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Part III

Environmental Protection Agency

40 CFR Part 763

Asbestos-Containing Materials in Schools; Proposed Rule and Model Accreditation Plan; Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 763

[OPTS-62048C; FRL-3190-2A]

Asbestos-Containing Materials in Schools

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: EPA is proposing a rule under section 203 of Title II of the Toxic Substances Control Act (TSCA), 15 U.S.C. 2643, to require all Local Education Agencies (LEAs) to identify asbestos-containing materials (ACM) in their school buildings and take appropriate actions to control release of asbestos fibers. The LEAs would also be required to describe their activities in management plans, which must be made available to all concerned persons and submitted to state governors. The proposed rule would require LEAs to use specially-trained persons to conduct inspections for asbestos, develop the management plans, and design or conduct major actions to control asbestos. Exclusions would be provided for LEAs which have previously conducted inspections and for LEAs subject to any state requirement at least as stringent as the comparable requirement in this proposed rule.

DATE: Comments regarding this proposed rule must be submitted by June 29, 1987.

ADDRESSES: Comments should be submitted to: Document Control Officer (TS-790), Office of Toxic Substances, Environmental Protection Agency, Rm. NE-G004, 401 M Street SW., Washington, DC 20460.

Comments should include the docket control number [OPTS-62048C] and will be available for reviewing and copying from 8 a.m. to 4 p.m., Monday through Friday, excluding legal holidays, in Room NE-G004 at the address given above.

FOR FURTHER INFORMATION CONTACT: Edward A. Klein, Director, TSCA Assistance Office (TS-799), Office of Toxic Substances, Environmental Protection Agency, Rm. E-543, 401 M Street SW., Washington, DC 20460, Telephone: (202-554-1404).

SUPPLEMENTARY INFORMATION:

I. Background

A. Description of the Enabling Legislation

On October 22, 1986, President Reagan signed into law the Asbestos Hazard Emergency Response Act (AHERA) which enacted among other provisions, Title II of the Toxic Substances Control Act (TSCA) 15 U.S.C. sections 2641 through 2654. Section 203 of Title II, 15 U.S.C. 2643, requires EPA to issue proposed rules by April 20, 1987 (180 days after enactment), and final rules by October 17, 1987 (360 days after enactment), regarding: (1) The inspection of all public and private school buildings for ACM; (2) the identification of circumstances requiring response actions; (3) description of the appropriate response actions; (4) the implementation of response actions; (5) the establishment of a reinspection and periodic surveillance program for ACM; (6) the establishment of an operations and maintenance program for friable ACM; (7) the preparation and implementation of asbestos management plans by local educational agencies and the submission of the management plans to State Governors, who may review the plans and approve or disapprove them; and (8) the transportation and disposal of waste ACM from schools. This proposal implements the Title II requirements to issue the section 203 rules (except for transportation and disposal, as discussed further below).

Section 206 of TSCA Title II, 15 U.S.C. 2646, also requires EPA to issue by April 20, 1987, a final model accreditation plan for persons who inspect for asbestos, develop management plans, and design or conduct response actions, which appears elsewhere in this issue of the **Federal Register**. States are required to adopt an accreditation program at least as stringent as the EPA model within 180 days after the beginning of their next legislative session. Accreditation of laboratories which analyze asbestos bulk samples and asbestos air samples is also required by TSCA Title II. The National Bureau of Standards (NBS), U.S. Department of Commerce is required to establish the bulk sampling accreditation program by October 17, 1987, and the air sampling accreditation program by October 12, 1988.

States are required to notify LEAs by October 17, 1987, regarding where to submit management plans. LEAs must submit those plans to their State no later than October 12, 1988. The plans must include the results of school building inspections and a description of all response actions planned, completed, or in progress. After receiving a management plan, States are allowed 90 days to disapprove the plan. If the plan is disapproved, the State must provide a written explanation of the disapproval and the LEA must revise the plan within 30 days to conform with the State's suggested changes. The 30-day period can be extended to 90 days by the State. LEAs are required to begin implementation of their management plans by July 9, 1989, and to complete implementation in a timely fashion.

TSCA Title II requires that the transport and disposal provision be promulgated as a final rule at the same time as other provisions of regulations promulgated under AHERA. However, proposed rules on transport and disposal are not required to be issued at the same time as proposed rules for other provisions required by section 203 of AHERA. Regulations governing disposal of asbestos-containing waste, including school waste already regulated by the National Emission Standard for Hazardous Air Pollutants (NESHAP) (40 CFR Part 61, Subpart M) under the Clean Air Act (42 U.S.C. section 7401, *et seq.*), were promulgated by the Department of Transportation (DOT) on November 21, 1986. For purposes of TSCA Title II EPA believes that the combined current DOT regulations and the NESHAP will be sufficient to ensure the proper loading and unloading of vehicles and to ensure the physical integrity of containers. The NESHAP waste disposal regulations are currently being revised and are expected to be proposed during the summer of 1987.

B. Previous EPA Asbestos Activities

EPA has undertaken a variety of technical assistance and regulatory activities designed to control asbestos-containing materials in buildings and minimize inhalation of asbestos fibers.

1. *Technical assistance program.* Since 1979, EPA staff have assisted schools and other building owners in identifying and controlling ACM in their buildings. Through a cooperative agreement with the American Association of Retired Persons (AARP), EPA has hired architects, engineers, and other professionals to provide on-site assistance to school officials and other building owners. With AARP assistance, many school officials and building owners have effectively and safely dealt with ACM in ways that are appropriate for the particular situation in their building.

In addition, EPA has published state-of-the-art guidance to help identify and control asbestos in buildings. EPA's principal asbestos guidance document, "Guidance for Controlling Asbestos-Containing Materials in Buildings," (Purple Book) was expanded and updated in June 1985, based on recommendations from recognized

national experts. The document provides criteria for building owners to use in deciding which abatement method is most appropriate for each particular situation.

An important EPA goal has been to provide training for people involved in all aspects of the identification and control of asbestos. EPA has established five Asbestos Information and Training Centers to provide information concerning the identification and abatement of asbestos hazards and to train people in proper asbestos abatement techniques. The five centers are located at the Georgia Institute of Technology in Atlanta, the University of Kansas in Kansas City, Tufts University in Medford, Massachusetts, the University of Illinois in Chicago, and the University of California at Berkeley. Courses attended by more than 8,000 building owners and managers, maintenance personnel, school officials, architects, consultants, and abatement contractors have been taught at the centers since December 1984.

Finally, because of the large number of asbestos abatement projects and the short-term nature of many of them, EPA believes that contractors should be State certified and that States should oversee projects to ensure that they are properly performed. EPA has provided models for State certification legislation and start-up funding for the initiation of 38 State oversight programs.

2. *EPA's regulatory program.* In the Federal Register of May 27, 1982 (47 FR 23360), EPA issued a school identification and notification rule (hereinafter called the 1982 Asbestos-in-Schools Rule). This rule required school officials by June 28, 1983, to inspect all school buildings for friable materials, take a minimum of three samples of each type of friable material found, analyze samples using polarized light microscopy (PLM) to determine if asbestos is present, and keep records of the findings.

School district officials who found friable ACM were required to notify employees of the location of the materials, post a notification form in the primary administrative and custodial offices and faculty common rooms, provide maintenance and custodial employees with a guide for reducing asbestos exposure, and notify parent-teacher associations or parents directly of the inspection results.

EPA also issued a rule to protect public employees who perform asbestos abatement work in those States not covered by the current asbestos standard issued by the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor. This rule complements the OSHA asbestos regulations that protect private sector workers from exposure to asbestos in occupational settings. The rule requires specific work practices, personal protective equipment, environmental monitoring, medical exams, and other provisions. The EPA rule also includes a provision not in the OSHA rule, i.e., notification to EPA generally 10 days before an asbestos abatement project is begun when public employees are doing the work. In the Federal Register of June 20, 1986 (51 FR 22612), OSHA published revised regulations regarding occupational asbestos exposure. EPA published in the Federal Register of February 25, 1987 (51 FR 5618), revision of its worker protection rule to make it consistent with the new OSHA regulations.

3. *Recent developments.* EPA issued an Advance Notice of Proposed Rulemaking (ANPR) on August 12, 1986, entitled "Asbestos-Containing Materials in Schools: Inspection, Notification, Management Plans and Technical Assistance." The purpose of this ANPR was to solicit comments on the future direction of EPA's program to reduce risks from asbestos in schools and to solicit information about a variety of technical and policy issues. This proposal is a logical extension of the ANPR, which is incorporated in the record of this proceeding.

EPA had also initiated development of two new guidance documents on asbestos control. One document was being developed to provide more detailed guidance about assessing ACM in buildings and selecting abatement actions. A second document was being developed to provide more detailed guidance about practices and procedures which should be included in an operations and maintenance program. Both documents had been developed with the assistance of panels of national experts who convened in Washington, DC, to discuss technical and operational issues associated with these subjects. The work done in these two guidance documents has been valuable in developing provisions of this proposed rule.

Also, in 1986, EPA, in cooperation with the National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health and Human Services, published "A Guide to Respiratory Protection for the Asbestos Abatement Industry" to provide practical guidance in the selection and use of respiratory protection to persons who work in asbestos abatement. The "Guide" also provides information relevant to other work activities, such as maintenance or repair, where the exposure to asbestos or the potential for exposure exists. The "Guide" was updated in September 1986 to include the text of the OSHA June 1986 revision of its asbestos standard.

C. Use of Negotiated Rulemaking

This proposed rule was developed through the process of regulatory negotiation, an alternative process for developing regulations in which individuals and groups with negotiable interests directly affected by the rulemaking work together with EPA in a cooperative venture to develop a proposed rule by committee agreement. The negotiation group was established as a Federal Advisory Committee and consisted of representatives of national educational organizations, labor unions, asbestos product manufacturers, the environmental community, asbestos abatement contractors, professional associations of architects, consulting engineers, industrial hygienists, States, and EPA.

After an organizational meeting in Washington, DC, on January 23, 1987 (announced in the Federal Register on January 13, 1987, 52 FR 1377), the committee was established with 23 interests represented. Meetings were scheduled on February 5 through 6, February 17 through 18, March 9 through 10, March 26 through 27, and April 1 through 3. During the March 10, 1987 meeting, the plenary session of the committee accepted two more parties on the committee, one taking a seat representing State attorneys general, the other (representing big city schools) sharing a seat with a previously seated member representing big city schools.

The members of the negotiating committee and their interest represented are as follows:

1. Allen Abend, Council of Chief State School Officers.
2. Bill Borwegen, Service Employees International Union/Jordan Barab, American Federation of State, County and Municipal Employees (school service employees).
3. Dr. William Brown, Baltimore City Schools/Michael Young, New York City Law Department (big city schools).
4. Brian Christopher, Committee on Occupational Safety and Health.
5. Donald Elisburg, Laborers' International Union and Laborers-AGC Education and Training Fund.
6. Kellen Flannery, Council for American Private Education.
7. Steve Hays, Asbestos abatement engineer.
8. Jesse Hill, Manufacturers of asbestos pipe and block insulation products.

9. Edward Kealy, National School Boards Association.
10. Lloyd A. Kelley, Jr., Superintendent of Schools, Rutland S.W. Vermont, Supervisory Union (rural schools).
11. William Lewis, Manufacturers of asbestos surfacing products.
12. Lynn MacDonald, Sheet Metal Workers International Association.
13. Claudia Mansfield, American Association of School Administrators.
14. Roger Morse, American Institute of Architects.
15. David Ouimette, Colorado Department of Health (states with developing asbestos programs).
16. Joel Packer, National Education Association.
17. Robert Percival, Environmental Defense Fund.
18. Miriam Rosenberg, National PTA.
19. Paul Schur, Connecticut Department of Health/Dr. Donald Anderson, Illinois Department of Public Health (states with implemented asbestos programs).
20. Robert Sheriff, American Industrial Hygienists Association.
21. David Spinazzolo, Association of Wall and Ceiling Industries (asbestos abatement contractors).
22. Susan Vogt, U.S. E.P.A.
23. John Welch, Safe Buildings Alliance (former manufacturers of asbestos products).
24. Margaret Zaleski, National Association of State Attorneys General.

Facilitation Team and Executive Secretary

Owen Olpin, Consultant to EPA
Eileen B. Hoffman, Federal Mediation & Conciliation Services
Kathy Tyson, U.S. E.P.A. (Executive Secretary)
Leah Haygood, The Conservation Foundation
Dan Dozier, Federal Mediation & Conciliation Services
John Wagner, Federal Mediation & Conciliation Services

The committee met in plenary sessions as well as in four work groups. Each work group focused on a cluster of related issues and reported to the plenary on options and recommendations. The plenary retained all decision-making power of the committee and often gave guidance to work groups. Generally, for each day of a plenary session, work groups convened the day before to prepare reports for the plenary. Neutral facilitators were present at all work group and plenary meetings to assist the negotiations in moving forward.

At the end of the 2-month negotiating process on April 3, 1987, and after extensive efforts, the committee was in general agreement on the vast majority of issues before it for the purposes of the proposal. Agreement to solicit further comment about alternatives was often important in developing provisions to be included as proposals. At the close of the negotiations, some items remained at issue and were not subject to universal agreement. These consisted of the following: definitions and response actions for damaged and significantly damaged thermal system insulation ACM (relates to being deemed non-friable in the inspection section) and damaged and significantly damaged friable surfacing and miscellaneous ACM. Also, the definition of asbestos debris and the nature of cleaning practices (initial and routine) for friable ACBM or damaged or significantly damaged thermal insulation under the operations and maintenance section were still at issue. While extending negotiations beyond April 3, 1987 may well have enabled the committee to resolve these issues, the Congressional April 20, 1987 deadline for issuing a proposed rule precluded this possibility. Although **Federal Register** practices preclude the Agency from highlighting these issues in the text of the proposed rule, the public docket contains a copy of the proposed rule which clearly identifies the sections which contain these unresolved issues.

On April 3, 1987, the facilitators prepared, for members' signatures, statements supporting the use of the agreed-on portions of the regulatory language as a basis for a Notice of Proposed Rulemaking. Members representing 20 of the 24 interests seated on the committee signed these statements. Members representing 4 of the interests seated on the committee did not sign the statements, due to the status of the unresolved issues described above. Mr. Paul Schur, a co-representative of states with an implemented asbestos program (an interest that did not sign), signed in an individual capacity. All committee members, signatories and non-signatories alike, have retained for themselves and for their constituencies all rights which bear on the rulemaking, including the right to comment fully during the public comment period.

Notably, signatories supporting the agreed-on regulatory language as a basis for a Notice of Proposed Rulemaking did so in considering that language as a whole. The agreed-on language is not necessarily ideal from any one party's interests.

II. Provisions of the Proposed Rule

A. Introduction

This unit describes the various provisions of the proposed rule. Following a discussion of applicable regulatory definitions in Unit B and general responsibilities in Unit C, inspections and reinspections, sampling and analysis, and assessment of materials are discussed in Units D, E, and F, respectively. In Unit G, the major elements of the management plan, availability of the plan, and review of the plan by Governors are discussed.

Unit H describes proposed requirements for response actions to be taken by LEAs under circumstances described in that section. Section I explains proposed requirements for air sampling for determining when a response action has been completed.

Unit J discusses requirements to use accredited persons to inspect buildings for asbestos, develop management plans, and design or conduct response actions. Proposed requirements to protect abatement workers, custodial and maintenance staff, and building occupants are explained in Unit K.

Waivers for all or part of a State asbestos program are described in Unit L, including information required in the waiver request and the process for granting or denying such waivers. Proposed requirements for recordkeeping and enforcement provisions are described in Units M and N, respectively.

B. Definitions

The negotiating committee spent much of its time crafting definitions of key concepts for the proposed regulation. Several important definitions are discussed below.

"Asbestos-containing building material (ACBM)" was proposed as a general concept encompassing surfacing ACM, thermal system insulation ACM, and miscellaneous ACM in or on interior parts of the school building. These include specified exterior portions of school buildings that, for the purposes of this rule, may fairly be considered interior parts. EPA focused upon interior building materials because, in the Agency's experience, such materials represent a very large percentage of ACM in schools and appear to pose the greatest hazards to occupants. There was considerable discussion regarding other exterior asbestos materials and nonbuilding ACM inside schools, such as asbestos gloves or vehicle brake linings in garages or automotive shops, but these were not included in the definition.

The definition of "school building," in the proposed rule however, makes it clear that exterior hallways connecting buildings, porticos, and mechanical system insulation are considered to be in a building and are subject to jurisdiction under TSCA Title II. The committee believed that these exterior areas, by virtue of the accessibility of the ACM found there, warranted inclusion under the standard. Often, these exterior areas are connected to interior areas and could be considered to be a single homogeneous area in terms of a removal project design.

"Asbestos debris" is defined as pieces of ACBM that can be identified by color, texture, or fiber content as originating from adjacent ACBM. Previous Agency guidance has suggested that dust be assumed as ACM, and treated accordingly. Some committee members claimed, particularly in schools where chalk is commonly used, that dust is often not asbestos-containing and therefore areas of unidentified dust should not necessarily be subject to special cleaning practices.

"Damaged or significantly damaged thermal system insulation ACM" is defined as ACM on pipes, boilers, and other similar components and equipment where the insulation has lost its structural integrity or its covering is not intact such that it is not able to contain fibers. An accredited inspector shall classify this material based upon a determination of damage or significant damage and an accredited management planner shall recommend in writing appropriate response action.

Such damage or deterioration may be illustrated by ACM hanging from pipes; crushed, water-damaged or otherwise injured ACM; sections of ripped, torn or missing protective coverings/ jackets. It may further be 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. The definition allows that even though the insulation is marred, scratched or otherwise marked, it may not be, in the judgment of the accredited expert, damaged so as to release fibers.

EPA is interested in comments as to whether or not, in the absence of physical deterioration, the physical presence of detectable amounts of asbestos fibers of ACM powder, dust or debris from the ACM in the area is sufficient to establish such deterioration or damage.

"Damaged friable surfacing ACM" is defined as ACM which has deteriorated or sustained physical injury such that the cohesion of the material or its adhesion to the substrate is inadequate, or which, for any other reason, lacks fiber cohesion or adhesion qualities. Accredited experts will classify material based upon a determination of damage and recommend appropriate response actions.

Such damage or deterioration may be illustrated by delamination (such as the separation of ACM into layers); adhesive failure (separating 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. The definition allows that such surfacing material may show signs of water damage or physical injury without, in the judgment of the accredited expert, always demonstrating a lack of fiber cohesion or adhesion.

As with thermal system insulation, EPA is interested in comments as to whether or not, in the absence of physical deterioration of asbestos fibers or ACM powder, dust or debris from the ACM in the area is sufficient to establish such deterioration or damage.

"Miscellaneous ACM" includes a wide variety of materials in buildings, such as vinyl flooring, fire-resistant gaskets and seals, and asbestos cement. Presently, damage to these materials is defined by the same cohesion and adhesion (if appropriate) properties as surfacing materials. The Agency believes this definition is sufficiently general to provide a reasonable approach to assessing damage to so wide a range of materials, although it is interested in receiving comments on this topic. Other committee members expressed interest in soliciting public comment on whether miscellaneous ACM should include non-building ACM, such as asbestos gloves or brake linings.

"Significantly damaged friable surfacing ACM" is defined as material in a functional space where the damage is extensive and severe. (The definition of significantly damaged friable miscellaneous ACM closely parallels the definition for significantly damaged surfacing ACM.) Again, this determination of significant damage will be made by accredited experts.

The definition is a function of two major factors. The first factor deals with extent, or scope, of damage across a functional space. The Agency, in draft guidance, suggested that damage evenly distributed across one-tenth of a functional space or localized over one-quarter represented significant damage (See Seventh Draft Report, "Guidance for Assessing and Managing Exposure to Asbestos in Buildings," November 7, 1986, p. 9). This represents a level of damage which a panel of experts, convened by the Agency, believed was generally, although perhaps not always, unreasonable to repair or restore.

The second factor involves the degree or severity of the damage itself. A major delamination of asbestos material, for instance, constitutes damage which is more severe than slight marks or mars. ACM, in the accredited expert's judgment, may be so severely damaged that there is no feasible means of restoring it to an undamaged condition.

Material has potential for significant damage as opposed to only potential for damage if it is accessible (i.e., subject to disturbance by school building occupants or workers in the course of the normal activities). Material within reach of students above an entrance is clearly accessible. Thermal system insulation running along the base of a wall in a boiler room is also accessible. Material on the ceiling of a school auditorium, beyond the reach of students, is not. ACM on a high school gymnasium ceiling, which might be reached with basketballs or other objects, is subject to either classification, although an LEA might be well advised in this instance to implement a preventive measure to avoid disturbance.

The negotiating committee and EPA contemplated a wide range of "preventive measures." One example is the installation of a stop to prevent a door from striking (and damaging) thermal system insulation ACM behind it. Another might involve restricting access of a corridor with surfacing ACM on a low ceiling, where students continually marred and vandalized the material. The problem of high school students hitting the gym ceiling with basketballs may be eliminated by a policy prohibiting such activities, if it can be effectively implemented. LEAs, in consultation with maintenance staff and, if desired, accredited experts, will identify a variety of creative and effective means of eliminating potential damage or significant damage to ACM.

If, however, such preventive measures cannot be effectively implemented, other response actions, including removal, will be required. The Act is clear that EPA, as part of its rulemaking, direct LEAs to mitigate those circumstances which involve potential for significant damage.

The "enclosure" definition requiring an airtight, impermeable, permanent barrier around ACBM to control the release of asbestos fibers into the air does not contemplate a vacuum-sealed area which is impossible to access. Instead, this definition, used in the National Institute of Building Sciences'

(NIBS') "Model Guide Specifications, Asbestos Abatement in Buildings," July 18, 1986, is associated with precise engineering specifications, found in Section 09251 and elsewhere in the NIBS' Model Guide, to construct enclosures sufficiently to control fibers. Also, this term, from the standpoint of permanence, is not intended to apply to mini-enclosures described in the EPA worker protection rule or Appendix B of the proposed regulation, as these enclosures are used temporarily for repair or abatement activities.

"Functional space" is a term of art used by the accredited expert to appropriately characterize an area as containing "significantly damaged friable surfacing ACM" or "significantly damaged friable miscellaneous ACM." The "functional space" may be a room, group of rooms, or a homogeneous area, as determined appropriate by the accredited expert. Note that the functional space includes the area above a dropped ceiling.

C. LEA General Responsibilities

The proposed rule requires LEAs to designate a person to carry out certain duties and ensure that such person receives training adequate to perform the duties.

Proposed § 763.83 requires LEAs to ensure that: (1) Inspections, reinspections, periodic surveillance and response action activities are carried out in accordance with the proposed rule; (2) custodial and maintenance employees are properly trained as required by this proposed rule; (3) workers and building occupants are informed annually about inspections, response actions, and post-response action activities including reinspections and periodic surveillance; (4) short-term workers (e.g., telephone repair workers) who may come in contact with asbestos in a school are provided information about locations of asbestos-containing building material (ACBM) and are instructed in safe work practices; (5) warning labels are posted as required by this proposed rule; and (6) management plans are available for review and that parent, teacher, and employee organizations are notified of the availability of the plan.

D. Inspections and Reinspections

1. Inspections.

Proposed § 763.85 would require LEAs to have an accredited inspector visually inspect all areas of each school building to identify locations of all friable and nonfriable suspected ACBM, determine friability by touching, and either sample the suspected ACBM or assume that suspected materials contain asbestos. The inspector must then develop an inventory of areas where samples are taken or material is assumed to contain asbestos. Finally, the accredited inspector is required to assess the physical condition of friable known or assumed ACBM as required under proposed § 763.88.

2. Exclusions.

Proposed § 763.99 defines conditions that would exclude an LEA from all or part of the initial inspection. The accredited inspector is a key element in the exclusion process. For all inspection exclusions, areas previously identified as having friable ACM or non-friable ACM that has become friable would have to be assessed as required under proposed § 763.88. All information regarding inspection exclusions shall be placed in the management plan.

Five types of exclusions for LEAs are discussed in the proposed rule. First, LEAs do not need to have an initial inspection conducted in specific areas of a school where ACBM has already been identified. Second, if previous sampling of a specific area of the school indicated that no ACM was present, and the sampling was done in substantial compliance with the proposed rule, the LEA does not have to perform an initial inspection of that area. Third, LEAs do not have to inspect specific areas of schools where records indicate that all ACM was removed. Fourth, LEAs can receive an inspection exclusion for schools built after October 12, 1988 (the date when management plans are to be submitted to Governors), if no ACBM was specified for use in the school. Fifth, States that receive a waiver from the inspection requirements of the rule can grant exclusions to schools that had performed inspections in substantial compliance with the rule.

3. Reinspections.

Proposed § 763.85(b) would require LEAs to have accredited inspectors conduct reinspections at least once every 3 years. The inspector must reinspect all known or assumed ACBM and shall determine by touching whether non-friable material has become friable since the last inspection. The inspector may sample any newly friable materials or continue to assume the material to be ACM. The inspector shall record changes in the material's conditions, sample locations, and the inspection date for inclusion in the management plan. In addition, the inspector must assess newly friable known or assumed ACBM, re-assess the condition of friable known or assumed ACBM, and include assessment and reassessment information in the management plan.

Proposed § 763.85(c) states that thermal system insulation that has retained its structural integrity and that has an undamaged protective jacket or wrap is deemed non-friable.

E. Sampling and Analysis

1. Sampling.

Proposed § 763.86 would permit an LEA to assume that suspected ACBM is ACM. If the LEA does not assume suspected ACBM to be ACM, the LEA shall use an accredited inspector to collect bulk samples for analysis.

EPA expects that a school is likely to sample only friable suspected ACBM. For non-friable suspected ACBM, EPA anticipates most schools will assume this material contains asbestos. However, this proposed rule does not preclude a school from sampling all of its suspected ACBM, both friable and nonfriable. Sampling of friable surfacing materials should follow the guidance provided in the EPA publication "Simplified Sampling Scheme for Friable Surfacing Materials" (EPA 560/5-85-030a). To determine whether an area of surfacing material contains asbestos, sufficient samples shall be taken in a statistically random manner to provide data representative of each homogeneous area being sampled.

In most cases, sampling of thermal system insulation would require an accredited inspector to take at least three randomly distributed samples per homogeneous area. The proposed rule includes three exceptions to this proposed requirement for sampling of thermal system insulation. First, an accredited inspector can determine through visual inspection that the material is non-ACM (e.g., fiberglass). Second, only one sample is required for patched homogeneous areas of thermal system insulation. Third, an accredited inspector needs to collect an appropriate number of samples to determine whether cement tees are ACM.

For friable miscellaneous material or non-friable suspected ACBM, an accredited inspector must collect bulk samples in an appropriate manner.

2. Analysis.

Proposed § 763.87 requires analysis of bulk samples by laboratories accredited by NBS. In the period before NBS has developed its accreditation program, laboratories which have received interim accreditation from EPA may be used to analyze samples. After receiving the sample results, the LEA must consider an area to contain asbestos if

asbestos is present in any sample in a concentration greater than 1 percent. Compositing of samples (mixing several samples together) is prohibited.

The 1982 EPA rule "Asbestos in Schools: Identification and Notification", 40 CFR 763, Subpart F, required analysis of bulk asbestos samples by PLM and provided a protocol for analysis in its Appendix A. EPA proposes to require use of the same PLM method for this proposed rule. As it develops the accreditation process for laboratories performing analysis of bulk samples, NBS will consider whether to change the PLM protocol. If NBS recommends changes, EPA will amend this rule accordingly.

F. Assessment

Proposed § 763.88 outlines a general assessment procedure to be conducted by an accredited inspector during each inspection or reinspection. The inspector is required to classify ACBM and suspected ACBM assumed to be ACM in the school building into broad categories appropriate for response actions. Assessment may include a variety of considerations, including the location and amount of material, its condition, accessibility, potential for disturbance, known or suspected causes of damage, or preventive measures which might eliminate the reasonable likelihood of damage. The LEA is directed to select an accredited management plan developer who, after a review of the results of the inspection and the assessment, shall recommend in writing appropriate response actions.

G. Management Plans

Proposed § 763.93 requires LEAs to develop an asbestos management plan for each school under its administrative control or direction. The plan must be developed by an accredited asbestos management planner. Some of the major components required in the plan include: A description of inspections and response actions; an assurance that accredited persons were used to conduct inspections, develop management plans, and design or conduct response actions; and a plan for reinspection and operations and maintenance.

Each LEA is required to maintain a copy of the management plan in its administrative office, and each school is required to maintain a copy of its management plan in its administrative office. These plans are to be made available for inspection by the public without cost or restriction. LEAs must notify parent, teacher, and employee organizations of the availability of management plans upon submission of the plan to the State and at least once each school year.

Proposed § 763.93 would require local LEAs to submit their management plans to their States on or before October 12, 1988. Each LEA must begin implementation of its management plan on or before July 9, 1989, and complete implementation of the plan in a timely fashion.

H. Response Actions

The proposed rule identifies five major response actions—operations and maintenance (O&M) in proposed § 763.91 and in proposed § 763.90, repair, encapsulation, enclosure and removal—and describes appropriate conditions under which they may be selected by the LEA. The proposed rule also identifies the steps which shall be taken to properly conduct and complete the response actions.

The LEA is required to select and implement in a timely manner the appropriate response action. Local education agencies are required to use accredited persons to design or conduct response actions. Proposed § 763.90 specifically provides that nothing in the proposed rule shall be construed to prohibit the removal of ACBM from a school building at any time, should removal be the preferred response action of the local education agency.

Different response actions are required for each of the five major categories of damaged or potentially damaged ACBM. These categories are:

1. Damaged or significantly damaged thermal system insulation ACM.
2. Damaged friable surfacing or miscellaneous ACM.
3. Significantly damaged friable surfacing or miscellaneous ACM.
4. Friable surfacing or miscellaneous ACM, and thermal system insulation ACM which has potential for significant damage; and
5. Friable surfacing or miscellaneous ACM, thermal system insulation ACM which has potential for damage.

In each of the categories above, procedures for appropriately controlling or abating the hazards posed by the ACBM are set forth. (1) For damaged or significantly damaged thermal system insulation, the LEA must at least repair the damaged area. If it is not feasible, due to either technological factors or economic considerations, to repair the damaged material, it must be removed. Further, the LEA must maintain all thermal system insulation in an intact state and undamaged condition. (2) If damaged friable surfacing or miscellaneous ACM is present, the LEA shall encapsulate, enclose, remove, or repair the damaged area. In selecting the appropriate response action, the LEA may consider local circumstances, including occupancy and use patterns within the school building, and economic concerns, such as short- and long-term costs. (3) When friable surfacing or miscellaneous ACBM is significantly damaged, the LEA must immediately isolate the functional space and then must remove the material in the functional space, unless enclosure or encapsulation would be sufficient to contain fibers.

For 4 and 5 above, response actions for ACBM with potential for damage and potential for significant damage emphasize O&M and preventive measures to eliminate the reasonable likelihood that damage will occur. (4) When potential damage is possible, the LEA must at least implement an O&M program. (5) If there is potential for significant damage and preventive measures cannot be effectively implemented, response actions other than O&M or area isolation may be required.

Proposed § 763.91 would require the LEA to implement an operations, maintenance and repair (O&M) program for any school building in which friable ACBM is present or assumed to be present in the building or about to become friable. The O&M program, which must be documented in the LEA management plan, consists of worker protection (summarized in Unit II.K. below), worker training, periodic surveillance, cleaning, operations and maintenance activities (also in Unit II.K.), and fiber release episodes.

The LEA shall ensure that all members of its maintenance and custodial staff receive at least 2 hours of awareness training. The LEA must also ensure that staff who conduct any activities which will disturb ACBM receive an additional 14 hours of training. Specific topics to be covered in the 2-hour and 14-hour training courses are listed.

An initial cleaning is required, which employs wet methods and is conducted at least once after completion of the inspection and before the initiation of a response action other than an O&M activity.

Proposed § 763.91(d) would require periodic surveillance to be performed at least once every 6 months. The LEA may use unaccredited personnel such as custodians or maintenance workers to conduct surveillance activities. Periodic surveillance requires checking known or assumed ACBM to determine if the ACBM's physical condition has changed since the last inspection or surveillance. The date of the surveillance and any

changes in the condition of the ACBM must be added to the management plan.

The proposed rule requires that O&M activities, other than small-scale, short-duration activities, which disturb asbestos shall be designed and conducted by persons accredited to do such work. (A discussion of what constitutes small-scale, short-duration projects is given Appendix B to this rule.) Finally, procedures are provided for responding to fiber release episodes—the uncontrolled or unintentional disturbance of ACBM. For minor episodes (i.e., those involving 3 square or linear feet or less of ACBM), basic cleaning and containment practices for O&M staff are listed. For larger amounts, accredited personnel are required to respond.

I. Completion of Response Actions

After performing a thorough visual inspection, air testing is used to determine if a response action has been completed. Clearance air monitoring will not be required for small-scale, short-duration projects. Phase Contrast Microscopy (PCM) is allowed for response actions involving 260 linear or 160 square feet or less, the amounts used to trigger removal requirements under EPA's NESHAP (40 CFR Part 61, Subpart M).

The proposed rule requires the use of transmission electron microscopy (TEM) for most removal, enclosure, and encapsulation response actions. EPA continues to believe that TEM is the method of choice for air sample analysis because, unlike PCM, TEM analysis can distinguish asbestos from other fibers and detect the small thin fibers found at abatement sites. Therefore the use of TEM will significantly improve the adequacy of cleanup and is recommended over PCM when available. However, due to limited availability of microscopes for air sample analysis and the cost and time associated with TEM analysis, the proposed rule allows a phase-in period for the TEM requirement. For 2 years after the rule becomes effective, local education agencies may choose to use PCM for response actions comprising 3,000 square or 1,000 linear feet or less. For 1 year after this, LEAs may use PCM for clearance of projects of 1,500 square or 500 linear feet or less. LEAs retain full discretion to require use of TEM at any time for any project.

The criterion for determining whether a response action is complete when using PCM will require multiple samples (minimum of five) with clearance allowed only if all of the individual samples are below the limit of quantitation of the PCM method (0.01 fibers/cm^3). The proposed rule would require persons to use the EPA/OSHA Reference Method found in Appendix A to 40 CFR 763.121 for PCM clearance. This method is identical to the OSHA Reference Method found at Appendix A to 1929 CFR 1926.58 and very similar to the NIOSH 7400 method. (OSHA's rationale for adopting the method is found at 51 FR 22684–22692, June 20, 1986. EPA adopts OSHA's reasoning.)

The proposed rule has a three-step process for using TEM to determine successful completion of a removal response action. The first step is a careful visual inspection, as mentioned above. The two steps that follow involve a sequential evaluation of the five samples taken inside the worksite and five samples taken outside the worksite. Both sets of samples must be taken at the same time to ensure that atmospheric conditions are the same and that the comparisons are valid. The inside samples are analyzed first. If the average concentration of the inside samples does not exceed the limit of quantitation for the TEM method (discussed in detail in Appendix A of this proposed rule), then the removal is considered complete.

Step three is taken if the average concentration of the samples taken inside the worksite are greater than the TEM limit of quantitation. In this case, an encapsulation, enclosure, or removal response action is considered complete when the average of five samples taken inside the worksite is not significantly larger than the average of five samples taken outside the worksite. A statistical comparison using the Z-Test must be used to determine whether the two averages are significantly different. (A discussion on how to compare measured levels of airborne asbestos with the Z-Test is given in Appendix A of this proposed rule.) If the concentrations are not significantly different, then the response action is considered complete. If the inside average concentration is significantly higher, recleaning is required and new air samples must be collected and evaluated after the worksite has been cleaned and reinspected.

J. Use of Accredited Persons

Section 206 of Title II of TSCA requires accreditation of persons who:

1. Inspect for ACM in school buildings.
2. Prepare management plans for such schools.
3. Design or conduct response actions with respect to friable ACM in such schools (other than O&M activities).

The Model Plan requires persons seeking accreditation to take an initial course, pass an examination, and participate in continuing education. Persons can receive accreditation from a State that has instituted an accreditation program at least as stringent as the requirements of the Model Plan. In addition, persons in States that have not yet developed programs at least as stringent as the Model Plan can receive accreditation by passing an EPA-approved training course and exam that are consistent with the Model Plan.

Section 206 of Title II of TSCA requires EPA to develop a Model Contractor Accreditation Plan by April 20, 1987. The plan appears as Appendix C to Subpart E. A notice issuing the plan appears elsewhere in this edition of the **Federal Register.**

K. Worker and Occupant Protection

Worker protection requirements for removal, encapsulation and/or enclosure response actions are already in effect under the EPA worker protection rule (40 CFR 763.121, *et seq.*); and the OSHA construction standard (29 CFR Subpart G). EPA's NESHAP standard, although designed to protect outdoor air, also provides incidental protection to workers.

Essentially, under proposed § 763.91, the regulation extends coverage of EPA's worker protection rule at 40 CFR 763.121 to maintenance and custodial personnel in schools who perform O&M activities but are not covered by OSHA's construction standard or an asbestos regulation under an OSHA approved state plan. The EPA worker protection rule itself extended the same protections as this OSHA construction standard to asbestos abatement workers who are employees of state and local governments and who are not otherwise covered by OSHA regulation or OSHA approved state plans. This proposed rule further extends these standards to O&M workers who are LEA employees. These regulations basically establish a Permissible Exposure Limit (PEL) of 0.2 fibers per cubic centimeter (f/cm^3) over an 8-hour period for abatement project workers exposed to airborne asbestos and an action level of 0.1 f/cm^3 which triggers a variety of worker protection practices. These practices include air monitoring, regulated work areas, engineering and work practice controls, respiratory protection and protective clothing, hygiene facilities and practices, worker training, medical surveillance, and recordkeeping requirements.

As an alternative, however, OSHA's standard allows employers to institute the provisions of its Appendix G in the case of small-scale, short-duration projects rather than comply with the full

worker protection standard. Appendix B to this proposed rule is an adaptation of OSHA's Appendix G and, thus, allows more flexibility in dealing with minor (small-scale, short-duration) projects.

None of the requirements of the OSHA standard or the EPA worker protection rule would apply if asbestos concentrations are below the action level (0.1 f/cm³). There are, however, fairly stringent requirements established by OSHA and proposed to be adopted by EPA for purposes of this rule to show that levels are below this action level for any activity, including small-scale, short-duration projects. These requirements are discussed in the following paragraphs.

Employers who have a workplace or work operation covered by the EPA worker protection rule must perform initial monitoring to determine the airborne concentrations of asbestos to which employees may be exposed. If employers can demonstrate that employee exposures are below the action level (0.1 f/cm³) by means of objective data, then initial monitoring is not required. If initial monitoring indicates that employee exposures are below the PEL, then periodic monitoring is not required.

The exemption from monitoring in paragraph (f)(2)(iii) of the worker protection rule for employers who have historical monitoring data is included in recognition of the fact that many employers have conducted or are currently conducting exposure monitoring. This exemption would prevent these employers from having to repeat monitoring activity for O&M activities that are substantially similar to previous jobs for which monitoring was conducted.

However, for purposes of this rule, EPA proposes that such monitoring data must have been obtained from projects conducted by the employer that meet the following conditions:

1. The data upon which judgments are based are scientifically sound and collected using methods that are sufficiently accurate and precise.

2. The processes and work practices in use when the historical data were obtained are essentially the same as those to be used during the job for which initial monitoring will not be performed.

3. The characteristics of the asbestos-containing material being handled when the historical data were obtained are the same as those on the job for which initial monitoring will not be performed.

4. Environmental conditions prevailing when the historical data were obtained are the same as for the job for which initial monitoring will not be performed.

When OSHA issued the final asbestos standard on June 20, 1986 (51 FR 22664), it published data from routine facility maintenance which "demonstrates a potential for exposure of maintenance personnel to concentrations exceeding 0.5 f/cm³ (fibers per cubic centimeter)." OSHA further stated:

> With the exception of wet handling, which is feasible in only very limited situations due to problems such as electrical wiring, and the use of HEPA vacuums for the clean-up of any debris generated during maintenance activities, OSHA believes that there do not appear to be any feasible engineering controls or work practices available to reduce these potential exposures to levels below the 0.2 f/cm³ PEL and that respirators will be required to comply with the 0.2 f/cm³ PEL.

LEAs are required, under the provisions of § 763.91 of this proposal, to ascertain, through monitoring procedures or historic monitoring data, and to document that these levels have not been reached.

Under proposed § 763.91, basic occupant protection requirements are established (regardless of air level) for any O&M activity in a school building which disturbs ACBM. Primarily, access must be restricted, signs posted, and air movement outside the area modified. Necessary work practices shall be implemented to contain fibers, the area shall be properly cleaned after the activity is completed, and asbestos debris must be disposed of in a proper manner.

Proposed § 763.95 requires the LEA to attach warning labels immediately adjacent to any friable and non-friable ACBM or suspected ACBM in routine maintenance areas, such as boiler rooms, until the material is removed. They shall read, in large size or bright colors, as follows: CAUTION: ASBESTOS. HAZARDOUS. DO NOT DISTURB WITHOUT PROPER TRAINING AND EQUIPMENT.

L. Waiver for State Programs

Proposed § 763.98 provides a procedure to implement the statutory provision that a State can receive a waiver from some or all of the requirements of the proposed rule if the State has established and is implementing or intends to implement a program of asbestos inspection and management at least as stringent as the requirements of the proposed rule. The proposed rule requests specific information to be included in the waiver request submitted to EPA, establishes a process for reviewing waiver requests, and sets forth procedures for oversight and rescission of waivers granted to States.

Within 30 days of receiving a waiver request, EPA must determine whether the request is complete. Within 30 days after determining that a request is complete, EPA will issue in the **Federal Register** a notice that announces receipt of the request and solicit written comments from the public. Comments must be submitted within 60 days. If, during the comment period, EPA receives a written objection to the State's request or a written request for a public hearing, EPA will schedule a public hearing (as is required by TSCA Title II) to be held in the affected State after the close of the comment period. EPA will issue a notice in the **Federal Register** announcing its decision to grant or deny, in whole or in part, a request for waiver within 30 days after the close of the comment period or within 30 days following a public hearing.

M. Recordkeeping

Proposed § 763.94 requires that LEAs collect and retain various records which are not part of the information submitted to the Governor in the management plan. Records required by the proposed rule include those pertaining to certain events which occur after the submission of the management plan, including: Response actions and preventive measures; fiber release episodes; periodic surveillance; and various operations and maintenance activities.

N. Enforcement

The proposed rule includes civil penalities of up to $5,000 per day for violations of Title II of TSCA when an LEA fails to conduct inspections in a manner consistent with this proposed rule, knowingly submits false information to the Governor, or fails to develop a management plan in a manner consistent with this proposed rule. The proposed rule also includes civil penalties of up to $25,000 per day for violations of Title I of TSCA when a person fails or refuses to establish or maintain records, or fails or refuses to permit entry or inspection. Criminal penalties may be assessed if any violation committed by any person (including an LEA) is knowing or willful.

The proposed rule provides a process for filing complaints by citizens and requires that such complaints be investigated and responded to within a reasonable period of time consistent with the nature of the violation alleged.

III. Options Considered

A. Introduction

This unit discusses approaches and options considered by the committee or

its work groups and solicits comments. This unit identifies issues which were controversial, unresolved, or in need of further public comment. Issues for which comment is especially encouraged are so noted.

B. Local Education Agencies' General Responsibilities

Members of the negotiating committee discussed the possibility of requiring LEAs to appoint an Asbestos Program Manager to carry out the functions specified in proposed § 763.83. The appointment of an Asbestos Program Manager is recommended in "Guidance for Controlling Asbestos-Containing Materials in Buildings," EPA's principal asbestos guidance document. A requirement for a specific amount of training for the Asbestos Program Manager was also discussed by the negotiating committee.

Appointment of a trained Asbestos Program Manager is not required by Title II of TSCA. The committee generally agreed to require that LEAs designate a person to oversee or coordinate asbestos-related activities and serve as a contact person about those activities. They also agreed to require "adequate" training be given to perform these duties. There is no designation of such persons as an "Asbestos Program Manager" nor any specification of the amount of training.

EPA invites comment on the issue of the duties of the person designated by LEAs and whether a more specific training requirement is appropriate. A number of committee members wanted comments on how LEAs would notify parents about actions taken under the management plan.

C. Inspections, Reinspections, and Exclusions

The negotiating committee discussed a number of major options regarding inspections, reinspections, and exclusions. The primary issue involved the scope of the inspection. Some members of the committee believed that only interior areas ACBM should be inspected. Other committee members emphasized the need to inspect both the interior and the exterior of school buildings. The proposed rule would require LEAs to inspect interior ACBM and limited exterior locations such as porticos, exterior covered hallways and walkways and the exterior portion of a mechanical system used to condition interior space.

EPA believes that the jurisdiction of TSCA Title II may be limited to asbestos materials "in" school buildings, apart from the specified exterior areas previously identified. EPA is interested in receiving comments on the issue of whether exterior materials should be included in the definition of "school building" and thereby included in the inspection requirement.

The second major issue discussed by the committee was the idea of a national standard inspection form. Many members believed that a required form would standardize the information collected and reported by inspectors, while other members argued that a form might unduly limit the types and amount of information reported by the inspector. The inspection form is not required in the proposed rule. However, the issue was raised whether the final rule should recommend a particular form. In conjunction with the final rule, EPA plans to distribute a nonmandatory example form that States may use to standardize the inspection process. EPA requests comment on whether a form should be required.

The regulatory negotiation committee also focused on which types of school buildings could be covered under the rule. Specifically, many panel members believe student dormitories should be covered by the rule. However, Congress did not specifically include these facilities in the statutory language of Title II. The proposed rule would require dormitories to be inspected. Because Title II defines a school building as a "facility used for the administration of educational or research programs," EPA believes that it is a reasonable interpretation of TSCA Title II to include dormitories, but that expanding beyond dormitories would be an unreasonable extension of this statutory jurisdiction.

Another issue discussed by the regulatory negotiation committee was the criteria for exempting schools from the inspection requirements of this rule if previous inspections had been conducted. Committee members expressed concern that the vast majority of previous inspections could not meet all of the inspection requirements of the proposed rule. Most inspections may not have included non-friable ACM and EPA's 1982 Asbestos-in-Schools rule did not require inspection of non-friable ACBM. The negotiating committee established a mechanism to grant exclusions from the requirement of this proposed rule for previous inspections for friable materials if conducted in substantial compliance with this proposed rule.

Proposed section § 763.85(c) deems as non-friable thermal system insulation ACM that has retained its structural integrity and that has an undamaged protective jacket or wrap which prevents fiber release. EPA stated its intention before the committee to include this provision in the proposed rule. The committee, however, did not agree to this language. EPA has traditionally treated undamaged thermal system insulation ACM as non-friable for the purposes of a variety of O&M activities, including routine cleaning. Typically, such ACBM is a less significant source of airborne asbestos fibers than surfacing ACM.

The Agency recognizes that thermal system insulation ACM, even if structurally sound and completely covered, may still be friable by nature under its covering. However, given structural integrity and an undamaged protective wrap, the covering effectively acts as an enclosure to prevent fiber release. Undamaged thermal system insulation ACM is still subject to periodic surveillance and protective measures, if accessible, to ensure that it remains in an undamaged state. Further, the response action for this material requires at least repair whenever damage is detected. The Agency is interested in comments on this approach.

D. Sampling and Analysis

1. Sampling

The regulatory negotiation committee focused on three key issues regarding sampling. First, the committee believed LEAs should have the option to assume suspected ACBM are ACM rather than requiring sampling of all suspected ACBM. As a result, the proposed rule provides LEAs with the option of taking samples or assuming material is ACM. Second, the committee discussed sampling of friable materials to a much greater extent than sampling of non-friable materials. EPA anticipates that most schools will choose to sample friable materials and to assume non-friable suspected ACBM is ACM. Third, the committee provided flexibility in the sampling requirements for thermal system insulation and friable miscellaneous materials. EPA believes this will help reduce sampling costs by reducing the number of samples that need to be taken.

2. Analysis

A portion of the discussion on bulk sampling requirements consisted of questions about methods which will be used for bulk sample analysis in the interim period before the National Bureau of Standards (NBS) begins to operate its accreditation programs for labs that perform these analyses. Laboratories which perform bulk analysis in the interim period must use the "Interim Methods for the

Determination of Asbestos in Bulk Insulation Samples." This protocol was published in the 1982 Asbestos in Schools Rule (40 CFR Part 763, Subpart F) and was modified in 47 FR 38535, September 1, 1982. Laboratories performing TEM analysis must use Appendix A of Subpart F, and laboratories performing PCM analysis must use the EPA/OSHA Reference Method found in Appendix A of 40 CFR 763.121, the Asbestos Abatement Projects; Worker Protection rule.

Comments are requested on the following: Whether TEM should be added as an optional additional method for bulk analysis; whether a quality assurance sample should be required or suggested to allow for false positives in bulk sample analysis; and for PCM air analysis, should either the P & CAM 239 Method or NIOSH 7400 Method or both be allowed in addition to the EPA/OSHA Reference Method?

E. Assessment

The negotiating committee generally agreed that assessment, as provided in the proposed regulation, should be flexible enough to accommodate a wide variety of acceptable and available methods and schemes. Prior to passage of the TSCA Title II, the Agency began the development of a new guidance document on assessment which included a decision tree for selecting and ordering abatement activities. The decision tree was included in an initial draft regulation, but was dropped due to committee sentiment that it was inappropriate for the Agency to require a single assessment method. Assessment was perceived as the means of collecting and considering whatever data was necessary for the management planner to make an informed, responsible recommendation to the LEA consistent with response action requirements.

F. Management Plans

Section 203 of AHERA includes specific provisions regarding information to be included by LEAs in their management plans, and section 205 of AHERA provides a specific process for State review of management plans.

The language of the statute provided a detailed framework for the proposed rule. However, members of the negotiating committee added management plan provisions to the proposed rule to require that specific items of information be included in the plan for subjects not mentioned in the statute, ensure that the plan be available to interested parties at the administrative office of the LEA and the administrative office of the school, and enhance the use of the management plan as an enforcement tool.

EPA invites comment on the information required in the management plan under this proposed rule and is interested in whether other information is necessary.

Another issue discussed by the committee was the potential for conflicts of interest in the relationship among the management plan developer, inspector, the persons who design or conduct response actions and analytical laboratories. Certain members were concerned about the incentive to drive up LEA costs if the inspector, plan developer and abatement contractor had any financial relationship or all worked for the same firm. Other members felt that in areas of the nation where the supply of accredited persons might be limited, use of a single firm might be necessary. The committee chose not to address this in the proposed rule, but thought further public comment would be helpful.

G. Response Actions

The negotiating committee spent a great deal of time composing definitions of the various hazardous conditions established by TSCA Title II and considering ways to ensure appropriate response actions. EPA is directed by TSCA Title II to describe response actions "using the least burdensome methods which protect human health and the environment." This concept of "least burdensome methods. . . ." guided much of the committee's deliberations and is basic to understanding the proposed regulation's description of response actions. Although agreement was not reached on all points, EPA believes the proposed regulation as a whole will protect human health and the environment.

The proposed regulation is intended, whenever possible, to highlight factors which the LEA must consider to determine the proper asbestos control strategies, including timing, for appropriately and responsibly addressing asbestos hazards in schools, given local circumstances. EPA intends to produce guidance to further elaborate on factors which may be considered in selecting appropriate response actions.

A formal response action structure was not generally endorsed by the negotiating committee. Instead, the committee generally preferred to allow the LEA discretion within a range of acceptable response action alternatives, given the condition of the material, local circumstances, technological feasibility of response actions, economic considerations, and other relevant factors. Reliance is placed upon accredited experts to ensure that the LEA inspects properly for ACM in its buildings, develops and implements responsible management plans, and designs and conducts all abatement activity in an appropriate manner. No preference is suggested for any particular response action and LEAs may at any time decide to remove ACM if that is deemed appropriate.

The Agency's general position on asbestos in schools is that eventually it must be removed. That removal may occur immediately or may only be appropriate at a later time, such as when the asbestos becomes seriously damaged. Under the NESHAP, for actions such as major building renovation, it is required that if friable ACM is removed it must be done using specified work techniques. The demolition requirement of NESHAP requires removal of all affected friable ACM regardless of its condition prior to demolition. Therefore, the central issue is not whether ACM shall be removed, but rather, when. EPA, however, wishes to avoid unnecessary removal and does not wish to encourage schools to institute massive removal of asbestos that is in good condition before demolition. The EPA further recognizes that ill-conceived or poorly conducted removal activities often create hazards for workers and building occupants far greater than those associated with leaving ACM in place.

The remainder of this section deals with EPA's reasons for choosing the specific response action provisions in this proposed rule, discusses EPA's assessment of various technologies intended to improve the decisionmaking process regarding response actions and explains EPA's rationale for choosing operations and maintenance (O&M) provisions in the proposal.

1. Response Actions

For most of the hazard situations described in TSCA Title II, a step-wise ordering of considerations, based on using the "least burdensome methods. . . ." approach, is proposed. EPA believes that this step-wise procedure allows the LEA to consider the full range of options available. This step-wise order of considerations, however, should not be construed as limiting LEA choice for selecting removal as a response action, should removal be the preferred response action of the LEA. EPA's reasons for choosing the specific response action provisions in the proposed rule follow. Except for potential for damage and potential for significant damage, the

language in the provisions was not agreed on by the committee.

The proposed response action for damaged and significantly damaged thermal system insulation ACM would require that all damaged areas at least be repaired. If it is not feasible, due to technological factors or economic considerations, to repair these materials, they must be removed. EPA believes that this approach is consistent with previous guidance and recognizes that repair is often successful in containing fiber release from thermal system insulation ACM. Techniques for thermal system insulation ACM repair are well-developed and easily accomplished. Furthermore, the nature of the material makes it especially susceptible to repair with simple techniques.

Significantly damaged friable surfacing or miscellaneous ACM is defined as material in a functional space where the damage is extensive and severe. The response action for these materials involves the immediate isolation of the functional space, if necessary to protect human health and the environment, and the removal of the material in the space, unless enclosure or encapsulation are sufficient to contain fibers and are preferred by the LEA. The materials in this category demonstrate a relatively great potential for release of fibers. Therefore, a first consideration is given to isolating the area. It is presumed that, given levels of current technology and an assessment of long-term costs, response actions short of removal are on the average less likely to be viable options for long-term response actions in areas which fall within this category. Furthermore, improper or inappropriate repair of these types of materials may contribute to an increase in fiber levels. EPA believes that this response action scheme will allow LEAs and accredited experts to properly identify those functional spaces which may warrant restricted access and priority attention.

Response actions are also proposed for undamaged materials that have the potential for damage. Such material is not readily accessible and therefore is subject, in most instances, only to disturbance by O&M staff. Accordingly, the response action for ACBM that has potential for damage requires the LEA to at least establish an O&M program to avoid uncontrolled disturbance. Again, a school is not precluded from taking other response actions it deems appropriate in dealing with ACM with potential damage.

Accessibility is the key factor which distinguishes material with the potential for significant damage from material with the potential only for damage. Accessibility means that the material is subject to disturbance by school building occupants or workers in the course of their normal activities. For example, material within reach of students above an entrance is clearly accessible, as is thermal system insulation running along the base of a wall in a boiler room. Material on the ceiling of a school auditorium, beyond the reach of students, is not. ACBM on a high school gymnasium ceiling, which might be reached with basketballs or other objects, is subject to either classification, although an LEA might be well advised in this instance to implement a preventive measure to avoid disturbance.

The response action for ACBM that has potential for significant damage requires the LEA to implement an O&M plan and to institute preventive measures appropriate to eliminate the reasonable likelihood of damage. If these measures cannot be effectively implemented or unless other response actions are determined to be a preferred response, the material must be removed as soon as possible. EPA believes that this step-wise ordering of considerations for potential significantly damaged friable ACBM allows the LEA to select the least burdensome methods to minimize the likelihood of damage in the future. Preventive measures are generally expected to be the least burdensome methods, since undamaged material is less likely to release fibers. The potential for damage, however, may be so great in particular circumstances that removal may be indicated.

The response action for damaged friable surfacing or miscellaneous ACM directs the LEA to choose from among encapsulation, enclosure, removal, or repair of the damaged material, depending upon local circumstances, including occupancy and use patterns within the school and LEA economic concerns, including short- and long-term costs. Since the types of surfacing and miscellaneous materials vary, the EPA chose not to include a step-wise ordering of considerations or identify a single response approach for all types. EPA believes that determinations within this category are so circumstantial that recommendations for specific response actions are best offered on a case-by-case basis, relying upon the judgment of accredited experts. No abatement method is given first consideration.

Response actions other than small-scale, short-duration O&M activities shall be designed by persons accredited to design response actions under TSCA Title II, section 206. The Agency believes that project designs would benefit from model guide specifications, such as those prepared by the National Institute of Building Sciences (NIBS). NIBS' "Model Guide Specifications, Asbestos Abatement in Buildings," were published July 18, 1986, for use by the sectors of the building community engaged in asbestos abatement activities.

2. Assessment of Technologies to Improve Response Actions Decisions

TSCA Title II, section 203(c)(2) requires EPA to consider and assess the value of various technologies intended to improve the decision-making process regarding response actions and the quality of any work that is deemed necessary. This section discusses the committee's considerations in this area and EPA's evaluation of the committee's deliberations.

Consideration of transmission electron microscopy (TEM) and chemical encapsulants shows the committee's attempt to create flexibility for technical innovation in the field of asbestos abatement.

Use of TEM, an advanced technology that can be used for measuring levels of airborne asbestos fibers, has been generally endorsed by the committee in order to determine when an abatement project is completed. TEM is discussed in the section dealing with completion of response actions. Comment is welcome on this method, the proposed clearance standards, and protocol.

Another technology discussed in the negotiations was removal encapsulants, chemicals designed to ease the removal of ACM. While some of these encapsulants may not be effective, others may have some promise. EPA does not wish to stifle development of innovative technology and, thus, endorses the language in several places in the proposed regulation permitting the use of "wet methods" for cleaning and abatement activities. EPA is reviewing the removal encapsulant technology and is preparing a technical bulletin based on reports from a wide range of professional assessments about the efficacy of these products.

Air monitoring as a primary assessment technique for determining what response actions to take was not fully debated in committee discussions. Some groups have been advocating use of air monitoring for this purpose, although EPA has a long history of not recommending air monitoring and many other groups concur with EPA's recommendation. Comments by the Safe Building Alliance (SBA) in response to the Advance Notice of Proposed Rulemaking for this proposed rule promoted the use of air monitoring as an

assessment tool. However, SBA did not force the issue in negotiations. EPA believes that agreement could not have been reached on air monitoring issues had they been debated before the committee.

EPA has traditionally recommended assessment of asbestos in schools by visual evaluation of the material's condition, physical characteristics, and location. EPA continues to discourage the use of air monitoring for the primary assessment of exposure potential, since it only provides information on conditions during the period the air is sampled (usually a few hours) and cannot be used to assess the potential for damage or significant damage. When air monitoring costs and technical requirements are also considered, the Agency believes that assessment by physical characteristics is presently a more reasonable approach. However, EPA is conducting an air monitoring study which will, in part, compare assessment by physical characteristics and air monitoring techniques.

3. Operations and Maintenance

Under the proposal, an O&M program shall be established in a school building whenever any friable ACBM is present or assumed to be present. Friable ACBM includes thermal system insulation ACM or other ACBM which is damaged or about to become damaged, perhaps due to a maintenance activity such as cutting, drilling or sanding. The proposed regulation requires training for school workers, special cleaning provisions, including those for episodic releases and following planned maintenance projects which disturb ACM, and periodic surveillance of the materials as essential components of an O&M program.

The O&M worker training provision establishes topic and hourly requirements for this training, but allows the LEA discretion on how, where, when and by whom the instruction is provided. EPA believes that it is reasonable, given the short time frames to accomplish the training and the limited availability of present training, to allow the LEAs flexibility in the manner in which this training is provided to O&M workers.

Some committee members suggested, as an alternative to a set 16-hour training requirement for maintenance staff who may disturb asbestos, a more flexible training approach (perhaps involving fewer hours) tailored to the activities within a particular school or LEA. Under this approach, for example, hands-on training in glove bags would not be required if the LEA or the school in which the employee works has no thermal system insulation ACM. Other members preferred accreditation of O&M workers who perform small-scale, short-duration projects. EPA is interested in comments on these approaches.

The proposed regulation contains provisions for initial and episodic cleaning (associated with minor fiber release episodes), but no explicit requirement for routine cleaning. The committee was not able to agree on all cleaning requirements. As the Agency's Purple Book indicates, wet cleaning practices are a central part of a responsible O&M asbestos control program. As a prudent measure, monthly wet cleaning is recommended for areas where friable surfacing ACM is present, and semi-annual wet cleaning is suggested in areas with damaged thermal system insulation ACM.

EPA continues to recommend wet cleaning as a means of cleaning up asbestos fibers previously released and encourages LEAs, whenever they clean, to adopt wet methods in those areas which contain friable ACBM. However, it is possible that improper cleaning on a routine basis may actually increase fiber levels in the air. EPA is interested in comments on routine cleaning.

The negotiating committee generally adopted, in Appendix B for the purposes of this proposed rule, the basic OSHA approach to deal with small-scale, short-duration projects. But many members desired to further clarify the OSHA definition of small-scale, short-duration projects by adding five clarifications, added to Appendix B, as to the scope of these projects. EPA believes that these considerations are generally consistent with OSHA intent, although it is possible that some points alter, rather than merely clarify, the definition. Comments on this modified definition are invited.

Discussion also focused on the point (level of O&M activity) at which accreditation should be required for maintenance project design and O&M workers. In the proposed regulation, accreditation is necessary for all project designers and maintenance workers employed in activities greater than small-scale, short-duration projects. (Schools, of course, may have in-house architects, engineers, or other professionals accredited as project designers and O&M workers accredited to perform such abatement jobs.) EPA is interested in comments on the appropriateness of this requirement.

Fiber release episodes are uncontrolled or unintentional disturbances of ACBM resulting in visible emission which may pose a hazard to building occupants. EPA believes that episodes involving 3 or less square or linear feet of ACBM can be contained and cleaned up by properly trained and equipped O&M staff. For larger fiber release episodes, accredited personnel are required to respond.

H. Completion of Response Actions

In considering the provisions of this section, the negotiating committee first discussed whether or not to require TEM as the only permissible method of analysis for clearance air measurement following a response action. The PCM method is nonspecific for asbestos and it cannot detect the small thin fibers found at abatement sites. EPA research data has shown the PCM is often inadequate for post abatement monitoring of airborne asbestos. These data indicate that sites which were shown to be clean with PCM data were found by TEM data to be still contaminated. Therefore, reoccupancy of sites initially cleared by PCM, and thus, assumed to have been adequately cleaned, may in fact result in high exposures to asbestos. Although present data would indicate that TEM is a clearly superior monitoring method for purposes of this rule, the committee recognized the relative difficulty in finding laboratories which can perform TEM analysis in a timely manner.

Committee members generally agreed that the number of facilities providing TEM analysis of asbestos air samples will increase as a result of the requirements of this regulation, and that turn-around time and price will drop as more instruments become available. The phase-in of TEM was intended to provide a period for laboratories to react to the increased demand for electron microscopes. However, comments are requested on the extent to which practical problems of availability, response time and cost of TEM analysis exist and whether these problems warrant the use of the phase-in period in the proposal during which PCM analysis would be allowed. EPA is concerned that some research data has shown that PCM can be inadequate for post abatement monitoring of airborne asbestos.

The committee also considered whether the artificial separation of one large response action into several small ones in order to qualify for the TEM phase-in should be prohibited. Among the options discussed was a requirement that all projects completed during a given time period such as 4 months be added together to determine qualification for the use of PCM. Another option discussed was a

requirement that all buildings for a given school be added together. The committee generally agreed to require addition of all contiguous portions of a project conducted in the same building to determine whether the project could be cleared with PCM analysis.

Concern was expressed by the committee about the timing of clearance sampling requirements. The TEM protocol in Appendix A reflects general work group agreement that measurements be made after the primary containment barrier is taken down and after the secondary barrier is either wet-wiped or HEPA-vacuumed.

The committee generally agreed that aggressive sampling should be required and should be defined in the TEM protocol. This section of the regulation requires the use of aggressive sampling for both TEM and PCM measurements, and proposed Appendix A defines a method for aggressive sampling similar to that used in several EPA guidance documents.

The committee considered several options under which less stringent clearance procedures would be allowed following removal, encapsulation, and enclosure. One of these options was to allow response actions to be considered complete with only visual inspection when the project was below the point at which the NESHAP provisions concerning asbestos demolition and renovation apply—160 square feet or 260 linear feet. Another option which the committee considered was to permit an accredited abatement designer discretion on whether or not to require air sampling. The general agreement was to allow the LEA discretion to use PCM measurement on these small jobs rather than to require TEM for small jobs.

Consideration was also given by the committee on a requirement for air sampling for clearance after small jobs of short duration. The committee generally agreed to allow these jobs, which often involve a foot or less of ACBM, to be considered complete after they have passed a careful visual inspection.

I. Accreditation

Appendix C, appearing in a notice elsewhere in this edition of the Federal Register, includes the final Model Contractor Accreditation Plan for States required by TSCA Title II. As the negotiating committee developed its approach to the inspection, assessment, and response action sections of the proposed rule which provide flexibility based on professional judgment and local circumstances, the committee generally agreed that stringent accreditation requirements were crucial to successful implementation of TSCA Title II. The committee established a work group which met several times to discuss accreditation matters. The committee agreed in principle on an accreditation framework and delegated the development of exact wording to the Agency. The EPA Model Plan is the only part of this regulation which is a final Agency product.

J. Worker and Occupant Protection

The regulation, through the provisions of the EPA worker protection rule, extends coverage already in place for O&M workers in private schools under the OSHA's construction standard to public sector O&M workers now unprotected in schools. It also allows LEAs, when they conduct small-scale, short-duration projects (all of which are presumed to exceed the action level of 0.1 f/cm^3), to implement the provisions of Appendix B of this rule instead of the full scope of the EPA worker protection regulation.

Some committee members, particularly the union representatives, desired greater personal protection measures than this coverage afforded. In particular, strong preference was expressed to require respirators whenever ACBM is likely to be disturbed, even if the fiber level is expected to be below the 0.1 f/cm^3 action level established by OSHA. The issue was particularly contentious. Some committee members expressed the opinion that coverage should be consistent for public workers (covered by EPA regulations) and for private workers (covered by OSHA regulations) in schools. Others indicated that risks at such low levels would not warrant the use of respirators. EPA's opinion is that OSHA recently completed a lengthy and detailed worker protection rulemaking proceeding to develop the action level and EPA does not intend to reassess the OSHA determination regarding worker protection. EPA is, however, committed to changing the provisions of the worker protection rule (and hence, this regulation) to conform with any modifications adopted by OSHA in the area of worker protection that may result from the litigation on OSHA's rule. In addition, the Committee agreed that information on respiratory protection, as contained in "A Guide to Respiratory Protection for the Asbestos Abatement Industry" (White Book) September 1986, published jointly by EPA and National Institute for Occupational Safety and Health (NIOSH), should be made available to workers during their O&M training.

Some committee members argued for a regulatory provision on an employee's right to refuse work, if certain personal protective measures are not taken, training is not afforded, or if the proposed regulation is otherwise violated. EPA believes that this issue is more properly addressed by the Department of Labor, but the Agency is interested in comments on this issue.

Proposed § 763.91(e) would establish procedures to protect building occupants from any O&M activity which disturbs asbestos. These procedures largely involve isolation, scheduling, good work practices, proper cleaning and asbestos debris disposal. Generally, these procedures represent simple, low-cost activities which will help contain fibers and control asbestos debris created by the disturbance. For custodial or maintenance activities which do not disturb asbestos these precautions are not required.

Finally, labelling procedures, in committee deliberations, were primarily intended to prevent unknowing or uncontrolled disturbance to ACBM by maintenance personnel rather than to identify ACBM for building occupants. The Agency is seeking comments on whether labels should be provided in languages other than English and on alternative labelling systems for use in routine maintenance areas.

K. Waiver for State Programs

The negotiating committee's general approach in developing the State waiver section of the proposed rule was to provide States with a clear and structured process for requesting waivers. The process set forth in the proposed rule requires that States submit specific information about their programs to EPA so that the Agency can make an informed decision about whether to grant or deny a waiver request. The committee attempted to strike a balance between providing EPA with adequate information for this purpose without making the waiver request unduly burdensome on the States.

Much of the discussion of State waivers pertained to time periods allowed for various steps in the waiver process. EPA is interested in receiving comments about the deadlines and time intervals set forth in this section of the proposed rule.

EPA is also interested in comments about the requirements to hold a public hearing in a State upon request. Specifically, what types of concerns or issues warrant a public hearing on a State waiver request?

There was also significant discussion about coverage of both public and private schools in State asbestos inspection or management programs for which a waiver is sought. While the committee stopped short of specifying private school coverage as a criteria for granting a waiver, support was expressed for the concept that States which already have programs that cover only public schools should consider expanding their program to include private schools.

IV. EPA's Decision To Use the Results of the Negotiated Rulemaking Process

EPA's own analysis indicates that it should use the results of this negotiated rulemaking process as the basis for its proposed rules under Title II of TSCA. The Agency has preliminarily decided, based on the rationale stated below, that the proposed rule represents a reasonable way of carrying out its statutory responsibilities. EPA believes that the proposed rule would result in the use of the least burdensome methods which protect public health or the environment from the risks of asbestos in school buildings.

EPA decided not to set levels in this rulemaking related to the health effects of asbestos. While the Agency's position regarding the health effects of asbestos has been stated publicly on a number of occasions (51 FR 15722, April 25, 1986, and 51 FR 3738, January 29, 1986) that position is by no means without controversy and the various parties to this negotiation espouse a wide range of opinions. No accommodation could have been reached on this rule with respect to health effects. Some parties to the negotiation would argue that the risks from asbestos in buildings in many situations is zero or de minimus, while others may advocate that any exposure to asbestos presents an unacceptable risk that must be eliminated regardless of cost. EPA has considered the range of opinion regarding asbestos health effects and has decided that for purposes of this proposed rule it is not necessary to resolve this divergence.

The Agency has in its rulemaking record an analysis of risk, using reasonably conservative assumptions, that shows statistical risks could be considerable if the appropriate measures required by this proposed regulation are not implemented, and that a significant number of statistical cases of disease could be avoided if the measures are implemented. This analysis has been used by EPA only to indicate that asbestos in schools could present a risk of concern and that measures proposed in this rule are necessary to protect public health or the environment. The Agency acknowledges, however, that some parties to this negotiating process may advocate more protective measures and that other parties may advocate less protective measures depending upon their views on the health effects of low level exposure to asbestos.

Regardless of EPA's decision not to set regulatory levels, the Agency has chosen the provisions of the proposed rule based on a determination that the cost of this rule is reasonable, and, thus, represents the least burdensome requirements necessary to protect public health and the environment. All public and private schools will experience the cost of inspecting which, as discussed later in this preamble, will not exceed a few hundred dollars per school. Many schools, finding no asbestos, will experience no further costs. Most of the remaining schools that find ACM are expected to implement operations and maintenance programs along with periodic surveillance and reinspection. The operations and maintenance program is expected to average approximately $6,000 per school per year, a cost which is clearly minimal if there is a possibility that adverse health effects may be avoided. The reasonableness of the costs of all other response actions is ensured by the decisionmaking process provided in the rule. This process is based on the responsibility of local officials, with input from the local community, to make the appropriate decisions. The LEAs, with the help of specially-trained experts, are to develop management plans to implement the appropriate measures and are required to consider economic factors as appropriate. This proposed rule relies heavily upon the use of trained experts. By requiring that the management plans are publicly available, the proposed rule would ensure public input as a check on the reasonableness of the LEA's decision.

It is especially important to note that the negotiating committee generally agreed that LEAs should have discretion to make the appropriate decisions using trained experts with the procedural safeguards provided by publicly available management plans. While there was disagreement on how to implement all provisions of the regulations, EPA regards these differences as all within a general zone of reasonableness that may be appropriate for regulation. The proposed rule is also within that zone of reasonableness.

Finally, in choosing the provisions of the proposed rule, EPA believes that the interests of public health have been served by reaching a reasonable accommodation among the interests and the views of the negotiating parties. No party achieved all the goals it would have liked, but each party gained substantial concessions. Much of the agreement in the negotiating sessions resulted because parties did not insist that the committee adopt their own positions on the most contentious issues, such as those involving health effects of asbestos at exposure levels found in schools, use of air monitoring as a tool to determine what response actions are appropriate, and use of respirators regardless of the level of exposure to asbestos. In EPA's experience in other regulations, contentious issues like these are only resolved after long regulatory and judicial proceedings. EPA may develop a final rule after a protracted rulemaking proceeding that tries to resolve such issues but displeases any number of interested parties ranging from one of the parties to all of them. The issues then become the subject of judicial challenge on the final rule and may only be resolved after long years of judicial proceedings during which parties to the litigation may eventually be forced by circumstances, or the courts, to negotiate anyway. By moving the negotiations to the beginning of the process, EPA has hoped that it may avoid the long delays inherent in the normal process. The Agency hopes the parties to this negotiating proceeding reach the same conclusion and support this proposed rule and any substantially similar final rule.

V. Economic Impact

The economic impact analysis estimates the incremental costs attributable to the proposed regulation, including costs of inspection, sampling, development and management plans, implementation of response actions, periodic surveillance, and provision of required training. Estimates of the number of schools affected and square footage of asbestos were developed based on the 1984 EPA survey of asbestos in schools and data compiled from the Asbestos School Hazard Abatement Act (ASHAA) loan and grant program. Estimates of the percentage of asbestos which falls into each of the hazard categories were based on the results of a survey of the EPA's Regional Asbestos Coordinators (RACs). Using a model school/model project approach, costs of inspection, sampling, and appropriate response actions were developed for schools with ACM in each of the different hazard categories. For schools with only non-friable ACM the only costs estimated

were for management plan development, training of the asbestos program manager, and custodial training for proper repair and maintenance of ACM. For purposes of the economic analysis, we assumed that all schools with only nonfriable ACM would choose to forego sampling and instead just treat suspect material as asbestos-containing.

Asbestos abatement-related costs expected to be incurred regardless of the existence of these regulations were subtracted from the total costs to calculate only the incremental cost of the proposed regulation. For example, data from the Asbestos School Hazard Abatement Act (ASHAA) loan and grant application data base were used to project an average annual rate of removal of asbestos that is assumed would have occurred even if TSCA Title II legislation and these regulations were not promulgated. That average annual rate was estimated to be approximately 3.4 percent for primary schools, 3.3 percent for secondary schools, and 1.8 percent for private schools. The costs associated with this underlying rate of removal were subtracted from the total costs. Also, the costs of removal of friable ACM prior to demolition that is required by the NESHAPs regulations were also netted out of the total costs.

The estimated net present value of the costs of these proposed regulations is approximately $3,219 million (using a 10 percent discount rate) over 30 years. This includes the cost of initial inspection and sampling—$58.2 million; development and implementation of management plans—$970.8 million; periodic surveillance—$41.8 million; reinspection—$34.7 million; special operations and maintenance programs—$525.4 million; and abatement response actions $1,587.8 million.

The total number of primary and secondary schools potentially affected by these regulations is estimated to be 107,550. Approximately 44,900 are estimated to have approximately 213 million square feet of surfacing or thermal system insulation ACM. Of these an estimated 10,700 schools have surfacing ACM only. It is likely that every school contains some amount of non-friable ACM such as floor tile, transite board, and fire doors.

The cost of an asbestos inspection is estimated to range from $60 to $290 per school depending upon the size of the school and type of professional doing the work. The costs of sampling and analysis if friable materials are found will depend upon the number of samples taken and analyzed. Costs of analysis are estimated to range from $25 to $47 per sample. Assuming the average school has to analyze 20 samples, the cost of analysis will be $500 to $940 per school. The cost of mapping ACM is estimated to range from $60 to $260 per school.

The cost of developing a management plan if asbestos-surfacing ACM or thermal system insulation ACM is present is estimated to range from $320 for an average-size public primary school for $480 for an average-size public secondary school if the plan is prepared in-house. A much less extensive management plan would be required for schools containing only non-friable materials. The average development cost for a management plan where only non-friable materials are present is estimated to be $200.

The estimated cost of training required by the proposed regulations is approximately $50 per person for a 2-hour awareness training session for all school maintenance employees in schools with surfacing ACM and thermal system insulation ACM, $250 for the additional 14 hours of training for workers who may come in contact with asbestos in doing minor repair and maintenance work in which asbestos is disturbed, and $420 for the 24 hours of training required for certification of asbestos abatement workers doing more than just minor repair and small glove-bag jobs. The cost of the 40-hour training course and certification required for asbestos abatement contractors is estimated to be $640.

Response action costs depend on the condition of the asbestos in a school. For surfacing material in all but the significantly damaged category, it is likely that the primary response action undertaken by a school will be special operations and maintenance activities until or unless the ACBM deteriorates to a "significantly damaged" condition. The annual cost of a special operations and maintenance program (excluding acquisition of special equipment) is estimated to range from $4,200 for a typical private school to $8,300 for a typical public secondary school. Initial cleaning costs are expected to range from $900 to $1,700.

The cost of removal depends upon many factors including size of the project. The estimated cost of removal for a 4,000 square foot project in which surfacing material is removed would be approximately $51,000. The cost of removal for a 900 square linear foot boiler wrap project is estimated to be approximately $31,000. The total discounted costs of response actions were estimated assuming schools undertake a combination of response actions which depend on the condition of the ACM.

VI. Rulemaking Record

EPA has established a record for this rulemaking (docket control number OPTS–62048C). The record is available in the Office of Toxic Substances Public Information Office, from 8 a.m. to 4 p.m., Monday through Friday, except legal holidays. The Public Information Office is located in Rm. NE–G004, 401 M Street, SW., Washington, DC.

The record includes information considered by EPA in developing this proposed rule. EPA will supplement the record with additional information as it is received. The record now includes the following categories of information:

1. Federal Register notices.
2. Support documents.
3. Reports.
4. Memoranda and letters.
5. Records of the negotiating committee.

EPA will identify the complete rulemaking record by date of promulgation. EPA will accept additional material for inclusion in the record at any time between this document and designation of the complete record. The final rule will also permit persons to point out any errors or omissions in the record.

VII. References

1. USEPA. "Guidance for Controlling Asbestos-Containing Materials in Buildings," EPA 560/5–85–024, June 1985.

2. USEPA. "A Guide to Respiratory Protection for the Asbestos Abatement Industry." EPA 560–OPTS–86–001, September 1986.

3. USEPA. "Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials," EPA 560/5–85–030a. October 1985.

4. USEPA. Friable Asbestos-Containing Materials in Schools, 40 CFR Part 763, Subpart F.

5. USEPA. National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 61, Subpart M.

6. USDOL. OSHA. Occupational Exposure to Asbestos, 29 CFR 1926.58.

7. USEPA. Toxic Substances; Asbestos Abatement Projects, 40 CFR Part 763, Subpart G.

VIII. Regulatory Assessment Requirements

A. Executive Order 12291

Under Executive Order 12291, EPA has determined that this proposed rule is a "Major Rule" and has developed a Regulatory Impact Analysis. EPA has prepared an economic impact analysis of the proposed TSCA Title II regulations.

B. Regulatory Flexibility Act

EPA has analyzed the economic impact of this rule on small businesses. EPA's analysis of the economic consequences of this proposed rule appears in Unit V.

C. Paperwork Reduction Act

The reporting and recordkeeping provisions in this proposed rule have been submitted to the Office of Management and Budget (OMB) for approval under the Paperwork Reduction Act. Comments on these requirements should be submitted to the Office of Information and Regulatory Affairs at OMB and marked Attention: Desk Officer for EPA. The final rule will explain EPA's response to OMB and public comments on the proposed reporting and recordkeeping requirements.

List of Subjects in 40 CFR Part 763

Asbestos, Environmental protection, Occupational health and safety Hazardous substances, Recordkeeping, Schools.

Dated: April 20, 1987.

Lee M. Thomas,

Administrator.

PART 763—[AMENDED]

Therefore, it is proposed that 40 CFR Part 763 be amended as follows:

1. The authority citation for Part 763 continues to read as follows:

Authority: 15 U.S.C. 2605 and 2607(c). Subpart E also issued under 15 U.S.C. 2641, 2643, 2646, and 2647.

2. Subpart E is amended by adding §§ 763.80 through 763.99 and Appendices A and B to read as follows:

Subpart E—Asbestos-Containing Materials in Schools

Sec.

Subpart E—Asbestos—Containing Materials in Schools

* * * * *

§ 763.80 Scope and purpose.

This rule requires local education agencies to identify friable and non-friable 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. The transportation of asbestos waste generated by the activities of this rule is covered by the Department of Transportation and disposal requirements are covered by the National Emission Standard for Hazardous Air Pollutants (NESHAP). 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.

§ 763.81 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.

"Asbestos" means the asbestiform varieties of: Chrysotile (serpentine); crocidolite (riebeckite); amosite (cummingtonite- grunerite); anthophyllite; tremolite; and actinolite.

"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-containing material" (ACM) when referring to school buildings means any material or product which contains more than 1 percent asbestos.

"Asbestos debris" means pieces of ACBM that can be identified by color, texture, or fiber content as originating from adjacent ACBM.

"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.

"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.

"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.

"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 the construction of an airtight, impermeable, permanent barrier around ACBM to control 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 non-friable 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.

"Functional space" means a room, group of rooms, or homogeneous area (including 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 micrometers 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, and

(3) The governing authority of any school operated under the defense dependents' 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.

"Non-friable" 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 training, work practices, and periodic surveillance 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, and

(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, and

(3) The material is subject to major or continuing disturbance, due to factors including, but not limited to, accessibility.

"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 contain 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 under paragraphs (1), (2), or (3) of this definition.

(5) Any portico or covered exterior hallway or walkway, and

(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.

"Structural member" means any load-supporting member of a school building, such as beams and load-supporting walls, or any non-load-supporting member, such as ceilings and non-load-supporting walls.

"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.

§ 763.83 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 (i.e., 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, 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 and are instructed in safe work practices regarding such material.

(e) Ensure that warning labels are posted in accordance with § 763.95.

(f) Ensure that management plans are available for inspection and that parent, teacher, and employee organizations are notified of such availability as specified in the management plan under § 763.93.

(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.

§ 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 non-friable 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) through (5) 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 non-friable 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 § 763.83 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 non-friable 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 non-friable 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 non-friable 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 § 763.83 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 deemed as non-friable 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 square feet 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 square feet but less than or equal to 5,000 square feet, 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 square feet, 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 damaged or significantly damaged and 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 is used on 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) *Non-friable suspected ACBM.* If any homogeneous area of non-friable 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 non-friable 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, or which have received interim accreditation from EPA.

(b) Bulk samples shall not be composited for analysis and shall be analyzed for asbestos content by polarized light microscopy (PLM), using the Interim Method of the Determination of Asbestos in Bulk Insulation Samples found at Appendix A of Subpart F in 40 CFR Part 763.

(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 § 763.83 for inclusion into the management plan within 30 days of the analysis.

§ 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 § 763.83 for inclusion in the management plan within 30 days of the assessment.

(b) The inspector shall classify 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, 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., water, vibration, air erosion, vandalism).

(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 § 763.83 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. 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 either technological factors or economic considerations, 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 § 763.81, the local education agency may 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 contain fibers, 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, by either technological factors or economic considerations, to be a preferred response. 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 Subpart E of this part 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.

(3)(i) 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.

(ii) The action shall be considered complete when the results of samples collected in the affected functional space show that the concentration of asbestos for each of the five samples is less than or equal to the limit of quantitation for PCM (0.01 fibers per cubic centimeter (0.01 f/cm^3) of air).

(4)(i) Except as provided in paragraphs (i) (5) and (6) of this section, an action to remove, encapsulate, or enclose ACBM shall be considered complete when the average concentration of asbestos does not exceed the limit of quantitation for the Transmission Electron Microscopy (TEM) protocol described in Appendix A of this Subpart E, based on five air samples collected within the affected functional space with an analytical sensitivity at a level no higher than 0.005 f/cm^3 of air.

(ii) If the average concentration of asbestos within the affected functional space exceeds the limit of quantitation for the TEM protocol, then the action to remove, encapsulate, or enclose ACBM shall be considered complete when the average concentration of asbestos based on five air samples collected within the affected functional space is not significantly different, as determined by the Z-test method found in Appendix A to Subpart E of this Part, from the average of five air samples collected at the same time outside the affected functional space.

(5)(i) Until October 7, 1989, a local education agency may analyze air monitoring samples collected for clearance purposes by PCM to confirm completion of removal, encapsulation, or enclosure of ACBM that is less than or equal to 3,000 square feet or 1,000 linear feet.

(ii) The section shall be considered complete when the results of samples collected in the affected functional space show that the concentration of asbestos for each of the five samples is less than or equal to the limit of quantitation for PCM (0.01 f/cm^3 of air).

(6)(i) From October 8, 1989, to October 7, 1990, a local education agency may analyze air monitoring samples collected for clearance purposes by PCM to confirm completion of removal, encapsulation, or enclosure of ACBM that is less than or equal to 1,500 square feet or 500 linear feet.

(ii) The action shall be considered complete when the results of samples collected in the affected functional space show that the concentration of asbestos for each of the five samples is less than or equal to the limit of quantitation for PCM (0.01 f/cm^3 of air).

(7) To determine the amount of ACBM affected under paragraphs (i) (5) and (6) 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) or (6) of this section.

§ 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 non-friable ACBM or non-friable assumed ACBM must be treated as friable ACBM for the 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.* The protection provided by EPA at 40 CFR 763.121 for worker protection during asbestos abatement projects is extended to employees of local education agencies who perform operations, maintenance, and repair (O&M) activities involving ACM and who are not covered by the OSHA asbestos construction standard at 29 CFR 1926.58 or an asbestos worker protection standard adopted by a state under a state plan approved by OSHA under section 19 of the Occupational Safety and Health Act. Local education agencies may consult Appendix B of this subpart if their employees are performing operations, maintenance, and repair activities that are of small-scale, short-duration.

(c) *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 employees shall be trained within 30 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 § 763.83 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 (c)(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–OPTS–86–001), available from TSCA Assistance Office (TS–799), Office of Toxic Substances, Environmental Protection Agency, Room E–543, 401 M Street SW., Washington, DC 20460, and other personal protection measures.

(iii) The provisions of this section, appendices to this Subpart, 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 activities involving asbestos shall be considered trained for the purposes of this section.

(d) *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 § 763.83 a copy of such record for inclusion in the management plan.

(e) *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:

(1) HEPA-vacuum or steam-clean all carpets.

(2) HEPA-vacuum or wet-clean all other floors and all other horizontal surfaces.

(3) Dispose of all debris, filters, mopheads, and cloths in sealed leak-tight containers.

(f) *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.

(g) *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.

(h) *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):

(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.

§ 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 their 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 effective date of this Subpart E:

(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 the effective date of this Subpart E 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, and a statement that the laboratory has been accredited under section 206(d) of Title II of the Act, 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 of the person designated under § 763.83 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 and a plan for operations and maintenance activities, including periodic surveillance, developed under § 763.91.

(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 and operations and maintenance activities.

(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 the 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, 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 its management plan. 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 management plans.

(4) Upon submission of its management plan to the Governor and at least once each school year, the local education agency shall notify 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.

(h) Records required under § 763.94 shall be made by local education agencies and maintained as part of the management plan.

§ 763.94 Recordkeeping.

(a) Records required under this section shall be maintained as part of the management plan.

(b) For each preventive measure and response action taken for friable and non-friable ACBM and friable and non-friable 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, and the name and signature of the person performing the analysis.

(c) For each person required to be trained under § 763.91(c) (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 § 763.91(d) 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(e) 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(f) 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(g) 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(h), 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.

§ 763.95 Warning labels.

(a) The local education agency shall attach a warning label immediately adjacent to any friable and non-friable 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 regulation, 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 rule 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. The citizen complaint should be in writing and identified as a citizen complaint pursuant to section 207(d) of Title II of TSCA Asbestos Hazard Emergency Response Act. The EPA Asbestos Ombudsman or the Governor shall investigate and respond to the complaint within in 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 E.

(2) A waiver from any requirement of Subpart E shall apply only to the specific provision for which a waiver has been granted under this section. All requirements of Subpart E of this part 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 Director, Office of Toxic Substances 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 is at least as stringent as the requirements of this Subpart E.

(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) Ensurance 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.

(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 ensurances 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 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 Director, Office of Toxic Substances 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.

(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.

§ 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 area during an inspection conducted before the effective date of this Subpart E. 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 § 763.83 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, non-friable ACBM was identified in that area during an inspection conducted before the effective date of this Subpart E. 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 § 763.83 for inclusion in the management plan. However, an accredited inspector shall identify whether material that was non-friable 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 area and the records show that the area was sampled, before the effective date of this Subpart E, 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 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 area and the records show that the area was sampled before the effective date of this Subpart E 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 the effective date of this Subpart E, suspected ACBM identified in that 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 § 763.83 for inclusion in the management plan. However, an accredited inspector shall identify whether material that was non-friable 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 area where asbestos removal operations have been conducted before the effective date of this Subpart E 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 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.

Appendix A to Subpart E—Interim Transmission Electron Microscopy Analytical Method and Field Sampling Protocol for the Clearance Testing of an Abatement Site

Definitions of Terms

"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 f/cm^3.

"Asbestiform"—A specific type of mineral fibrosity in which the fibers and fibrils possess high tensile strength and flexibility.

"Aspect ratio"—A relative comparison of the length to the width of a particle.

"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 <0.5 fibers per 10 grid openings and seldom more than 3 fibers for that same area.

"EDXA"—Energy dispersive X-ray analysis.

"Fiber"—A structure >0.5 micrometers in length with an aspect ratio (length to width) of 5 to 1 or greater and having substantially parallel sides.

"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.

"Laboratory sample coordinator"—That person responsible for the conduct of sample handling and the certification of the testing procedures.

"Limit of quantitation"—Defined as four times the analytical sensitivity of this method.

"Operator"—A person responsible for the TEM instrumental analysis of the sample.

"PCM"—Phase contrast microscopy.

"SAED"—Selected area electron diffraction.

"SEM"—Scanning electron microscope.

"STEM"—Scanning transmission electron microscope.

"Structure"—A microscopic bundle, cluster, fiber, or matrix which may contain asbestos.

"TEM"—Transmission electron microscope.

SELECTED SILICATE MINERALS AND THEIR ASBESTIFORM VARIETIES

Mineral	Asbestiform variety
Amphibole group	
Anthophyllite: $(Mg,Fe^{2+})_7Si_8O_{22}(OH,F)_2$	Anthophyllite asbestos.
Cummingtonite-grunerite: $(Mg,Fe^{2+})_7Si_8O_{22}(OH)_2$	Cummingtonite-grunerite asbestos.
Tremolite-actinolite: $Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH,F)_2$	Tremolite-actinolite asbetos.
Riebeckite: $Na_2Fe_3Fe_2^{3+}Si_8O_{22}(OH,F)_2$	Crocidolite.
Serpentine group	
Serpentine: $Mg_6Si_4O_{10}(OH)_8$	Chrysotile.

I. Sampling

A. Sampling operations must be performed by qualified individuals completely independent of the abatement contractor to avoid possible conflict of interest (References 1–3, 5). Special precautions must be taken to avoid contamination of the sample. For example, do not use materials that have not been prescreened for their asbestos background content; also, do not use sample handling procedures which do not take cross contamination possibilities into account.

B. Material and supply checks must be made on all critical supplies and reagents before their use in a monitoring study.

C. Quality control and quality assurance steps are mandatory to identify problem areas and isolate the cause of the contamination (Ref. 5). Control checks shall be permanently recorded to document the quality of the information produced.

D. Sampling medium. 1. Sample for airborne asbestos following an abatement action using a three-piece cassette available commercially in 25 mm, 37 mm, or 47 mm diameter sizes.

2. Use either a cowling or a filter-retaining middle piece made of a conductive material to minimize possible static charge effects on the sample.

3. Load cassettes with filters from stock lots that have been sampled and found to meet background asbestos content as specified by this TEM analysis method.

4. Use sample collection filters which are either polycarbonate or mixed cellulose ester having a pore size of 0.45 μm or less.

5. Place these filters in series with a 5.0 μm backup filter and cellulosic support pad.

6. When polycarbonate filters are used, position the highly reflective face such that the incoming particulate is received on this surface.

7. Assemble the cassettes in a clean facility (see Definitions).

8. 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.

9. Use wrinkle-free loaded cassettes in the sampling operation.

E. *Sampling.* 1. Calibrate the sampling pump over the range of flow rates and loads anticipated for the study with its flow measuring device in series. Perform this calibration using guidance from EPA Method 2A each time the unit is sent to the field (Ref. 6).

2. 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.

3. Maintain constant flow conditions by damping out any pump action fluctuations.

4. Check the sampling system for leaks with the end cap still in place and the pump before initiating sample collection. Trace and stop the source of any flow indicated by the flowmeter under these conditions.

5. Select an appropriate flow rate equal to or less than 10 L/min for 25 mm cassettes. Larger filters may be operated at proportionally higher flow rates.

6. Orient the cassette downward at approximately 45 degrees.

7. 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.

8. Initiate a chain of custody procedure at the start of each sampling, if this is requested by the client.

9. Maintain a close check of all aspects of the sampling operation.

10. Continue sampling until at least the minimum volume to obtain the desired quantitation limits (see Table I) is collected. Do not exceed the maximum volumes described in Table II.

11. 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.

12. Double check to see that all information has been recorded on the data collection forms and that the cassette is securely closed and appropriately labeled before shipment.

13. Do not change containers or take portions of these filters for other purposes.

F. *Abatement area sampling.*

1. 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. Note the final plastic barrier remains in place for the sampling period. (Ref. 1)

2. 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.

3. Collect five samples per abatement area to compare to the five ambient samples.

4. Select sampling sites in the abatement area on a random basis to provide an unbiased and representative sample.

5. Take a field blank at each abatement area before sampling is initiated by removing the cap for not more than 30 seconds and replacing it at the time of sampling. (Do not leave the blank open during the sampling period.)

6. Carry a sealed blank with each sample set. This representative cassette is not to be opened in the field.

7. Use aggressive sampling conditions to dislodge any remaining dust.

a. Negative filtration units shall remain on during the air monitoring period.

b. Prior to air monitoring, floors, ceiling and walls shall be swept with the exhaust of a 1 horsepower leaf blower.

c. Stationary fans are placed on two-meter high stands in locations which will not interfere with air monitoring equipment. Fan air is directed at ceiling and is operated at low speed. One fan shall be used for each 10,000 cubic feet of worksite.

8. Pump flow rates up to 10 L/min may be used for 25 mm cassettes. The larger cassette diameters may have comparably increased flow.

9. Sample a volume of air sufficient to ensure the minimum quantitation limits. See Table I.

G. *Ambient sampling.* 1. Site 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 this area. If no areas exist in the building and the air is drawn from outside of the building, pumps should be placed out of doors located near the building, and away from any obstructions that may influence wind patterns. Samples should be representative of any air entering the worksite.

2. Locate the ambient samplers at least 3 feet apart and protect them from adverse weather conditions.

3. Unless otherwise indicated, take five samples to match the clearance sampling.

4. Take a field blank at the ambient site.

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TABLE I — RELATIONSHIP BETWEEN VOLUME FILTERED AND EFFECTIVE AREA ON THE NUMBER OF EM GRID OPENINGS TO BE SCANNED

Volume filtered in Liters

Filter	Eff. Area	514	922	1331	1739	2148	2556	2965	3373	3782	4190	4599
25 mm	385 sq. mm	24†	13	9	7	6	5	4				
37 mm	855 sq. mm			21	16	13	11	9	8	7	7	6
47 mm	1134 sq. mm				21	17	14	12	11	10	9	8

Volume Filtered in Liters

Filter	Eff. Area	5007	5416	5824	6233	6641	7050	7458	7867	8275	8684	9092
25 mm	385 sq. mm											
37 mm	855 sq. mm	5	5	5	4	4	4	4				
47 mm	1134 sq. mm	7	7	6	6	5	5	5	5	4	4	4

TABLE II — MINIMUM/MAXIMUM VOLUMES TO MAINTAIN ANALYTICAL SENSITIVITY OF 0.005 FIBERS PER CC

	Filter size		
	25 mm	37 mm	47 mm
Minimum Volume (liters)	514	1142	1515
Maximum Volume (liters)	3087	6855	9092

BILLING CODE 6560-50-C

II. Sample Shipment

A. Select a rigid shipping container and pack the cassettes upright in a noncontaminating nonfibrous medium such as a bubble pack.

B. Avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials because of possible contamination.

C. Include a shipping bill and a detailed listing of samples shipped, their descriptions and all identifying numbers or marks, air volumes collected, 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 sampling is to be performed.

D. 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.

E. 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.

III. Sample Receiving

A. 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.

B. Adhere to the following procedures to ensure the continued chain of custody and also the accountability of all other samples passing through the laboratory.

1. Note the condition of the shipping package and data contained on it on receipt.

2. Retain all bills of lading or shipping slips to document the shipper and delivery time.

3. Examine the chain-of-custody seal, if any, and the package for their integrity.

4. 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.

5. Packages with significant damage shall be accepted only by the responsible laboratory manager after discussions with the client.

C. 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 Chain-of-Custody Sample Receiving Form to document this information is attached for use when necessary.

Note.—The person breaking the chain of custody seal and itemizing the contents assumes responsibility for the shipment and signs documents accordingly.

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Example Form

Page ____ of ____

CHAIN-OF-CUSTODY SAMPLE RECEIVING FORM

Date of package delivery _____ Package shipped from _____

Carrier _____ Shipping bill retained _____

*Condition of package on receipt _____

*Condition of custody seal _____

Comments _____

Number of samples received _____ Shipping manifest attached _____

(Use as many additional sheets as needed)

No.	Description	Receiving ID #	Assigned #
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

(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.

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D. Assign a laboratory number and schedule an analysis sequence.

E. Secure samples in a locked storage or convey them immediately to the analyst if they represent custody samples.

F. Manage all Chain-of-Custody samples within the laboratory such that their integrity can be ensured and documented.

G. Check-in and check-out from the locked storage area shall be conducted by the sample coordinator or his or her designee.

H. Treat all other samples in a similar manner except for use of chain custody forms, which are not necessary.

IV. Sample Preparation

A. Wet-wipe cassettes to clean the exterior of any possible contamination before taking them into the clean room facility.

B. Perform sample preparation in a well-equipped clean facility (see Definitions and Sections E and F).

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 then 0.5 fibers per preparation (ten 200 mesh grid openings) with no single preparation to exceed 3 fibers.

C. Preparation areas for air samples must be separated from preparation areas for bulk samples.

D. Procedures. 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 particular laboratory are permitted.

1. Measure the grid opening areas of the TEM grids. This can be accomplished on the TEM at a properly calibrated low magnification or on an optical microscope at the magnification of approximately 400 by using an eyepiece fitted with a scale that has been calibrated against the stage micrometer. The dimensions of the grid openings must be measured.

Case No. 1. The dimensions of one grid opening for each of two grids examined for each sample will be reported along with the measurement method used.

Case No. 2. The 20-grid openings will be measured on each of 20 grids from a batch of 1,000 grids. This will certify the dimensions of the grid openings for the batch of 1,000. This must be performed prior to the grids being sent to the sample preparation area for use in sample preparation.

2. Remove the inlet and outlet caps prior to opening the cassette to minimize any pressure differential that may be present.

3. Examples of techniques used to prepare polycarbonate filters are described in Section G.

4. Examples of techniques used to prepare mixed cellulose ester filters are described in Sections H and I.

5. Prepare at least three satisfactory grids for each sample. A TEM grid is considered satisfactory if the grid openings exhibit uniform clarity and contrast and have at least 50 percent of the replicate grid openings intact.

6. Store the three grids to be measured in appropriate grid holders or plastic capsules, numbered one through three, and labeled with the same number.

E. *Equipment in clean room.* 1. Clean area.

2. Tweezers. Fine-point tweezers for handling of filters and TEM grids.

3. Scalpel Holder and Curved-No. 10 Surgical Blades.

4. Microscope Slides, 75 mm×50 mm and 75 mm×25 mm.

5. Double-Coated Adhesive Tape (3M Scotch No. 666).

6. Gummed Page Reinforcements.

7. Micro-Pipet With Disposable Tips 10 to 100 microliter variable volume.

8. High-Vacuum Coating Unit With Facilities for Evaporation of Carbon. The coating unit must be capable of producing a vacuum better than 0.013 Pa (10^{-4} torr). A holder is required that will allow a 75 mm×50 mm or a 75 mm×25 mm glass microscope slide to be tilted and rotated during the evaporation procedure. Use of a liquid nitrogen cold trap above the diffusion pump will minimize the possibility of contamination of the filter surfaces by oil from the pumping system. The vacuum-coating unit can also be used for deposition of a thin film of gold, which is required on TEM specimens that are used to obtain calibrated SAED patterns. If available, a sputter coater is recommended because it allows better control of deposition of gold.

9. *Carbon Rod Electrodes.* Spectrochemically pure carbon rods are required for use in the vacuum evaporator for carbon coating of filters.

10. *Carbon Rod Sharpener.* This is used to sharpen carbon rods to a neck of about 3.6 mm long and 1.0 mm in diameter. The use of necked carbon rods (or equivalent) allows the carbon to be applied to the filters with a minimum of heating.

11. *Low-Temperature Plasma Asher.* This is used to etch the surface of collapsed mixed ester cellulose (MEC) filters. The asher should be supplied with oxygen, and should be modified as necessary to provide a valve to control the speed of air admission. Some early models of asher admit air too rapidly, which may disturb particulate on the surface of the filter after the etching step.

12. 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 improved by grinding the base and lid together with an abrasive grinding material.

13. Stainless Steel Mesh.

14. Lens Tissue.

15. Copper 200-mesh TEM Grids, 3 mm in diameter, or equivalent.

16. Gold 200-mesh TEM Grids, 3 mm in diameter, or equivalent.

17. Condensation Washer.

18. Carbon-Coated, 200-mesh TEM Grids, or equivalent.

19. Analytical Balance, 0.1 mg sensitivity.

20. Filter Paper, 9 cm in diameter.

21. Oven or Slide Warmer. Must be capable of maintaining a temperature of 65 to 70 degrees C.

22. Polyurethane Foam, 12 mm thickness.

23. Gold Wire for Evaporation.

F. *Reagents.* 1. 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, deionized water is satisfactory for this purpose. Reagents must be fiber free.

2. Nuclepore Preparation Method—Chloroform.

3. MEC Preparation Method A—Dimethyl Formamide and Glacial Acetic Acid.

4. MEC Preparation Method B—Acetone.

G. *TEM specimen preparation from nuclepore polycarbonate filters*—1. *Specimen Preparation Laboratory.* It is most important to ensure that contamination of TEM specimens by extraneous asbestos fibers is minimized during preparation.

2. *Cleaning of Sample Cassettes.* Upon receipt at the analytical laboratory, 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. After the cassettes have been checked to ensure that it is tightly sealed and the plugs are in both ends, it should be thoroughly cleaned by rinsing with water and wet-wiping and then dried with a clean paper towel.

3. *Preparation of the carbon evaporator.* If the Nuclepore 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 3.6 mm long and 1.0 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.

4. *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, separated by a distance of approximately 22 mm. Polycarbonate filters are easily stretched during handling, and cutting of areas for further preparation must be performed with great care. The filter and the MEC backing filter are removed together from the cassette and placed on a cleaned glass microscope slide. The filter can be cut with a curved scapel blade by rocking the blade from the point placed in contact with 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 22 mm 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 between the handlinq of each sample. The filter strips should be identified by writing on the glass slide with a wax pencil. 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. This cassette will then be archived.

5. *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 to a vacuum better than 0.013 Pa. 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 SAED patterns will be compromised. The carbon film should be as thin as possible and still retain most of the grid openings of the TEM specimen intact.

6. *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. The washer consisting of a simple stainless steel bridge is recommended. Several pieces of lens tissue approximately 1.0 cm×1.5 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.

7. *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, carbon side up, 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. The three excised squares of filter 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 Jeffe Washer, and the system is allowed to stand for several hours, preferably overnight.

8. *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. Undissovled filter medium also compromises the ability to obtain SAED 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.

H. *TEM specimen preparation from MEC filters (Method A)*— 1. *Preparation of collapsing solution.* The collapsing solution is prepared by mixing 35 ml of analytical-grade dimethyl formamide, 15 ml of analytical-grade glacial acetic acid, and 50 ml of freshly distilled water. The solution must be stored in a prewashed glass bottle with a polyethylene stopper. Ground-glass stoppers must not be used (Ref. 7 and 8).

2. *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. After the analyst has checked to ensure that the cassette is tightly sealed and the plugs are in both ends, the cassettes should be thoroughly cleaned by rinsing with water and wet-wiping and then dried with clean paper towel.

3. *Selection of area of MEC filter for preparation.* One-quarter of the filter will be prepared by the collapsing procedure. This allows adequate filter area for the preparation of at least three TEM specimens and leaves sufficient filter area for interlaboratory and intralaboratory QA analyses. Using clean tweezers, the analyst removes the MEC filter from the filter cassette and places it on a washed microscope slide. A clean curved-blade scalpel is used to cut out a 90-degree sector, and the balance of the filter is returned to the cassette to be archived.

4. *Filter collapsing procedure.* A 75 mm x 25 mm microscope slide is washed in detergent, rinsed several times in distilled or filtered, deionized water, and then allowed to dry. Twenty to 30 microliters of the collapsing solution is placed in the middle of the slide by using a disposable tip micropipet, and the end of the pipet is used to spread the liquid out over the area to be occupied by the quarter filter. The quarter filter, active surface upwards, is then laid on top of the solution and the edge of the filter is lowered at an angle of about 20 degrees so that air bubbles are excluded. Solution not absorbed by the filter is then removed by allowing a tissue to contact the liquid at the edge of the filter. The slide is then placed either in an oven at 65 to 70 degress C or on a slide warmer at the same temperature, for about 10 minutes. If the slide becomes too warm, bubbles will develop. The filter collapses slowly to about 15 percent of its original thickness. The procedure leaves a thin, transparent plastic film, with particulate and fibers embedded in the upper surface.

5. *Plasma etching of the collapsed filter.* The collapsed filter on the microscope slide is placed in a plasma asher for a period of approximately 6 minutes. 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-micrometer layer of collapsed surface will be removed.

6. *Preparation of the carbon evaporator.* 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 with the carbon rod sharpener to necks of about 3.6 mm long and 1.0 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.

7. *Carbon coating of collapsed and etched filter.* The glass slide holding the collapsed filter portion is placed on the rotation-tilting device, and the evaporator chamber is evacuated to a vaccum better than 0.013 Pa. 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 surface of the collapsed filter may be damaged from heating. An experienced analyst can judge the thickness of carbon film to be applied, and some tests 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 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 SAED patterns will be compromised. The carbon film should be as thin as possible and still retain most of the grid openings of the TEM specimen intact.

8. *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. The washer consisting of a simple stainless steel bridge is recommended. Several pieces of lens tissue approximately 1.0 cm x 1.5 cm are placed on the stainless steel bridge, and the washer is filled with dimethyl formamide to a level where the meniscus contacts the underside of the mesh, which results in saturation of the lens tissue. Like chloroform, dimethyl formamide is a toxic solvent, and appropriate precautions should be taken in its use.

9. *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 2 to 3 mm square pieces of the collapsed, etched, and carbon-coated filter from the quarter filter. The three squares are selected close to the apex of the sector, and at two other points midway between the apex and the outer edge. Each piece of filter, carbon side up, is placed on a TEM specimen grid with the shiny side of the TEM grid facing upward, and the whole assembly is placed boldy onto the saturated lens tissue in the Jaffe Washer. The three excised squares of filter 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.

I. *TEM specimen preparation from MEC filters (Method B)*— 1. This method of preparing TEM specimens from MEC filters is similar to that specified in NIOSH Method 7402 (Ref. 9).

2. 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. After the analyst has checked to ensure that the cassette is tightly sealed and the plugs are in both ends, it should be thoroughly cleaned by rinsing with water and wet-wiping and then dried with clean paper towel.

3. Remove a section from any quadrant of the sample and blank filters.

4. Place the section on a clean microscope slide. Affix the filter section to the slide with a gummed page reinforcement or other suitable means. Label the slide with a waterproof marking pen.

5. 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.

Note.—The "hot block" clearing technique of Method .7400 may be used instead of steps 4 and 5.

6. Plasma Etching of the Collapsed Filter.

a. The microscope slide to which the collapsed filter pieces are attached is placed in a plasma ashers for a period of about 6 minutes. 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 fibers, 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 particular asher and operating conditions will then be set such that a 1-micrometer layer of collapsed filter will be removed (Ref. 7 and 9).

b. Place the slide containing the collapsed filters into a low-temperature

plasma asher. Etch the filter at 100 degrees C for about 2 minutes at an oxygen pressure of 130 Pa (1 torr).

Note.—Plasma ashers may vary. Determine optimum etching time on blank filters before etching samples. Optimum etching time is determined to be half the time needed to completely ash a filter preparation.

7. Transfer the slide to a rotating stage inside the bell jar of a vacuum evaporator. Evaporate a 1 mm x 5 mm section of a graphite rod onto the cleared filter. Remove the slide to a clean, dry, covered petri dish.

8. Prepare a second petri dish as a Jaffe wick washer with the wicking substrate prepared from filter or lens paper placed on top of a 12 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.

Note.—The wicking substrate should be thin enough to fit into the petri dish without touching the lid.

9. 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.

Note.—The level of acetone should be just high enough to saturate the filter paper without creating puddles.

10. 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.

V. TEM Method

A. *Instrumentation.* 1. 80–120 kV Analytical TEM, preferably with STEM (Scanning Transmission Electron Microscopy) and with a fluorescent screen inscribed with calibrated gradations. The microscope shall be calibrated routinely (see Unit VIII.) for magnification with a standard replica grating and with a gold standard for camera length.

2. Energy Dispersive X-ray Detector mounted on TEM column and associated hardware/software to collect, save, and read out spectral information. Calibration of Multi-Channel Analyzer shall be checked regularly for Al at 1.48 KeV and Cu at 8.04 KeV, as well as the manufacturer's procedures.

3. Specimen holder with single tilt/rotate and/or double tilt capabilities.

4. Dissecting Light Microscope with long working distance for orienting specimen.

B. *Supplies.* 1. Computer software disc for data collection.

2. Forceps, for grid handling.

3. Lint-free gloves for loading sample.

4. Blank form count sheet required and grid map optional.

5. Recording tool (pen).

C. *Procedure.* 1. 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.

2. Check that the microscope is properly aligned and calibrated according to the manufacturer's specifications and instructions.

3. Use the following microscope settings: 80–120 kV, grid assessment 250X–1000X; then 15,000–20,000X screen magnification for analysis.

4. Analyze two sample grids. 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.

5. Start with the first sample grid from the grid holder or plastic capsule.

6. Load the grid into its holder, with its highly reflective face upwards. Check its orientation in the light microscope. Load the specimen into the TEM.

7. Determine the Suitability of the Grid. a. Examine the grid at low magnification (<1000X) to determine its suitability for detailed study at higher magnifications.

b. Reject the grid if: (1) Less than 50 percent of the grid openings covered on the replica are intact.

(2) It is doubled or folded.

(3) It is too dark because of incomplete dissolution of the filter.

c. Individual grid openings with >5 percent openings (holes) or covered with greater than 25 percent particulate matter shall not be analyzed.

d. If the grid is rejected, load the second sample grid and start from Step 5.

e. If the grid is acceptable, continue on to Step 7 if mapping is to be used; otherwise see Step 8.

8. Grid Map (Optional). a. Set the TEM to the low magnification mode.

b. Use flat edge or finder grids for mapping. Write "flat side" in the right hand margin to indicate that the orientation was checked.

c. 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.

d. 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.

9. Scan the grid. a. Select a field to start the examination.

b. Choose the appropriate magnification (15,000X to 20,000X SCREEN magnification). (See Unit VIII.).

c. Scan the grid as follows. (1) At the selected magnification, make a series of parallel traverses across the field. Start at one corner and use the tilting section of the fluorescent screen as a gate or window. 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.

10. Identify each structure for appearance and size.

a. Appearance and size. Any contiguous 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 micrometer detected shall be recorded on the count sheet. These will be designated asbestos structures and will be classified as fibers, bundles, clusters, or matrices. See Figure 1. Combinations such as a matrix and cluster, matrix and a bundle, or bundle and a cluster are categorized by the dominant fiber quality-cluster, bundle, and matrix, respectively. Fiber length must be recorded as to whether it is greater than or less than 5 micrometers. Not required, but useful, may be to record the fiber length in 1 micron intervals. (Identify each structure morphologically and analyze it as it enters the "window.")

Fiber. A structure having a minimum length equal to 0.5 micrometer 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, whether it is flat, rounded or dovetailed.

Bundle. A structure composed of fibers in a parallel arrangement with each fiber closer than one fiber diameter.

Cluster. A structure with fibers in a random arrangement such that all fibers are intermixed and no single fiber is isolated from the group.

Matrix. Fiber or fibers with one end free and the other end embedded in or hidden by a particulate.

NFD. Record NFD when no fibers are detected in the field.

b. Structure Management. (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 after Steps (3), (4), and (5).

(3) Measure the structure using the scale on the screen.

(4) Record the length category and structure type classification (see Section 12e) on the count sheet after the field number and fiber number.

(5) Record also if the fiber contains a tubular structure.

(6) 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.

11. Selected Area Electron Diffraction (SAED) Pattern. SAED is required for all counted structures.

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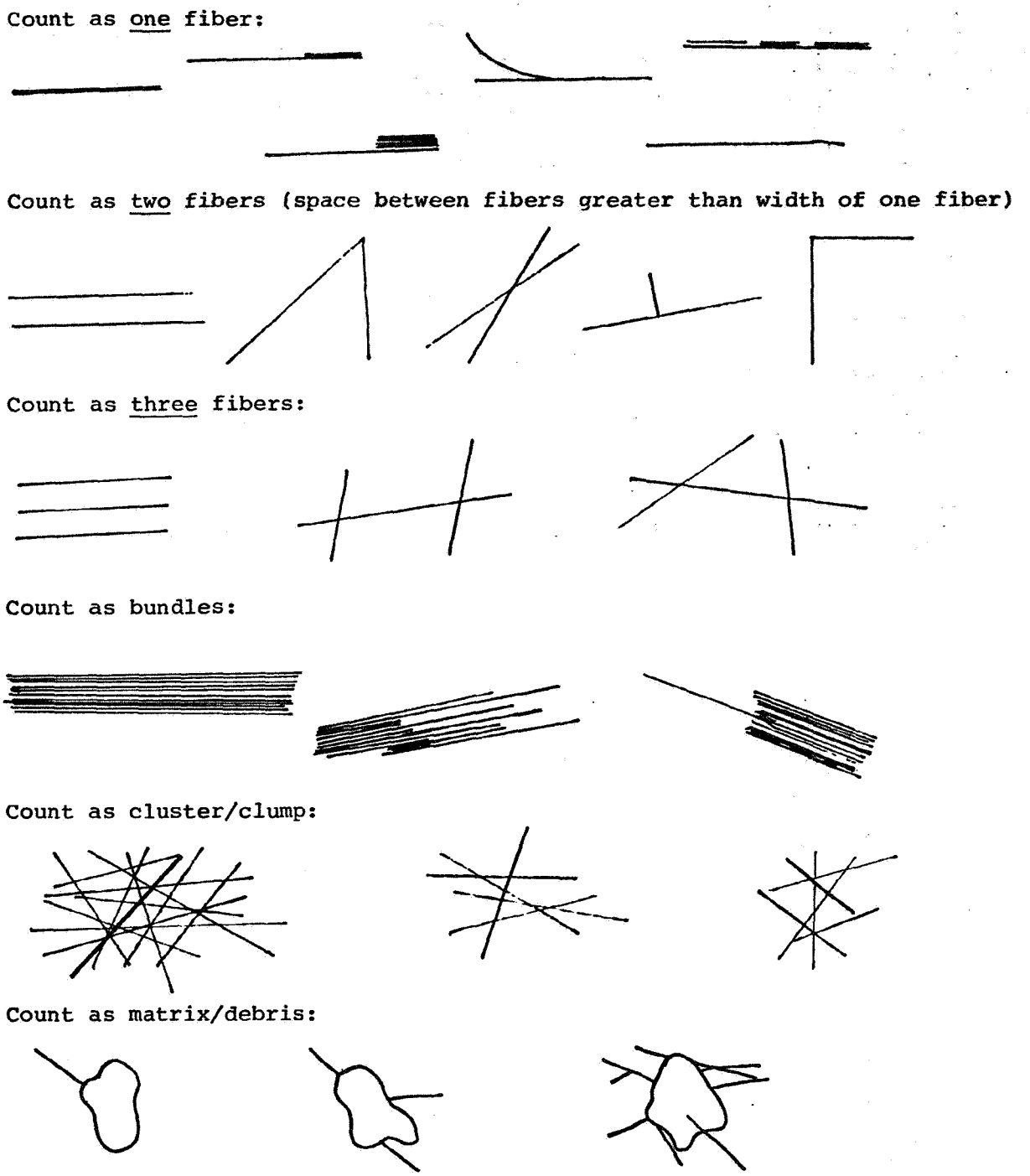
Figure 1.—*Counting guidelines used in determining asbestos structures.* (From Yamate et al., 1984)



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a. Center the structure, focus, and obtain a selected area electron diffraction (SAED) pattern as follows: (See Microscope Instruction Manual for more detailed instructions)

(1) Select a magnification and focus. The tilt should be at 0 degrees.

(2) Bring the desired field of view to the screen center, making sure the diffraction spot has been centered to that point during the alignment procedure.

(3) Remove the objective aperture from the beam.

(4) Insert the appropriate field limiting aperture (usually the smallest) into the beam path. The size will depend on the desired field of view.

(5) Obtain the sharpest field limiting aperture shadow.

(6) Confirm that the desired field of view is in the field limiting aperture.

(7) Overfocus the condenser to decrease illumination.

(8) Obtain a diffraction pattern.

(9) The beam stop may be used to cover the central bright spot to protect the screen.

(10) Check the pattern on the tilted screen through the binoculars. Use a camera length (C.L.) of approximately 20 mm (short camera length).

b. From a visual examination of the electron diffraction pattern, obtained with a short camera length of approximately 20 mm depending on the instrument, through the binoculars on the small screen, classify the observed structure as belonging to one of the following categories by comparing it to known patterns.

(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 are 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 7.3 nm. The pattern should display (002), (110), (130) diffraction maxima; distances and geometry should match a chrysotile pattern and be measured semiquantitively.

(2) Amphibole Group (includes 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) Ambiguous (incomplete spot patterns).

(4) N, if there is no pattern present. (This should be recorded under the SAED column.)

Note.—It is not possible to inspect electron diffraction patterns for some fibers. There are several reasons for the absence of a recognizable diffraction pattern. These include contamination of the fiber, interference from nearby particles, too small a fiber, too thick a fiber, and non-suitable orientation of the fiber. Some chrysotile fibers are destroyed in the electron beam resulting in patterns that fade away within seconds of being formed. Some patterns are very faint and can be seen only under the binocular microscope. For that reason, patterns should always be examined with a short camera length (approximately 20 cm) and through the binoculars on the focusing screen.

c. Recording of an SAED pattern is required for at least one structure of each classification. 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 rotated to obtain a simple geometric array of spots.

(1) Change the camera length so the photographed area of the screen is filled by the diffraction pattern.

(2) Record the following information for the photograph:

(a) On the count sheet: Record the negative number (see Note below) under the SAED column.

(b) On the negative recording log, record. i. Date.

ii. Negative number (see Note below).

iii. kV=80–120 kV.

iv. Magnification not applicable for diffraction.

v. Initials of Operator.

vi. Sample number, grid number, field number, and fiber number.

vii. Tilt used picture: 0 degrees for chrysotile.

viii. Seconds of Exposure.

ix. Camera Length (CL).

d. Return the stage to 0 degrees tilt when finished.

e. Develop the film. Compare the pattern with standard reference patterns and record the results of the verification.

12. X-ray Analysis (EDXA) (Required if the number of NA or amphiboles exceed 70 fiber per mm^2):

a. Examine each fiber for which elemental analysis is necessary (see Section 11e) with EDXA system as follows, after ascertaining that the stage is at 0 degrees tilt.

(1) In the TEM mode:

(a) Choose a magnification such that the fiber fills the "window" area.

(b) Reduce the spot size and stigmate so that the beam overlaps the fiber.

(c) Run the analysis on the EDXA system.

(2) In the STEM mode (See the TEM Instruction Booklet for details):

(a) Get the STEM image.

(b) Choose a magnification such that the fiber fills the STEM screen and position the spot over the fiber.

(c) Run the analysis on the EDXA system.

b. If the EDXA signal is weak, take another spectrum, being sure that the spot is still on the fiber.

c. If the EDXA is used for confirmation, record the spectrum on a computer disk, with proper identification as to fiber number, disk number, and file number recorded on the count sheet.

Note.—When to do EDXA:

i. Record the elemental analysis on at least one amphibole asbestos fiber for which the diffraction pattern was recorded.

ii. No background spectrum or constant acquisition time is required (although normally 60 seconds is used) since the shape of the spectrum (profile) is the criterion.

iii. Compare spectrum profiles with profiles obtained from asbestos standards. The closest match identifies and categorizes the structure.

iv. Use the following guidelines to determine when to do EDXA, after having already done SAED and visually interpreting that pattern:

A. For identifying and categorizing the amphibole structure, analyze ALL confirmed amphiboles by the EDXA.

B. For identifying and categorizing the ambiguous structure, analyze ALL by the EDXA.

13. Record the following on the count sheet:

a. Field: List field number.

b. Fiber:

(1) If no fibers are found in the field, record "NFD."

(2) If fibers, bundles, clusters, and/or matrices are found, then list them in consecutive numerical order, starting over with each field.

c. Length: Record length category of asbestos fibers that were examined.

d. Fiber Type: Positive identification of asbestos fibers is required by the method. At least one diffraction pattern of each fiber type on the sample must be recorded and compared with a standard diffraction pattern. Use the following designations. To take into account the wide variation in operator skills and equipment and also to assist in the interpretation of fibers counts, fiber identifications shall be reported according to a defined set of codes which are shown in Table III. These codes allow those using the data to determine the basis on which a fiber was identified and how certain the identification is for the fiber. For each

asbestos fiber reported, both a morphological descriptor and an identification descriptor shall be specified by using the count sheet;

e. *Classification Rules.* Fibers classified as chrysotile must be identified by CD or CX. Fibers classified as amphibole must be identified by ADX or AZ. Chrysotile is identified by diffraction pattern and confirmed with Mg/Si ratio with absence of other elements from EDS. Amphibole can usually be categorized, if desired, after a SAED pattern is obtained by comparing the EDS profiles of Na, Mg, Si, Ca, and Fe with known profiles.

If the number of fibers in the nonasbestos class would cause the analysis to exceed the detection limit of the method, their identities must be confirmed by EDXA or measurement of a zone axis diffraction pattern.

Reference samples typical of minerals commonly encountered during abatement analysis must be used in training operators. These include gypsum, calcite, dolomite, quartz, vermiculite, fibrous clays, talc, glass fibers, and diatoms.

f. *Morphology.* (1) Assume a single fiber, if the fiber type is identified.

(2) Indicate if a tubular structure exists inside the fiber (chrysotile as a tubular structure inside, as do some nonasbestos particulates).

g. EDXA. (1) List the disk number and file number if any spectra of the fiber were saved.

(2) Use a check mark or an "X" in this column if the elemental analysis was checked but not saved.

h. *Photograph.* List the negative number if a photograph of the sample was taken.

i. SAED:

(1) Mark an "X" if the pattern confirmed an identification, but no photograph was taken.

(2) List the negative number if the diffraction pattern was recorded.

(3) Record "N" if no pattern was found.

14. After all necessary analyses of a fiber, return the goniometer stage to 0 degrees and return the structure to its original location by recall of the original location.

15. Continue scanning until all the structures are identified, measured, analyzed, and categorized in the field.

16. Select additional fields at low magnification, scan at a chosen magnification (14,000X to 20,000X screen magnification) and analyze until the stopping rule becomes applicable.

17. Carefully record all data as it is being collected, and check it for accuracy.

18. 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 2 years from the date of the analysis; the sample cassette must be retained for a minimum of 30 days.

19. *Equipment Calibration:* In this method, calibration is necessary for the air-sampling equipment, the TEM in both microscopy and SAED modes, and the EDXA system.

a. *TEM Magnification.* The magnification at the fluorescent screen of the TEM must be calibrated at the grid opening magnification (if used) and also as the magnification used for fiber counting. This is performed with a cross grating replica. 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; no frequency is specified. After any maintenance of the microscope that involves adjustment of the power supplies 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.

b. Determination of the TEM magnification on the fluorescent screen:

1. Define a field of view on the fluorescent screen either by markings or physical boundaries.

Note.—The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric).

2. Insert a diffraction grating replica 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.

3. 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.

4. Calculate the true magnification (M) on the fluorescent screen:

$$M = \frac{XG}{Y}$$

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. SAED Calibration. The camera length of the TEM in SAED operating mode must be calibrated before SAED patterns on unknown samples are observed. This is achieved by using a carbon-coated grid on which a thin film of gold has been sputtered or evaporated. For photographic recording of SAED patterns, the only satisfactory record of the camera length of the pattern is by an internal standard technique. After a thin film of gold is sputtered or evaporated onto the actual sample specimen grid, a gold calibration SAED ring appears on each fiber SAED pattern recorded.

d. *Magnification calibration.* The following steps should be performed to calibrate the magnification of the EM:

1. Align the EM using the manufacturer's instructions.

2. Insert magnification-calibration grating replica (as an example a grating containing 54,864 lines per inch, or 1,260 lines per mm) in the specimen holder.

3. Switch on the beam, obtain the image of the replica grating at 20,000X magnification (or at the magnification at which the asbestos samples will be analyzed), and focus.

4. If the fluorescent screen has scribed circles of known diameters, align one line tangentially to the circumference of one circle using stage control. Count the number of lines in a diameter perpendicular to the lines. In most cases, the other end of the diameter will be between the n^{th} and $n^{th} + 1$ line. The fractional spacing can be estimated by eye. Alternatively, the separation between lines can be estimated using the scribed circles.

5. If X line spacings span Y mm on the fluorescent screen using this grating replica, the true magnification, M, is given by

$$M = \frac{Yx2160}{X}$$

The readings should be repeated at different locations on the replica, and the average of about six readings should be taken as the representative or true magnification for that setting of the EM, as in the following example:

Line spacings X	mm on screen Y	Magnification M
9.5	83	16871
9.3	80	16580
7.0	60	16514
8.8	80	19636
9.0	80	19200
9.0	80	19200
Average		19000

On most EM's with large (18-cm diameter) fluorescent screens, the magnification is substantially constant only with the central 8- to 10-cm-diameter region. Therefore, calibration measurements should be made within this small region and not over the entire screen.

e. 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.

f. *Calibration of Grid Openings.* Measure 20 grid openings on each of 30 random 200-mesh copper grids by placing a grid on a glass slide and examining it under the PCM. Use the Walton-Beckett graticule to measure the grid opening diameters. Calculate an average field diameter from the data and use this number to calculate the field area for an average grid opening. Grids to be randomly selected from batches up to 1,000.

Note.—A grid opening is considered as one field.

g. Measurement of Grid Opening Area. 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 400 by using an eyepiece fitted with a scale that has been calibrated against a stage micrometer.

19. Crystallography and Morphological Properties:

Both crystallographic and morphological characteristics of asbestos minerals can help considerably in asbestos identification and analysis. Chrysotile displays a unique narrow tubular morphology. The amphibole asbestos minerals have very similar morphologies—they are elongated along the z-axis (the chain direction) and generally lie with (100) planes approximately perpendicular to the electron beam. All varieties of amphiboles exhibit these Wadsley faults parallel to the length of the fiber.

Chrysotile possesses a cylindrical lattice which produces a unique SAED pattern. All the amphiboles, except anthophyllite, which is orthorhombic, have a monoclinic crystal structure. The amphiboles are double-chain silicates in which the fiber axis, z, has a repeat of 0.53 nm (inter-row spacing 'R' in real space). Since the other lattice parameters are also very similar, detailed zone-axis SAED analysis in more than one orientation is needed for positive identification. The nonasbestos forms of amphiboles have properties very similar to their asbestos counterparts, thus they must be distinguished from asbestos on the basis of morphology alone.

Note.—This section and sections 19–26 have been drawn from Reference 10.

20. Chemical Properties—Elemental Analysis by EDS:

Amphiboles are nonstochiometric minerals and often contain substitutional cations in varying amounts. Therefore, precise determination of their chemistry is difficult and positive identification based on chemistry alone is not reliable. This may be particularly pertinent when dealing with asbestos minerals present as minor constituents in mineral samples.

Elemental ratios, which are sometimes used to distinguish between asbestos types, often vary over wide ranges even in standard samples. The presence of gold coating, which would tend to preferentially absorb X-rays from lighter elements more than heavier elements, may make the situation even worse. In view of these ambiguities, and due to inherent practical difficulties in obtaining representative quantitative EDS elemental analyses from submicroscopic fibers, the present Level II and Level III protocols specify the use of only qualitative EDXA spectra, which are often very valuable for screening purposes in the identification procedure. For example, in distinguishing between tremolite and actinolite type of amphibole, actinolite usually contains Fe, but tremolite does not.

21. Selected Area Electron Diffraction (SAED). The method of obtaining an SAED pattern of a randomly oriented specimen is usually described in the EM instruction manual. The general directions for using the instrument to obtain and photograph SAED patterns are:

a. Select the image magnification for the selected area.

b. Bring the desired field of view to the center of the screen.

c. Insert the appropriate field-limiting aperture (according to the desired field of view) into the beam bath.

d. Obtain the sharpest field-limiting aperture shadow.

e. Confirm that the desired field of view is in the field-limiting aperture.

f. Focus the specimen image; a photograph of the selected area image can be taken.

g. Obtain the SAED pattern, remembering to retract the objective lens aperture from the beam path. The SAED pattern will be observed on the fluorescent screen.

h. Select the desired camera length (the shorter the length, the better for SAED patterns of asbestos taken at high magnification).

i. Focus the SAED pattern sharply. The beam stopper is used to intercept the bright center spot.

j. For photography, the illumination is expanded (condenser reduced) after focusing the pattern, so that the pattern becomes barely visible (indistinct). A manual time exposure of approximately 20 to 30 seconds (maybe more depending on such factors as specimen and film) is required. The beam stopper can be left in place or removed from the beam path 1 to 2 seconds before closing the shutter. A double exposure of the specimen image and the SAED pattern can be taken if particle-to-particle spacing is adequate.

22. Use of Tilting to Acquire Exact Zone-Axis SAED Patterns:

Determination of the Tilt Axis. In the side-entry type electron microscopes, the instrument tilt axis is always fixed. However, the position of the tilt axis on the viewing screen shifts with magnification. Also, there is always an angular rotation between the image and the SAED pattern. It is highly desirable

to know the location of the tilt axis on the viewing screen and its relationship vis-a-vis SAED pattern under the operating conditions to make effective use of specimen tilting for obtaining exact zone-axis orientations. The following steps can be used to locate the position of the tilt axis:

a. A gold-coated TEM grid with a standard asbestos mineral specimen on a polycarbonate replica film is placed in a tiltrotation or double-tilt holder and inserted at 0 degrees tilt into an aligned TEM set at 100 kV, 100 μA (microampere) 20,000X magnification, and 20-μm micrometer camera length operation.

b. The image is focused on the fluorescent screen, which is at approximately 16,000X magnification.

c. A circular hole in the polycarbonate replica is positioned in the center of the field of view.

d. On tilting, the circular feature changes to an ellipse with the major axis unchanged, and indicates the position (direction) of tilt axis at that magnification. The minor axis shows the perpendicular direction to the tilt axis. A high tilt angle defines the tilt axis more accurately than a small tilt angle.

e. A double-exposure photograph at 0 degrees tilt and at some high tilt angle, such as 30 degrees, is taken of the focused circular hole for reference.

Tilting—for zone-axis SAED Patterns. Quantitative SAED requires knowledge of crystallography to obtain useful zone axis diffraction patterns from which precise measurements can be made for comparison with known asbestos standards on file. Thus the method of obtaining the visual SAED pattern of randomly oriented specimens, as in Level I and Level II analysis, is modified for quantitative SAED pattern analysis. It requires tilting of the specimen to align major crystallographic directions with the electron beam. The zone axis is a line parallel to a set of intersecting crystal planes and nearly parallel to the electron beam. A zone-axis pattern thus gives regular repeat distances and even intensities of spots throughout the pattern.

Either a double-tilt or a tilt-rotation type specimen holder can be used for obtaining zone-axis patterns. A double-tilt holder is often preferred because tilt-rotation combination involves translational movement of the fiber during tilting, necessitating constant adjustment of the specimen-positioning controls to keep the specimen centered in the SAED aperture. On the other hand, it is much easier to obtain an accurate measure of the degree of tilt and perform systematic tilting with the tilt-rotation specimen holder. It is only necessary to rotate the specimen (fiber) until the tilt axis (as determined earlier) coincides with a major row of spots and then tilt until a major zone axis is parallel to the incident electron beam. Alternately, fiber axis of the fiber can be oriented either parallel or perpendicular to the tilt axis and then further tilting is used to obtain exact zone-axis orientations.

In order to avoid flip-flopping between image and diffraction modes while tilting, a recommended procedure is to defocus the diffraction pattern (the aperture becomes visible and the specimen/fiber can be seen in it) so that a double image of fiber in aperture can be seen with a poorly focused diffraction pattern. The movement of the fiber can be tracked in relation to the spot pattern tilting and kept centered in the SAED aperture by use of the specimen-positioning controls (knobs) of the microscope. Sometimes a larger aperture aids in the tracking-pattern recognition process.

An experienced electron microscopist can readily recognize the geometrical features like Kikuchi lines or Laue zones in the SAED pattern and use these to obtain the exact zone-axis SAED patterns. A detailed discussion of Kikuchi patterns and Laue zones and their utility in tilting experiments may be found in any standard textbook on electron microscopy. Use of the double-tilt specimen holder is very helpful and less tedious in tilting experiments. However, all laboratories may not have both types of specimen holders available. A skilled microscopist can use either specimen holder without much difficulty. Experience and skill are more important factors in SAED analysis than the type of specimen holder used.

23. Characteristics of SAED Patterns Encountered in Asbestos Analysis. Successful application and exploitation of SAED analysis in asbestos analysis needs prior knowledge of the general appearance and distinguishing characteristics of other SAED patterns which are often encountered. The following discussion summarizes some of the observed SAED features of asbestos and other related minerals. This discussion is by no means comprehensive and assumes that the reader is familiar with general crystallography and the nomenclature pertaining to various aspects of SAED patterns.

Minnesotaite and Stilpnomelane. These iron-rich nonasbestos layer minerals are often encountered in asbestos analysis of specimens from certain geographic locations. Particulates of these minerals lie near their basal (001) planes. Stilpnomelane and minnesotaite both possess large superlattices and their commonly observed SAED patterns are easily distinguishable from amphibole patterns. The spacing (in reciprocal space) is about half (for minnesotaite) or less than that for most amphiboles. These minerals can be readily distinquished in Level I or Level II analyses if a gold coating (optional) is applied to the specimen grids. A visual inspection of the number of rows of spots inside the (111) gold ring is sufficient to distinguish minnesotaite and stilpnomelane from amphiboles.

Chrysotile. Due to the cylindrical lattice of chrysotile the SAED pattern is unique. The SAED pattern observed is symmetrical about the cylinder axis, x, and the spacing of the rows of spots is proportional to 1/a, where a is 0.53 nm. The most distinguishing features of the pattern are the flared spots of the type (130) which occur in the first layer line. The flaring is due to the cylindrical lattice. A typical EDS spectrum shows the presence of only Mg and Si.

Amphiboles—Systematic Absences, Twinning, and Double Diffraction. The most commonly observed row of diffraction spots found in SAED patterns in amphiboles is in the y^* or b^* direction, representing the shortest reciprocal spacing between the spots (18.4 A in real space). There are many strong zone axis orientations containing the y^* row of spots. The lattice of amosite, crocidolite, tremolite, and actinolite is c-centered, and for such a lattice the h+k odd spots are absent along the y^* or b^* row. In practice, however, weak spots may be present in forbidden positions due to the presence of thin twinning on (100), which cause streaking parallel to a^*. Often, reciprocal nets from both twins are present in the same SAED pattern. In a twinned crystal, the number of important diffraction nets containing b^* is doubled, leading to the observation that the diffraction patterns appear insensitive to tilt.

In some cases SAED patterns can contain spots from both twin individuals which overlap. However, not all the spots present in the composite SAED patterns are generated by the overlapping nets; some spots may be present because of double diffraction where a diffracted beam from one twin becomes the transmitted beam when it enters the other twin.

The purpose of the above discussion is to point out that although many complications exist in the analysis of SAED patterns, these can be overcome: in a good goniometric tilting stage most

amphiboles can be identified by SAED analysis.

Amosite. The nearest reciprocal lattice section to the (100) direct lattice plane in amosite is (301)* and it is also the most commonly observed section. Due to the presence of the thin (100) twins, this section closely resembles (100)*.

Typical EDXA spectra from amosite fibers show mainly Si and Fe with smaller amounts of Mg and Mn. Mn is frequently observed as a substitutional cation in amosite.

Crocidolite. Most of the commonly observed patterns are asymmetrical and cannot be indexed easily. However, they all show rows of spots separated by a reciprocal repeat (R) corresponding to the fiber axis (0.53 nm).

The main elements observed in typical EDXA analysis are Mg, Si, Ca, and Fe. Na, which is usually present in crocidolite, may not be detected in gold-coated specimens because of absorption, or because of overlapping secondary peaks from the copper grid.

Tremolite-Actinolite. Tremolite and actinolite show a variety of SAED patterns which have very similar appearances. In actinolite some of the Mg is replaced by Fe, with the result that interplanar d-spacings of actinolite are slightly larger than tremolite. In both tremolite and actinolite, the main elemental constituents are Mg, Si, and Ca. Actinolite also contains some Fe.

Anthophyllite. Even though anthophyllite has an orthorhombic crystal structure, its commonly observed patterns are similar to the monoclinic amphiboles. Anthophyllite fibers dehydrate more easily in an electron beam and are, therefore, more difficult to study.

EDS elemental analysis shows the main constituents to be Si and Mg with a small amount of Fe.

24. Determination of Camera Constant and SAED Pattern Analysis:

A thin film of gold is evaporated on the specimen TEM grid to obtain zone-axis SAED patterns superimposed with a ring pattern from the polycrystalline gold film. Since d-spacings corresponding to identifiable gold rings are known, these can be used as an internal standard in measuring unknown d-spacings on an SAED pattern from a fiber. The precision of measurement is as good as the quality of the photograph (or negative) and usually the measurements should be in the order of 0.1–0.2 mm with an angular tolerance of 0.5–1.5 degrees. The measurements can be made by several methods: manually with a ruler, with a mechanical aid, or a densitometer, etc. The patterns can be read directly on the developed negative or on an enlarged nonglossy print.

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 SAED 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 SAED patterns.

25. Determination of Camera Constant Using Gold Rings:

An average camera constant using multiple gold rings can be determined as explained below. However, in practice, in most cases determination of the average camera constant is not necessary and thicker gold films are not desirable. The camera constant, CC, is one-half the diameter, D, of the rings times the interplanar spacing, d, of the ring being measured and is expressed as:

$$CC\ (mm\ \text{Å}) = \frac{D(mm)}{2} \times d(\text{Å})$$

The value of d for each ring can be obtained from the JCPDS file.

a. Measure the diameters (two perpendicular locations of the gold rings in mm) as precisely as possible.

b. Measure as many distinct rings as possible to minimize systematic errors.

c. Example: if the measured values in mm are D_1, D_2, D_3, D_4, and D_5, these will represent, respectively, d-spacings of

$$\frac{4.079}{\sqrt{3}},\ \frac{4.079}{2},\ \frac{4.079}{\sqrt{8}},\ \frac{4.079}{\sqrt{11}},\ \text{and}\ \frac{4.079}{\sqrt{12}}\ \text{Å}$$

d. The camera constants will be:

$$CC_1 = \frac{D_1}{2} \times \frac{4.079}{\sqrt{3}} = \frac{D_1}{2} \times 2.355$$

$$CC_2 = \frac{D_2}{2} \times \frac{4.079}{2} = \frac{D_2}{2} \times 2.04$$

$$CC_3 = \frac{D_3}{2} \times \frac{4.079}{\sqrt{8}} = \frac{D_3}{2} \times 1.442$$

$$CC_4 = \frac{D_4}{2} \times \frac{4.079}{\sqrt{11}} = \frac{D_4}{2} \times 1.23$$

$$CC_5 = \frac{D_5}{2} \times \frac{4.079}{\sqrt{12}} = \frac{D_5}{2} \times 1.178$$

e. The camera constant for the SAED pattern is the average of CC_1, CC_2, CC_3, CC_4, and CC_5. The following Table presents an example of camera-constant determination.

DETERMINATION OF CAMERA CONSTANT (EXAMPLE)

Ring No.	D_1 readings (mm)	Mean D_1 (mm)	d-spacing, d_1 (Å)	Camera constant $C_1 = D_1/2 \times d_1$
1	23.0, 22.0	22.5	2.355	26.5
2	27.4, 27.6	27.5	2.04	28.0
3	37.8, 38.2	38.0	1.44	27.4
4	44.6, 45.4	45.0	1.23	27.7

Mean Value of Camera Constant $= \frac{C_1}{n} = \frac{26.5 + 28.0 + 27.4 + 27.7}{4} = 27.4$ (mm Å)

25. Measurement of d-Spacings and Interplanar Angles. The gold film, because of its small, randomly oriented crystallites, produces a ring pattern superimposed on the SAED pattern from the fibers. The diameters of the gold rings correspond to known values of d-spacings, and this provides an internal standard to correct for inherent uncertainties present due to variations in instrumental and/or operating conditions. Since the d-spacings of interest on SAED patterns are usually the ones that lie closest to the center spot (transmitted beam), a camera constant measured from the first gold ring in the direction of measurement of d-spacings will usually give better accuracy in computed spacings than the use of an average camera constant. This method will account for any distortions in the symmetry of the spots within the circular pattern of the gold rings. These rows of spots contain information about the two sets of planes in the crystal structure and the angle between them. The following procedure outlines the steps necessary to obtain the distances between planes (d-spacings) and the corresponding interplanar angle, Θ:

a. From the spot pattern, determine the row with spots most closely spaced, and designate this as a horizontal row. Draw a fine line to show the row through the origin, and designate this the zeroeth row. Draw fine lines to show the first and succeeding horizontal rows. For a few horizontal rows, measure the mean spacing between adjacent spots (or the minimum vector):

$$X_1 = \frac{\text{Distance between spots m units apart}}{m}$$

where m is chosen as an optimum number to minimize measurement errors. The mean horizontal spot distance, X, equals the summation of X_1 divided by the number, n, of rows measured. The d-spacing in A corresponding to this vector is the camera constant divided by X, and is labeled d_2. The following table presents an example of spot spacing measurement within a horizontal row.

b. The perpendicular distance between two adjacent horizontal rows is similarly measured. This interrow spacing, Z, is the mean separation between horizontal rows, and equals the distance between a number of rows divided by the number of spaces. This distance is an additional vector for comparison that coincides with the slant vector, d_1-spacing, when angle $\Theta_{1,2}$ is 90 degrees. The row-spacing (R) equals the camera constant divided by Z. The following table presents an example of perpendicular spacing between horizontal rows.

c. To obtain the d_1-spacing and corresponding angle $\Theta_{1,2}$, a perpendicular is drawn to the zeroeth horizontal row through the origin. A line is drawn to the first spot to the right of the perpendicular in the first row and extended through the succeeding rows. This line, called the slant vector, forms the acute angle $\Theta_{1,2}$. The mean spacing, Y, between spots on the slant vector can be measured by dividing the maximum distance between spots by the number of spaces between them, or by calculating from the interrow spacing:

$$Y = \frac{R}{\sin \Theta_{1,2}}$$

The d-spacing in A corresponding to this vector is the camera constant, CC, divided by Y and leveled d_1.

$$d_1(\text{Å}) = \frac{CC \times \sin \Theta_{1,2}}{R} = \frac{CC}{Y}$$

In some cases, the interplanar angle $\Theta_{1,2}$ may be more than 90 degrees.

Summary of Data From Each SAED Pattern:

(1) The camera constant, CC, as determined from the gold rings, normalizes the distances on the SAED pattern regardless of such factors as magnification and tilting.

DETERMINATION OF SPOT SPACINGS (EXAMPLES)

Reading	Separation (mm)	Mean spacing Units	X_1(Å)
Spot spacing within a horizontal row, d_2:			
1	49	16	3.006
2	42.7	14	3.05
3	--	--	--
			3.028 = Mean
d-spacing = $\frac{27.4}{3.028}$ = 9.05 Å			
Perpendicular spacing between horizontal rows, R:			
1	43	8	5.0375
--	--	--	--
--	--	--	--
			5.0375 = Mean
d-spacing, R = $\frac{27.4}{5.0375}$ = 5.44 Å			

Note: It is preferable that the camera constant values used in computing d-spacings are measured from the first one or two gold ring diameters in the direction of d-spacing measurement.

(2) The parameters of interest are:

(a) d-spacing of spots in a horizontal row: $CC/X = d_2$

(b) d-spacing of spots in the slant vector: $CC/Y = d_1$

(c) angle $\Theta_{1,2}$ formed between a horizontal row and slant vector

(d) d-spacing corresponding to row separation as an additional parameter of interest: $CC/Z = R$.

It should be noted that the use of camera constant in the form used here in calculating d_1, d_2, and R, which are measured in reciprocal space on SAED patterns, automatically converts the calculated numbers into real space spacings, which are then compared to those from a suitable standard file.

26. Identification of Unknown Fibers:

Unknown d-spacings (d_1 and d_2), interrow spacing (R), and interplanar angles (Θ) measured from zone-axis SAED patterns of unknown fibers are compared with corresponding known values tabulated in JCPDS powder diffraction files, or those computed using lattice parameters and crystal structures of candidate asbestos minerals, or with the values contained in an internally developed file from standard specimens of candidate minerals. The following table is an example of the IITRI standards file.

Unknowns are matched as closely as possible to the file parameters for positive identification. However, considerable care and competent judgment are required in Level III confirmatory analysis. For example, amphiboles are usually nonstochiometric minerals, and thus a perfect match may not be possible between the d-spacings and interplanar angles determined from unknown fibers and those available from standard minerals. JCPDS Powder Diffraction files do not list interplanar angles. Since amphiboles have low-symmetry crystal structures, tabulated values of d-spacings and interplanar angles would be extensive and very expensive to generate, and to get an accurate match may not be possible because these tables are derived assuming certain lattice parameters which may not be the same as those of the unknown fibers being analyzed. Given these inherent uncertainties, it would seem that use of internally developed SAED files consisting of several readily accessible orientations (by virtue of natural habit of amphibole fibers) from standard amphibole species could eliminate a lot of tedious unnecessary work and yet provide reliable data for comparison and identification of unknown fibers.

In practice, SAED analysis combined with qualitative EDS analysis may help resolve certain cases where a close match in d-spacings and interplanar angles is not possible. For difficult specimens or SAED patterns of controversial nature, a second opinion may prove useful.

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COMPARISON OF d-SPACINGS FROM SAED FILE AND POWDER DIFFRACTION FILE (EXAMPLE)

Amphibole Type	Zone Axis	Internal Standard File Data			Interrow spacing, R (Å)	Powder Diffraction File Data (1975)		
		d_1 (Å)	d_2 (Å)	(deg)		d_1 (Å)	d_2 (Å)	File Index No.
Amosite	[100]	5.3	9.14	90.0	5.3	5.22	9.20	17-725
	[30$\bar{1}$]	1.79	9.26	84.0	--	1.76	9.20	17-725
	[101]	4.88	9.23	74.0	5.17	4.84	9.20	17-725
	[$\bar{1}$01]	4.14	9.11	78.0	4.21	4.10	9.20	17-725
	[$\bar{3}$10]	5.22	5.13	95.0	--	5.22	5.12	17-725
Crocidolite	[100]	5.22	8.97	90.0	5.22	5.20	9.02	19-1061
	[101]	4.94	9.05	75.0	5.19	5.89	9.02	19-1061
	[$\bar{1}$10]	4.79	8.19	79.0	5.23	4.89	8.40	19-1061
	[30$\bar{1}$]	1.75	8.97	83.5	--	1.76	9.02	19-1061
	[$\bar{3}$10]	5.12	5.12	96.0	--	--	--	19-1061
Tremolite	[100]	5.04	9.03	90.0	--	5.07	8.98	13-437
	[101]	4.83	9.03	75.0	--	4.87	8.98	13-437
	[$\bar{2}$0$\bar{1}$]	2.59	8.97	80.5	--	2.59	8.98	13-437
	[30$\bar{1}$]	1.72	8.98	83.5	--	1.69	8.98	13-347
Anthophyllite	[100]	--	--	90.0	5.24	5.28	8.90	9-455
	[$\bar{1}$42]	4.56	4.56	60.0	--	4.50	4.50	9-455

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Table III—Fiber Identification Codes

A. Classification of Fibers With Tubular Morphology

CM—Fiber with chrysotile morphology that may be used only after concentration of chrysotile exceeds 70f/mm².

CD—Fiber with chrysotile morphology that yielded a chrysotile SAED pattern.

CX—Fiber with chrysotile morphology that yielded an EDXA spectrum appropriate for chrysotile.

CDX—Fiber with chrysotile morphology that yielded a chrysotile SAED pattern and an EDXA spectrum appropriate for chrysotile.

B. Classification of Fibers Without Tubular Morphology

UF—Unidentified fiber suspected to be amphibole.

AD—Fiber classified as amphibole by random orientation SAED (shows layer SAED pattern of 0.53-nm-spacing).

AX—Fiber classified as amphibole by semiquantitative EDXA (spectrum has elemental components and peak heights consistent with those of an amphibole).

ADX—Fiber classified as amphibole by random orientation SAED and by semiquantitative EDXA (shows layer SAED pattern of 0.53 nm spacing, and spectrum has elemental components and peak heights consistent with those of an amphibole).

AZ—Fiber classified as amphibole by recording and measurement of one zone-axis SAED pattern.

AZX—Fiber classified as amphibole by one zone-axis SAED pattern and by semiquantitative EDXA.

AZZ—Fiber classified as amphibole by two zone-axis SAED patterns, consistent interaxial angle, and semiquantitative EDXA.

Note.—Fibers cannot be placed into the last two classifications at the microscope during fiber counting.

C. Classification of Nonasbestos Fibers

ND—Fiber with nonasbestos morphology that yielded a nonasbestos SAED pattern.

NX—Fiber with nonasbestos morphology that yielded an EDXA spectrum appropriate for nonasbestos.

NDX—Fiber with nonasbestos morphology that yielded a nonasbestos SAED pattern and an EDXA spectrum appropriate for nonasbestos.

VI. Sample Analytical Sequence

Under the present sampling requirements at least 13 samples are collected for the clearance testing of an abatement site. These include 5 abatement area samples, 5 ambient samples, 2 field blanks, and 1 sealed blank. While all samples must be taken, not all samples need necessarily be analyzed to allow sound decision-making on the airborne asbestos levels of an area. The sample type and its analytical value will indicate the relative value of knowing the asbestos concentrations for the other sample types. For example, if all abatement area samples were analyzed first and each was found to be below the acceptance criteria, then there would be no value in analyzing the ambient control samples or blanks. Final clearance could be granted on the basis of finding all interior samples below the acceptance limits. If instead the sample had been above the limit, then the values on the field blanks and the ambient control samples would be of pivotal decision-making importance. By prioritizing the analysis of those samples with the highest information potential under a given circumstance, one maximizes the impact and minimizes the cost. A sample sequencing method is presented in Figure 2 and in the text below to take advantage of this possibility.

1. Carry out visual inspection of worksite prior to air monitoring.

2. Collect a minimum of 5 air samples inside the worksite and 5 samples outside the worksite. 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 f/cm³ analytical sensitivity.

4. Calculate the average airborne asbestos concentration of the abatement area samples.

5. If the average is less than 70 f/mm², the samples are indistinguishable from background and meet the clearance standard. No further analysis is required.

6. If the average is more than 70 f/mm², two options exist. The site may be recleaned or the blanks may be analyzed. If the blanks are analyzed, analyze each blank. The minimum filter area to be analyzed on each blank is 0.057 mm² (nominally ten 200-mesh grid openings).

7. If the blank(s) yields concentrations of fibers greater than 70 f/mm², then there is evidence of procedural contamination. The contamination problem must be resolved and new sample collected.

(a) Abatement area blank indicates possible contamination from supplies and/or field handling.

(b) Ambient area blank indicates possible contamination from supplies and/or handling.

(c) Sealed blank indicates possible contamination from supplies.

8. If the blank(s) yield concentrations less than 70 f/mm², then proceed to analyze the five ambient samples.

9. Determine whether the inside airborne asbestos concentrations are statistically higher than the outside asbestos concentrations according to the Z-test comparison.

10. If the abatement area samples are not significantly different in concentration from the ambient control samples, the area meets the clearance criteria.

11. If the abatement area samples are significantly higher than the ambient asbestos concentration, then the abatement area must be recleaned and resampled.

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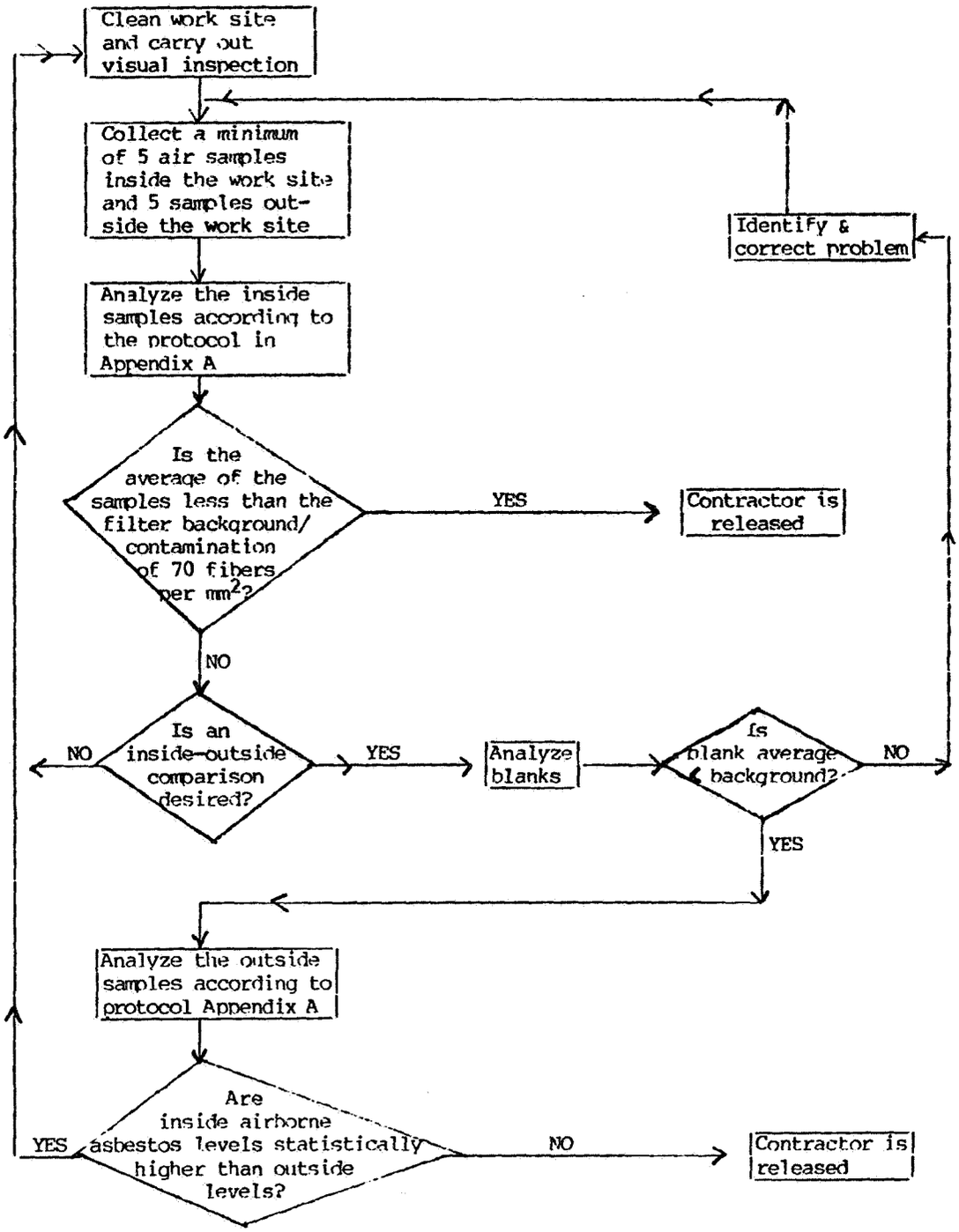
FIGURE 2 --
FLOW CHART FOR DETERMINING COMPLETION OF A REMOVAL RESPONSE ACTION



CALCULATION OF Z-TEST WORKSHEET

Inside Work Site ID No. _____

Outside Work Site ID No. _____

n_i = number of inside samples = _____

n_o = number of outside samples = _____

	INSIDE SAMPLES (f/cc)	LOG INSIDE SAMPLES	OUTSIDE SAMPLES (f/cc)	LOG OUTSIDE SAMPLES
(1)	log (_____) =	_____	log (_____) =	_____
(2)	log (_____) =	_____	log (_____) =	_____
(3)	log (_____) =	_____	log (_____) =	_____
(4)	log (_____) =	_____	log (_____) =	_____
(5)	log (_____) =	_____	log (_____) =	_____
	Total =	_____	Total =	_____
	$\bar{Y}_i$ = Total ÷ n_i =	_____	$\bar{Y}_o$ = Total ÷ n_o =	_____

(a) $\bar{Y}_i - \bar{Y}_o$ = _____

(b) $\frac{1}{n_i} + \frac{1}{n_o}$ = _____ , $\sqrt{\frac{1}{n_i} + \frac{1}{n_o}}$ = _____

(c) $0.8 \times \sqrt{\frac{1}{n_i} + \frac{1}{n_o}}$ = _____

$$z = \frac{\bar{Y}_i - \bar{Y}_o}{0.8\sqrt{\frac{1}{n_i} + \frac{1}{n_o}}} = (a) \div (c) = \_\_\_\_\_$$

Conclusion: _____ Work site fails if $z > 1.65$

_____ Work site passes if $z < 1.65$

LABORATORY LETTERHEAD

EXAMPLE FOR REPORTING ANALYTICAL RESULTS

Laboratory ID	Client ID	FILTER MEDIA DATA				Analyzed Area, mm ^{2}	Sample Volume, cc
		Type	Diameter, mm	Effective Area, mm^2	Pore Size, µm		

INDIVIDUAL ANALYTICAL RESULTS

Laboratory ID	Client ID	# Asbestos Fibers	Analytical Sensitivity, f/cc	CONCENTRATION	
				Fibers/mm ^{2}	Fibers/cc

RESULTS OF Z-TEST: _____

The analysis was carried out according to the approved TEM method. This laboratory is in compliance with the quality assurance as specified by the method.

_____
Authorized Signature

TABLE 3

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VIII. 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 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 Table IV and 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 0.5 asbestos fibers per 10 grid openings 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. Insure that the samples are stored in a secure and representative location.

5. Insure that mechanical vibrations from the pump will be minimized.

6. Insure that a constant 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. Insure that the sampler will be 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.

13. When the samples arrive at the laboratory, check the samples and documentation for completeness and requirements before initiating the analysis.

14. Check all laboratory reagents and supplies for acceptable asbestos background levels.

15. Conduct all sample preparations in a clean room environment monitored by laboratory blanks and special testing after cleaning or service in the area.

16. Prepare multiple grids of each sample for possible duplicate count comparison.

17. Provide laboratory blanks with each sample batch. Maintain a moving average of these results. If there are more than 3 fibers per 10 grid openings the system will be checked for possible sources of contamination.

18. Check for recovery of asbestos from cellulose ester filters submitted to plasma asher treatment by including a known asbestos particulate sample with every 25th numbered sample. Recoveries of 75 percent or greater are acceptable.

19. Check for asbestos carryover in the plasma asher by including a blank alongside the positive control sample.

20. Perform a systems check on the transmission electron microscope each time it is used.

21. Make periodic performance checks of magnification selected area electron diffraction and energy dispersive X-ray systems as set forth in Table IV.

22. Insure qualified operator performance by evaluation of replicate counting, duplicate analysis and standard sample comparisons as set forth in Table IV.

23. Validate all data entries.

24. Recalculate a percentage of all computations and automatic data reduction steps as specified in Table IV.

25. Use the outdoor control samples for comparison with the abatement area samples for clearance approval if the abatement area samples exceed the permissible limits.

The outline of quality control procedures presented above is viewed as the minimal required to assure the data quality 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.

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TABLE IV -- Summary of DQOs

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 references 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 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 asher blank	1 per 20 samples	75%
	Sample recovery check	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 operator	Each day
	Alignment check	Each operator	Each day
	Magnification calibration with low and high standards	Each month or after service	95%
	SAED 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%
Calculations and data reduction	Hand calculation of automated data reduction procedure or independent recalculation of hand-calculated data	1 per 100 samples	85%
Site evaluation	Abatement area versus ambient	When abatement area is >0.02 f/cc	100%

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IX. References

(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 Toxic Substances, 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 Systems. 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 SOPO 87-1, March 5, 1987.

(9) NIOSH 7402 Method for Asbestos Fibers, 12-11-86 Draft.

(10) Yamate, G., Agarwal, S.C., Gibbons, R.D., IITRI, "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy," Draft report, Contract 68-02-3266, July 1984.

(11) "Guidance to the Preparation of Quality Assurance Project Plans," USEPA, Office of Toxic Substances, 1984.

Appendix B to Subpart E—Work Practices and Engineering Controls for Small-Scale, Short-Duration Operations Maintenance and Repair (O&M) Activities Involving ACM

This appendix is not mandatory, in that local education agencies may choose to comply with all the requirements of 40 CFR 763.121. Section 763.91(b) extends the protection provided by EPA in its 40 CFR 763.121 for worker protection during asbestos abatement projects to employees of local education agencies who perform small-scale, short-duration operations, maintenance and repair (O&M) activities involving asbestos-containing materials and are not covered by the OSHA asbestos construction standard at 29 CFR 1926.58 or an asbestos worker protection standard adopted by a State as part of a State plan approved by OSHA under section 18 of the Occupational Safety and Health Act. Employers wishing to be exempt from the requirements of § 763.121 (e)(6) and (f)(2)(i) may instead comply with the provisions of this appendix when performing small-scale, short-duration O&M activities.

Definition of Small-Scale, Short-Duration Activities

For the purposes of this appendix, small-scale, short-duration maintenance activities are tasks such as, but not limited to:

1. Removal of asbestos-containing insulation on pipes.
2. Removal of small quantities of asbestos-containing insulation on beams or above ceilings.
3. Replacement of an asbestos-containing gasket on a valve.
4. Installation or removal of a small section of drywall.
5. Installation of electrical conduits through or proximate to asbestos-containing materials.

Small-scale, short-duration maintenance activities can be further defined, for the purposes of this subpart, by the following considerations:

1. Removal of small quantities of asbestos-containing materials (ACM) only if required in the performance of another maintenance activity not intended as asbestos abatement.
2. Removal of asbestos-containing thermal system insulation not to exceed amounts greater than those which can be contained in a single glove bag.
3. Minor repairs to damaged thermal system insulation which do not require removal.
4. Repairs to a piece of asbestos-containing wallboard.
5. Repairs, involving encapsulation, enclosure or removal, to small amounts of friable asbestos-containing material 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.

OSHA concluded that the use of certain engineering and work practice controls is capable of reducing employee exposures to asbestos to levels below the final standard's action level (0.1 f/cm^3) (See 51 FR 22714, June 20, 1986). Several controls and work practices, used either singly or in combination, can be employed effectively to reduce asbestos exposures during small maintenance and renovation operations. These include:

1. Wet methods.
2. Removal methods.
   i. Use of glove bags.
   ii. Removal of entire asbestos insulated pipes or structures.
   iii. Use of mini-enclosures.
3. Enclosure of asbestos materials.
4. Maintenance programs.

This appendix describes these controls and work practices in detail.

Preparation of the Area Before Renovation or Maintenance Activities

The first step in preparing to perform a small-scale, short-duration asbestos renovation or maintenance task, regardless of the abatement method that will be used, is the removal from the work area of all objects that are movable to protect them from asbestos contamination. Objects that cannot be removed must be covered completely with 6-mil-thick polyethylene plastic sheeting before the task begins. If objects have already been contaminated, they should be thoroughly cleaned with a High Efficiency Particulate Air (HEPA) filtered vacuum or be wet-wiped before they are removed from the work area or completely encased in the plastic.

Wet Methods

Whenever feasible, and regardless of the abatement method to be used (e.g., removal, enclosure, use of glove bags), wet methods must be used during small-scale, short-duration maintenance and renovation activities that involve disturbing asbestos-containing materials. Handling asbestos materials wet is one of the most reliable methods of ensuring that asbestos fibers do not become airborne, and this practice should therefore be used whenever feasible. Wet methods can be used in the great majority of workplace situations. Only in cases where asbestos work must be performed on live electrical equipment, on live steam lines, or in other areas where water will seriously damage materials or equipment may dry removal be performed. Amended water or another wetting agent should be applied by means of an airless sprayer to minimize the extent to which the asbestos-containing material is disturbed.

Asbestos-containing material should be wetted from the initiation of the maintenance or renovation operation and wetting agents should be used continually throughout the work period to ensure that any dry asbestos-containing material exposed in the course of the work is wet and remains wet until final disposal.

Removal of Small Amount of Asbestos-Containing Materials

Several methods can be used to remove small amounts of asbestoscontaining materials during small-scale, short-duration renovation or maintenance tasks. These include the use of glove bags, the removal of an entire asbestos-covered pipe or structure, and the construction of mini-enclosures. The procedures that employers must use for each of these operations if they wish to avail themselves of the rule's exemptions are described in the following sections.

Glove Bags

OSHA found that the use of glove bags to enclose the work area during small-scale, short-duration maintenance or renovation activities will result in employee exposure to asbestos that are below the rule's action level of 0.1 f/cm^3. This appendix provides requirements for glove-bag procedures to be followed by employers wishing to avail themselves of the rule's exemption for each activities. OSHA has determined that the use of these procedures will reduce the 8-hour time weighted average (TWA) exposure of employees involved in these work operations to levels below the action level and will thus provide a degree of employee protection equivalent to that provided by compliance with all provisions of the rule.

Glove Bag Installation

Glove bags are approximately 40-inch-wide times 64-inch-long bags fitted with arms through which the work can be performed. When properly installed and used, they permit workers to remain completely isolated from the asbestos material removed or replaced inside the bag. Glove bags can thus provide a flexible, easily installed, and quickly dismantled temporary small work area enclosure that is ideal for small-scale asbestos renovation or maintenance jobs. These bags are single-use control devices that are disposed of at the end of each job. The bags are made of transparent 6-mil-thick polyethylene plastic with areas of Tyvek [1] material (the same material used to make the disposal protective suits used in major asbestos removal, renovation, and demolition operations and in protective gloves). Glove bags are readily available from safety supply stores or specialty asbestos removal supply houses. Glove bag come pre-labelled with the asbestos warning label prescribed by OSHA and EPA for bags used to dispose of asbestos waste.

Glove Bag Equipment and Supplies

Supplies and materials that are necessary to use glove bags effectively include:

1. Tape to seal glove bag to the area from which asbestos is to be removed.
2. Amended water or other wetting agents.
3. An airless sprayer for the application of the wetting agent.
4. Bridging encapsulant (a paste-like substance for coating asbestos) to seal the rough edges of any asbestos-containing materials that remain within the glove bag at the points of attachment after the rest of the asbestos has been removed.
5. Tools such as razor knives, nips, and wire brushes (or other tools suitable for cutting wires, etc.).
6. A HEPA filter-equipped vacuum for evacuating the glove bag (to minimize the release of asbestos fibers) during removal of the bag from the work area and for cleaning any material that may have escaped during the installation of the glove bag.
7. HEPA-equipped dual-cartridge or more protective respirators for use by the employees involved in the removal of asbestos with the glove bag.

Glove Bag Work Practices

The proper use of glove bags requires the following steps:

1. Glove bags must be installed so that they completely cover the pipe or other structure where asbestos work is to be done. Glove bags are installed by cutting the sides of the glove bag to fit the size of the pipe from which asbestos is to be removed. The glove bag is attached to the pipe by folding the open edges together and securely sealing them with tape. All openings in the glove bag must be sealed with duct tape or equivalent material. The bottom seam of the glove bag must also be sealed with duct tape or equivalent to prevent any leakage from the bag that may result from a defect in the bottom seam.
2. The employee who is performing the asbestos removal with the glove bag must don at least a half mask dual-cartridge HEPA-equipped respirator; respirators should be worn by employees who are in close contact with the glove bag and who may thus be exposed as a result of small gaps in the seams of the bag or holes punched through the bag by a razor knife or a piece of wire mesh.
3. The removed asbestos material from the pipe or other surface that has fallen into the enclosed bag must be thoroughly wetted with a wetting agent (applied with an airless sprayer through the precut port provided in most gloves bags or applied through a small hole in the bag).
4. Once the asbestos material has been thoroughly wetted, it can be removed from the pipe, beam, or other surface. The choice of tool to use to remove the asbestos-containing material depends on the type of material to be removed. Asbestos-containing materials are generally covered with painted canvas and/or wire mesh. Painted canvas can be cut with a razor knife and peeled away from the asbestos-containing material underneath. Once the canvas has been peeled away, the asbestos-containing material underneath may be dry, in which case it should be resprayed with a wetting agent to ensure that it generates as little dust as possible when removed. If the asbestos-containing material is covered with wire mesh, the mesh should be cut with nips, tin snips, or other appropriate tool and remove.

A wetting agent must then be used to spray any layer of dry material that is exposed beneath the mesh, the surface of the stripped underlying structure, and the inside of the glove bag.

5. After removal of the layer of asbestos-containing material, the pipe or surface from which asbestos has been removed must be thoroughly cleaned with a wire brush and wetwiped with a wetting agent until no traces of the asbestos-containing material can be seen.
6. Any asbestos-containing insulation edges that have been exposed as a result of the removal or maintenance activity must be encapsulated with bridging encapsulant to ensure that the edges do not release asbestos fibers to the atmosphere after the glove bag has been removed.
7. When the asbestos removal and encapsulation have been completed, a vacuum hose from a HEPA filtered vacuum must be inserted into the glove bag through the port to remove any air in the bag that may contain asbestos fibers. When the air has been removed from the bag, the bag should be squeezed tightly (as close to the top as possible), twisted, and sealed with tape, to keep the asbestos materials safely in the bottom of the bag. The HEPA vacuum can then be removed from the bag and the glove bag itself can be removed from the work area to be disposed of properly.

Mini-Enclosures

In some instances, such as removal of asbestos from a small ventilation system

[1] Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

or from a short length of duct, a glove bag may not be either large enough or of the proper shape to enclose the work area. In such cases, a minienclosure can be built around the area where small-scale, shortduration asbestos maintenance or renovation work is to be performed. Such enclosures should be constructed of 6-mil-thick polyethylene plastic sheeting and can be small enough to restrict entry to the asbestos work area to one worker.

For example, a mini-enclosure can be built in a small utility closet when asbestos-containing duct covering is to be removed. The enclosure is constructed by:

1. Affixing plastic sheeting to the walls with spray adhesive and tape.
2. Covering the floor with plastic and sealing the plastic covering the floor to the plastic on the walls.
3. Sealing any penetrations such as pipes or electrical conduits with tape.
4. Constructing a small change room (approximately 3 feet square) made of 6-mil-thick polyethylene plastic supported by 2-inch by 4-inch lumber (the plastic should be attached to the lumber supports with staples or spray adhesive and tape).

The change room should be contiguous to the mini-enclosure, and is necessary to allow the worker to vacuum off his protective coveralls and remove them before leaving the work area. While inside mini-enclosure, the worker should wear Tyvek[1] disposable coveralls and use the appropriate HEPA-filtered dual-cartridge or more protective respiratory protection.

The advantages of mini-enclosures are that they limit the spread of asbestos contamination, reduce the potential exposure of bystanders and other workers who may be working in adjacent areas, and are quick and easy to install. The disadvantage of mini-enclosures is that they may be too small to contain the equipment necessary to create a negative pressure within the enclosure; however the double layer of plastic sheeting will serve to restrict the release of asbestos fibers to the area outside the enclosure.

Removal of Entire Structures

When pipes are insulated with asbestos-containing materials, removal of the entire pipe may be more protective, easier, and more cost-effective than stripping the asbestos insulation from the pipe. Before such a pipe is cut, the asbestos-containing insulation must be wrapped with 6-mil polyethylene plastic and securely sealed with duct tape or equivalent. This plastic covering will prevent asbestos fibers from becoming airborne as a result of the vibration created by the power saws used to cut the pipe. If possible, the pipes should be cut at locations that are not insulated to avoid disturbing the asbestos. If a pipe is completely insulated with asbestos-containing materials, small sections should be stripped using the glove-bag method described above before the pipe is cut at the stripped sections.

Enclosure

The decision to enclose rather than remove asbestos-containing material from an area depends on the building owner's preference, i.e., for removal or containment. Owners consider such factors as cost effectiveness, the physical configuration of the work area, and the amount of traffic in the area when determining which abatement method to use.

If the owner chooses to enclose the structure rather than to remove the asbestos-containing material insulating it, a solid structure (airtight walls and ceilings) must be built around the asbestos covered pipe or structure to prevent the release of asbestos-containing materials into the area beyond the enclosure and to prevent disturbing these materials by casual contact during future maintenance operations.

Such a permanent (i.e., for the life of the building) enclosure should be built of new construction materials and should be impact resistant and airtight. Enclosure walls should be made of tongue-and-groove boards, boards with spine joints, or gypsum boards having taped seams. The underlying structure must be able to support the weight of the enclosure. (Suspended ceilings with laid-in panels do not provide airtight enclosures and should not be used to enclose structures covered with asbestos-containing materials.) All joints between the walls and ceiling of the enclosure should be caulked to prevent the escape of asbestos fibers. During the installation of enclosures, tools that are used (such as drills or rivet tools) should be equipped with HEPA-filtered vacuums. Before constructing the enclosure, all electrical conduits, telephone lines, recessed lights, and pipes in the area to be enclosed should be moved to ensure that the enclosure will not have to be re-opened later for routine or emergency maintenance. If such lights or other equipment cannot be moved to a new location for logistic reasons, or if moving them will disturb the asbestos-containing materials, removal rather than enclosure of the asbestos-containing materials is the appropriate control method to use.

Maintenance Program

An asbestos maintenance program must be initiated in all facilities that have asbestos-containing materials. Such a program should include:

1. Development of an inventory of all asbestos-containing materials in the facility.
2. Periodic examination of all asbestos-containing materials to detect deterioration.
3. Written procedures for handling asbestos materials during the performance of small-scale, short-duration maintenance and renovation activities.
4. Written procedures for asbestos disposal.
5. Written procedures for dealing with asbestos-related emergencies.

Members of the building's maintenance engineering staff (electricians, heating/air conditioning engineers, plumbers, etc.) who may be required to handle asbestos-containing materials should be trained in safe procedures. Such training should include at a minimum:

1. Information regarding types of ACM and its various uses and forms.
2. Information on the health effects associated with asbestos exposure.
3. Descriptions of the proper methods of handling asbestos-containing materials.
4. Information on the use of HEPA-equipped dual-cartridge respirators and other personal protection during maintenance activities.

Prohibited Activities.

The training program for the maintenance engineering staff should describe methods of handling asbestos-containing materials as well as routine maintenance activities that are prohibited when asbestos-containing materials are involved. For example, maintenance staff employees should be instructed:

1. *Not* to drill holes in asbestos-containing materials.
2. *Not* to hang plants or pictures on structures covered with asbestos-containing materials.
3. *Not* to sand asbestos-containing floor tile.
4. *Not* to damage asbestos-containing materials while moving furniture or other objects.
5. *Not* to install curtains, drapes, or dividers in such a way that they damage asbestos-containing materials.
6. *Not* to dust floors, ceilings, moldings or other surfaces in asbestos-contaminated environments with a dry brush or sweep with a dry broom.

7. *Not* to use an ordinary vacuum to clean up asbestos-containing debris.

8. *Not* to remove ceiling tiles below asbestos-containing materials without wearing the proper respiratory protection, clearing the area of other people, and observing asbestos removal waste disposal procedures.

9. *Not* to remove ventilation system filters dry.

10. *Not* to shake ventilation system filters.

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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 763

[OPTS-62048B; FRL-3190-2B]

Asbestos-Containing Material in Schools; Model Accreditation Plan

AGENCY: Environmental Protection Agency (EPA).

ACTION: Model Accreditation Plan.

SUMMARY: Section 206 of Title II of the Toxic Substances Control Act (TSCA), 15 U.S.C. 2646, requires EPA to develop by April 20, 1987 a Model Contractor Accreditation Plan. To conduct asbestos-related work in schools, persons must receive accreditation in order to inspect school buildings for asbestos, develop management plans, and design or conduct response actions. Such persons can be accredited by States, which are required to adopt contractor accreditation plans at least as stringent as the EPA Model Plan, or by completing an EPA-approved training course and passing an examination for such course. The EPA Model Contractor Accreditation Plan, which will be codified in the Code of Federal Regulations, establishes those areas of knowledge of asbestos inspection, management plan development and response action technology that persons seeking accreditation must demonstrate and States must include in their accreditation programs.

EPA is not required to issue this Model Plan as a final regulation, since section 206 of TSCA only requires the Agency to "develop" the Model Plan "after consultation with affected organizations." However, EPA has decided to make the Model Plan available in the Code of Federal Regulations as an appendix to regulations required under TSCA Title II.

DATE: This Model Plan is effective June 1, 1987.

FOR FURTHER INFORMATION CONTACT: By mail: Edward A. Klein, Director, TSCA Assistance Office (TS-799), Office of Toxic Substances, Environmental Protection Agency, 401 M Street SW., Washington, DC 20460. Office location and telephone number: Rm. E-543, (202-554-1404).

SUPPLEMENTARY INFORMATION: Elsewhere in this issue of the **Federal Register**, EPA is proposing rules involving asbestos-containing materials in schools. The proposed rules were developed through the regulatory negotiation process described in the preamble to that proposal. The proposed rules require the use of accredited persons to perform certain tasks associated with asbestos-related work in schools.

In addition to developing the proposed rules, the regulatory negotiation committee negotiated and reached agreements, in principle, on the requirements of this EPA Model Contractor Accreditation Plan required to be developed by April 20, 1987 under section 206 of Title II of TSCA. This Model Plan is issued in this **Federal Register** document and will be codified in the Code of Federal Regulations.

Section 206 of TSCA Title II, requires local education agencies (LEAs) to use accredited persons to perform the following asbestos-related tasks:

1. Inspecting for asbestos-containing materials (ACM) in school buildings under a local education agency's authority.

2. Preparing management plans for such schools.

3. Designing or conducting response actions with respect to ACM in such schools.

The Model Plan requires persons seeking accreditation to take an initial training course, pass an examination, and participate in continuing education. LEA's have the option of hiring accredited contractors to conduct asbestos work or having in-house personnel receive accreditation. Accredited personnel are not required to be used to conduct operations and maintenance activities.

TSCA Title II requires States to adopt a contractor accreditation plan at least as stringent as the EPA Model Plan. States must adopt such a plan within 180 days after the commencement of the first regular session of the State's legislature which convenes following the date EPA issues the Model Plan. Persons can be accredited by a State with an accreditation program at least as stringent as the EPA Model Plan. Persons may also obtain accreditation by passing an EPA-approved training course and examination that, in EPA's judgment, are consistent with the Model Plan.

States may exercise their authority to have accreditation program requirements more stringent than the Model Plan. As a result, some EPA-approved training courses may not meet the requirements of a particular State's accreditation program. Sponsors of training courses and persons who have received accreditation or are seeking accreditation should contact individual States to check on accreditation requirements.

The Model Contractor Accreditation Plan is divided into four units. The first unit discusses EPA's Model Contractor Accreditation Plan for States. Unit II specifies procedures a State must follow to receive EPA Model Plan approval for the State's contractor accreditation program. Unit III discusses EPA approval of training courses. The fourth unit addresses the treatment of persons who have had previous training and an examination.

In Unit I, the Model Contractor Accreditation Plan for States specifies separate accreditation requirements for inspectors, management planners, and for those persons who design and carry out response actions. This latter group includes abatement project designers, asbestos abatement contractors, supervisors, and workers.

Persons in each of the above disciplines perform a different function. Inspectors identify and assess the ACM's condition. Management planners use the data gathered by inspectors to assess the ACM's hazard, determine the appropriate response actions, and develop a schedule for implementing response actions. Abatement project designers determine how the asbestos abatement work should be conducted. Lastly, asbestos abatement contractors, supervisors and workers carry out the abatement work.

The length of initial training courses for accreditation under the Model Plan varies by discipline. Inspectors must take a 3-day training course. Management planners must take the inspection course plus an additional 2 days devoted to management planning. Abatement project designers are required to have at least 3 days of training. Asbestos abatement contractors and supervisors must take a 4-day training course. Asbestos abatement workers are required to take a 3-day training course.

For asbestos abatement workers, while EPA is requiring a 3-day training course, States may want to consider requiring 4 days of training. States could use the additional day to provide more hands-on training or to elaborate on State regulations. States may also wish to consider the relative merits of a worker apprenticeship program. In any case, EPA recommends worker training courses be small, with a student to teacher ratio of about 25 to 1.

States may also consider requiring project monitors to be trained. Project monitors oversee the abatement work and are the on-site representative of the building owner. These persons should take the training course for asbestos abatement contractors and supervisors.

The second unit of the Model Plan specifies procedures a State must follow

to receive EPA Model Plan approval for the State's contractor accreditation program. States may seek approval for one or more of the disciplines requiring accreditation under TSCA Title II. For example, if a State currently only has an accreditation program for inspectors, EPA will grant a partial approval of the State's contractor accreditation program provided that the State's requirements for inspectors are at least as stringent as those in the EPA Model. EPA encourages States to seek partial approvals. EPA will publish an initial list of those States that have programs at least as stringent as the EPA Model within 90 days after publication of this Federal Register Notice.

The third unit of this Model Plan discusses EPA approval of courses. EPA will require sponsors seeking approval of training courses to submit training materials to EPA. The training course and examination must be consistent with the Model Plan's requirements in these areas. EPA will publish an initial list of those courses and examinations approved by EPA for purposes of TSCA Title II within 90 days after publication of this Federal Register Notice.

The fourth unit of the Model Plan addresses the treatment of persons who have had previous training. Persons may be accredited if they have completed an EPA-approved asbestos training course in their discipline and have passed or pass an examination in their discipline. Such persons may be accredited, on an interim basis, if in EPA's judgment the course and examination are equivalent to the Model Plan's requirements.

The interim accreditation will extend for no longer than 1 year after the date that the State in which the person is employed adopts an accreditation program at least as stringent as the EPA Model. If the State does not adopt an accreditation program within the 180 day time period after the State legislature reconvenes for its first regular session, the person with interim accreditation must complete training requirements at least as stringent as those described in the EPA Model within 1 year after the date that the State was required to have established a program. EPA will publish a list of those courses and examinations which qualify for equivalency treatment under the provisions for interim accreditation within 90 days after publication of this Federal Register Notice.

EPA has consulted extensively with affected organizations on the Model Plan. The Agency has had extensive discussions on Model Plan issues with interested persons even before Title II was enacted. EPA also solicited comment on general issues affecting the Model Plan in the Advanced Notice of Proposed Rulemaking issued on December 31, 1986, in compliance with TSCA Title II. Finally, since enactment of TSCA Title II, EPA has solicited comment from over 75 organizations and has discussed the Model Plan in the negotiated rulemaking. The various data, views, and arguments submitted are part of the administrative record for this proceeding.

I. Administrative Record

EPA has established an administrative record under control number [OPTS-62048B]. A public version of the record and an index of documents in the record are available to the public in the Toxic Substances Public Information Office from 8 a.m. to 4 p.m., Monday through Friday, except legal holidays. The Public Information Office is located in Rm. NE-G004, 401 M St., SW., Washington, DC.

II. References

(1) USEPA. "Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials," EPA 560/5-85-030a. October 1985.

(2) USEPA. Friable Asbestos-Containing Materials in Schools: Identification and Notification [40 CFR Part 763 Subpart F].

(3) USEPA. National Emission Standards for Hazardous Air Pollutants: Amendments to Asbestos Standard; Final Rule [40 CFR Part 61].

(4) USDOL. OSHA. Occupational Exposure to Asbestos, Final Rule [29 CFR 1926.58].

(5) USEPA. Toxic Substances; Asbestos Abatement Projects; Final Rule [40 CFR Part 763 Subpart G]

(6) USDOL. OSHA. Occupational Safety and Health Standards, Subpart I, Personal Protective Equipment [29 CFR 1910.134].

III. Regulatory Assessment Requirements

A. Executive Order 12291

Under Executive Order 12291, EPA prepared a Regulatory Impact Analysis. The analysis estimated that the first year cost of this Model Accreditation Plan would be about $7.7 million. EPA believes that these costs are reasonable. Under Executive Order 12291, EPA must judge whether a regulation is "major" and therefore requires a Regulatory Impact Analysis. EPA has determined that this Model Accreditation Plan, by itself, will not have an effect on the economy of $100 million or more and it will not have a significant effect on competition, costs, or prices. For more detailed information, see the proposed rules on Asbestos-Containing Materials found elsewhere in this issue of the Federal Register and the accompanying Regulatory Impact Analysis.

This Model Accreditation Plan was submitted to the Office of Management and Budget (OMB) for review as required by Executive Order 12291.

B. Regulatory Flexibility Act

EPA believes the economic impact of the Model Accreditation Plan on small businesses is negligible. Roughly 25 States already have accreditation programs of some type in effect. In addition, EPA-funded training centers currently train several thousand persons each year.

C. Paperwork Reduction Act

The information collection requirements contained in this Model Accreditation Plan have been submitted to the Office of Management and Budget (OMB) as part of the proposed regulations concerning asbestos-containing materials in schools under the provisions of the Paperwork Reduction Act. Comments on these requirements should be submitted to the Office of Information and Regulatory Affairs at OMB and marked Attention: Desk Officer for EPA.

List of Subjects in 40 CFR Part 763

Asbestos, Environmental protection, Hazardous substances, Occupational safety and health, Reporting and recordkeeping requirements, Schools.

Dated: April 20, 1987.

Lee M. Thomas,

Administrator.

PART 763—[AMENDED]

Therefore, 40 CFR Part 763 is amended as follows:

1. The authority citation for Part 763 is revised to read as follows:

Authority: 15 U.S.C. 2605 and 2607(c). Subpart E also issued under 15 U.S.C. 2641, 2643, 2646, and 2647.

2. Subpart E is added consisting at this time of Appendix C to read as follows:

Subpart E—Asbestos-Containing Materials in Schools

* * * * *

Appendix C to Subpart E—EPA Model Contractor Accreditation Plan

I. Model Contractor Accreditation Plan for States

The Model Contractor Accreditation Plan for States has six components:

(1) Initial training,

(2) Examinations,

(3) Refresher training course,

(4) Qualifications,

(5) Decertification requirements,

(6) Reciprocity.

For purposes of TSCA Title II accreditation requirements, the duration of initial and refresher training courses is specified in number of days. A day of training equals 8 hours including breaks and lunch.

In several instances, initial training courses for a specific discipline (e.g., workers, inspectors) require hands-on training. For asbestos abatement contractors, supervisors and workers, hands-on training should include working with asbestos-substitute materials, fitting and using respirators, use of glovebags, donning protective clothing, constructing a decontamination unit as well as other abatement work activities. Hands-on training must permit contractors, supervisors, and workers to have actual experience performing tasks associated with asbestos abatement. For inspectors, hands-on training should include conducting a simulated building walk-through inspection and respirator fit testing.

1. Initial Training

States have the option to provide initial training directly or approve other entities to offer training. The following are the initial training course requirements for persons required to have accreditation under TSCA Title II.

A. *Inspectors.* A State shall require that all persons seeking accreditation as inspectors complete a 3-day training course as outlined below. The 3-day program 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.

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 period for asbestos-related diseases; a discussion of the relationship of asbestos exposure to asbestosis, lung cancer, mesothelioma, and cancer 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 disruption; 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 asbestos-containing material (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 in schools.* 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; sampling equipment the inspector should use; patching or repair of damage done in sampling; an inspector's repair kit; discussion of polarized light microscopy; choosing an accredited laboratory to analyze bulk samples; quality control and quality assurance procedures.

(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-mouth seal (positive and negative pressure fitting tests); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors; factors that alter respirator 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 by TSCA Title II section 203(i)(1).

(l) *Regulatory review.* EPA Worker Protection Rule found at 40 CFR Part 763, Subpart G; TSCA Title II; OSHA Asbestos Construction Standard 29 CFR 1926.58; OSHA respirator requirements found at 29 CFR 1910.134; the Friable ACM in Schools Rule found at 40 CFR Part 763, Subpart F; applicable State and local regulations, and differences in Federal/State requirements where they apply and the effects, if any, on public and non-public schools.

(m) *Field trip.* To include a field exercise including a walk-through inspection; on-site discussion on information gathering and 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.

B. Management Planners. A State shall require that all persons seeking accreditation as management planners complete an inspection training course as outlined above and a 2-day management planning training course. The 2-day training program shall include lectures, demonstrations, course review, and a written examination. EPA recommends the use of audiovisual materials to complement lectures, where appropriate.

The management planner training course shall adequately address the following topics:

(a) *Course overview.* The role 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 as given in section 203(i)(1) of TSCA Title II; summarized field data and laboratory results; comparison between 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 high efficiency particulate aerosol (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 (NESHAPS) 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.

(j) *Assembling and submitting the management plan.* Plan requirements 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 operations and maintenance costs; Asbestos School Hazard Abatement Act grants and loans.

(l) *Course review.* A review of key aspects of the training course.

C. Abatement Project Designers. A State shall require that all persons seeking accreditation as abatement project designers complete either a 3-day abatement project designer training course as outlined below or the 4-day asbestos abatement contractor and supervisor's training course that is outlined in the next sub-unit. The 3-day abatement project designer training program 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 3-day 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 cancer 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.* Construction and maintenance of containment barriers and decontamination enclosure systems; positioning of warning signs; electrical and ventilation system lock-out; proper working techniques for minimizing fiber release; entry and exit procedures for the work area; use of wet methods; use of negative pressure exhaust ventilation equipment; use of high efficiency particulate aerosol (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.* Visit an abatement site or other suitable building site, including on-site discussions of abatement design, building walk-through inspection, and discussion following the walk-through.

(f) *Employee personal protective equipment.* To include the classes and characteristics of respirator types; limitations of respirators; proper selection, inspection, donning, use, maintenance, and storage procedures; methods for field testing of the facepiece-to-face seal (positive and negative pressure fitting tests); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors; factors that alter respirator fit (e.g., facial hair); 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.

(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) *Budgeting/cost estimation.* Development of cost estimates; present costs of abatement versus future operations and maintenance costs; setting priorities for abatement jobs to reduce cost.

(k) *Writing abatement specifications.* Means and methods specifications versus performance specifications; design of abatement in occupied buildings; modification of guide specifications to a particular building; worker and building occupant health/medical considerations; replacement of ACM with non-asbestos substitutes; clearance of work area after abatement; air monitoring for clearance.

(l) *Preparing abatement drawings.* Use of as-built drawings; use of inspection photographs and on-site reports; particular problems in abatement drawings.

(m) *Contract preparation and administration.*

(n) *Legal/liabilities/defenses.* Insurance considerations; bonding; hold harmless clauses; use of abatement contractor's liability insurance; claims-made versus occurrence policies.

(o) *Replacement.* Replacement of asbestos with asbestos-free substitutes.

(p) *Role of other consultants.* Development of technical specification sections by industrial hygienists or engineers; the multidisciplinary team approach to abatement design.

(q) *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.

(r) *Relevant Federal State, and local regulatory requirements.* Procedures and standards, including:

(1) Requirements of TSCA Title II.

(2) 40 CFR Part 61, National Emission Standards for Hazardous Air Pollutants, Subparts A (General Provisions) and M (National Emission Standard for Asbestos).

(3) OSHA standards for permissible exposure to airborne concentrations of asbestos fibers and respiratory protection (29 CFR 1910.134).

(4) EPA Worker Protection Rule, found at 40 CFR Part 763, Subpart G.

(5) OSHA Asbestos Construction Standard found at 29 CFR 1926.58.

(s) *Course Review.* A review of key aspects of the training course.

D. Asbestos Abatement Contractors and Supervisors. A State shall require that all persons seeking accreditation as asbestos abatement contractors or supervisors complete a 4-day training course as outlined below. The training course shall include lectures, demonstrations, at least 6 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.

The contractor may designate a supervisor to serve as his agent for the purposes of the accreditation requirement. For purposes of TSCA Title II accreditation, asbestos abatement supervisors include those persons who provide supervision and direction to workers engaged in asbestos removal, encapsulation, enclosure, and repair. Supervisors may include those individuals with the position title of foreman, working foreman, or leadman pursuant to collective bargaining agreements. Under this Model Plan, at least one supervisor is required to be at the worksite at all times while work is in progress. Asbestos workers must have access to accredited supervisors throughout the duration of the project.

The contractor and supervisor's 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; latency period for disease.

(c) *Employee personal protective equipment.* Classes and characteristics of respirator types; limitations of respirators and their proper selection, inspection, donning, use, maintenance, and storage procedures; methods for field testing of the facepiece-to-face seal (positive and negative pressure fitting tests); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors; factors that alter respirator 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 and maintenance of barriers and decontamination enclosure systems; positioning of warning signs; electrical and ventilation system lockout; proper working techniques for minimizing fiber release; use of wet methods; use of negative pressure ventilation equipment; use of high efficiency particulate air (HEPA) vacuums; proper clean-up and disposal procedures. Work practices for removal, encapsulation, enclosure, and repair; emergency procedures for sudden releases; potential exposure situations; transport and disposal procedures, and recommended and prohibited work practices. Discussion of new abatement-related techniques and methodologies may be included.

(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 requirements for 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 a description of aggressive sampling, sampling equipment and methods, reasons for air monitoring, types of samples, and interpretation of results, specifically from analysis performed by polarized light, phase-contrast, and electron microscopy analyses.

(i) *Relevant Federal, State, and local regulatory requirements.* Procedures and standards, including:

(A) Requirements of TSCA Title II.

(B) 40 CFR Part 61, National Emission Standards for Hazardous Air Pollutants, Subparts A (General Provisions) and M (National Emission Standard for Asbestos).

(C) OSHA standards for permissible exposure to airborne concentrations of asbestos fibers and respiratory protection (29 CFR 1910.134).

(D) OSHA Asbestos Construction Standard (29 CFR 1926.58).

(E) EPA worker Protection Rule, 40 CFR Part 763, Subpart G.

(j) *Respiratory protection programs and medical surveillance 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.* Discussion of key elements that are included in contract specifications.

(o) *Course review.* A review of key aspects of the training course.

E. *Asbestos Abatement Workers.* Each State shall require that all persons seeking accreditation as asbestos abatement workers complete at least a 3-day training course as outlined below. The worker training course shall include lectures, demonstrations, at least 6 hours of hands-on training, individual respirator fit testing, course review, and an examination. EPA recommends the use of audiovisual 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, synergism between cigarette smoking and asbestos exposure, and latency period for disease.

(c) *Employee personal protective equipment.* Classes and characteristics of respirator types; limitations of respirators and their proper selection, inspection, donning, use, maintenance, and storage procedures; methods for field testing of the facepiece-to-face seal (positive and negative pressure fitting tests); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors; factors that alter respirator 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-disposal clothing; and regulations covering personal protective equipment.

(d) *State-of-the-art work practices.* Proper asbestos abatement activities including descriptions of proper construction and maintenance of barriers and decontamination enclosure systems; positioning of warning signs; electrical and ventilation system lock-out; proper working techniques for minimizing fiber release; use of wet methods; use of negative pressure ventilation equipment; use of high efficiency particulate air (HEPA) vacuums; proper clean-up and disposal procedures; work practices for removal, encapsulation, enclosure, and repair; 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 requirements for 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. Examinations

Each State shall administer a closed book examination or designate other entities such as State-approved 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 accreditation in a specific discipline shall pass the examination for that discipline to receive accreditation. For example, a person seeking accreditation as an inspector must pass the State's inspector accreditation examination.

States may develop their own examinations, have training courses develop examinations or use standardized examinations developed for purposes of TSCA Title II accreditation. The National Asbestos Council (NAC) is working with the Georgia Institute of Technology to develop standardized examinations for all disciplines. States may supplement standardized examinations with questions on State regulations. To receive more information on this topic, interested States should contact NAC at the following address: National Asbestos Council, Training Department, 2786 North Decatur Rd., Suite 260, Decatur, Georgia 30033.

Each examination shall adequately cover the topics included in the training course for that discipline. Persons who pass the State examination, and fulfill whatever other requirements the State imposes, must receive some form of identification indicating that they are accredited in a specific discipline. For example, a State may wish to provide each accredited person with a photoidentification card. Where necessary, States should consider developing examinations in languages other than English.

The following are the requirements for examinations in each area:

1. Inspectors:
   i. 50 multiple choice questions.
   ii. Passing score: 70 percent.
2. Management Planners:
   i. 50 multiple choice questions.
   ii. Passing score: 70 percent.
3. Abatement Project Designers:
   i. 100 multiple choice questions.
   ii. Passing score: 70 percent.
4. Asbestos abatement contractors and supervisors:
   i. 100 multiple choice questions.
   ii. Passing score: 70 percent.
5. Asbestos Abatement Workers:
   i. 50 multiple choice questions.
   ii. Passing score: 70 percent.

3. Refresher Training Courses

For all disciplines except inspectors, a State's accreditation program shall include a 1-day annual refresher training course for reaccreditation. Refresher courses for inspectors shall be a half-day in length. Management planners shall attend the inspector refresher course, plus an additional half-day on management planning.

The refresher course shall be specific to each discipline. For each discipline, the refresher course shall review and discuss changes in Federal and State 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 an additional year. A State may consider requiring persons to pass reaccreditation examinations at specific intervals (every 3 years, for example).

4. Qualifications

In addition to training and an examination, a State may require whatever qualifications and experience that the State considers appropriate for some or all disciplines. States may want to consider requiring qualifications similar to the examples outlined below for inspectors, management planners and abatement project designers. States should modify these as appropriate. In addition, States may want to include some requirements based on experience in conducting a task directly or in an apprenticeship role:

Inspectors

Qualifications—Possess a high school diploma.

States may want to require an Associate's Degree in particular fields (e.g., environmental or physical sciences).

Management Planners

Qualifications—Registered architect, engineer, or certified industrial hygienist or related scientific field.

Abatement Project Designer

Qualifications—Registered architect, engineer, or a certified industrial hygienist.

5. Decertification Requirements

A State must include conditions and procedures for decertifying accredited inspectors, management planners, abatement project designers, asbestos abatement contractors, supervisors and workers.

6. Reciprocity

EPA recommends that each State establish reciprocal arrangements with other States that have established accreditation programs that meet or exceed the EPA Model Plan.

II. EPA Approval Process for State Contractor Accreditation Programs

States seeking EPA approval of their State Contractor Accreditation Programs required under TSCA shall follow the procedures outlined below. States may seek approval for some or all disciplines as specified in the Model Plan. For example, a State that currently only requires worker accreditation can receive EPA approval for that discipline alone. EPA encourages States that currently do not have accreditation requirements for all the disciplines required under TSCA 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.

States seeking EPA approval shall submit the following information to the Regional Asbestos Coordinator at their EPA Regional Office:

(1) A copy of the legislation establishing the State's accreditation program (if applicable).

(2) A copy of the State's accreditation regulations.

(3) A letter to the Regional Asbestos Coordinator that clearly indicates how the State meets the program requirements of the Model Contractor Accreditation Plan for States. Addresses of Regional Asbestos Coordinators are shown below:

Asbestos Coordinator, EPA, Region I, Air & Management Div. (APT-231), JFK Federal Bldg., Boston, MA 02203, (617) 565-3273

Asbestos Coordinator, EPA, Region II, Woodbridge Ave., Raritan Depot, Bldg. 10, Edison, NJ 08837, (201) 321-6668, (FTS) 340-6671

Asbestos Coordinator, EPA, Region III (3HW-40), 841 Chestnut Bldg., Philadelphia, PA 19107, (215) 597-9859, (FTS) 597-9859

Asbestos Coordinator, EPA, Region IV, 345 Courtland St. NE., Atlanta, GA 30365, (404) 347-3864, (FTS) 257-3864

Asbestos Coordinator, EPA, Region V, 536 S. Clark Street, Chicago, IL 60604, (312) 886-6879, (FTS) 886-6879

Asbestos Coordinator, 6t-Pt, EPA, Region VI, 1445 Ross Avenue, Dallas, TX 75202-2733, (214) 655-7244, (FTS) 255-7235

Asbestos Coordinator, EPA, Region VII, 726 Minnesota Ave., Kansas City, KS 66101, (913) 236-2834, (FTS) 757-2834

Asbestos Coordinator, (8AT-TS), EPA, Region VIII, 1 Denver Place, 999—18th Street, Suite 1300, Denver, CO 80202-2413, (303) 564-1730, (FTS) 564-1742

Asbestos Coordinator, (T-52), EPA, Region IX, 215 Fremont Street, San Francisco, CA 94105, (415) 974-7290, (FTS) 454-7290

Asbestos Coordinators, EPA, Region X, 1200 Sixth Avenue, Seattle, WA-98101, (206) 442-2870, (FTS) 399-2870

EPA will publish a list of those States that have accreditation requirements that are at least as stringent as the EPA Model for one or more disciplines. Any training courses approved by such States are EPA-approved for purposes of accreditation.

III. EPA Approval of Training Courses

Individuals or groups wishing to sponsor training courses for disciplines required to be accredited under TSCA Title II may apply for EPA approval. For a course to receive approval, it must meet the requirements for the course as outlined in the Model Plan for States. EPA will not review courses that are already approved in a State that has a Contractor Accreditation Program that meets the EPA Model. These courses already are approved under TSCA Title II in the State where they are approved and in all States without an accreditation program that meets the EPA Model.

Applicants shall send the information requested below to the Regional Asbestos Coordinator at the EPA Regional Office (see addresses in Section II) located in the Region where the training course maintains its principal business office. The following information is required:

(1) The course sponsor's name, address and phone number.

(2) A list of any States that currently approve the training course.

(3) The course curriculum.

(4) A letter from the training course sponsor that clearly indicates how the course meets the Model Plan requirements for:

(a) Length of training in days.

(b) Amount and type of hands-on training.

(c) Examinations (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 course instructors. Instructors must have academic credentials and/or field experience in asbestos abatement.

(8) Description and an example of numbered certificates issued to students

who attend the course and pass the examination.

For refresher courses in any of the disciplines, information required is as follows:

(1) Length of training.

(2) Topics covered in the course.

(3) A copy of all course materials.

(4) Names and qualifications of course instructors.

(5) Description and an example of certificates issued to students who complete the refresher course.

As noted above, the training course administrator must issue numbered certificates to students who successfully pass the training course's examination. The numbered certificate would indicate the name of the student and the course completed, the dates of the course and the examination, and a statement indicating that the student passed the examination.

The certificate also would include an expiration date for accreditation that is 1 year after the date on which the student completed the course and examination. Training course administrators who offer refresher training courses must also provide certificates with all of the above information (except testing information).

Accredited persons must have their initial and current accreditation certificates at the location where they are conducting work. Failure to have accreditation certificates at the job site could result in decertification.

EPA may revoke or suspend EPA approval if field site inspections indicate a training course is not conducting training that meets the requirements of the Model Plan. Training course sponsors shall permit EPA representatives to attend, evaluate, and monitor any training course without charge to EPA. EPA inspection staff may not give advance notice of their inspections.

EPA will publish a list of those training courses that are consistent with the Model Plan and are approved for purposes of TSCA Title II.

IV. Provisions for Interim Accreditation

TSCA Title II enables EPA to permit persons to be accredited on an interim basis if they have attended previous EPA-approved asbestos training and have passed (or pass) an asbestos examination. Only those persons who have taken training courses since January 1, 1985 will be considered under these interim accreditation provisions. EPA will determine whether the course and examination are equivalent to the training and examination requirements of the Model Plan. This accreditation is interim since the person shall be considered accredited for only 1 year after the date on which the State where the person is employed establishes an accreditation program at least as stringent as the EPA Model.

For purposes of the Model Plan, an equivalent training course is one that is essentially similar in length and content to the curriculum found in the Model Plan. In addition, an equivalent examination must be essentially similar to the requirements of the Model Plan.

Persons who have taken equivalent courses in their discipline, and can produce evidence that they have successfully completed the course by passing the examination, are accredited on an interim basis under TSCA Title II. They can conduct work under TSCA Title II in their discipline for 1 year after their State establishes an accreditation program in their discipline that is at least as stringent as the EPA Model. EPA will publish a list of training courses that are equivalent to the training requirements for each discipline in the Model Plan.

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