work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos and/or PACM, of the existence of and requirements pertaining to regulated areas, and the measures taken to ensure that employees of such other employers are not exposed to asbestos.

1926.1101(d)(2)

Asbestos hazards at a multi-employer work site shall be abated by the contractor who created or controls the source of asbestos contamination. For example, if there is a significant breach of an enclosure containing Class I work, the employer responsible for erecting the enclosure shall repair the breach immediately.

1926.1101(d)(3)

In addition, all employers of employees exposed to asbestos hazards shall comply with applicable protective provisions to protect their employees. For example, if employees working immediately adjacent to a Class I asbestos job are exposed to asbestos due to the inadequate containment of such job, their employer shall either remove the employees from the area until the enclosure breach is repaired; or perform an initial exposure assessment pursuant to (f) of this section.

1926.1101(d)(4)

All employers of employees working adjacent to regulated areas established by another employer on a multi-employer work-site, shall take steps on a daily basis to ascertain the integrity of the enclosure and/or the effectiveness of the control method relied on by the primary asbestos contractor to assure that asbestos fibers do not migrate to such adjacent areas.

1926.1101(d)(5)

All general contractors on a construction project which includes work covered by this standard shall be deemed to exercise general supervisory authority over the work covered by this standard, even though the general contractor is not qualified to serve as the asbestos "competent person" as defined by paragraph (b) of this section. As supervisor of the entire project, the general contractor shall ascertain whether the asbestos contractor is in compliance with this standard, and shall require such contractor to come into compliance with this standard when necessary.

1926.1101(e)

Regulated areas.

1926.1101(e)(1)

All Class I, II and III asbestos work shall be conducted within regulated areas. All other operations covered by this standard shall be conducted within a regulated area where airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed a PEL. Regulated areas shall comply with the requirements of paragraphs (2), (3),(4) and (5) of this section.

1926.1101(e)(2)

Demarcation. The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they may demarcate the regulated area. Signs shall be provided and displayed pursuant to the requirements of paragraph (k)(7) of this section.

1926.1101(e)(3)

Access. Access to regulated areas shall be limited to authorized persons and to persons authorized by the Act or regulations issued pursuant thereto.

1926.1101(e)(4)

Respirators. All persons entering a regulated area where employees are required pursuant to paragraph (h)(1) of this section to wear respirators shall be supplied with a respirator selected in accordance with paragraph (h)(2) of this section.

1926.1101(e)(5)

Prohibited activities. The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

1926.1101(e)(6)

Competent Persons. The employer shall ensure that all asbestos work performed within regulated areas is supervised by a competent person, as defined in paragraph (b) of this section. The duties of the competent person are set out in paragraph (o) of this section.

1926.1101(f)

Exposure assessments and monitoring.

1926.1101(f)(1)

General monitoring criteria.

1926.1101(f)(1)(i)

Each employer who has a workplace or work operation where exposure monitoring is required under this section shall perform monitoring to determine accurately the airborne concentrations of asbestos to which employees may be exposed.

1926.1101(f)(1)(ii)

Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee.

1926.1101(f)(1)(iii)

Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area. Representative 30-minute short-term employee exposures shall be determined on the basis of one or more samples representing 30 minute exposures associated with operations that are most likely to produce exposures above the excursion limit for employees in each work area.

1926.1101(f)(2)

Initial Exposure Assessment.

1926.1101(f)(2)(i)

Each employer who has a workplace or work operation covered by this standard shall ensure that a "competent person" conducts an exposure assessment immediately before or at the initiation of the operation to ascertain expected exposures during that operation or workplace. The assessment must be completed in time to comply with requirements which are triggered by exposure data or the lack of a "negative exposure assessment," and to provide information necessary to assure that all control systems planned are appropriate for that operation and will work properly.

1926.1101(f)(2)(ii)

Basis of Initial Exposure Assessment: Unless a negative exposure assessment has been made pursuant to paragraph (f)(2)(iii) of this section, the initial exposure assessment shall, if feasible, be based on monitoring conducted pursuant to paragraph (f)(1)(iii) of this section. The assessment shall take into consideration both the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the employer which indicate the levels of airborne asbestos likely to be encountered on the job. For Class I asbestos work, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in excess of the PELs, or otherwise makes a negative exposure assessment pursuant to paragraph (f)(2)(iii) of this section, the employer shall presume that employees are exposed in excess of the TWA and excursion limit.

1926.1101(f)(2)(iii)

Negative Exposure Assessment: For any one specific asbestos job which will be performed by employees who have been trained in compliance with the standard, the employer may demonstrate that employee exposures will be below the PELs by data which conform to the following criteria;

1926.1101(f)(2)(iii)(A)

Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the TWA and excursion limit under those work conditions having the greatest potential for releasing asbestos; or

1926.1101(f)(2)(iii)(B)

Where the employer has monitored prior asbestos jobs for the PEL and the excursion limit within 12 months of the current or projected job, the monitoring and analysis were performed in compliance with the asbestos standard in effect; and the data were obtained during work operations conducted under workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the operations were conducted by employees whose training and experience are no more extensive than that of employees performing the current job, and these data show that under the conditions prevailing and which will prevail in the current workplace there is a high degree of certainty that employee exposures will not exceed the TWA and excursion limit; or

1926.1101(f)(2)(iii)(C)

The results of initial exposure monitoring of the current job made from breathing zone air samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee covering operations which are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

1926.1101(f)(3)

Periodic monitoring.

1926.1101(f)(3)(i)

Class I and II operations. The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area who is performing Class I or II work, unless the employer pursuant to (f)(2)(iii) of this section, has made a negative exposure assessment for the entire operation.

1926.1101(f)(3)(ii)

All operations under the standard other than Class I and II operations. The employer shall conduct periodic monitoring of all work where exposures are expected to exceed a PEL, at intervals sufficient to document the validity of the exposure prediction.

1926.1101(f)(3)(iii)

Exception: When all employees required to be monitored daily are equipped with supplied-air respirators operated in the pressure demand mode, or other positive pressure mode respirator, the employer may dispense with the daily monitoring required by this paragraph. However, employees performing Class I work using a control method which is not listed in paragraph (g)(4)(i), (ii), or (iii) of this section or using a modification of a listed control method, shall continue to be monitored daily even if they are equipped with supplied-air respirators.

1926.1101(f)(4)

Termination of monitoring.

1926.1101(f)(4)(i)

If the periodic monitoring required by paragraph (f)(3) of this section reveals that employee exposures, as indicated by statistically reliable measurements, are below the permissible exposure limit and excursion limit the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

1926.1101(f)(4)(ii)

Additional monitoring. Notwithstanding the provisions of paragraph (f)(2) and (3), and (f)(4) of this section, the employer shall institute the exposure monitoring required under paragraph (f)(3) of this section whenever there has been a change in process, control equipment, personnel or work practices that may result in new or additional exposures above the permissible exposure limit and/or excursion limit or when the employer has any reason to suspect that a change may result in new or additional exposures above the permissible exposure limit and/or excursion limit. Such additional monitoring is required regardless of whether a "negative exposure assessment" was previously produced for a specific job.

1926.1101(f)(5)

Employee notification of monitoring results. The employer must, as soon as possible but no later than 5 working days after the receipt of the results of any monitoring performed under this section, notify each affected employee of these results either individually in writing or by posting the results in an appropriate location that is accessible to employees.

1926.1101(f)(6)

Observation of monitoring.

1926.1101(f)(6)(i)

The employer shall provide affected employees and their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos conducted in accordance with this section.

1926.1101(f)(6)(ii)

When observation of the monitoring of employee exposure to asbestos requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

1926.1101(g)

Methods of compliance.

1926.1101(g)(1)

Engineering controls and work practices for all operations covered by this section. The employer shall use the following engineering controls and work practices in all operations covered by this section, regardless of the levels of exposure:

1926.1101(g)(1)(i)

Vacuum cleaners equipped with HEPA filters to collect all debris and dust containing ACM and PACM, except as provided in paragraph (g)(8)(ii) of this section in the case of roofing material.

1926.1101(g)(1)(ii)

Wet methods, or wetting agents, to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup, except where employers demonstrate that the use of wet methods is infeasible due to for example, the creation of electrical hazards, equipment malfunction, and, in roofing, except as provide in paragraph (g)(8)(ii) of this section; and

1926.1101(g)(1)(iii)

Prompt clean-up and disposal of wastes and debris contaminated with asbestos in leak-tight containers except in roofing operations, where the procedures specified in paragraph (g)(8)(ii) of this section apply.

1926.1101(g)(2)

In addition to the requirements of paragraph (g)(1) of this section, the employer shall use the following control methods to achieve compliance with the TWA permissible exposure limit and excursion limit prescribed by paragraph (c) of this section;

1926.1101(g)(2)(i)

Local exhaust ventilation equipped with HEPA filter dust collection systems;

1926.1101(g)(2)(ii)

Enclosure or isolation of processes producing asbestos dust;

1926.1101(g)(2)(iii)

Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;

1926.1101(g)(2)(iv)

Use of other work practices and engineering controls that the Assistant Secretary can show to be feasible.

1926.1101(g)(2)(v)

Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the permissible exposure limit and/or excursion limit prescribed in paragraph (c) of this section, the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (h) of this section.

1926.1101(g)(3)

Prohibitions. The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM or PACM, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

1926.1101(g)(3)(i)

High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

1926.1101(g)(3)(ii)

Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

1926.1101(g)(3)(iii)

Dry sweeping, shoveling or other dry clean-up of dust and debris containing ACM and PACM.

1926.1101(g)(3)(iv)

Employee rotation as a means of reducing employee exposure to asbestos.

1926.1101(g)(4)

Class I Requirements. In addition to the provisions of paragraphs (g)(1) and (2) of this section, the following engineering controls and work practices and procedures shall be used.

1926.1101(g)(4)(i)

All Class I work, including the installation and operation of the control system shall be supervised by a competent person as defined in paragraph (b) of this section;

1926.1101(g)(4)(ii)

For all Class I jobs involving the removal of more than 25 linear or 10 square feet of thermal system insulation or surfacing material; for all other Class I jobs, where the employer cannot produce a negative exposure assessment pursuant to paragraph (f)(2)(iii) of this section, or where employees are working in areas adjacent to the regulated area, while the Class I work is being performed, the employer shall use one of the following methods to ensure that airborne asbestos does not migrate from the regulated area:

1926.1101(g)(4)(ii)(A)

Critical barriers shall be placed over all the openings to the regulated area, except where activities are performed outdoors; or

1926.1101(g)(4)(ii)(B)

The employer shall use another barrier or isolation method which prevents the migration of airborne asbestos from the regulated area, as verified by perimeter area surveillance during each work shift at each boundary of the regulated area, showing no visible asbestos dust; and perimeter area monitoring showing that clearance levels contained in 40 CFR Part 763, Subpt. E, of the EPA Asbestos in Schools Rule are met, or that perimeter area levels, measured by Phase Contrast Microscopy (PCM) are no more than background levels representing the same area before the asbestos work began. The results of such monitoring shall be made known to the employer no later than 24 hours from the end of the work shift represented by such monitoring. Exception: For work completed outdoors where employees are not working in areas adjacent to the regulated areas, this paragraph (g)(4)(ii) is satisfied when the specific control methods in paragraph (g)(5) of this section are used.

1926.1101(g)(4)(iii)

For all Class I jobs, HVAC systems shall be isolated in the regulated area by sealing with a double layer of 6 mil plastic or the equivalent;

1926.1101(g)(4)(iv)

For all Class I jobs, impermeable dropcloths shall be placed on surfaces beneath all removal activity;

1926.1101(g)(4)(v)

For all Class I jobs, all objects within the regulated area shall be covered with impermeable dropcloths or plastic sheeting which is secured by duct tape or an equivalent.

1926.1101(g)(4)(vi)

For all Class I jobs where the employer cannot produce a negative exposure assessment, or where exposure monitoring shows that a PEL is exceeded, the employer shall ventilate the regulated area to move contaminated air away from the breathing zone of employees toward a HEPA filtration or collection device.

1926.1101(g)(5)

Specific control methods for Class I work. In addition, Class I asbestos work shall be performed using one or more of the following control methods pursuant to the limitations stated below:

1926.1101(g)(5)(i)

Negative Pressure Enclosure (NPE) systems: NPE systems may be used where the configuration of the work area does not make the erection of the enclosure infeasible, with the following specifications and work practices.

1926.1101(g)(5)(i)(A)

Specifications:

1926.1101(g)(5)(i)(A)*(1)*

The negative pressure enclosure (NPE) may be of any configuration,

1926.1101(g)(5)(i)(A)*(2)*

At least 4 air changes per hour shall be maintained in the NPE,

1926.1101(g)(5)(i)(A)*(3)*

A minimum of -0.02 column inches of water pressure differential, relative to outside pressure, shall be maintained within the NPE as evidenced by manometric measurements,

1926.1101(g)(5)(i)(A)*(4)*

The NPE shall be kept under negative pressure throughout the period of its use, and

1926.1101(g)(5)(i)(A)*(5)*

Air movement shall be directed away from employees performing asbestos work within the enclosure, and toward a HEPA filtration or a collection device.

1926.1101(g)(5)(i)(B)

Work Practices:

1926.1101(g)(5)(i)(B)*(1)*

Before beginning work within the enclosure and at the beginning of each shift, the NPE shall be inspected for breaches and smoke-tested for leaks, and any leaks sealed.

1926.1101(g)(5)(i)(B)*(2)*

Electrical circuits in the enclosure shall be deactivated, unless equipped with ground-fault circuit interrupters.

1926.1101(g)(5)(ii)

Glove bag systems may be used to remove PACM and/or ACM from straight runs of piping and elbows and other connections with the following specifications and work practices:

1926.1101(g)(5)(ii)(A)

Specifications:

1926.1101(g)(5)(ii)(A)*(1)*

Glovebags shall be made of 6 mil thick plastic and shall be seamless at the bottom.

1926.1101(g)(5)(ii)(A)*(2)*

Glovebags used on elbows and other connections must be designed for that purpose and used without modifications.

1926.1101(g)(5)(ii)(B)

Work Practices:

1926.1101(g)(5)(ii)(B)*(1)*

Each glovebag shall be installed so that it completely covers the circumference of pipe or other structure where the work is to be done.

1926.1101(g)(5)(ii)(B)*(2)*

Glovebags shall be smoke-tested for leaks and any leaks sealed prior to use.

1926.1101(g)(5)(ii)(B)*(3)*

Glovebags may be used only once and may not be moved.

1926.1101(g)(5)(ii)(B)*(4)*

Glovebags shall not be used on surfaces whose temperature exceeds 150 deg. F.

1926.1101(g)(5)(ii)(B)*(5)*

Prior to disposal, glovebags shall be collapsed by removing air within them using a HEPA vacuum.

1926.1101(g)(5)(ii)(B)*(6)*

Before beginning the operation, loose and friable material adjacent to the glovebag/box operation shall be wrapped and sealed in two layers of six mil plastic or otherwise rendered intact,

1926.1101(g)(5)(ii)(B)*(7)*

Where system uses attached waste bag, such bag shall be connected to collection bag using hose or other material which shall withstand pressure of ACM waste and water without losing its integrity:

1926.1101(g)(5)(ii)(B)*(8)*

Sliding valve or other device shall separate waste bag from hose to ensure no exposure when waste bag is disconnected:

1926.1101(g)(5)(ii)(B)*(9)*

At least two persons shall perform Class I glovebag removal operations.

1926.1101(g)(5)(iii)

Negative Pressure Glove Bag Systems. Negative pressure glove bag systems may be used to remove ACM or PACM from piping.

1926.1101(g)(5)(iii)(A)

Specifications: In addition to specifications for glove bag systems above, negative pressure glove bag systems shall attach HEPA vacuum systems or other devices to bag to prevent collapse during removal.

1926.1101(g)(5)(iii)(B)

Work Practices:

1926.1101(g)(5)(iii)(B)*(1)*

The employer shall comply with the work practices for glove bag systems in paragraph (g)(5)(ii)(B)(4) of this section.

1926.1101(g)(5)(iii)(B)*(2)*

The HEPA vacuum cleaner or other device used to prevent collapse of bag during removal shall run continually during the operation until it is completed at which time the bag shall be collapsed prior to removal of the bag from the pipe.

1926.1101(g)(5)(iii)(B)*(3)*

Where a separate waste bag is used along with a collection bag and discarded after one use, the collection bag may be reused if rinsed clean with amended water before reuse.

1926.1101(g)(5)(iv)

Negative Pressure Glove Box Systems: Negative pressure glove boxes may be used to remove ACM or PACM from pipe runs with the following specifications and work practices.

1926.1101(g)(5)(iv)(A)

Specifications:

1926.1101(g)(5)(iv)(A)*(1)*

Glove boxes shall be constructed with rigid sides and made from metal or other material which can withstand the weight of the ACM and PACM and water used during removal:

1926.1101(g)(5)(iv)(A)*(2)*

A negative pressure generator shall be used to create negative pressure in the system:

1926.1101(g)(5)(iv)(A)*(3)*

An air filtration unit shall be attached to the box:

1926.1101(g)(5)(iv)(A)*(4)*

The box shall be fitted with gloved apertures:

1926.1101(g)(5)(iv)(A)*(5)*

An aperture at the base of the box shall serve as a bagging outlet for waste ACM and water:

1926.1101(g)(5)(iv)(A)*(6)*

A back-up generator shall be present on site:

1926.1101(g)(5)(iv)(A)*(7)*

Waste bags shall consist of 6 mil thick plastic double-bagged before they are filled or plastic thicker than 6 mil.

1926.1101(g)(5)(iv)(B)

Work practices:

1926.1101(g)(5)(iv)(B)*(1)*

At least two persons shall perform the removal:

1926.1101(g)(5)(iv)(B)*(2)*

The box shall be smoke-tested for leaks and any leaks sealed prior to each use:

1926.1101(g)(5)(iv)(B)*(3)*

Loose or damaged ACM adjacent to the box shall be wrapped and sealed in two layers of 6 mil plastic prior to the job, or otherwise made intact prior to the job.

1926.1101(g)(5)(iv)(B)*(4)*

A HEPA filtration system shall be used to maintain pressure barrier in box.

1926.1101(g)(5)(v)

Water Spray Process System. A water spray process system may be used for removal of ACM and PACM from cold line piping if, employees carrying out such process have completed a 40-hour separate training course in its use, in addition to training required for employees performing Class I work. The system shall meet the following specifications and shall be performed by employees using the following work practices.

1926.1101(g)(5)(v)(A)

Specifications:

1926.1101(g)(5)(v)(A)*(1)*

Piping shall be surrounded on 3 sides by rigid framing,

1926.1101(g)(5)(v)(A)*(2)*

A 360 degree water spray, delivered through nozzles supplied by a high pressure separate water line, shall be formed around the piping.

1926.1101(g)(5)(v)(A)*(3)*

The spray shall collide to form a fine aerosol which provides a liquid barrier between workers and the ACM and PACM.

1926.1101(g)(5)(v)(B)

Work Practices:

1926.1101(g)(5)(v)(B)*(1)*

The system shall be run for at least 10 minutes before removal begins.

1926.1101(g)(5)(v)(B)*(2)*

All removal shall take place within the water barrier.

1926.1101(g)(5)(v)(B)*(3)*

The system shall be operated by at least three persons, one of whom shall not perform removal, but shall check equipment, and ensure proper operation of the system.

1926.1101(g)(5)(v)(B)*(4)*

After removal, the ACM and PACM shall be bagged while still inside the water barrier.

1926.1101(g)(5)(vi)

A small walk-in enclosure which accommodates no more than two persons (mini-enclosure) may be used if the disturbance or removal can be completely contained by the enclosure with the following specifications and work practices.

1926.1101(g)(5)(vi)(A)

Specifications:

1926.1101(g)(5)(vi)(A)*(1)*

The fabricated or job-made enclosure shall be constructed of 6 mil plastic or equivalent:

1926.1101(g)(5)(vi)(A)*(2)*

The enclosure shall be placed under negative pressure by means of a HEPA filtered vacuum or similar ventilation unit:

1926.1101(g)(5)(vi)(B)

Work practices:

1926.1101(g)(5)(vi)(B)*(1)*

Before use, the mini-enclosure shall be inspected for leaks and smoke-tested to detect breaches, and breaches sealed.

1926.1101(g)(5)(vi)(B)*(2)*

Before reuse, the interior shall be completely washed with amended water and HEPA-vacuumed.

1926.1101(g)(5)(vi)(B)*(3)*

During use, air movement shall be directed away from the employee's breathing zone within the mini-enclosure.

1926.1101(g)(6)

Alternative control methods for Class I work. Class I work may be performed using a control method which is not referenced in paragraph (g)(5) of this section, or which modifies a control method referenced in paragraph (g)(5)of this section, if the following provisions are complied with:

1926.1101(g)(6)(i)

The control method shall enclose, contain or isolate the processes or source of airborne asbestos dust, or otherwise capture or redirect such dust before it enters the breathing zone of employees.

1926.1101(g)(6)(ii)

A certified industrial hygienist or licensed professional engineer who is also qualified as a project designer as defined in paragraph (b) of this section, shall evaluate the work area, the projected work practices and the engineering controls and shall certify in writing that the planned control method is adequate to reduce direct and indirect employee exposure to below the PELs under worst-case conditions of use, and that the planned control method will prevent asbestos contamination outside the regulated area, as measured by clearance sampling which meets the requirements of EPA's Asbestos in Schools rule issued under AHERA, or perimeter monitoring which meets the criteria in paragraph (g)(4)(ii)(B) of this section.

1926.1101(g)(6)(ii)(A)

Where the TSI or surfacing material to be removed is 25 linear or 10 square feet or less , the evaluation required in paragraph (g)(6) of this section may be performed by a "competent person", and may omit consideration of perimeter or clearance monitoring otherwise required.

1926.1101(g)(6)(ii)(B)

The evaluation of employee exposure required in paragraph (g)(6) of this section, shall include and be based on sampling and analytical data representing employee exposure during the use of such method under worst-case conditions and by employees whose training and experience are equivalent to employees who are to perform the current job.

1926.1101(g)(7)

Work Practices and Engineering Controls for Class II work.

1926.1101(g)(7)(i)

All Class II work shall be supervised by a competent person as defined in paragraph (b) of this section.

1926.1101(g)(7)(ii)

For all indoor Class II jobs, where the employer has not produced a negative exposure assessment pursuant to paragraph (f)(2)(iii) of this section, or where during the job, changed conditions indicate there may be exposure above the PEL or where the employer does not remove the ACM in a substantially intact state, the employer shall use one of the following methods to ensure that airborne asbestos does not migrate from the regulated area;

1926.1101(g)(7)(ii)(A)

Critical barriers shall be placed over all openings to the regulated area; or,

1926.1101(g)(7)(ii)(B)

The employer shall use another barrier or isolation method which prevents the migration of airborne asbestos from the regulated area, as verified by perimeter area monitoring or clearance monitoring which meets the criteria set out in paragraph (g)(4)(ii)(B) of this section.

1926.1101(g)(7)(ii)(C)

Impermeable dropcloths shall be placed on surfaces beneath all removal activity;

1926.1101(g)(7)(iii)

[Reserved]

1926.1101(g)(7)(iv)

All Class II asbestos work shall be performed using the work practices and requirements set out above in paragraph (g)(1)(i) through (g)(1)(iii) of this section.

1926.1101(g)(8)

Additional Controls for Class II work. Class II asbestos work shall also be performed by complying with the work practices and controls designated for each type of asbestos work to be performed, set out in this paragraph. Where more than one control method may be used for a type of asbestos work, the employer may choose one or a combination of designated control methods. Class II work also may be performed using a method allowed for Class I work, except that glove bags and glove boxes are allowed if they fully enclose the Class II material to be removed.

1926.1101(g)(8)(i)

For removing vinyl and asphalt flooring materials which contain ACM or for which in buildings constructed no later than 1980, the employer has not verified the absence of ACM pursuant to paragraph (g)(8)(i)(I) of this section. The employer shall ensure that employees comply with the following work practices and that employees are trained in these practices pursuant to paragraph (k)(9):

1926.1101(g)(8)(i)(A)

Flooring or its backing shall not be sanded.

1926.1101(g)(8)(i)(B)

Vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) shall be used to clean floors.

1926.1101(g)(8)(i)(C)

Resilient sheeting shall be removed by cutting with wetting of the snip point and wetting during delamination. Rip-up of resilient sheet floor material is prohibited.

1926.1101(g)(8)(i)(D)

All scraping of residual adhesive and/or backing shall be performed using wet methods.

1926.1101(g)(8)(i)(E)

Dry sweeping is prohibited.

1926.1101(g)(8)(i)(F)

Mechanical chipping is prohibited unless performed in a negative pressure enclosure which meets the requirements of paragraph (g)(5)(i) of this section.

1926.1101(g)(8)(i)(G)

Tiles shall be removed intact, unless the employer demonstrates that intact removal is not possible.

1926.1101(g)(8)(i)(H)

When tiles are heated and can be removed intact, wetting may be omitted.

1926.1101(g)(8)(i)(I)

Resilient flooring material including associated mastic and backing shall be assumed to be asbestos-containing unless an industrial hygienist determines that it is asbestos-free using recognized analytical techniques.

1926.1101(g)(8)(ii)

For removing roofing material which contains ACM the employer shall ensure that the following work practices are followed:

1926.1101(g)(8)(ii)(A)

Roofing material shall be removed in an intact state to the extent feasible.

1926.1101(g)(8)(ii)(B)

Wet methods shall be used to remove roofing materials that are not intact, or that will be rendered not intact during removal, unless such wet methods are not feasible or will create safety hazards.

1926.1101(g)(8)(ii)(C)

Cutting machines shall be continuously misted during use, unless a competent person determines that misting substantially decreases worker safety.

1926.1101(g)(8)(ii)(D)

When removing built-up roofs with asbestos-containing roofing felts and an aggregate surface using a power roof cutter, all dust resulting from the cutting operation shall be collected by a HEPA dust collector, or shall be HEPA vacuumed by vacuuming along the cut line. When removing built-up roofs with asbestos-containing roofing felts and a smooth surface using a power roof cutter, the dust resulting from the cutting operation shall be collected either by a HEPA dust collector or HEPA vacuuming along the cut line, or by gently sweeping and then carefully and completely wiping up the still-wet dust and debris left along the cut line.

1926.1101(g)(8)(ii)(E)

Asbestos-containing material that has been removed from a roof shall not be dropped or thrown to the ground. Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered, dust-tight chute, crane or hoist:

1926.1101(g)(8)(ii)(E)*(1)*

Any ACM that is not intact shall be lowered to the ground as soon as is practicable, but in any event no later than the end of the work shift. While the material remains on the roof it shall either be kept wet, placed in an impermeable waste bag, or wrapped in plastic sheeting.

1926.1101(g)(8)(ii)(E)*(2)*

Intact ACM shall be lowered to the ground as soon as is practicable, but in any event no later than the end of the work shift.

1926.1101(g)(8)(ii)(F)

Upon being lowered, unwrapped material shall be transferred to a closed receptacle in such manner so as to preclude the dispersion of dust.

1926.1101(g)(8)(ii)(G)

Roof level heating and ventilation air intake sources shall be isolated or the ventilation system shall be shut down.

1926.1101(g)(8)(ii)(H)

Notwithstanding any other provision of this section, removal or repair of sections of intact roofing less than 25 square feet in area does not require use of wet methods or HEPA vacuuming as long as manual methods which do not render the material non-intact are used to remove the material and no visible dust is created by the removal method used. In determining whether a job involves less than 25 square feet, the employer shall include all removal and repair work performed on the same roof on the same day.

1926.1101(g)(8)(iii)

When removing cementitious asbestos-containing siding and shingles or transite panels containing ACM on building exteriors (other than roofs, where paragraph (g)(8)(ii) of this section applies) the employer shall ensure that the following work practices are followed:

1926.1101(g)(8)(iii)(A)

Cutting, abrading or breaking siding, shingles, or transite panels, shall be prohibited unless the employer can demonstrate that methods less likely to result in asbestos fiber release cannot be used.

1926.1101(g)(8)(iii)(B)

Each panel or shingle shall be sprayed with amended water prior to removal.

1926.1101(g)(8)(iii)(C)

Unwrapped or unbagged panels or shingles shall be immediately lowered to the ground via covered dust-tight chute, crane or hoist, or placed in an impervious waste bag or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift.

1926.1101(g)(8)(iii)(D)

Nails shall be cut with flat, sharp instruments.

1926.1101(g)(8)(iv)

When removing gaskets containing ACM, the employer shall ensure that the following work practices are followed:

1926.1101(g)(8)(iv)(A)

If a gasket is visibly deteriorated and unlikely to be removed intact, removal shall be undertaken within a glovebag as described in paragraph (g)(5)(ii) of this section.

1926.1101(g)(8)(iv)(B)

[Reserved]

1926.1101(g)(8)(iv)(C)

The gasket shall be immediately placed in a disposal container.

1926.1101(g)(8)(iv)(D)

Any scraping to remove residue must be performed wet.

1926.1101(g)(8)(v)

When performing any other Class II removal of asbestos containing material for which specific controls have not been listed in paragraph (g)(8)(iv)(A) through (D) of this section, the employer shall ensure that the following work practices are complied with.

1926.1101(g)(8)(v)(A)

The material shall be thoroughly wetted with amended water prior to and during its removal.

1926.1101(g)(8)(v)(B)

The material shall be removed in an intact state unless the employer demonstrates that intact removal is not possible.

1926.1101(g)(8)(v)(C)

Cutting, abrading or breaking the material shall be prohibited unless the employer can demonstrate that methods less likely to result in asbestos fiber release are not feasible.

1926.1101(g)(8)(v)(D)

Asbestos-containing material removed, shall be immediately bagged or wrapped, or kept wetted until transferred to a closed receptacle, no later than the end of the work shift.

1926.1101(g)(8)(vi)

Alternative Work Practices and Controls. Instead of the work practices and controls listed in paragraph (g)(8)(i) through (v) of this section, the employer may use different or modified engineering and work practice controls if the following provisions are complied with.

1926.1101(g)(8)(vi)(A)

The employer shall demonstrate by data representing employee exposure during the use of such method under conditions which closely resemble the conditions under which the method is to be used, that employee exposure will not exceed the PELs under any anticipated circumstances.

1926.1101(g)(8)(vi)(B)

A competent person shall evaluate the work area, the projected work practices and the engineering controls, and shall certify in writing, that the different or modified controls are adequate to reduce direct and indirect employeeexposure to below the PELs under all expected conditions of use and that the method meets the requirements of this standard. The evaluation shall include and be based on data representing employee exposure during the use of such method under conditions which closely resemble the conditions under which the method is to be used for the current job, and by employees whose training and experience are equivalent to employees who are to perform the current job.

1926.1101(g)(9)

Work Practices and Engineering Controls for Class III asbestos work. Class III asbestos work shall be conducted using engineering and work practice controls which minimize the exposure to employees performing the asbestos work and to bystander employees.

1926.1101(g)(9)(i)

The work shall be performed using wet methods.

1926.1101(g)(9)(ii)

To the extent feasible, the work shall be performed using local exhaust ventilation.

1926.1101(g)(9)(iii)

Where the disturbance involves drilling, cutting, abrading, sanding, chipping, breaking, or sawing of thermal system insulation or surfacing material, the employer shall use impermeable dropcloths, and shall isolate the operation using mini-enclosures or glove bag systems pursuant to paragraph (g)(5) of this section or another isolation method.

1926.1101(g)(9)(iv)

Where the employer does not produce a "negative exposure assessment" for a job, or where monitoring results show the PEL has been exceeded, the employer shall contain the area using impermeable dropcloths and plastic barriers or their equivalent, or shall isolate the operation using a control system listed in and in compliance with paragraph (g)(5) of this section.

1926.1101(g)(9)(v)

Employees performing Class III jobs, which involve the disturbance of thermal system insulation or surfacing material, or where the employer does not produce a "negative exposure assessment" or where monitoring results show a PEL has been exceeded, shall wear respirators which are selected, used and fitted pursuant to provisions of paragraph (h) of this section.

1926.1101(g)(10)

Class IV asbestos work. Class IV asbestos jobs shall be conducted by employees trained pursuant to the asbestos awareness training program set out in paragraph (k)(9) of this section. In addition, all Class IV jobs shall be conducted in conformity with the requirements set out in paragraph (g)(1) of this section, mandating wet methods, HEPA vacuums, and prompt clean up of debris containing ACM or PACM.

1926.1101(g)(10)(i)

Employees cleaning up debris and waste in a regulated area where respirators are required shall wear respirators which are selected, used and fitted pursuant to provisions of paragraph (h) of this section.

1926.1101(g)(10)(ii)

Employers of employees who clean up waste and debris in, and employers in control of, areas where friable thermal system insulation or surfacing material is accessible, shall assume that such waste and debris contain asbestos.

1926.1101(g)(11)

Alternative methods of compliance for installation, removal, repair, and maintenance of certain roofing and pipeline coating materials. Notwithstanding any other provision of this section, an employer who complies with all provisions of this paragraph (g)(11) when installing, removing, repairing, or maintaining intact pipeline asphaltic wrap, or roof flashings which contain asbestos fibers encapsulated or coated by bituminous or resinous compounds shall be deemed to be in compliance with this section. If an employer does not comply with all provisions of this paragraph (g)(11) or if during the course of the job the material does not remain intact, the provisions of paragraph (g)(8) of this section apply instead of this paragraph (g)(11).

1926.1101(g)(11)(i)

Before work begins and as needed during the job, a competent person who is capable of identifying asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, and who has the authority to take prompt corrective measures to eliminate such hazards, shall conduct an inspection of the worksite and determine that the roofing material is intact and will likely remain intact.

1926.1101(g)(11)(ii)

All employees performing work covered by this paragraph (g)(11) shall be trained in a training program that meets the requirements of paragraph (k)(9)(viii) of this section.

1926.1101(g)(11)(iii)

The material shall not be sanded, abraded, or ground. Manual methods which do not render the material non-intact shall be used.

1926.1101(g)(11)(iv)

Material that has been removed from a roof shall not be dropped or thrown to the ground. Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered, dust-tight chute, crane or hoist. All such material shall be removed from the roof as soon as is practicable, but in any event no later than the end of the work shift.

1926.1101(g)(11)(v)

Where roofing products which have been labeled as containing asbestos pursuant to paragraph (k)(8) of this section are installed on non-residential roofs during operations covered by this paragraph (g)(11), the employer shall notify the building owner of the presence and location of such materials no later than the end of the job.

1926.1101(g)(11)(vi)

All removal or disturbance of pipeline asphaltic wrap shall be performed using wet methods.

1926.1101(h)

Respiratory protection.

1926.1101(h)(1)

General. For employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this paragraph. Respirators must be used during:

1926.1101(h)(1)(i)

Class I asbestos work.

1926.1101(h)(1)(ii)

Class II asbestos work when ACM is not removed in a substantially intact state.

1926.1101(h)(1)(iii)

Class II and III asbestos work that is not performed using wet methods, except for removal of ACM from sloped roofs when a negative-exposure assessment has been conducted and ACM is removed in an intact state.

1926.1101(h)(1)(iv)

Class II and III asbestos work for which a negative-exposure assessment has not been conducted.

1926.1101(h)(v)

Class III asbestos work when TSI or surfacing ACM or PACM is being disturbed.

1926.1101(h)(1)(vi)

Class IV asbestos work performed within regulated areas where employees who are performing other work are required to use respirators.

1926.1101(h)(1)(vii)

Work operations covered by this section for which employees are exposed above the TWA or excursion limit.

1926.1101(h)(1)(viii)

Emergencies.

1926.1101(h)(2)

Respirator program.

1926.1101(h)(2)(i)

The employer must implement a respiratory protection program in accordance with § 1910.134 (b) through (d) (except (d)(1)(iii)), and (f) through (m), which covers each employee required by this section to use a respirator.

1926.1101(h)(2)(ii)

No employee shall be assigned to asbestos work that requires respirator use if, based on their most recent medical examination, the examining physician determines that the employee will be unable to function normally while using a respirator, or that the safety or health of the employee or other employees will be impaired by the employee's respirator use. Such employees must be assigned to another job or given the opportunity to transfer to a different position that they can perform. If such a transfer position is available, it must be with the same employer, in the same geographical area, and with the same seniority, status, rate of pay, and other job benefits the employee had just prior to such transfer.

1926.1101(h)(3)

Respirator selection.

1926.1101(h)(3)(i)

Employers must:

1926.1101(h)(3)(i)(A)

Select, and provide to employees, the appropriate respirators specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134; however, employers must not select or use filtering facepiece respirators for use against asbestos fibers.

1926.1101(h)(3)(i)(B)

Provide HEPA filters for powered and non-powered air-purifying respirators.

1926.1101(h)(3)(ii)

Employers must provide an employee with tight-fitting, powered air-purifying respirator (PAPR) instead of a negative pressure respirator selected according to paragraph (h)(3)(i)(A) of this standard when the employee chooses to use a PAPR and it provides adequate protection to the employee.

1926.1101(h)(3)(iii)

Employers must provide employees with an air-purifying half mask respirator, other than a filtering facepiece respirator, whenever the employees perform:

1926.1101(h)(3)(iii)(A)

Class II or Class III asbestos work for which no negative exposure assessment is available.

1926.1101(h)(3)(iii)(B)

Class III asbestos work involving disturbance of TSI or surfacing ACM or PACM.

1926.1101(h)(3)(iv)

Employers must provide employees with:

1926.1101(h)(3)(iv)(A)

A tight-fitting powered air-purifying respirator or a full facepiece, supplied-air respirator operated in the pressure-demand mode and equipped with either HEPA egress cartridges or an auxiliary positive-pressure, self-contained breathing apparatus (SCBA) whenever the employees are in a regulated area performing Class I asbestos work for which a negative exposure assessment is not available and the exposure assessment indicates that the exposure level will be at or below 1 f/cc as an 8-hour time-weighted average (TWA).

1926.1101(h)(3)(iv)(B)

A full facepiece supplied-air respirator operated in the pressure-demand mode and equipped with an auxiliary positive-pressure SCBA whenever the employees are in a regulated area performing Class I asbestos work for which a negative exposure assessment is not available and the exposure assessment indicates that the exposure level will be above 1 f/cc as an 8-hour TWA.

1926.1101(i)

Protective clothing.

1926.1101(i)(1)

General. The employer shall provide and require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos that exceed the TWA and/or excursion limit prescribed in paragraph (c) of this section, or for which a required negative exposure assessment is not produced, or for any employee performing Class I operations which involve the removal of over 25 linear or 10 square feet of TSI or surfacing ACM and PACM.

1926.1101(i)(2)

Laundering.

1926.1101(i)(2)(i)

The employer shall ensure that laundering of contaminated clothing is done so as to prevent the release of airborne asbestos in excess of the TWA or excursion limit prescribed in paragraph (c) of this section.

1926.1101(i)(2)(ii)

Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (i)(2)(i) of this section to effectively prevent the release of airborne asbestos in excess of the TWA and excursion limit prescribed in paragraph (c) of this section.

1926.1101(i)(3)

Contaminated clothing. Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and be labeled in accordance with paragraph (k) of this section.

1926.1101(i)(4)

Inspection of protective clothing.

1926.1101(i)(4)(i)

The competent person shall examine worksuits worn by employees at least once per workshift for rips or tears that may occur during performance of work.

1926.1101(i)(4)(ii)

When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

1926.1101(j)

Hygiene facilities and practices for employees.

1926.1101(j)(1)

Requirements for employees performing Class I asbestos jobs involving over 25 linear or 10 square feet of TSI or surfacing ACM and PACM.

1926.1101(j)(1)(i)

Decontamination areas. the employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of such employees. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

1926.1101(j)(1)(i)(A)

Equipment room. The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective equipment.

1926.1101(j)(1)(i)(B)

Shower area. Shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3), unless the employer can demonstrate that they are not feasible. The showers shall be adjacent both to the equipment room and the clean room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean room, or where the work is performed outdoors, the employers shall ensure that employees:

1926.1101(j)(1)(i)(B)*(1)*

Remove asbestos contamination from their worksuits in the equipment room using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or

1926.1101(j)(1)(i)(B)*(2)*

Remove their contaminated worksuits in the equipment room, then don clean worksuits, and proceed to a shower that is not adjacent to the work area.

1926.1101(j)(1)(i)(C)

Clean change room. The clean room shall be equipped with a locker or appropriate storage container for each employee's use. When the employer can demonstrate that it is not feasible to provide a clean change area adjacent to the work area or where the work is performed outdoors, the employer may permit employees engaged in Class I asbestos jobs to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the regulated area. Following showering, such employees however must then change into street clothing in clean change areas provided by the employer which otherwise meet the requirements of this section.

1926.1101(j)(1)(ii)

Decontamination area entry procedures. The employer shall ensure that employees:

1926.1101(j)(1)(ii)(A)

Enter the decontamination area through the clean room;

1926.1101(j)(1)(ii)(B)

Remove and deposit street clothing within a locker provided for their use; and

1926.1101(j)(1)(ii)(C)

Put on protective clothing and respiratory protection before leaving the clean room.

1926.1101(j)(1)(ii)(D)

Before entering the regulated area, the employer shall ensure that employees pass through the equipment room.

1926.1101(j)(1)(iii)

Decontamination area exit procedures. The employer shall ensure that:

1926.1101(j)(1)(iii)(A)

Before leaving the regulated area, employees shall remove all gross contamination and debris from their protective clothing.

1926.1101(j)(1)(iii)(B)

Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

1926.1101(j)(1)(iii)(C)

Employees shall not remove their respirators in the equipment room.

1926.1101(j)(1)(iii)(D)

Employees shall shower prior to entering the clean room.

1926.1101(j)(1)(iii)(E)

After showering, employees shall enter the clean room before changing into street clothes.

1926.1101(j)(1)(iv)

Lunch Areas. Whenever food or beverages are consumed at the worksite where employees are performing Class I asbestos work, the employer shall provide lunch areas in which the airborne concentrations of asbestos are below the permissible exposure limit and/or excursion limit.

1926.1101(j)(2)

Requirements for Class I work involving less than 25 linear or 10 square feet of TSI or surfacing ACM and PACM, and for Class II and Class III asbestos work operations where exposures exceed a PEL or where there is no negative exposure assessment produced before the operation.

1926.1101(j)(2)(i)

The employer shall establish an equipment room or area that is adjacent to the regulated area for the decontamination of employees and their equipment which is contaminated with asbestos which shall consist of an area covered by a impermeable drop cloth on the floor or horizontal working surface.

1926.1101(j)(2)(ii)

The area must be of sufficient size as to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area (as determined by visible accumulations).

1926.1101(j)(2)(iii)

Work clothing must be cleaned with a HEPA vacuum before it is removed.

1926.1101(j)(2)(iv)

All equipment and surfaces of containers filled with ACM must be cleaned prior to removing them from the equipment room or area.

1926.1101(j)(2)(v)

The employer shall ensure that employees enter and exit the regulated area through the equipment room or area.

1926.1101(j)(3)

Requirements for Class IV work. Employers shall ensure that employees performing Class IV work within a regulated area comply with the hygiene practice required of employees performing work which has a higher classification within that regulated area. Otherwise employers of employees cleaning up debris and material which is TSI or surfacing ACM or identified as PACM shall provide decontamination facilities for such employees which are required by paragraph (j)(2) of this section.

1926.1101(j)(4)

Smoking in work areas. The employer shall ensure that employees do not smoke in work areas where they are occupationally exposed to asbestos because of activities in that work area.

1926.1101(k)

Communication of hazards.

1926.1101(k)(1)

Hazard communication.

1926.1101(k)(1)(i)

This section applies to the communication of information concerning asbestos hazards in construction activities to facilitate compliance with this standard. Most asbestos-related construction activities involve previously installed building materials. Building owners often are the only and/or best sources of information concerning them. Therefore, they, along with employers of potentially exposed employees, are assigned specific information conveying and retention duties under this section. Installed Asbestos Containing Building Material. Employers and building owners shall identify TSI and sprayed or troweled on surfacing materials in buildings as asbestos-containing, unless they determine in compliance with paragraph (k)(5) of this section that the material is not asbestos-containing. Asphalt and vinyl flooring material installed no later than 1980 must also be considered as asbestos containing unless the employer, pursuant to paragraph (g)(8)(i)(I) of this section determines that it is not asbestos-containing. If the employer/building owner has actual knowledge, or should have known through the exercise of due diligence, that other materials are asbestos-containing, they too must be treated as such. When communicating information to employees pursuant to this standard, owners and employers shall identify "PACM" as ACM. Additional requirements relating to communication of asbestos work on multi-employer worksites are set out in paragraph (d) of this section.

1926.1101(k)(1)(ii)

The employer shall include asbestos in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of asbestos and safety data sheets, and is trained in accordance with the provisions of HCS and paragraphs (k)(9) and (10) of this section. The employer shall provide information on at least the following hazards: Cancer and lung effects.

1926.1101(k)(2)

Duties of building and facility owners.

1926.1101(k)(2)(i)

Before work subject to this standard is begun, building and facility owners shall determine the presence, location, and quantity of ACM and/or PACM at the work site pursuant to paragraph (k)(1)(i) of this section.

1926.1101(k)(2)(ii)

Building and/or facility owners shall notify the following persons of the presence, location and quantity of ACM or PACM, at the work sites in their buildings and facilities. Notification either shall be in writing, or shall consist of a personal communication between the owner and the person to whom notification must be given or their authorized representatives:

1926.1101(k)(2)(ii)(A)

Prospective employers applying or bidding for work whose employees reasonably can be expected to work in or adjacent to areas containing such material;

1926.1101(k)(2)(ii)(B)

Employees of the owner who will work in or adjacent to areas containing such material:

1926.1101(k)(2)(ii)(C)

On multi-employer worksites, all employers of employees who will be performing work within or adjacent to areas containing such materials;

1926.1101(k)(2)(ii)(D)

Tenants who will occupy areas containing such material.

1926.1101(k)(3)

Duties of employers whose employees perform work subject to this standard in or adjacent to areas containing ACM and PACM. Building/facility owners whose employees perform such work shall comply with these provisions to the extent applicable.

1926.1101(k)(3)(i)

Before work in areas containing ACM and PACM is begun; employers shall identify the presence, location, and quantity of ACM, and/or PACM therein pursuant to paragraph (k)(1)(i) of this section.

1926.1101(k)(3)(ii)

Before work under this standard is performed employers of employees who will perform such work shall inform the following persons of the location and quantity of ACM and/or PACM present in the area and the precautions to be taken to insure that airborne asbestos is confined to the area.

1926.1101(k)(3)(ii)(A)

Owners of the building/facility;

1926.1101(k)(3)(ii)(B)

Employees who will perform such work and employers of employees who work and/or will be working in adjacent areas.

1926.1101(k)(3)(iii)

Within 10 days of the completion of such work, the employer whose employees have performed work subject to this standard, shall inform the building/facility owner and employers of employees who will be working in the area of the current location and quantity of PACM and/or ACM remaining in the area and final monitoring results, if any.

1926.1101(k)(4)

In addition to the above requirements, all employers who discover ACM and/or PACM on a worksite shall convey information concerning the presence, location and quantity of such newly discovered ACM and/or PACM to the owner and to other employers of employees working at the work site, within 24 hours of the discovery.

1926.1101(k)(5)

Criteria to rebut the designation of installed material as PACM.

1926.1101(k)(5)(i)

At any time, an employer and/or building owner may demonstrate, for purposes of this standard, that PACM does not contain asbestos. Building owners and/or employers are not required to communicate information about the presence of building material for which such a demonstration pursuant to the requirements of paragraph (k)(5)(ii) of this section has been made. However, in all such cases, the information, data and analysis supporting the determination that PACM does not contain asbestos, shall be retained pursuant to paragraph (n) of this section.

1926.1101(k)(5)(ii)

An employer or owner may demonstrate that PACM does not contain more than 1 percent asbestos by the following:

1926.1101(k)(5)(ii)(A)

Having a completed inspection conducted pursuant to the requirements of AHERA (40 CFR Part 763, Subpart E) which demonstrates that the material is not ACM; or

1926.1101(k)(5)(ii)(B)

Performing tests of the material containing PACM which demonstrate that no ACM is present in the material. Such tests shall include analysis of bulk samples collected in the manner described in 40 CFR 763.86. The tests, evaluation and sample collection shall be conducted by an accredited inspector or by a CIH. Analysis of samples shall be performed by persons or laboratories with proficiency demonstrated by current successful participation in a nationally recognized testing program such as the National Voluntary Laboratory Accreditation Program (NVLAP) or the National Institute for Standards and Technology (NIST) or the Round Robin for bulk samples administered by the American Industrial Hygiene Association (AIHA) or an equivalent nationally-recognized round robin testing program.

1926.1101(k)(5)(iii)

The employer and/or building owner may demonstrate that flooring material including associated mastic and backing does not contain asbestos, by a determination of an industrial hygienist based upon recognized analytical techniques showing that the material is not ACM.

1926.1101(k)(6)

At the entrance to mechanical rooms/areas in which employees reasonably can be expected to enter and which contain ACM and/or PACM, the building owner shall post signs which identify the material which is present, its location, and appropriate work practices which, if followed, will ensure that ACM and/or PACM will not be disturbed. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

1926.1101(k)(7)

Signs.

1926.1101(k)(7)(i)

Warning signs that demarcate the regulated area shall be provided and displayed at each location where a regulated area is required to be established by paragraph (e) of this section. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

1926.1101(k)(7)(ii)(A)

The warning signs required by paragraph (k)(7) of this section shall bear the following information.

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY

1926.1101(k)(7)(ii)(B)

In addition, where the use of respirators and protective clothing is required in the regulated area under this section, the warning signs shall include the following:

WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA

1926.1101(k)(7)(ii)(C)

Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (k)(7)(ii)(A) of this section:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

1926.1101(k)(7)(ii)(D)

Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (k)(7)(ii)(B) of this section:

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

1926.1101(k)(7)(iii)

The employer shall ensure that employees working in and contiguous to regulated areas comprehend the warning signs required to be posted by paragraph (k)(7)(i) of this section. Means to ensure employee comprehension may include the use of foreign languages, pictographs and graphics.

1926.1101(k)(8)

Labels.

1926.1101(k)(8)(i)

Labels shall be affixed to all products containing asbestos and to all containers containing such products, including waste containers. Where feasible, installed asbestos products shall contain a visible label.

1926.1101(k)(8)(ii)

The employer shall ensure that such labels comply with paragraphs (k) of this section.

1926.1101(k)(8)(iii)

The employer shall ensure that labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers bear the following information:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

1926.1101(k)(8)(iv)(A)

Prior to June 1, 2015, employers may include the following information on raw materials, mixtures or labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers in lieu of the labeling requirements in paragraphs (k)(8)(ii) and (k)(8)(iii) of this section:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

1926.1101(k)(8)(iv)(B)

Labels shall also contain a warning statement against breathing asbestos fibers.

1926.1101(k)(8)(v)

[Reserved]

1926.1101(k)(8)(vi)

The provisions for labels required by paragraphs (k)(8)(i) through (k)(8)(iii) of this section do not apply where:

1926.1101(k)(8)(vi)(A)

Asbestos fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the permissible exposure limit and/or excursion limit will be released, or

1926.1101(k)(8)(vi)(B)

Asbestos is present in a product in concentrations less than 1.0 percent.

1926.1101(k)(8)(vii)

When a building owner or employer identifies previously installed PACM and/or ACM, labels or signs shall be affixed or posted so that employees will be notified of what materials contain PACM and/or ACM. The employer shall attach such labels in areas where they will clearly be noticed by employees who are likely to be exposed, such as at the entrance to mechanical room/areas. Signs required by paragraph (k)(6) of this section may be posted in lieu of labels so long as they contain information required for labelling. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs or labels can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

1926.1101(k)(9)

Employee Information and Training.

1926.1101(k)(9)(i)

The employer shall train each employee who is likely to be exposed in excess of a PEL, and each employee who performs Class I through IV asbestos operations, in accordance with the requirements of this section. Such training shall be conducted at no cost to the employee. The employer shall institute a training program and ensure employee participation in the program.

1926.1101(k)(9)(ii)

Training shall be provided prior to or at the time of initial assignment and at least annually thereafter.

1926.1101(k)(9)(iii)

Training for Class I operations and for Class II operations that require the use of critical barriers (or equivalent isolation methods) and/or negative pressure enclosures under this section shall be the equivalent in curriculum, training method and length to the EPA Model Accreditation Plan (MAP) asbestos abatement workers training (40 CFR Part 763, subpart E, appendix C).

1926.1101(k)(9)(iv)

Training for other Class II work.

1926.1101(k)(9)(iv)(A)

For work with asbestos containing roofing materials, flooring materials, siding materials, ceiling tiles, or transite panels, training shall include at a minimum all the elements included in paragraph (k)(9)(viii) of this section and in addition, the specific work practices and engineering controls set forth in paragraph (g) of this section which specifically relate to that category. Such course shall include "hands-on" training and shall take at least 8 hours.

1926.1101(k)(9)(iv)(B)

An employee who works with more than one of the categories of material specified in paragraph (k)(9)(iv)(A) of this section shall receive training in the work practices applicable to each category of material that the employee removes and each removal method that the employee uses.

1926.1101(k)(9)(iv)(C)

For Class II operations not involving the categories of material specified in paragraph (k)(9)(iv)(A) of this section, training shall be provided which shall include at a minimum all the elements included in paragraph (k)(9)(viii) of this section and in addition, the specific work practices and engineering controls set forth in paragraph (g) of this section which specifically relate to the category of material being removed, and shall include "hands-on" training in the work practices applicable to each category of material that the employee removes and each removal method that the employee uses.

1926.1101(k)(9)(v)

Training for Class III employees shall be consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92(a)(2). Such a course shall also include "hands-on" training and shall take at least 16 hours. Exception: For Class III operations for which the competent person determines that the EPA curriculum does not adequately cover the training needed to perform that activity, training shall include as a minimum all the elements included in paragraph (k)(9)(viii) of this section and in addition, the specific work practices and engineering controls set forth in paragraph (g) of this section which specifically relate to that activity, and shall include "hands-on" training in the work practices applicable to each category of material that the employee disturbs.

1926.1101(k)(9)(vi)

Training for employees performing Class IV operations shall be consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92(a)(1). Such a course shall include available information concerning the locations of thermal system insulation and surfacing ACM/PACM, and asbestos-containing flooring material, or flooring material where the absence of asbestos has not yet been certified; and instruction in recognition of damage, deterioration, and delamination of asbestos containing building materials. Such course shall take at least 2 hours.

1926.1101(k)(9)(vii)

Training for employees who are likely to be exposed in excess of the PEL and who are not otherwise required to be trained under paragraph (k)(9)(iii) through (vi) of this section, shall meet the requirements of paragraph (k)(9)(viii) of this section.

1926.1101(k)(9)(viii)

The training program shall be conducted in a manner that the employee is able to understand. In addition to the content required by provisions in paragraphs (k)(9)(iii) through (vi) of this section, the employer shall ensure that each such employee is informed of the following:

1926.1101(k)(9)(viii)(A)

Methods of recognizing asbestos, including the requirement in paragraph (k)(1) of this section to presume that certain building materials contain asbestos;

1926.1101(k)(9)(viii)(B)

The health effects associated with asbestos exposure;

1926.1101(k)(9)(viii)(C)

The relationship between smoking and asbestos in producing lung cancer;

1926.1101(k)(9)(viii)(D)

The nature of operations that could result in exposure to asbestos, the importance of necessary protective controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures; where Class III and IV work will be or is performed, the contents of EPA 20T-2003, "Managing Asbestos In-Place" July 1990 or its equivalent in content;

1926.1101(k)(9)(viii)(E)

The purpose, proper use, fitting instructions, and limitations of respirators as required by 29 CFR 1910.134;

1926.1101(k)(9)(viii)(F)

The appropriate work practices for performing the asbestos job;

1926.1101(k)(9)(viii)(G)

Medical surveillance program requirements;

1926.1101(k)(9)(viii)(H)

The content of this standard including appendices;

1926.1101(k)(9)(viii)(I)

The names, addresses and phone numbers of public health organizations which provide information, materials and/or conduct programs concerning smoking cessation. The employer may distribute the list of such organizations contained in Appendix J to this section, to comply with this requirement; and

1926.1101(k)(9)(viii)(J)

The requirements for posting signs and affixing labels and the meaning of the required legends for such signs and labels.

1926.1101(k)(10)

Access to training materials.

1926.1101(k)(10)(i)

The employer shall make readily available to affected employees without cost, written materials relating to the employee training program, including a copy of this regulation.

1926.1101(k)(10)(ii)

The employer shall provide to the Assistant Secretary and the Director, upon request, all information and training materials relating to the employee information and training program.

1926.1101(k)(10)(iii)

The employer shall inform all employees concerning the availability of self-help smoking cessation program material. Upon employee request, the employer shall distribute such material, consisting of NIH Publication No, 89-1647, or equivalent self-help material, which is approved or published by a public health organization listed in Appendix J to this section.

1926.1101(l)

Housekeeping --

1926.1101(l)(1)

Vacuuming. Where vacuuming methods are selected, HEPA filtered vacuuming equipment must be used. The equipment shall be used and emptied in a manner that minimizes the reentry of asbestos into the workplace.

1926.1101(l)(2)

Waste disposal. Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal shall be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled, impermeable containers except in roofing operations where the procedures specified in paragraph (g)(8)(ii) of this section apply.

1926.1101(l)(3)

Care of asbestos-containing flooring material.

1926.1101(l)(3)(i)

All vinyl and asphalt flooring material shall be maintained in accordance with this paragraph unless the building/facility owner demonstrates, pursuant to paragraph (g)(8)(i)(I) of this section that the flooring does not contain asbestos.

1926.1101(l)(3)(ii)

Sanding of flooring material is prohibited.

1926.1101(l)(3)(iii)

Stripping of finishes shall be conducted using low abrasion pads at speeds lower than 300 rpm and wet methods.

1926.1101(l)(3)(iv)

Burnishing or dry buffing may be performed only on flooring which has sufficient finish so that the pad cannot contact the flooring material.

1926.1101(l)(4)

Waste and debris and accompanying dust in an area containing accessible thermal system insulation or surfacing ACM/PACM or visibly deteriorated ACM:

1926.1101(l)(4)(i)

Shall not be dusted or swept dry, or vacuumed without using a HEPA filter;

1926.1101(l)(4)(ii)

Shall be promptly cleaned up and disposed of in leak tight containers.

1926.1101(m)

Medical surveillance.

1926.1101(m)(1)

General --

1926.1101(m)(1)(i)

Employees covered.

1926.1101(m)(1)(i)(A)

The employer shall institute a medical surveillance program for all employees who for a combined total of 30 or more days per year are engaged in Class I, II and III work or are exposed at or above a permissible exposure limit. For purposes of this paragraph, any day in which a worker engages in Class II or Class III operations or a combination thereof on intact material for one hour or less (taking into account the entire time spent on the removal operation, including cleanup) and, while doing so, adheres fully to the work practices specified in this standard, shall not be counted.

1926.1101(m)(1)(i)(B)

For employees otherwise required by this standard to wear a negative pressure respirator, employers shall ensure employees are physically able to perform the work and use the equipment. This determination shall be made under the supervision of a physician.

1926.1101(m)(1)(ii)

Examination.

1926.1101(m)(1)(ii)(A)

The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

1926.1101(m)(1)(ii)(B)

Persons other than such licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

1926.1101(m)(2)

Medical examinations and consultations.

1926.1101(m)(2)(i)

Frequency. The employer shall make available medical examinations and consultations to each employee covered under paragraph (m)(1)(i) of this section on the following schedules:

1926.1101(m)(2)(i)(A)

Prior to assignment of the employee to an area where negative-pressure respirators are worn;

1926.1101(m)(2)(i)(B)

When the employee is assigned to an area where exposure to asbestos may be at or above the permissible exposure limit for 30 or more days per year, or engage in Class I, II, or III work for a combined total of 30 or more days per year, a medical examination must be given within 10 working days following the thirtieth day of exposure;

1926.1101(m)(2)(i)(C)

And at least annually thereafter.

1926.1101(m)(2)(i)(D)

If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

1926.1101(m)(2)(i)(E)

Exception: No medical examination is required of any employee if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

1926.1101(m)(2)(ii)

Content. Medical examinations made available pursuant to paragraphs (m)(2)(i)(A) through (m)(2)(i)(C) of this section shall include:

1926.1101(m)(2)(ii)(A)

A medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

1926.1101(m)(2)(ii)(B)

On initial examination, the standardized questionnaire contained in Part 1 of Appendix D to this section, and, on annual examination, the abbreviated standardized questionnaire contained in Part 2 of Appendix D to this section.

1926.1101(m)(2)(ii)(C)

A physical examination directed to the pulmonary and gastrointestinal systems, including a chest roentgenogram to be administered at the discretion of the physician, and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV(1)). Interpretation and classification of chest shall be conducted in accordance with Appendix E to this section.

1926.1101(m)(2)(ii)(D)

Any other examinations or tests deemed necessary by the examining physician.

1926.1101(m)(3)

Information provided to the physician. The employer shall provide the following information to the examining physician:

1926.1101(m)(3)(i)

A copy of this standard and Appendices D, E, and I to this section;

1926.1101(m)(3)(ii)

A description of the affected employee's duties as they relate to the employee's exposure;

1926.1101(m)(3)(iii)

The employee's representative exposure level or anticipated exposure level;

1926.1101(m)(3)(iv)

A description of any personal protective and respiratory equipment used or to be used; and

1926.1101(m)(3)(v)

Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

1926.1101(m)(4)

Physician's written opinion.

1926.1101(m)(4)(i)

The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

1926.1101(m)(4)(i)(A)

The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos;

1926.1101(m)(4)(i)(B)

Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

1926.1101(m)(4)(i)(C)

A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.

1926.1101(m)(4)(i)(D)

A statement that the employee has been informed by the physician of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure.

1926.1101(m)(4)(ii)

The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos.

1926.1101(m)(4)(iii)

The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

1926.1101(n)

Recordkeeping.

1926.1101(n)(1)

Objective data relied on pursuant to paragraph (f) to this section.

1926.1101(n)(1)(i)

Where the employer has relied on objective data that demonstrates that products made from or containing asbestos or the activity involving such products or material are not capable of releasing fibers of asbestos in concentrations at or above the permissible exposure limit and/or excursion limit under the expected conditions of processing, use, or handling to satisfy the requirements of paragraph (f), the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

1926.1101(n)(1)(ii)

The record shall include at least the following information:

1926.1101(n)(1)(ii)(A)

The product qualifying for exemption;

1926.1101(n)(1)(ii)(B)

The source of the objective data;

1926.1101(n)(1)(ii)(C)

The testing protocol, results of testing, and/or analysis of the material for the release of asbestos;

1926.1101(n)(1)(ii)(D)

A description of the operation exempted and how the data support the exemption; and

1926.1101(n)(1)(ii)(E)

Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

1926.1101(n)(1)(iii)

The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

1926.1101(n)(2)

Exposure measurements.

1926.1101(n)(2)(i)

The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos as prescribed in paragraph (f) of this section. NOTE: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

1926.1101(n)(2)(ii)

This record shall include at least the following information:

1926.1101(n)(2)(ii)(A)

The date of measurement;

1926.1101(n)(2)(ii)(B)

The operation involving exposure to asbestos that is being monitored;

1926.1101(n)(2)(ii)(C)

Sampling and analytical methods used and evidence of their accuracy;

1926.1101(n)(2)(ii)(D)

Number, duration, and results of samples taken;

1926.1101(n)(2)(ii)(E)

Type of protective devices worn, if any; and

1926.1101(n)(2)(ii)(F)

Name, social security number, and exposure of the employees whose exposures are represented.

1926.1101(n)(2)(iii)

The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

1926.1101(n)(3)

Medical surveillance.

1926.1101(n)(3)(i)

The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (m) of this section, in accordance with 29 CFR 1910.20.

1926.1101(n)(3)(ii)

The record shall include at least the following information:

1926.1101(n)(3)(ii)(A)

The name and social security number of the employee;

1926.1101(n)(3)(ii)(B)

A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physician's recommendations.

1926.1101(n)(3)(ii)(C)

Physician's written opinions;

1926.1101(n)(3)(ii)(D)

Any employee medical complaints related to exposure to asbestos; and

1926.1101(n)(3)(ii)(E)

A copy of the information provided to the physician as required by paragraph (m) of this section.

1926.1101(n)(3)(iii)

The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

1926.1101(n)(4)

Training records. The employer shall maintain all employee training records for one (1) year beyond the last date of employment by that employer.

1926.1101(n)(5)

Data to Rebut PACM. Where the building owner and employer have relied on data to demonstrate that PACM is not asbestos-containing, such data shall be maintained for as long as they are relied upon to rebut the presumption.

1926.1101(n)(6)

Records of Required Notifications. Where the building owner has communicated and received information concerning the identification, location and quantity of ACM and PACM, written records of such notifications and their content shall be maintained by the building owner for the duration of ownership and shall be transferred to successive owners of such buildings/facilities.

1926.1101(n)(7)

Availability.

1926.1101(n)(7)(i)

The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

1926.1101(n)(7)(ii)

The employer must comply with the requirements concerning availability of records set forth in 29 CFR 1910.1020.

1926.1101(n)(8)

Transfer of records. The employer must comply with the requirements concerning transfer of records set forth in 29 CFR 1910.1020(h).

1926.1101(o)

Competent person.

1926.1101(o)(1)

General. On all construction worksites covered by this standard, the employer shall designate a competent person, having the qualifications and authorities for ensuring worker safety and health required by Subpart C, General Safety and Health Provisions for Construction (29 CFR 1926.20 through 1926.32).

1926.1101(o)(2)

Required Inspections by the Competent Person. Section 1926.20(b)(2) which requires health and safety prevention programs to provide for frequent and regular inspections of the job sites, materials, and equipment to be made by competent persons, is incorporated.

1926.1101(o)(3)

Additional Inspections. In addition, the competent person shall make frequent and regular inspections of the job sites, in order to perform the duties set out below in paragraph (o)(3)(i) and (ii) of this section. For Class I jobs, on-site inspections shall be made at least once during each work shift, and at any time at employee request. For Class II, III, and IV jobs, on-site inspections shall be made at intervals sufficient to assess whether conditions have changed, and at any reasonable time at employee request.

1926.1101(o)(3)(i)

On all worksites where employees are engaged in Class I or II asbestos work, the competent person designated in accordance with paragraph (e)(6) of this section shall perform or supervise the following duties, as applicable:

1926.1101(o)(3)(i)(A)

Set up the regulated area, enclosure, or other containment;

1926.1101(o)(3)(i)(B)

Ensure (by on-site inspection) the integrity of the enclosure or containment;

1926.1101(o)(3)(i)(C)

Set up procedures to control entry to and exit from the enclosure and/or area;

1926.1101(o)(3)(i)(D)

Supervise all employee exposure monitoring required by this section and ensure that it is conducted as required by paragraph (f) of this section;

1926.1101(o)(3)(i)(E)

Ensure that employees working within the enclosure and/or using glove bags wear respirators and protective clothing as required by paragraphs (h) and (i) of this section;

1926.1101(o)(3)(i)(F)

Ensure through on-site supervision, that employees set up, use and remove engineering controls, use work practices and personal protective equipment in compliance with all requirements;

1926.1101(o)(3)(i)(G)

Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section;

1926.1101(o)(3)(i)(H)

Ensure that through on-site inspection, engineering controls are functioning properly and employees are using proper work practices; and,

1926.1101(o)(3)(i)(I)

Ensure that notification requirement in paragraph (k) of this section are met.

1926.1101(o)(3)(ii)

[Reserved]

1926.1101(o)(4)

Training for the competent person.

1926.1101(o)(4)(i)

For Class I and II asbestos work the competent person shall be trained in all aspects of asbestos removal and handling, including: abatement, installation, removal and handling; the contents of this standard; the identification of asbestos; removal procedures, where appropriate; and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course for supervisors that meets the criteria of EPA's Model Accredited Plan (40 CFR part 763, subpart E, Appendix C), such as a course conducted by an EPA-approved or state-approved training provider, certified by EPA or a state, or a course equivalent in stringency, content, and length.

1926.1101(o)(4)(ii)

For Class III and IV asbestos work, the competent person shall be trained in aspects of asbestos handling appropriate for the nature of the work, to include procedures for setting up glove bags and mini-enclosures, practices for reducing asbestos exposures, use of wet methods, the contents of this standard, and the identification of asbestos. Such training shall include successful completion of a course that is consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92(a)(2), or its equivalent in stringency, content, and length. Competent persons for Class III and IV work, may also be trained pursuant to the requirements of paragraph (o)(4)(i) of this section.

1926.1101(p)

Appendices.

1926.1101(p)(1)

Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

1926.1101(p)(2)

Appendices B, F, H, I, J, and K to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

[59 FR 40964, Aug. 10, 1994; 60 FR 9624, Feb. 21, 1995; 60 FR 33343, June 28, 1995; 60 FR 33972, June 29, 1995; 60 FR 36043, July 13, 1995; 60 FR 50411, Sept. 29, 1995; 61 FR 5507, Feb. 13, 1996; 61 FR 43454, August 23, 1996; 63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998; 63 FR 35138, June 29, 1998; 70 FR 1143, Jan. 5, 2005; 71 FR 16675, April 3, 2006; 71 FR 50191, August 24, 2006; 73 FR 755889, Dec. 12, 2008; 76 FR 33612, June 8, 2011; 77 FR 17895, March 26, 2012]

Next Standard (1926.1101 App A)

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- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** Z
- **Subpart Title:** Toxic and Hazardous Substances
- **Standard Number:** 1910.1001
- **Title:** Asbestos.
- **Appendix:** A, B, C, D, E, F, G, H, I, J
- **GPO Source:** e-CFR

1910.1001(a)

Scope and application.

1910.1001(a)(1)

This section applies to all occupational exposures to asbestos in all industries covered by the Occupational Safety and Health Act, except as provided in paragraph (a)(2) and (3) of this section.

1910.1001(a)(2)

This section does not apply to construction work as defined in 29 CFR 1910.12(b). (Exposure to asbestos in construction work is covered by 29 CFR 1926.1101.)

1910.1001(a)(3)

This section does not apply to ship repairing, shipbuilding and shipbreaking employments and related employments as defined in 29 CFR 1915.4. (Exposure to asbestos in these employments is covered by 29 CFR 1915.1001).

1910.1001(b)

Definitions.

Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.

Asbestos-containing material (ACM) means any material containing more than 1% asbestos.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Authorized person means any person authorized by the employer and required by work duties to be present in regulated areas.

Building/facility owner is the legal entity, including a lessee, which exercises control over management and record keeping functions relating to a building and/or facility in which activities covered by this standard take place.

Certified Industrial Hygienist (CIH) means one certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.

Director means the Director of the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Employee exposure means that exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.

Fiber means a particulate form of asbestos 5 micrometers or longer,with a length-to-diameter ratio of at least 3 to 1.

High-efficiency particulate air (HEPA) filter means a filter capable of trapping and retaining at least 99.97 percent of 0.3 micrometer diameter mono-disperse particles.

Homogeneous area means an area of surfacing material or thermal system insulation that is uniform in color and texture.

Industrial hygienist means a professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards.

PACM means presumed asbestos containing material.

Presumed asbestos containing material means thermal system insulation and surfacing material found in buildings constructed no later than 1980. The designation of a material as "PACM" may be rebutted pursuant to paragraph (j)(8) of this section.

Regulated area means an area established by the employer to demarcate areas where airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the permissible exposure limits.

Surfacing ACM means surfacing material which contains more than 1 percent asbestos.

Surfacing material means material that is sprayed, troweled-on or otherwise applied to surfaces (such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, and other purposes).

Thermal System Insulation (TSI) means ACM applied to pipes, fittings, boilers, breeching, tanks, ducts or other structural components to prevent heat loss or gain.

Thermal System Insulation ACM means thermal system insulation which contains more than 1 percent asbestos.

1910.1001(c)

Permissible exposure limit (PELS) --

1910.1001(c)(1)

Time-weighted average limit (TWA). The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average (TWA) as determined by the method prescribed in Appendix A to this section, or by an equivalent method.

1910.1001(c)(2)

Excursion limit. The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air (1 f/cc) as averaged over a sampling period of thirty (30) minutes as determined by the method prescribed in Appendix A to this section, or by an equivalent method.

1910.1001(d)

Exposure monitoring. --

1910.1001(d)(1)

General.

1910.1001(d)(1)(i)

Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee.

1910.1001(d)(1)(ii)

Representative 8-hour TWA employee exposures shall be determined on the basis of one or more samples representing full-shift exposures for each shift for each employee in each job classification in each work area. Representative 30-minute short-term employee exposures shall be determined on the basis of one or more samples representing 30 minute exposures associated with operations that are most likely to produce exposures above the excursion limit for each shift for each job classification in each work area.

1910.1001(d)(2)

Initial monitoring.

1910.1001(d)(2)(i)

Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraphs (d)(2)(ii) and (d)(2)(iii) of this section, shall perform initial monitoring of employees who are, or may reasonably be expected to be exposed to airborne concentrations at or above the TWA permissible exposure limit and/or excursion limit.

1910.1001(d)(2)(ii)

Where the employer has monitored after March 31, 1992, for the TWA permissible exposure limit and/or the excursion limit, and the monitoring satisfies all other requirements of this section, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (d)(2)(i) of this section.

1910.1001(d)(2)(iii)

Where the employer has relied upon objective data that demonstrate that asbestos is not capable of being released in airborne concentrations at or above the TWA permissible exposure limit and/or excursion limit under the expected conditions of processing, use, or handling, then no initial monitoring is required.

1910.1001(d)(3)

Monitoring frequency (periodic monitoring) and patterns. After the initial determinations required by paragraph (d)(2)(i) of this section, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than six months for employees whose exposures may reasonably be foreseen to exceed the TWA permissible exposure limit and/or excursion limit.

1910.1001(d)(4)

Changes in monitoring frequency. If either the initial or the periodic monitoring required by paragraphs (d)(2) and (d)(3) of this section statistically indicates that employee exposures are below the TWA permissible exposure limit and/or excursion limit, the employer may discontinue the monitoring for those employees whose exposures are represented by such monitoring.

1910.1001(d)(5)

Additional monitoring. Notwithstanding the provisions of paragraphs (d)(2)(ii) and (d)(4) of this section, the employer shall institute the exposure monitoring required under paragraphs (d)(2)(i) and (d)(3) of this section whenever there has been a change in the production, process, control equipment, personnel or work practices that may result in new or additional exposures above the TWA permissible exposure limit and/or excursion limit or when the employer has any reason to suspect that a change may result in new or additional exposures above the PEL and/or excursion limit.

1910.1001(d)(6)

Method of monitoring.

1910.1001(d)(6)(i)

All samples taken to satisfy the monitoring requirements of paragraph (d) of this section shall be personal samples collected following the procedures specified in Appendix A.

1910.1001(d)(6)(ii)

All samples taken to satisfy the monitoring requirements of paragraph (d) of this section shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A of this section, or an equivalent counting method.

1910.1001(d)(6)(iii)

If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

1910.1001(d)(6)(iii)(A)

Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons; and

1910.1001(d)(6)(iii)(B)

The comparison indicates that 90% of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results at a 95% confidence level as demonstrated by a statistically valid protocol; and

1910.1001(d)(6)(iii)(C)

The equivalent method is documented and the results of the comparison testing are maintained.

1910.1001(d)(6)(iv)

To satisfy the monitoring requirements of paragraph (d) of this section, employers must use the results of monitoring analysis performed by laboratories which have instituted quality assurance programs that include the elements as prescribed in Appendix A of this section.

1910.1001(d)(7)

Employee notification of monitoring results.

1910.1001(d)(7)(i)

The employer must, within 15 working days after the receipt of the results of any monitoring performed under this sections, notify each affected employee of these results either individually in writing or by posting the results in an appropriate location that is accessible to affected employees.

1910.1001(d)(7)(ii)

The written notification required by paragraph (d)(7)(i) of this section shall contain the corrective action being taken by the employer to reduce employee exposure to or below the TWA and/or excursion limit, wherever monitoring results indicated that the TWA and/or excursion limit had been exceeded.

1910.1001(e)

Regulated Areas. --

1910.1001(e)(1)

Establishment. The employer shall establish regulated areas wherever airborne concentrations of asbestos and/or PACM are in excess of the TWA and/or excursion limit prescribed in paragraph (c) of this section.

1910.1001(e)(2)

Demarcation. Regulated areas shall be demarcated from the rest of the workplace in any manner that minimizes the number of persons who will be exposed to asbestos.

1910.1001(e)(3)

Access. Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

1910.1001(e)(4)

Provision of respirators. Each person entering a regulated area shall be supplied with and required to use a respirator, selected in accordance with paragraph (g)(2) of this section.

1910.1001(e)(5)

Prohibited activities. The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated areas.

1910.1001(f)

Methods of compliance. --

1910.1001(f)(1)

Engineering controls and work practices.

1910.1001(f)(1)(i)

The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to or below the TWA and/or excursion limit prescribed in paragraph (c) of this section, except to the extent that such controls are not feasible.

1910.1001(f)(1)(ii)

Wherever the feasible engineering controls and work practices that can be instituted are not sufficient to reduce employee exposure to or below the TWA and/or excursion limit prescribed in paragraph (c) of this section, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (g) of this section.

1910.1001(f)(1)(iii)

For the following operations, wherever feasible engineering controls and work practices that can be instituted are not sufficient to reduce the employee exposure to or below the TWA and/or excursion limit prescribed in paragraph (c) of this section, the employer shall use them to reduce employee exposure to or below 0.5 fiber per cubic centimeter of air (as an eight-hour time-weighted average) or 2.5 fibers/cc for 30 minutes (short-term exposure) and shall supplement them by the use of any combination of respiratory protection that complies with the requirements of paragraph (g) of this section, work practices and feasible engineering controls that will reduce employee exposure to or below the TWA and to or below the excursion limit permissible prescribed in paragraph (c) of this section: Coupling cutoff in primary asbestos cement pipe manufacturing; sanding in primary and secondary asbestos cement sheet manufacturing; grinding in primary and secondary friction product manufacturing; carding and spinning in dry textile processes; and grinding and sanding in primary plastics manufacturing.

1910.1001(f)(1)(iv)

Local exhaust ventilation. Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with good practices such as those found in the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1979.

1910.1001(f)(1)(v)

Particular tools. All hand-operated and power-operated tools which would produce or release fibers of asbestos, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems which comply with paragraph (f)(1)(iv) of this section.

1910.1001(f)(1)(vi)

Wet methods. Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers so as to expose employees to levels in excess of the TWA and/or excursion limit, prescribed in paragraph (c) of this section, unless the usefulness of the product would be diminished thereby.

1910.1001(f)(1)(vii)

[Reserved]

1910.1001(f)(1)(viii)

Particular products and operations. No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos, shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne fibers.

1910.1001(f)(1)(ix)

Compressed air. Compressed air shall not be used to remove asbestos or materials containing asbestos unless the compressed air is used in conjunction with a ventilation system which effectively captures the dust cloud created by the compressed air.

1910.1001(f)(1)(x)

Flooring. Sanding of asbestos-containing flooring material is prohibited.

1910.1001(f)(2)

Compliance program.

1910.1001(f)(2)(i)

Where the TWA and/or excursion limit is exceeded, the employer shall establish and implement a written program to reduce employee exposure to or below the TWA and to or below the excursion limit by means of engineering and work practice controls as required by paragraph (f)(1) of this section, and by the use of respiratory protection where required or permitted under this section.

1910.1001(f)(2)(ii)

Such programs shall be reviewed and updated as necessary to reflect significant changes in the status of the employer's compliance program.

1910.1001(f)(2)(iii)

Written programs shall be submitted upon request for examination and copying to the Assistant Secretary, the Director, affected employees and designated employee representatives.

1910.1001(f)(2)(iv)

The employer shall not use employee rotation as a means of compliance with the TWA and/or excursion limit.

1910.1001(f)(3)

Specific compliance methods for brake and clutch repair:

1910.1001(f)(3)(i)

Engineering controls and work practices for brake and clutch repair and service. During automotive brake and clutch inspection, disassembly, repair and assembly operations, the employer shall institute engineering controls and work practices to reduce employee exposure to materials containing asbestos using a negative pressure enclosure/HEPA vacuum system method or low pressure/wet cleaning method, which meets the detailed requirements set out in Appendix F to this section. The employer may also comply using an equivalent method which follows written procedures which the employer demonstrates can achieve results equivalent to Method A in Appendix F to this section. For facilities in which no more than 5 pair of brakes or 5 clutches are inspected, disassembled, repaired, or assembled per week, the method set forth in paragraph [D] of Appendix F to this section may be used.

1910.1001(f)(3)(ii)

The employer may also comply by using an equivalent method which follows written procedures, which the employer demonstrates can achieve equivalent exposure reductions as do the two "preferred methods." Such demonstration must include monitoring data conducted under workplace conditions closely resembling the process, type of asbestos containing materials, control method, work practices and environmental conditions which the equivalent method will be used, or objective data, which document that under all reasonably foreseeable conditions of brake and clutch repair applications, the method results in exposures which are equivalent to the methods set out in Appendix F to this section.

1910.1001(g)

Respiratory protection

1910.1001(g)(1)

General. for employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this paragraph. Respirators must be used during:

1910.1001(g)(1)(i)

Periods necessary to install or implement feasible engineering and work-practice controls.

1910.1001(g)(1)(ii)

Work operations, such as maintenance and repair activities, for which engineering and work-practice controls are not feasible.

1910.1001(g)(1)(iii)

Work operations for which feasible engineering and work-practice controls are not yet sufficient to reduce employee exposure to or below the TWA and/or excursion limit.

1910.1001(g)(1)(iv)

Emergencies.

1910.1001(g)(2)

Respirator program.

1910.1001(g)(2)(i)

The employer must implement a respiratory protection program in accordance with 29 CFR 134 (b) through (d) (except (d)(1)(iii)), and (f) through (m), which covers each employee required by this section to use a respirator.

1910.1001(g)(2)(ii)

Employers must provide an employee with a tight-fitting, powered air-purifying respirator (PAPR) instead of a negative pressure respirator selected according to paragraph (g)(3) of this standard when the employee chooses to use a PAPR and it provides adequate protection to the employee.

1910.1001(g)(2)(iii)

No employee must be assigned to tasks requiring the use of respirators if, based on their most recent medical examination, the examining physician determines that the employee will be unable to function normally using a respirator, or that the safety or health of the employee or other employees will be impaired by the use of a respirator. Such employees must be assigned to another job or given the opportunity to transfer to a different position, the duties of which they can perform. If such a transfer position is available, the position must be with the same employer, in the same geographical area, and with the same seniority, status, and rate of pay the employee had just prior to such transfer.

1910.1001(g)(3)

Respirator selection. Employers must:

(g)(3)(i)

Select, and provide to employees, the appropriate respirators specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134; however, employers must not select or use filtering facepiece respirators for protection against asbestos fibers.

(g)(3)(ii)

Provide HEPA filters for powered and non-powered air-purifying respirators.

1910.1001(h)

Protective work clothing and equipment --

1910.1001(h)(1)

Provision and use. If an employee is exposed to asbestos above the TWA and/or excursion limit, or where the possibility of eye irritation exists, the employer shall provide at no cost to the employee and ensure that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

1910.1001(h)(1)(i)

Coveralls or similar full-body work clothing;

1910.1001(h)(1)(ii)

Gloves, head coverings, and foot coverings; and

1910.1001(h)(1)(iii)

Face shields, vented goggles, or other appropriate protective equipment which complies with 1910.133 of this Part.

1910.1001(h)(2)

Removal and storage.

1910.1001(h)(2)(i)

The employer shall ensure that employees remove work clothing contaminated with asbestos only in change rooms provided in accordance with paragraph (i)(1) of this section.

1910.1001(h)(2)(ii)

The employer shall ensure that no employee takes contaminated work clothing out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

1910.1001(h)(2)(iii)

Contaminated work clothing shall be placed and stored in closed containers which prevent dispersion of the asbestos outside the container.

1910.1001(h)(2)(iv)

The employer shall ensure that containers of contaminated protective devices or work clothing, which are to be taken out of change rooms or the workplace for cleaning, maintenance or disposal, bear labels in accordance with paragraph (j) of this section.

1910.1001(h)(3)

Cleaning and replacement.

1910.1001(h)(3)(i)

The employer shall clean, launder, repair, or replace protective clothing and equipment required by this paragraph to maintain their effectiveness. The employer shall provide clean protective clothing and equipment at least weekly to each affected employee.

1910.1001(h)(3)(ii)

The employer shall prohibit the removal of asbestos from protective clothing and equipment by blowing or shaking.

1910.1001(h)(3)(iii)

Laundering of contaminated clothing shall be done so as to prevent the release of airborne fibers of asbestos in excess of the permissible exposure limits prescribed in paragraph (c) of this section.

1910.1001(h)(3)(iv)

The employer shall ensure that contaminated clothing is transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (j) of this section.

1910.1001(h)(3)(v)

The employer shall inform any person who launders or cleans protective clothing or equipment contaminated with asbestos of the potentially harmful effects of exposure to asbestos.

1910.1001(h)(3)(vi)

Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (j) of this section.

1910.1001(i)

Hygiene facilities and practices --

1910.1001(i)(1)

Change rooms.

1910.1001(i)(1)(i)

The employer shall provide clean change rooms for employees who work in areas where their airborne exposure to asbestos is above the TWA and/or excursion limit.

1910.1001(i)(1)(ii)

The employer shall ensure that change rooms are in accordance with 1910.141(e) of this part, and are equipped with two separate lockers or storage facilities, so separated as to prevent contamination of the employee's street clothes from his protective work clothing and equipment.

1910.1001(i)(2)

Showers.

1910.1001(i)(2)(i)

The employer shall ensure that employees who work in areas where their airborne exposure is above the TWA and/or excursion limit, shower at the end of the work shift.

1910.1001(i)(2)(ii)

The employer shall provide shower facilities which comply with 1910.141(d)(3) of this part.

1910.1001(i)(2)(iii)

The employer shall ensure that employees who are required to shower pursuant to paragraph (i)(2)(i) of this section do not leave the workplace wearing any clothing or equipment worn during the work shift.

1910.1001(i)(3)

Lunchrooms.

1910.1001(i)(3)(i)

The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure is above the TWA and/or excursion limit.

1910.1001(i)(3)(ii)

The employer shall ensure that lunchroom facilities have a positive pressure, filtered air supply, and are readily accessible to employees.

1910.1001(i)(3)(iii)

The employer shall ensure that employees who work in areas where their airborne exposure is above the PEL and/or excursion limit wash their hands and faces prior to eating, drinking or smoking.

1910.1001(i)(3)(iv)

The employer shall ensure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface asbestos fibers have been removed from the clothing or equipment by vacuuming or other method that removes dust without causing the asbestos to become airborne.

1910.1001(i)(4)

Smoking in work areas. The employer shall ensure that employees do not smoke in work areas where they are occupationally exposed to asbestos because of activities in that work area.

1910.1001(j)

Communication of hazards to employees -- Introduction. This section applies to the communication of information concerning asbestos hazards in general industry to facilitate compliance with this standard. Asbestos exposure in general industry occurs in a wide variety of industrial and commercial settings. Employees who manufacture asbestos-containing products may be exposed to asbestos fibers. Employees who repair and replace automotive brakes and clutches may be exposed to asbestos fibers. In addition, employees engaged in housekeeping activities in industrial facilities with asbestos product manufacturing operations, and in public and commercial buildings with installed asbestos containing materials may be exposed to asbestos fibers. Most of these workers are covered by this general industry standard, with the exception of state or local governmental employees in non-state plan states. It should be noted that employees who perform housekeeping activities during and after construction activities are covered by the asbestos construction standard, 29 CFR 1926.1101, formerly 1926.58. However, housekeeping employees, regardless of industry designation, should know whether building components they maintain may expose them to asbestos. The same hazard communication provisions will protect employees who perform housekeeping operations in all three asbestos standards; general industry, construction, and shipyard employment. As noted in the construction standard, building owners are often the only and/or best source of information concerning the presence of previously installed asbestos containing building materials. Therefore they, along with employers of potentially exposed employees, are assigned specific information conveying and retention duties under this section.

1910.1001(j)(1)

Hazard communication—general.

1910.1001(j)(1)(i)

Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for asbestos.

1910.1001(j)(1)(ii)

In classifying the hazards of asbestos at least the following hazards are to be addressed: Cancer and lung effects.

1910.1001(j)(1)(iii)

Employers shall include asbestos in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of asbestos and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (j)(7) of this section.

1910.1001(j)(2)

Installed Asbestos Containing Material. Employers and building owners are required to treat installed TSI and sprayed on and troweled-on surfacing materials as ACM in buildings constructed no later than 1980 for purposes of this standard. These materials are designated "presumed ACM or PACM", and are defined in paragraph (b) of this section. Asphalt and vinyl flooring material installed no later than 1980 also must be treated as asbestos-containing. The employer or building owner may demonstrate that PACM and flooring material do not contain asbestos by complying with paragraph (j)(8)(iii) of this section.

1910.1001(j)(3)

Duties of employers and building and facility owners.

1910.1001(j)(3)(i)

Building and facility owners shall determine the presence, location, and quantity of ACM and/or PACM at the work site. Employers and building and facility owners shall exercise due diligence in complying with these requirements to inform employers and employees about the presence and location of ACM and PACM.

1910.1001(j)(3)(ii)

Building and facility owners shall maintain records of all information required to be provided pursuant to this section and/or otherwise known to the building owner concerning the presence, location and quantity of ACM and PACM in the building/facility. Such records shall be kept for the duration of ownership and shall be transferred to successive owners.

1910.1001(j)(3)(iii)

Building and facility owners shall inform employers of employees, and employers shall inform employees who will perform housekeeping activities in areas which contain ACM and/or PACM of the presence and location of ACM and/or PACM in such areas which may be contacted during such activities.

1910.1001(j)(4)

Warning signs—

1910.1001(j)(4)(i)

Posting. Warning signs shall be provided and displayed at each regulated area. In addition, warning signs shall be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

1910.1001(j)(4)(ii)

Sign specifications:

1910.1001(j)(4)(ii)(A)

The warning signs required by paragraph (j)(4)(i) of this section shall bear the following legend:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY

1910.1001(j)(4)(ii)(B)

In addition, where the use of respirators and protective clothing is required in the regulated area under this section, the warning signs shall include the following:

WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA

1910.1001(j)(4)(ii)(C)

Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (j)(4)(ii)(A) of this section:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE
HAZARD
AUTHORIZED PERSONNEL ONLY

1910.1001(j)(4)(ii)(D)

Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (j)(4)(ii)(B) of this section:

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

1910.1001(j)(4)(iii)

The employer shall ensure that employees working in and contiguous to regulated areas comprehend the warning signs required to be posted by paragraph (j)(4)(i) of this section. Means to ensure employee comprehension may include the use of foreign languages, pictographs and graphics.

1910.1001(j)(4)(iv)

At the entrance to mechanical rooms/areas in which employees reasonably can be expected to enter and which contain ACM and/or PACM, the building owner shall post signs which identify the material which is present, its location, and appropriate work practices which, if followed, will ensure that ACM and/or PACM will not be disturbed. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

1910.1001(j)(5)

Warning labels—

1910.1001(j)(5)(i)

Labeling. Labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers. When a building owner or employer identifies previously installed ACM and/or PACM, labels or signs shall be affixed or posted so that employees will be notified of what materials contain ACM and/or PACM. The employer shall attach such labels in areas where they will clearly be noticed by employees who are likely to be exposed, such as at the entrance to mechanical room/areas. Signs required by paragraph (j) of this section may be posted in lieu of labels so long as they contain the information required for labeling.

1910.1001(j)(5)(ii)

Label specifications. In addition to the requirements of paragraph (j)(1), the employer shall ensure that labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers include the following information:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

1910.1001(j)(5)(iii)

Prior to June 1, 2015, employers may include the following information on raw materials, mixtures or labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers in lieu of the labeling requirements in paragraphs (j)(1)(i) and (j)(5)(ii) of this section:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

1910.1001(j)(6)

The provisions for labels and for safety data sheets required by paragraph (j) of this section do not apply where:

1910.1001(j)(6)(i)

Asbestos fibers have been modified by a bonding agent, coating, binder, or other material provided that the manufacturer can demonstrate that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of fibers of asbestos in excess of the TWA permissible exposure level and/or excursion limit will be released or

1910.1001(j)(6)(ii)

Asbestos is present in a product in concentrations less than 1.0%.

1910.1001(j)(7)

Employee information and training.

1910.1001(j)(7)(i)

The employer shall train each employee who is exposed to airborne concentrations of asbestos at or above the PEL and/or excursion limit in accordance with the requirements of this section. The employer shall institute a training program and ensure employee participation in the program.

1910.1001(j)(7)(ii)

Training shall be provided prior to or at the time of initial assignment and at least annually thereafter.

1910.1001(j)(7)(iii)

The training program shall be conducted in a manner which the employee is able to understand. The employer shall ensure that each employee is informed of the following:

1910.1001(j)(7)(iii)(A)

The health effects associated with asbestos exposure;

1910.1001(j)(7)(iii)(B)

The relationship between smoking and exposure to asbestos producing lung cancer:

1910.1001(j)(7)(iii)(C)

The quantity, location, manner of use, release, and storage of asbestos, and the specific nature of operations which could result in exposure to asbestos;

1910.1001(j)(7)(iii)(D)

The engineering controls and work practices associated with the employee's job assignment;

1910.1001(j)(7)(iii)(E)

The specific procedures implemented to protect employees from exposure to asbestos, such as appropriate work practices, emergency and clean-up procedures, and personal protective equipment to be used;

1910.1001(j)(7)(iii)(F)

The purpose, proper use, and limitations of respirators and protective clothing, if appropriate;

1910.1001(j)(7)(iii)(G)

The purpose and a description of the medical surveillance program required by paragraph (l) of this section;

1910.1001(j)(7)(iii)(H)

The content of this standard, including appendices.

1910.1001(j)(7)(iii)(I)

The names, addresses and phone numbers of public health organizations which provide information, materials, and/or conduct programs concerning smoking cessation. The employer may distribute the list of such organizations contained in Appendix I to this section, to comply with this requirement.

1910.1001(j)(7)(iii)(J)

The requirements for posting signs and affixing labels and the meaning of the required legends for such signs and labels.

1910.1001(j)(7)(iv)

The employer shall also provide, at no cost to employees who perform housekeeping operations in an area which contains ACM or PACM, an asbestos awareness training course, which shall at a minimum contain the following elements: health effects of asbestos, locations of ACM and PACM in the building/facility, recognition of ACM and PACM damage and deterioration, requirements in this standard relating to housekeeping, and proper response to fiber release episodes, to all employees who perform housekeeping work in areas where ACM and/or PACM is present. Each such employee shall be so trained at least once a year.

1910.1001(j)(7)(v)

Access to information and training materials.

1910.1001(j)(7)(v)(A)

The employer shall make a copy of this standard and its appendices readily available without cost to all affected employees.

1910.1001(j)(7)(v)(B)

The employer shall provide, upon request, all materials relating to the employee information and training program to the Assistant Secretary and the training program to the Assistant Secretary and the Director.

1910.1001(j)(7)(v)(C)

The employer shall inform all employees concerning the availability of self-help smoking cessation program material. Upon employee request, the employer shall distribute such material, consisting of NIH Publication No. 89-1647, or equivalent self-help material, which is approved or published by a public health organization listed in Appendix I to this section.

1910.1001(j)(8)

Criteria to rebut the designation of installed material as PACM.

1910.1001(j)(8)(i)

At any time, an employer and/or building owner may demonstrate, for purposes of this standard, that PACM does not contain asbestos. Building owners and/or employers are not required to communicate information about the presence of building material for which such a demonstration pursuant to the requirements of paragraph (j)(8)(ii) of this section has been made. However, in all such cases, the information, data and analysis supporting the determination that PACM does not contain asbestos, shall be retained pursuant to paragraph (m) of this section.

1910.1001(j)(8)(ii)

An employer or owner may demonstrate that PACM does not contain asbestos by the following:

1910.1001(j)(8)(ii)(A)

Having a completed inspection conducted pursuant to the requirements of AHERA (40 CFR 763, Subpart E) which demonstrates that no ACM is present in the material; or

1910.1001(j)(8)(ii)(B)

Performing tests of the material containing PACM which demonstrate that no ACM is present in the material. Such tests shall include analysis of bulk samples collected in the manner described in 40 CFR 763.86. The tests, evaluation and sample collection shall be conducted by an accredited inspector or by a CIH. Analysis of samples shall be performed by persons or laboratories with proficiency demonstrated by current successful participation in a nationally recognized testing program such as the National Voluntary Laboratory Accreditation Program (NVLAP) or the National Institute for Standards and Technology (NIST) or the Round Robin for bulk samples administered by the American Industrial Hygiene Association (AIHA) or an equivalent nationally-recognized round robin testing program.

1910.1001(j)(8)(iii)

The employer and/or building owner may demonstrate that flooring material including associated mastic and backing does not contain asbestos, by a determination of an industrial hygienist based upon recognized analytical techniques showing that the material is not ACM.

1910.1001(k)

Housekeeping.

1910.1001(k)(1)

All surfaces shall be maintained as free as practicable of ACM waste and debris and accompanying dust.

1910.1001(k)(2)

All spills and sudden releases of material containing asbestos shall be cleaned up as soon as possible.

1910.1001(k)(3)

Surfaces contaminated with asbestos may not be cleaned by the use of compressed air.

1910.1001(k)(4)

Vacuuming. HEPA-filtered vacuuming equipment shall be used for vacuuming asbestos containing waste and debris. The equipment shall be used and emptied in a manner which minimizes the reentry of asbestos into the workplace.

1910.1001(k)(5)

Shoveling, dry sweeping and dry clean-up of asbestos may be used only where vacuuming and/or wet cleaning are not feasible.

1910.1001(k)(6)

Waste disposal. Waste, scrap, debris, bags, containers, equipment, and clothing contaminated with asbestos consigned for disposal, shall be collected, recycled and disposed of in sealed impermeable bags, or other closed, impermeable containers.

1910.1001(k)(7)

Care of asbestos-containing flooring material.

1910.1001(k)(7)(i)

Sanding of asbestos-containing floor material is prohibited.

1910.1001(k)(7)(ii)

Stripping of finishes shall be conducted using low abrasion pads at speeds lower than 300 rpm and wet methods.

1910.1001(k)(7)(iii)

Burnishing or dry buffing may be performed only on asbestos-containing flooring which has sufficient finish so that the pad cannot contact the asbestos-containing material.

1910.1001(k)(8)

Waste and debris and accompanying dust in an areas containing accessible ACM and/or PACM or visibly deteriorated ACM, shall not be dusted or swept dry, or vacuumed without using a HEPA filter.

1910.1001(l)

Medical surveillance --

1910.1001(l)(1)

General --

1910.1001(l)(1)(i)

Employees covered. The employer shall institute a medical surveillance program for all employees who are or will be exposed to airborne concentrations of fibers of asbestos at or above the TWA and/or excursion limit.

1910.1001(l)(1)(ii)

Examination by a physician.

1910.1001(l)(1)(ii)(A)

The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee and at a reasonable time and place.

1910.1001(l)(1)(ii)(B)

Persons other than licensed physicians, who administer the pulmonary function testing required by this section, shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

1910.1001(l)(2)

Pre-placement examinations.

1910.1001(l)(2)(i)

Before an employee is assigned to an occupation exposed to airborne concentrations of asbestos fibers at or above the TWA and/or excursion limit, a pre-placement medical examination shall be provided or made available by the employer.

1910.1001(l)(2)(ii)

Such examination shall include, as a minimum, a medical and work history; a complete physical examination of all systems with emphasis on the respiratory system, the cardiovascular system and digestive tract; completion of the respiratory disease standardized questionnaire in Appendix D to this section, Part 1; a chest roentgenogram (posterior-anterior 14 x 17 inches); pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV(1.0)); and any additional tests deemed appropriate by the examining physician. Interpretation and classification of chest roentgenogram shall be conducted in accordance with Appendix E to this section.

1910.1001(l)(3)

Periodic examinations.

1910.1001(l)(3)(i)

Periodic medical examinations shall be made available annually.

1910.1001(l)(3)(ii)

The scope of the medical examination shall be in conformance with the protocol established in paragraph (l)(2)(ii) of this section, except that the frequency of chest roentgenogram shall be conducted in accordance with Table 1, and the abbreviated standardized questionnaire contained in, Part 2 of Appendix D to this section shall be administered to the employee.

Table 1. -- Frequency of Chest Roentgenogram

Years since first exposure	Age of employee		
	15 to 35	35+ to 45	45+
0 to 10	Every 5 years	Every 5 years	Every 5 years.
10+	Every 5 years	Every 2 years	Every 1 year.

1910.1001(l)(4)

Termination of employment examinations.

1910.1001(l)(4)(i)

The employer shall provide, or make available, a termination of employment medical examination for any employee who has been exposed to airborne concentrations of fibers of asbestos at or above the TWA and/or excursion limit.

1910.1001(l)(4)(ii)

The medical examination shall be in accordance with the requirements of the periodic examinations stipulated in paragraph (l)(3) of this section, and shall be given within 30 calendar days before or after the date of termination of employment.

1910.1001(l)(5)

Recent examinations. No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with any of paragraphs ((l)(2) through (l)(4)) of this section within the past 1 year period. A pre-employment medical examination which was required as a condition of employment by the employer, may not be used by that employer to meet the requirements of this paragraph, unless the cost of such examination is borne by the employer.

1910.1001(l)(6)

Information provided to the physician. The employer shall provide the following information to the examining physician:

1910.1001(l)(6)(i)

A copy of this standard and Appendices D and E.

1910.1001(l)(6)(ii)

A description of the affected employee's duties as they relate to the employee's exposure.

1910.1001(l)(6)(iii)

The employee's representative exposure level or anticipated exposure level.

1910.1001(l)(6)(iv)

A description of any personal protective and respiratory equipment used or to be used.

1910.1001(l)(6)(v)

Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

1910.1001(l)(7)

Physician's written opinion.

1910.1001(l)(7)(i)

The employer shall obtain a written signed opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

1910.1001(l)(7)(i)(A)

The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos;

1910.1001(l)(7)(i)(B)

Any recommended limitations on the employee or upon the use of personal protective equipment such as clothing or respirators;

1910.1001(l)(7)(i)(C)

A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions resulting from asbestos exposure that require further explanation or treatment; and

1910.1001(l)(7)(i)(D)

A statement that the employee has been informed by the physician of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure.

1910.1001(l)(7)(ii)

The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos.

1910.1001(l)(7)(iii)

The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

1910.1001(m)

Recordkeeping. --

1910.1001(m)(1)

Exposure measurements. NOTE: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

1910.1001(m)(1)(i)

The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos as prescribed in paragraph (d) of this section.

1910.1001(m)(1)(ii)

This record shall include at least the following information:

1910.1001(m)(1)(ii)(A)

The date of measurement;

1910.1001(m)(1)(ii)(B)

The operation involving exposure to asbestos which is being monitored;

1910.1001(m)(1)(ii)(C)

Sampling and analytical methods used and evidence of their accuracy;

1910.1001(m)(1)(ii)(D)

Number, duration, and results of samples taken;

1910.1001(m)(1)(ii)(E)

Type of respiratory protective devices worn, if any; and

1910.1001(m)(1)(ii)(F)

Name, social security number and exposure of the employees whose exposure are represented.

1910.1001(m)(1)(iii)

The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.1020.

1910.1001(m)(2)

Objective data for exempted operations.

1910.1001(m)(2)(i)

Where the processing, use, or handling of products made from or containing asbestos is exempted from other requirements of this section under paragraph (d)(2)(iii) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

1910.1001(m)(2)(ii)

The record shall include at least the following:

1910.1001(m)(2)(ii)(A)

The product qualifying for exemption;

1910.1001(m)(2)(ii)(B)

The source of the objective data;

1910.1001(m)(2)(ii)(C)

The testing protocol, results of testing, and/or analysis of the material for the release of asbestos;

1910.1001(m)(2)(ii)(D)

A description of the operation exempted and how the data support the exemption; and

1910.1001(m)(2)(ii)(E)

Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

1910.1001(m)(2)(iii)

The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

1910.1001(m)(3)

Medical surveillance.

1910.1001(m)(3)(i)

The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (l)(1)(i) of this section, in accordance with 29 CFR 1910.1020.

1910.1001(m)(3)(ii)

The record shall include at least the following information:

1910.1001(m)(3)(ii)(A)

The name and social security number of the employee;

1910.1001(m)(3)(ii)(B)

Physician's written opinions;

1910.1001(m)(3)(ii)(C)

Any employee medical complaints related to exposure to asbestos; and

1910.1001(m)(3)(ii)(D)

A copy of the information provided to the physician as required by paragraph (l)(6) of this section.

1910.1001(m)(3)(iii)

The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.1020.

1910.1001(m)(4)

Training. The employer shall maintain all employee training records for one (1) year beyond the last date of employment of that employee.

1910.1001(m)(5)

Availability.

1910.1001(m)(5)(i)

The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

1910.1001(m)(5)(ii)

The employer, upon request shall make any exposure records required by paragraph (m)(1) of this section available for examination and copying to affected employees, former employees, designated representatives and the Assistant Secretary, in accordance with 29 CFR 1910.1020(a) through (e) and (g) through (i).

1910.1001(m)(5)(iii)

The employer, upon request, shall make employee medical records required by paragraph (m)(3) of this section available for examination and copying to the subject employee, to anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.1020.

1910.1001(m)(6)

The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.1020(h).

1910.1001(n)

Observation of monitoring --

1910.1001(n)(1)

Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos conducted in accordance with paragraph (d) of this section.

1910.1001(n)(2)

Observation procedures. When observation of the monitoring of employee exposure to asbestos requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

1910.1001(o)

Appendices.

1910.1001(o)(1)

Appendices A, C, D, E, and F to this section are incorporated as part of this section and the contents of these Appendices are mandatory.

1910.1001(o)(2)

Appendices B, G, H, I, and J to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

[55 FR 50687, Dec. 10, 1990; 56 FR 43700, Sept. 4, 1991; 57 FR 24330, June 8, 1992; 59 FR 40964, Aug. 10, 1994; 60 FR 9624, Feb. 21, 1995; 60 FR 33343, June 28, 1995; 60 FR 33973, June 29, 1995; 61 FR 5507, Feb. 13, 1996; 61 FR 43454, August 23, 1996; 63 FR 1152, Jan. 8, 1998; 70 FR 1141, Jan. 5, 2005; 71 FR 16672 and 16673, April 3, 2006; 71 FR 50188, August 24, 2006; 73 FR 75584, Dec. 12, 2008; 76 FR 33608, June 8, 2011; 77 FR 17778, March 26, 2012]

Next Standard (1910.1001 App A)

Regulations (Standards - 29 CFR) - Table of Contents

UNITED STATES
DEPARTMENT OF LABOR

Occupational Safety and Health Administration
200 Constitution Ave., NW,
Washington, DC 20210
800-321-6742 (OSHA)
TTY
www.OSHA.gov

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APPENDIX P

VIRGINIA ASBESTOS REGULATIONS

REGULATIONS FOR ASBESTOS EMISSIONS STANDARDS FOR DEMOLITION AND RENOVATION CONSTRUCTION ACTIVITIES AND THE DISPOSAL OF ASBESTOS-CONTAINING CONSTRUCTION WASTES -- INCORPORATION BY REFERENCE, 40 CFR 61.140 through 61.156

16 VAC 25-30-10 et seq.



EFFECTIVE DATE: November 5, 1992

VIRGINIA SAFETY AND HEALTH CODES BOARD

AND

VIRGINIA DEPARTMENT OF LABOR AND INDUSTRY

REGULATIONS FOR ASBESTOS EMISSIONS STANDARDS FOR DEMOLITION AND RENOVATION CONSTRUCTION ACTIVITIES AND THE DISPOSAL OF ASBESTOS-CONTAINING CONSTRUCTION WASTES— INCORPORATION BY REFERENCE, 40 CFR 61.140 through 61.156

16 VAC 25-30-10. General.

Certain federal Environmental Protection Agency Regulations on National Emissions Standards for Hazardous Air Pollutants; Asbestos contained in 40 CFR Part 61 designated in 16 VAC 25-30-20 are incorporated by reference into this chapter amended by the word or phrase substitutions given in 16 VAC 25-30-30. The complete text or the subparts in 16 VAC 25-30-20 incorporated here by reference is contained in 40 CFR Part 61. The 40 CFR section numbers appearing under each subpart in 16 VAC 25-30-20 identify the specific provisions subpart incorporated by reference.

16 VAC 25-30-20. Designated standards of performance.

Subpart 61.140 - Applicability, 40 CFR 61.140
Subpart 61.141 - Definitions, 40 CFR 61.141
Subpart 61.145 - Standard for Demolition and Renovation, 40 CFR 61.145 (including figure 3)
Subpart 61.146 - Standard for Spraying, 40 CFR 61.146
Subpart 61.148 - Standard for Insulating Materials, 40 CFR 61.148
Subpart 61.150 - Standard for Waste Disposal, 40 CFR 61.150 (excluding subsection (a)(4) and including figure 4)
Subpart 61.154 - Standard for Active Waste Disposal Sites, 40 CFR 61.154 (excluding subsection (d))
Subpart 61.156 - Cross-reference to other Asbestos Regulations, 40 CFR 61.156 (including Table 1)

16 VAC 25-30-30. Word or phrase substitutions.

In all of the standards designated in 16VAC25-30-20 substitute:

1. "Commissioner of the Department of Labor and Industry" for "Administrator."

2. "Department of Labor and Industry" for "U.S. Environmental Protection Agency" (except in references).

3. "DLI NESHAP Standard" for "40 CFR."

4. "Owner or other person" for "owner or operator."

Regulation Concerning Licensed Asbestos Contractor Notification, Asbestos Project Permits, and Permit Fees; (16VAC25-20)

As Adopted by the

Safety and Health Codes Board

Date: November 20, 2008

VIRGINIA DEPARTMENT OF LABOR AND INDUSTRY

VIRGINIA OCCUPATIONAL SAFETY AND HEALTH PROGRAM

VIRGINIA DEPARTMENT OF LABOR AND INDUSTRY

Effective Date: February 1, 2009

16VAC25-20 Regulation Concerning Licensed Asbestos Contractor Notification, Asbestos Project Permits, and Permit Fees

TITLE 16 - LABOR AND EMPLOYMENT
AGENCY 25 - SAFETY AND HEALTH CODES BOARD

CHAPTER 20

REGULATION CONCERNING LICENSED ASBESTOS CONTRACTOR NOTIFICATION, ASBESTOS PROJECT PERMITS, AND PERMIT FEES

16VAC25-20-10. Definitions.

The following words and terms, when used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise:

"Activity" means from the set-up of negative air containment through the breakdown of that containment. Work within a single structure or building shall be considered as one "activity" so long as such work is not interrupted except for weekends, holidays, or delays due to inclement weather. Where containment is not required, all work within single structure or building shall be considered as one "activity."

"Asbestos" means any material containing more than 1.0% asbestos by area as determined by microscopy.

"Asbestos contractor's license" means an authorization issued by the Department of Professional and Occupational Regulation permitting a person to enter into contracts to perform an asbestos abatement project.

"Asbestos project" means an activity involving job set-up for containment, removal, encapsulation, enclosure, encasement, renovation, repair, construction or alteration of an asbestos-containing material. An asbestos project or asbestos abatement project shall not include nonfriable asbestos-containing roofing, flooring and siding material which when installed, encapsulated or removed does not become friable.

"Asbestos supervisor" means any person so designated by an asbestos contractor who provides on-site supervision and direction to the workers engaged in asbestos projects.

"Building" means a combination of any materials, whether portable or fixed including part or parts and fixed equipment of them, that forms a structure for use or occupancy by persons or property.

"Construction" means all the on-site work done in building or altering structures from land clearance through completion, including excavation, erection, and the assembly and installation of components and equipment.

"Department" means the Department of Labor and Industry.

"Friable" means that the material when dry, may be crumbled, pulverized, or reduced to powder by hand pressure and includes previously nonfriable material after such previously nonfriable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.

"Person" means a corporation, partnership, sole proprietorship, firm, enterprise, franchise, association, or any other individual or entity.

"Residential buildings" means site-built homes, modular homes, condominium units, mobile homes, manufactured housing, and duplexes, or other multi-unit dwelling consisting of four units or less which are currently in use or intended for use only for residential purposes. Demolitions of any of the above structures which are to be replaced by other than a residential building shall not fall within this definition.

"RFS contractor's license" means an authorization issued by the Department of Professional and Occupational Regulation permitting a person to enter into contracts to install, remove or encapsulate nonfriable asbestos-containing roofing, flooring, and siding materials.

"Site" means a specific geographically contiguous area with defined limits owned by a single entity on which asbestos removal will occur.

"Structure" means an assembly of materials, or part or parts of them, forming a construction.

16VAC25-20-20. Authority and application.

A. This chapter is established in accordance with § 40.1-51.20 of the Code of Virginia.

B. This chapter shall apply to all licensed asbestos contractors or RFS contractors who engage in asbestos projects.

C. The application of this chapter to contractors who work on federal property will be decided by the department based on a review of the facts in each case. The contractor shall contact the department to determine the applicability of the regulations to a specific project.

D. This chapter shall not affect the reporting requirements under § 40.1-51.20 C or any other notices or inspection requirements under any other provision of the Code of Virginia.

16VAC25-20-30. Notification and permit fee.

A. Written notification of any asbestos project of 10 linear feet or more or 10 square feet or more shall be made to the department on a department form. Such notification shall be sent by facsimile transmission as set out in 16VAC25-20-30 J, certified mail, or hand-delivered to the department. Notification shall be postmarked or made 20 days before the beginning of any asbestos project.

B. The department form shall include the following information:

1. Name, address, telephone number, and Virginia asbestos contractor's license number of persons intending to engage in an asbestos project;

2. Name, address, and telephone number of facility owner or operator;

3. Type of notification; amended, emergency, renovation, or demolition;

4. Description of building, structure, facility, installation, vehicle, or vessel to be demolished or renovated including present use, prior use or uses, age, and address;

5. Estimate of amount of friable asbestos and method of estimation;

6. Amount of the asbestos project fee submitted;

7. Schedule set-up date, removal date, and completion date of asbestos abatement work and times of removal;

8. Name and Virginia asbestos supervisor's license number of the project supervisor on site;

9. Name, address, telephone number, contact person, and landfill permit number of the waste disposal site where the asbestos containing material will be disposed;

10. Detailed description of the demolition or removal methods to be used;

11. Procedures and equipment to control emissions and protect public health during removal, transit, loading, and unloading. Including the monitoring plan;

12. Credit card number, expiration date, and signature of cardholder if a facsimile transmission is to be made pursuant to 16VAC25-20-30 J; and

13. Any other information requested on the department form.

C. An asbestos project permit fee shall be submitted with the completed project notification. The fee shall be in accordance with the following schedule unless a blanket notification is granted under subsection D of this section:

1. $50 for each project equal to or greater than 10 linear feet or 10 square feet up to and including 260 linear feet or 160 square feet;

2. $160 for each project of more than 260 linear feet or 160 square feet up to and including 2600 linear feet or 1600 square feet;

3. $470 for each project of more than 2600 linear feet or 1600 square feet; and

4. If the amount of asbestos is reported in both linear feet and square feet the amounts will be added and treated as if the total were all in square feet for the purposes of this subsection.

D. A blanket notification, valid for a period of one year, may be granted to a contractor who enters into a contract for asbestos removal or encapsulation on a specific site which is expected to last for one year or longer.

1. The contractor shall submit the notification required in 16VAC25-20-30 A to the department 20 days prior to the start of the requested blanket notification period. The notification submitted shall contain the following additional information:

a. The dates of work required by subdivision B 7 of this section shall be every workday during the blanket notification period excluding weekends or state holidays;

b. The estimate of asbestos to be removed required under subdivision B 5 of this section shall be signed by the owner and the owner's signature authenticated by a notary; and

c. A copy of the contract shall be submitted with the notification.

2. The asbestos project permit fee shall be 0.5% of the contract price or $470 whichever is greater. For contracts which require payments per square or linear foot of asbestos removed or encapsulated the contract price shall be the amount of asbestos estimated pursuant to subdivision B 5 of this section times the per foot charge in the contract;

3. The contractor shall submit an amended notification at least one day prior to each time the contractor will not be on site. The fee for each amended notification shall be $15;

4. A contractor shall submit an amended notification whenever the actual amount of asbestos removed or encapsulated exceeds the original estimate. If the contract was for a fixed cost regardless of the amount of asbestos the amendment fee shall be $15. If the contract was based on a price per square or linear foot the amendment fee shall be the difference between the actual amount removed and the estimated amount times the contract price per foot times 0.5% plus $15; and

5. Cancellation of a blanket notification may be made at any time by submitting a notarized notice of cancellation signed by the owner. The notice of cancellation must include the actual amount of asbestos removed and the actual amount of payments made under the contract. The refund shall be the difference between the original asbestos permit fee paid and either the actual amount of payments made under the contract times 0.5% or $470 whichever is greater.

E. Notification of less than 20 days may be allowed in case of an emergency involving protection of life, health, or property, including but not limited to: leaking or ruptured pipes; accidentally damaged or fallen asbestos that could expose nonasbestos workers or the public; unplanned mechanical outages or repairs essential to a work process that require asbestos removal and could only be removed safely during the mechanical outage. Notification and asbestos permit fee shall be submitted within five working days after the start of the emergency abatement. A description of the emergency situation shall be included when filing an emergency notification.

F. No notification shall be effective if an incomplete form is submitted, or if the proper permit fee is not enclosed with the completed form or if the credit card payment required for facsimile transmission in 16VAC25-20-30 J is not approved.

G. On the basis of the information submitted in the asbestos notification, the department shall issue a permit to the contractor within seven working days of the receipt of a completed notification form and permit fee.

1. The permit shall be effective for the dates entered on the notification.

2. The permit or a copy of the permit shall be kept on site during work on the project.

H. Amended notifications may be submitted for modification of 16VAC25-20-30 B 3 through 11. No amendments to 16VAC25-20-30 B 1 or 2 shall be allowed. A copy of the original notification form with the amended items circled and the permit number entered shall be submitted at any time prior to the removal date on the original notification.

1. No amended notification shall be effective if any incomplete form is submitted or if the proper permit amendment fee is not enclosed with the completed notification.

2. A permit amendment fee shall be submitted with the amended notification form. The fee shall be in accordance with the following schedule:

   a. For modification to 16VAC25-20-30 B 3, 16VAC25-20-30 B 4, and 16VAC25-20-30 B 6 through 16VAC25-20-30 B 10 - $15;

   b. For modifications to 16VAC25-20-30 B 5:

      (1) the difference between the permit fee in 16VAC25-20-30 C for the amended amount of asbestos and the original permit fee submitted; plus

      (2) $15.

3. Modifications to the completion date may be made at any time up to the completion date on the original notification.

4. If the amended notification is complete and the required fee is included, the department will issue an amended permit if necessary.

I. The department must be notified prior to any cancellation. A copy of the original notification form marked cancelled must be received no later than the scheduled removal date. Cancellation of a project may also be done by facsimile transmission. Refunds of the asbestos project permit fee will be made for timely cancellations when a notarized notice of cancellation signed by the owner is submitted. Fifteen dollars for processing for the original notification, $15 for each amendment filed and $15 for processing the refund payment will be deducted from the refund payment.

J. Notification for any project, emergency notification, or amendment to notification may be done by facsimile transmission if the required fees are paid by credit card.

16VAC25-20-40. Exemption.

No asbestos project fees will be required for residential buildings. Notification for asbestos projects in residential buildings shall otherwise be in accordance with applicable portions of this chapter.

FORMS (16VAC25-20)

Asbestos Permit Application and Notification for Demolition/Renovation (eff. 7/94).

APPENDIX Q

HISTORICAL INFORMATION

MasiMax
Resources, Inc.

THREE-YEAR REINSPECTION OF ASBESTOS-CONTAINING MATERIALS
ALEXANDRIA CITY PUBLIC SCHOOL SYSTEMS (ACPS)
Maury Elementary School
August 10, 2007

MasiMax Resources Inc. – Environmental Health & Safety Services (MasiMax) conducted the Three Year Re-Inspection of Asbestos-Containing Materials (ACM) at the Maury Elementary School on June 29, 2007. The purpose of the re-inspection was to assess the condition of all friable and non-friable Asbestos Containing Building Materials (ACBMs) listed as present from the previous triennial re-inspection.

The Scope of Work included a review of the Asbestos Operations & Management Plan (O&M), asbestos inspection and assessment of ACBM, and updated recommended response actions based on the condition of the ACBM.

All tasks were performed in accordance with re-inspection and assessment criteria established by the Environmental Protection Agency (EPA) Asbestos Hazard Emergency Response Act (AHERA), 40 CFR, Part 763.85 and Part 763.88. Each homogeneous area of ACM identified by the previous triennial re-inspection report was inspected. Additionally, the quantity, type, current conditions and recommendations are provided in the table presented in Attachment A.

MasiMax's performed an assessment of the school's asbestos O&M to review if the information required by AHERA is present and current. A checklist of the assessment findings is presented in Attachment B. Included in the checklist is the Local Education Agency's (LEA) designated person listed in the on-site O&M plan; however, ACPS should verify if this information is current.

The re-inspection was conducted by Virginia state licensed asbestos inspectors. All work was directed and supervised by a Certified Industrial Hygienist (CIH) who is also licensed by the State of Virginia as an Asbestos Management Planner. Copies of the Virginia asbestos inspector and management planner licenses are presented in Attachment C.

Under the AHERA requirements 763.93, a copy of the triennial re-inspection report shall be included in the ACPS's Management Plan. In addition, all six (6) month periodic inspection reports, response actions conducted at the school, and personnel training records shall be included in the Management Plan. It is the responsibility of the LEA designated person to ensure the Management Plan is updated regularly and made available to any interested party.

Mark Schneider, CIH, PG, LAC
VA Management Planner # 3304 001536
Exp. 06/30/2008

Bjarne Smith
VA Asbestos Inspector # 3303 002764
Exp. 08/31/2007

Amy Chang
VA Asbestos Inspector # 3303 002399
Exp. 05-31-2008

Corporate Headquarters
1375 Piccard Drive • Suite 175 • Rockville, MD 20850
Phone: 240-632-0610 • Fax: 240-632-0519 • www.masimax.com

Environmental Health and Safety Services
11417 Sunset Hills Road • Suite 225 • Reston, VA 20190
Phone: 571-203-7766 • Fax: 571-203-7911

CHECKLIST FOR ALEXANDRIA CITY PUBIC SCHOOLS AHERA MANAGEMENT PLANS

SCHOOL NAME: Maury

Yes No

■ ☐ Name and address of school, including a statement of whether the facility has friable, non-friable ACBM, suspect friable ACBM, or suspect non-friable ACBM.

Comments: _____

Yes

■ LEA – Designated Person

Name: William Simms Phone #: 703-823-9666, 703-836-7565

Yes No

■ ☐ Initial Inspection Reports including:

- Date of inspection;
- Diagram or description of ACBM material locations;
- Bulk sample analysis report;
- Initial response action recommendations;
- Assessment of asbestos materials; and,
- Signature, state, and accreditation # of inspector(s).

Comments: _____

Yes No

☐ ■ Records of all response actions for the last three (3) years (or longer), including:

- Detailed description of response actions;
- Air sample results;
- Signature, state, and accreditation of air sampler;
- Signature, state and accreditation of designer; and,
- Signature, state, and accreditation of contractor.

Comments: _____

Yes No

■ ☐ Recommendations for all response actions.

Comments: _____

Yes No

■ ☐ Signature, State, and accreditation of Management Planner, Inspector(s), Designer(s), and Contractor(s) for initial and all re-inspections.

Comments: 2004 re-inspection report found but no 1998 or 2001 reports found.

Yes No

☐ ■ 6-Month O&M Inspections

Comments: No six month re-inspections except for 1990.

Inspector (s): Bjarne Smith and Amy Chang Date: 6/29/2007

Management Planner: _____ Date: 08/07/2007

City of Alexandria - AHERA Inspection

School **Maury** Date 6/29/2007 Inspector(s) Bjarne Smith & Amy Chang

Location	Material	Size	Color	Amount	Unit	Comment	Class	Friable	Damage	Damage Location	Damage Amount	Damage Description	Recommend-ation
Back door of kitchen	Incandescent light fixture insulation	6 in	Foil	1	EA	Good condition.	5	No	No	N/A	N/A	N/A	O & M
Basement storage room	Black tar paper	ALL	Black	300	SF	Unable to Locate	0	No	No	Ceiling	< 5 SF	Localized	O & M
Basement, room next to it	Mastic on TSI & duct	large	White	ALL	ALL	Unable to Access	5	No	No	Throughout basement	N/A	N/A	O & M
Boiler Room	TSI-boiler insulation	ALL	N/A	2	EA	Removed and replaced with new boilers	0	No	No	N/A	N/A	N/A	N/A
Boiler Room	TSI-pipe runs	10 in	N/A	100	LF	Removed and replaced with fiberglass	0	No	No	N/A	N/A	N/A	N/A

City of Alexandria - AHERA Inspection

School **Maury** Date 6/29/2007 Inspector(s) Bjarne Smith & Amy Chang

Location	Material	Size	Color	Amount	Unit	Comment	Class	Friable	Damage	Damage Location	Damage Amount	Damage Description	Recommend-ation
Boiler Room	TSI-elbows	6 in	N/A	115	EA	Removed and replaced with fiberglass	0	No	No	N/A	N/A	N/A	N/A
Boiler Room	TSI-duct insulation	ALL	N/A	100	LF	Removed and replaced with fiberglass	0	No	No	N/A	N/A	N/A	N/A
Boiler Room	TSI-elbows, joints	6 in	N/A	100	LF	Removed and replaced with fiberglass	0	No	No	N/A	N/A	N/A	N/A
Boiler Room	TSI-boiler insulation	ALL	N/A	2	EA	Removed and replaced with fiberglass	5	No	No	N/A	N/A	N/A	N/A
Boiler Room Boiler	TSI-boiler insulation	ALL	N/A	2	EA	Removed and replaced with fiberglass	0	No	No	N/A	N/A	N/A	N/A

City of Alexandria - AHERA Inspection

School **Maury** Date 6/29/2007 Inspector(s) Bjarne Smith & Amy Chang

Location	Material	Size	Color	Amount	Unit	Comment	Class	Friable	Damage	Damage Location	Damage Amount	Damage Description	Recommend-ation
Café stage storage	Tile	9x9	Tan w/ white streaks			Tan with white streaks good condition.		No	No	N/A	N/A	N/A	O & M
Classrooms 1-5	Floor Tile	ALL	Black	>30	SF	Under carpet	5	No	No	N/A	N/A	N/A	O & M
Classrooms 1-5	Floor Tile	9x9	Medium green	100	SF	Under carpet	5	No	No	N/A	N/A	N/A	O & M
Crawlspace	TSI-elbows, joints	ALL	Gray	10000	LF	Removed 7/2004	1	Yes	No	N/A	N/A	N/A	N/A
Crawlspace	TSI-pipe runs (Mag)	ALL	N/A	10000	LF	Removed 7/2004	1	Yes	No	N/A	N/A	N/A	N/A

City of Alexandria - AHERA Inspection

School **Maury** Date 6/29/2007 Inspector(s) Bjarne Smith & Amy Chang

Location	Material	Size	Color	Amount	Unit	Comment	Class	Friable	Damage	Damage Location	Damage Amount	Damage Description	Recommend-ation
Gym	Blue elbows - 11		Blue			Gym ceiling - Good Condition - PACM		No	No	N/A	N/A	N/A	O & M
Gym AHU (4)	TSI-elbows, Vib Damp	ALL	N/A	60	EA	Unable to locate Vib Damp	5	Yes	Yes	AHU	<1 SF	Deterioriation	Verify Removal
Hallways	Fire Doors	door	N/A	ALL	ALL	Gym fire door across from café had minor damage	5	No	Yes	gym fire door	N/A	N/A	O & M
Janitor's closet by 17	Floor Tile	9x9	Maroon w/blk trim	<100	SF	Removed	5	Yes	No	N/A	N/A	N/A	N/A
Kitchen Dish Washer	Gasket	ALL	N/A	1	EA	Removed	5	No	No	N/A	N/A	N/A	N/A

City of Alexandria - AHERA Inspection

School **Maury** Date 6/29/2007 Inspector(s) Bjarne Smith & Amy Chang

Location	Material	Size	Color	Amount	Unit	Comment	Class	Friable	Damage	Damage Location	Damage Amount	Damage Description	Recommend-ation
Mechanical Area	TSI-elbows, joints	10 in	N/A	153	LF	Unable to Locate	5	No	No	N/A	N/A	N/A	Verify Removal
Mechanical Room	TSI-elbows, joints	4 in	N/A	183	LF	Removed 7/2004	5	No	No	N/A	N/A	N/A	N/A
Mechanical Room below 9	TSI-pipe runs	6 in	Gray	200	LF	Removed 7/2004	5	Yes	No	N/A	N/A	N/A	N/A
Room 19	TSI-elbows, joints	6 in	N/A	1	EA	Hard elbow - Unable to locate	5	No	No	N/A	N/A	N/A	O & M
Room 19	glue dots		Brown			Under 1x1 drop celing		No	No	N/A	N/A	N/A	O & M

City of Alexandria - AHERA Inspection

School **Maury** Date 6/29/2007 Inspector(s) Bjarne Smith & Amy Chang

Location	Material	Size	Color	Amount	Unit	Comment	Class	Friable	Damage	Damage Location	Damage Amount	Damage Description	Recommend-ation
Room 19/Kindergarten (maybe Room 292??)	Plaster on steel support beam	ALL	White/pink	ALL	ALL	Unable to locate	5	No	No	Above 1x1 drop ceiling	N/A	N/A	O & M
Room 20	Floor Tile	9x9	Green/ white	<200	SF	Approx. 128 sq. ft remaining most under tile	5	No	No	N/A	N/A	None	O & M
Room 20	Floor Tile	9x9	Maroon w/blk trim	<200	SF	Removed 7/2004	5	No	No	N/A	N/A	None	N/A
Room 3	Adhesive divot	ALL	Brown	ALL	ALL	Good condition	0	No	No	* Various	Various	Const/Demo	O & M