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Managing Asbestos In Place

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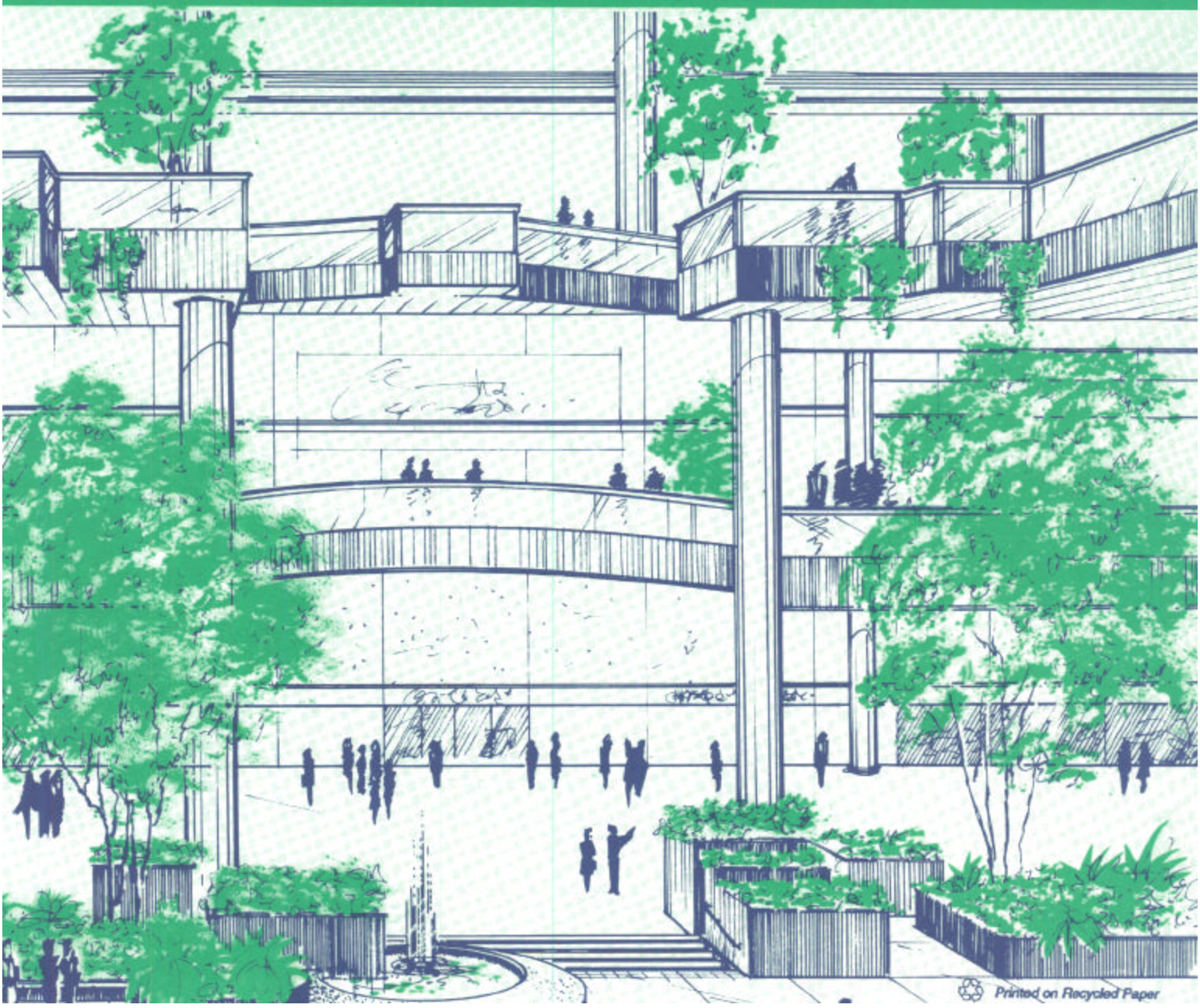
A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials



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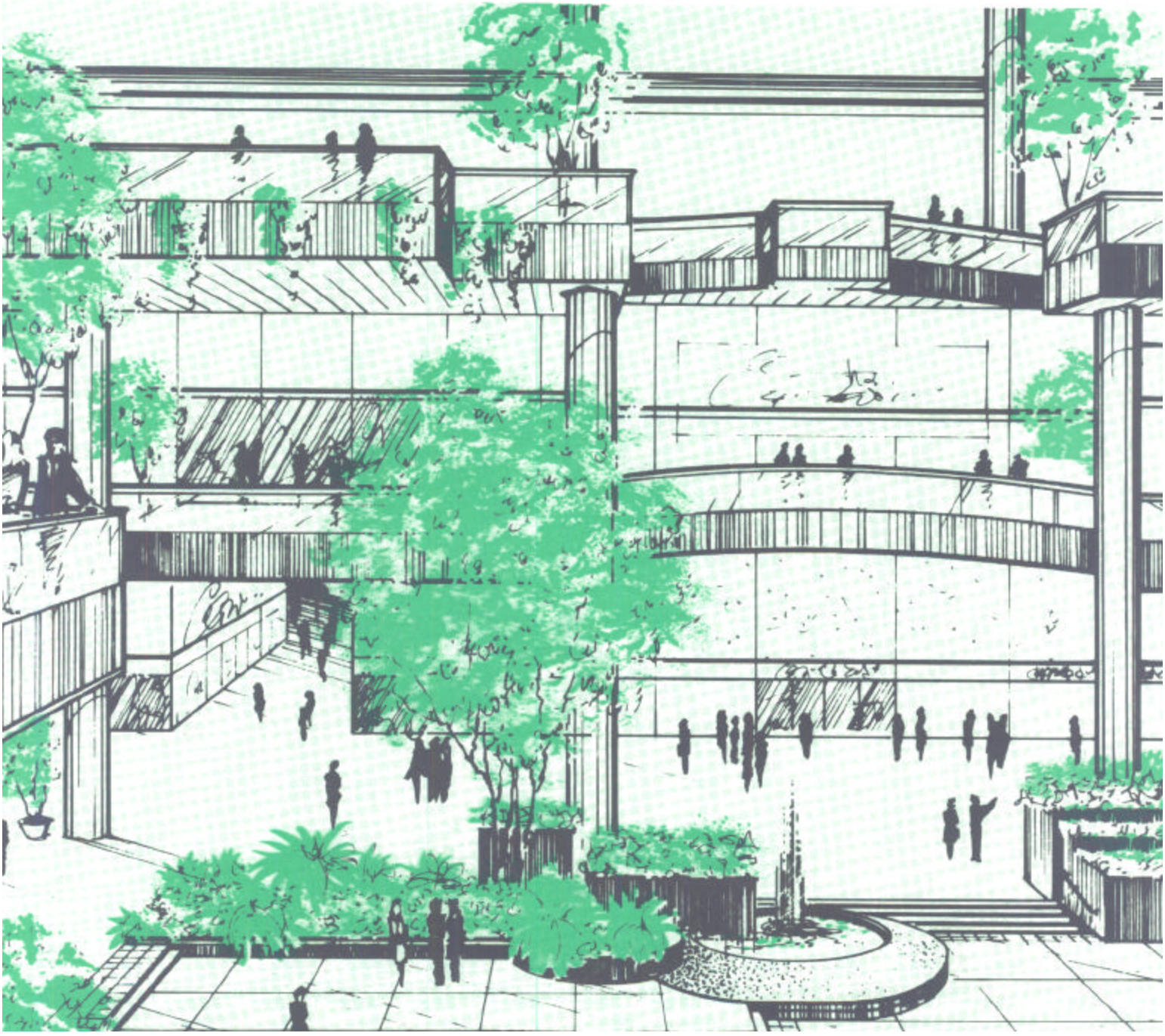
Managing Asbestos In Place

A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials



The time and effort that many individuals contributed to the development of this document is gratefully acknowledged by the U.S. Environmental Protection Agency (EPA). The material in this publication represents EPA's approximately 11 years of experience in considering public input and fine tuning policies on managing asbestos-containing materials in buildings. This document incorporates views expressed by safety and health professionals, property owners and managers, public officials, general industry representatives, workers, and the general public.

The primary EPA developer and coordinator of the final document was Dr. Robert Jordan of the Technical Assistance Section, Environmental Assistance Division, Office of Toxic Substances. Without Bob's constant oversight, combined with his technical knowledge and concern that the document be representative of state-of-the-art asbestos management, this document would not have reached the public.

Joe Schechter, Chief of the Technical Assistance Section, managed the project and helped clarify and edit the Guide. Bob McNally, Chief of the Assistance Programs Development Branch, was instrumental in the formative period of the Guide's development and also devoted long hours to its review. Other important contributions within the Environmental Assistance Division came from Tom Tillman and Dave Kling. Sylvia Thomas provided necessary assistance in revisions of the early drafts. Esther Tepper and Jane Gurin helped review the Guide in its final revisions, to make sure the document was written in easy-to-understand language.

The original work which provided the foundation for the project was performed under a contract with Battelle Memorial Institute (No. 68-02-4294) by Dr. Dale Keyes and Dr. Jean Chesson, under the direction of Edie Sterrett and Cindy Stroup of the EPA Exposure Evaluation Division. They prepared the first drafts of the document and were instrumental in establishing its final format.

EPA staff also gratefully acknowledge the work of staff from the Georgia Tech Research Institute (GTRI). Through a cooperative agreement with EPA they served as the overall project coordinator and provided thoughtful technical guidance throughout this entire process. The GTRI team also developed several key sections of the Guide.

This publication was refined through a peer review meeting held in October 1988 in Washington, DC, and by a series of comment periods provided through May 1990. The following individuals gave their time and provided comments:

John Biechman, *Safe Buildings Alliance*
Wolfgang Brandner, *U.S. EPA Region VII*
Frank Bull, *Bull, Brown & Kilgo Architects*
Eva Clay, *The Environmental Institute*
William Cobbs, *U.S. General Services Administration*
Mark Demyanek, *Georgia Tech Research Institute*
Michael Duffy, *Service Employees International Union*
Paul Fidducia, *Winston and Strawn*
Eugene Fisher, *Association of Wall and Ceiling Industries*
Douglas Greenaway, *Consultant (formerly, Building Owners and Managers Association International)*
David Harris, *National Institute of Building Sciences*
Steve Hays, *Gobbell Hays Partners*
Joseph Hopkins, *U.S. Department of Energy*
David Mayer, *Georgia Tech Research Institute*
Richard Mendes, *New York City Department of Environmental Protection*
Michael Miles, *Tishman Spyer Properties*
Roger Morse, *ENTEK Environmental and Technical Services, Inc.*
Robert Navratil, *RREEF Funds, Construction and Engineering*
Anthony Restaino, *U.S. EPA Region V*
Richard Roth, *Social Security Administration*
Sims Roy, *U.S. EPA, Office of Air Quality Planning and Standards*

Scott Schneider, *Workers' Institute for Occupational Safety and Health*
Henry Singer, *U.S. General Services Administration*
Thomas Warren, *Rose Associates, Inc.*

In addition to these individuals, the EPA acknowledges the contribution of the Policy Dialogue Group on Asbestos in Public and Commercial Buildings, which met several times during 1989–1990. The purpose of this multi-disciplinary group was to identify the problems associated with asbestos in public and commercial buildings and to develop policy recommendations for solving these problems. Many comments raised by the Dialogue Group in the area of asbestos management were incorporated into this document.

In February 1988, the Administrator of the Environmental Protection Agency (EPA) recommended to Congress that the Agency work during the next three years to enhance the nation's technical capability in asbestos by helping building owners better select and apply appropriate asbestos control and abatement actions in their buildings. The publication of this guidance document is EPA's most extensive effort to date to carry out that recommendation. In fact, *Managing Asbestos In Place* is the most comprehensive asbestos guide published by EPA since the Agency expanded and updated *Guidance for Controlling Asbestos-Containing Materials in Buildings* (also known as the Purple Book) in June 1985. Based on the insights and recommendations of nationally recognized asbestos experts, this new guide, along with a new operations and maintenance work practices manual expected to be available in 1991, provides "state-of-the-art" instruction to building owners to help them successfully manage asbestos-containing materials in place.

Managing Asbestos in Place does not supplant the 1985 Purple Book as EPA's principal asbestos guidance document. Rather, based on our experience since 1985, it expands and refines the Purple Book's guidance for a special operations and maintenance (O&M) program. In particular, the guide more strongly emphasizes the importance of in-place management. The guide's purpose is two-fold. First, it offers building owners the more detailed and up-to-date instruction they need to carry out a successful O&M program. Second, it informs building owners, lenders, and insurers that a properly conducted O&M program can in many cases be as appropriate an asbestos control strategy as removal. Furthermore, in some cases, an O&M program is *more* appropriate than other asbestos control strategies, including removal.

Emphasizing the importance and effectiveness of a good O&M program is a critical element of EPA's broader effort to put the potential hazard and risk of asbestos exposure in proper perspective. That effort centers around communicating the following *five facts*, which EPA hopes will help calm the unwarranted fears that a number of people seem to have about the mere presence of asbestos in their buildings and discourage the spontaneous decisions by some building owners to remove all asbestos-containing material regardless of its condition.

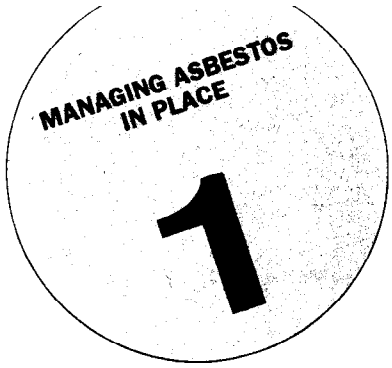
In other words, an individual must breathe asbestos fibers in order to incur any chance of developing an asbestos-related disease. How many fibers a person must breathe to develop disease is uncertain. However, at very low exposure levels, the risk may be negligible or zero.

A 1987 EPA study found asbestos air levels in a small segment of Federal buildings to be essentially the same as levels outside these buildings. Based on that limited data, most building occupants (i.e., those unlikely to disturb asbestos-containing building materials) appear to face only a very slight risk, if any, of developing an asbestos-related disease.

By their nature, asbestos removals tend to elevate the airborne level of asbestos fibers. Unless all safeguards are properly applied, a removal operation can actually increase rather than decrease the risk of asbestos-related disease.

Asbestos removal before the wrecking ball swings into action is appropriate to protect public health. At other times, EPA believes that asbestos removal projects, unless well-designed and properly performed, can actually increase health risk.

As this guide will explain in some detail, in-place management does *not* mean "do nothing." It means having a program to ensure that the day-to-day management of the building is carried out in a manner that minimizes release of asbestos fibers into the air, and ensures that when asbestos fibers are released, either accidentally or intentionally, proper control and cleanup procedures are implemented. As such, it may be all that is necessary to control the release of asbestos fibers, until the asbestos-containing material in a building is scheduled to be disturbed by renovation or demolition activities.



Why Is Asbestos a Problem?

Introduction: Asbestos in Buildings

This U.S. Environmental Protection Agency (EPA) guide is primarily directed to owners and managers of office buildings, shopping centers, apartment buildings, hospitals, and similar facilities which may contain asbestos materials. Managers of industrial plants and other types of structures may need to supplement this information with additional specialized guidance. This document gives building owners, managers, workers, and other key building staff basic information on how to develop and carry out high-quality operations and maintenance programs for managing asbestos in place to safeguard the health of all building occupants. An operations and maintenance (O&M) program can be defined as a formulated plan of training, cleaning, work practices, and surveillance to maintain asbestos-containing materials (ACM) in good condition.

In this document you will find the following information:

- The objectives of an O&M program, and an indication of the scope of O&M activities (Chapter 2);
- Basic steps to take before starting an O&M program, including an initial survey and evaluation of ACM (Chapter 3);
- How to implement and manage the program, including some basic cost considerations (Chapter 3);
- O&M work practices that protect both workers and the general building environment (Chapter 4);
- Recordkeeping suggestions and requirements (a section of Chapter 4);
- Training recommendations and requirements for workers performing O&M activities (Chapter 5); and
- An overview of federal regulations, including those affecting O&M programs (Chapter 6).

In addition, the Appendices provide other useful information, including a glossary of useful terms, and contacts for additional assistance.

There are steps which a building owner can take to prevent asbestos fiber releases or resuspension of already-released fibers, or control fiber releases quickly and safely if they occur. O&M programs are designed to achieve both these goals. This guide's purpose, therefore, is to inform building owners about how to develop, implement and manage effective O&M programs, and to encourage their use.

EPA recommends a pro-active, in-place management program whenever asbestos is discovered. In many buildings, a well-run O&M program may be all that is necessary to control the release of asbestos fibers until the ACM in the building is abated through renovation or demolition activities. Also, an emergency repair to equipment or building services, or an unexpected incident such as ACM falling from a surface could necessitate a different control strategy. However, barring such events, if ACM is properly managed, release of asbestos fibers into the air is minimized. The exposure to asbestos fibers, and therefore the risk of asbestos-related disease, can be reduced to a negligible level for all building occupants.

An O&M program may also provide an effective, less costly alternative to wholesale removal operations. Some additional cost-related considerations are discussed in Chapter 3.

The EPA National Emission Standards for Hazardous

Air Pollutants (NESHAP) regulations on asbestos may require ACM removal prior to renovation and/or demolition projects, to prevent significant asbestos releases into the air (see Chapter 6). Additionally, removal of some ACM in a building will be necessary if the material has been damaged beyond repair. *However,* at other times, removal is often *not* a building owner's best course of action to reduce asbestos exposure. (Extraneous factors — for example, difficulty in obtaining insurance, or obtaining financing relative to a real estate transaction — may actually represent the driving forces in a decision to remove all ACM, rather than a health-based need for removal.) In fact, unless all safeguards are properly applied by trained, experienced individuals, removing ACM can actually increase building occupants' risk of asbestos-related disease.

Asbestos fibers can cause serious health problems. If inhaled, they can cause diseases which disrupt the normal functioning of the lungs. Three specific diseases — asbestosis (a fibrous scarring of the lungs), lung cancer, and mesothelioma (a cancer of the lining of the chest or abdominal cavity) — have been linked to asbestos exposure. These diseases do not develop immediately after inhalation of asbestos fibers; it may be 20 years or more before symptoms appear.

In general, as with cigarette smoking and the inhalation of tobacco smoke, the more asbestos fibers a person inhales, the greater the risk of developing an asbestos-related disease. Most of the cases of severe health problems resulting from asbestos exposure have been experienced by workers who held jobs in industries such as shipbuilding, mining, milling, and fabricating, where they were exposed to very high levels of asbestos in the air, without benefit of the worker protections now afforded by law. Many of these same workers were also smokers. These employees worked directly with asbestos materials on a regular basis and, generally, for long periods of time as part of their jobs. Additionally, there is an increasing concern for the health and safety of construction, renovation, and building maintenance personnel, because of possible periodic exposure to elevated levels of asbestos fibers while performing their jobs.

Whenever we discuss the risk posed by asbestos, we must keep in mind that asbestos fibers can be found nearly everywhere in our environment (usually at very low levels). There is, at this time, insufficient information concerning health effects resulting from low-level asbestos exposure, either from exposures in buildings or from our environment. This makes it difficult to accurately assess the magnitude of cancer risk for building occupants, tenants, and building maintenance and custodial workers. Although in general the risk is likely to be negligible for occupants, health concerns remain, particularly for the building's custodial and maintenance workers. Their jobs are likely to bring them into close proximity to ACM, and may sometimes require them to disturb the ACM in the performance of maintenance activities. For these workers in particular, a complete and effective O&M program can greatly reduce asbestos exposure. This kind of O&M program can also minimize asbestos exposures for other building occupants as well.

The term "asbestos" describes six naturally occurring fibrous minerals found in certain types of rock formations. Of that general group, the minerals chrysotile, amosite, and crocidolite have been most commonly used in building products. When mined and processed, asbestos is typically separated into very thin fibers. When these fibers are present in the air, they are normally invisible to the naked eye. Asbestos fibers are commonly mixed during processing with a material which binds them together so that they can be used in many different products. Because these fibers are so small and light, they may remain in the air for many hours if they are released from ACM in a building. When fibers are released into the air they may be inhaled by people in the building.

Asbestos became a popular commercial product because it is strong, won't burn, resists corrosion, and insulates well. In the United States, its commercial use began in the early 1900's and peaked in the period from World War II into the 1970's. Under the Clean Air Act of 1970 the EPA has been regulating many asbestos-containing materials which, by EPA definition, are materials with more than 1 percent asbestos. The Occupational Safety and Health Administration's (OSHA) asbestos construction standard in section K, "Communication of hazards to employees," specifies labeling many materials containing 0.1% or more asbestos. In the mid-1970's several major kinds of asbestos materials, such as spray-applied insulation, fireproofing, and acoustical surfacing material, were banned by EPA because of growing concern about health effects, particularly cancer, associated with exposures to such materials.

In July 1989, EPA promulgated the Asbestos Ban and Phasedown Rule. The rule applies to new product manufacture, importation, and processing, and essentially bans almost all asbestos-containing products in the United States by 1997. This rule does *not* require removal of ACM currently in place in buildings.

In February 1988, the EPA released a report titled *EPA Study of Asbestos-Containing Materials in Public Buildings: A Report to Congress.* EPA found that "friable" (easily crumbled) ACM can be

found in an estimated 700,000 public and commercial buildings. About 500,000 of those buildings are believed to contain at least some damaged asbestos, and some areas of significantly damaged ACM can be found in over half of them.

According to the EPA study, significantly damaged ACM is found primarily in building areas not generally accessible to the public, such as boiler and machinery rooms, where asbestos exposures generally would be limited to service and maintenance workers. Friable ACM, if present in air plenums, can lead to distribution of the material throughout the building, thereby possibly exposing building occupants. ACM can also be found in other building locations.

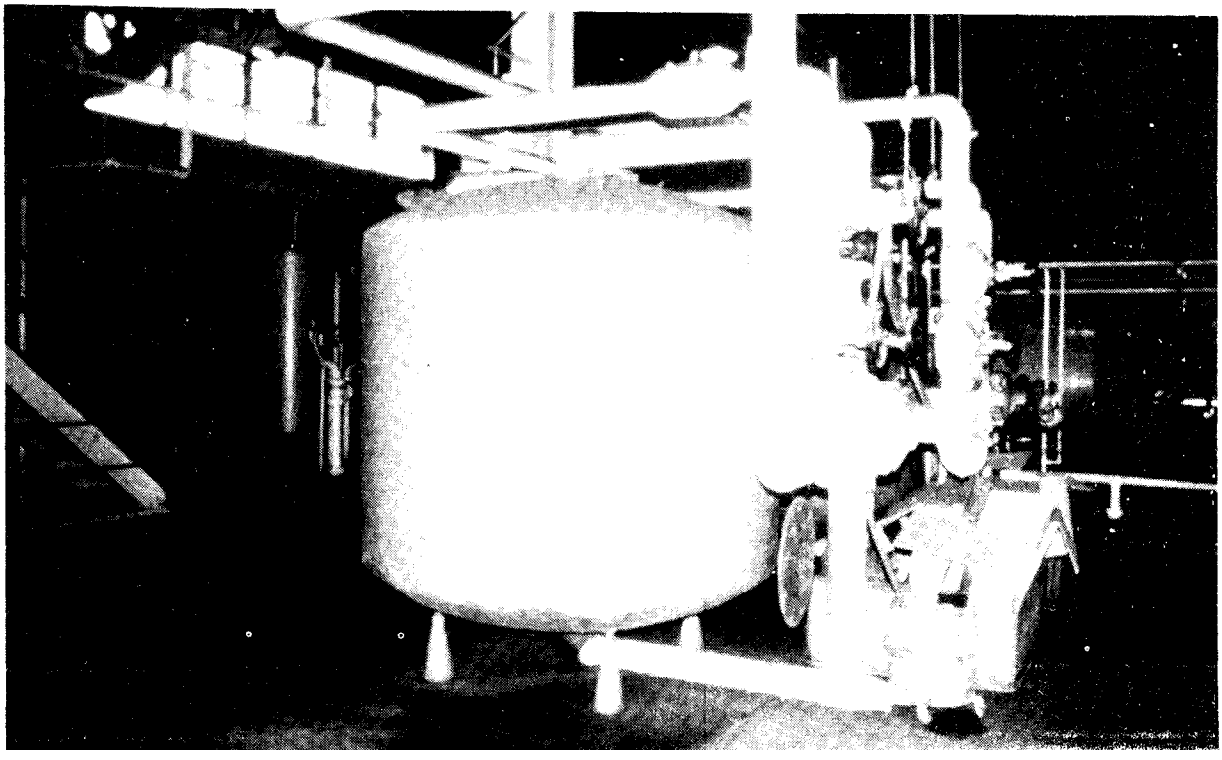
Asbestos in buildings has been commonly used for thermal insulation, fireproofing, and in various building materials, such as floor coverings and ceiling tile, cement pipe and sheeting, granular and corrugated paper pipe wrap, and acoustical and decorative treatment for ceilings and walls. Typically, it is found in pipe and boiler insulation and in spray-applied uses such as fireproofing or sound-deadening applications.

The amount of asbestos in these products varies widely (from approximately 1 percent to nearly 100 percent). The precise amount of asbestos in a product cannot always be accurately determined from labels or by asking the manufacturer. Nor can positive identification of asbestos be ascertained merely by visual examination. Instead, a qualified laboratory must analyze representative samples of the suspect material. Appendix G contains a sample list of some suspect materials.

Intact and undisturbed asbestos materials do not pose a health risk. The mere presence of asbestos in a building does not mean that the health of building occupants is endangered. ACM which is in good condition, and is not somehow damaged or disturbed, is not likely to release asbestos fibers into the air. When ACM is properly managed, release of asbestos fibers into the air is prevented or minimized, and the risk of asbestos-related disease can be reduced to a negligible level.

ACM which is in poor physical condition. Under a proper operations and maintenance program, corrective action would normally prevent deterioration of the insulation.

However, asbestos materials can become hazardous when, due to damage, disturbance, or deterioration over time, they release fibers into building air. Under these conditions, when ACM *is* damaged or disturbed — for example, by maintenance repairs conducted without proper controls — elevated airborne asbestos concentrations can create a potential hazard for workers and other building occupants.



ACM with sound structural integrity on the exterior of a domestic hot water tank. Note that the insulation jacketing is intact and there is no evidence of disturbance.

Chapter Summary

This document, directed to owners and managers of office buildings and similar facilities, should help lay the groundwork for developing and implementing effective operations and maintenance programs. Major highlights in this section have focused on background information concerning asbestos and have touched on the current asbestos-in-buildings situation. Important points to remember are the following:

Inhalation of asbestos fibers has been shown to cause asbestosis, lung cancer and mesothelioma. Much of our knowledge of these health effects has come primarily from studies of workers exposed routinely to very high levels of asbestos in their jobs.

Information on health effects of low-level asbestos exposure is less certain; custodial/maintenance workers who sometimes disturb asbestos as part of their job would benefit from properly executed O&M programs.

Three of the six naturally occurring asbestos minerals, chrysotile, amosite, and crocidolite, have been most commonly used in building products.

Asbestos became a popular commercial product because of its strength, heat resistance, corrosion resistance, and thermal insulation properties.

Asbestos-containing materials (ACM) are regulated by EPA, OSHA, and the Consumer Product Safety Commission (CPSC), and individual state and local agencies.

Friable ACM can be found in about 700,000 public and commercial buildings. Many areas where asbestos is found are not accessible to the general public.

Some common uses of asbestos have included pipe/boiler insulation, spray-applied fireproofing, floor and ceiling tile, cement pipe/sheeting and paper pipe wrap.

Positive identification of asbestos requires laboratory analysis; information on labels or visual examination only is not sufficient.

Intact, undisturbed materials generally do not pose a health risk; they may become hazardous when damaged, disturbed, or deteriorated over time and release fibers into building air.

What Is an O&M Program?

Purpose and Scope of an Operations and Maintenance Program

The principal objective of an O&M program is to minimize exposure of all building occupants to asbestos fibers. To accomplish this objective, an O&M program includes work practices to (1) maintain ACM in good condition, (2) ensure proper cleanup of asbestos fibers previously released, (3) prevent further release of asbestos fibers, and (4) monitor the condition of ACM.

An effective O&M program should address all types of ACM present in a building. ACM that may be managed as part of an O&M program in buildings can be classified in one of the following categories:

Surfacing Material: Examples include ACM sprayed or troweled onto surfaces, such as decorative plaster on ceilings or acoustical ACM on the underside of concrete slabs or decking, or fireproofing materials on structural members.

Thermal System Insulation (TSI): Examples include ACM applied to pipes, boilers, tanks, and ducts to prevent heat loss or gain, or condensation.

Miscellaneous ACM: Examples include asbestos-containing ceiling or floor tiles, textiles, and other components such as asbestos-cement panels, asbestos siding and roofing materials.

The O&M program, when developed and implemented in a particular facility, should include specific direction on how to deal with each of these general categories of ACM. Specified O&M work practices and procedures should be employed by trained personnel during building cleaning, maintenance, renovation, and general operational activities that may involve surfacing, thermal, or miscellaneous ACM. Some elaboration of O&M work practices and procedures is found in Chapter 4.

The O&M program can be divided into three types of projects:

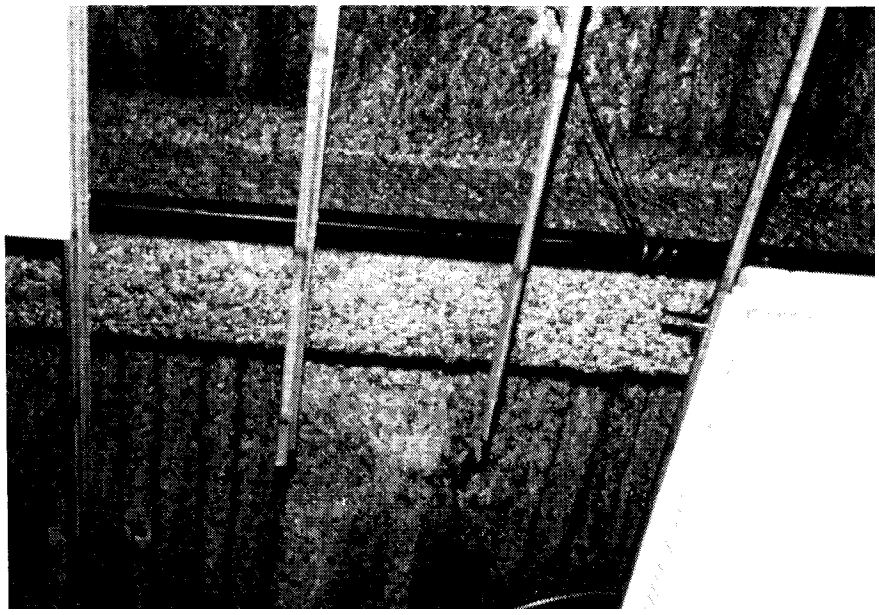
those which are unlikely to involve any direct contact with ACM;

those which may cause accidental disturbance of ACM;

those which involve relatively small disturbances of ACM.

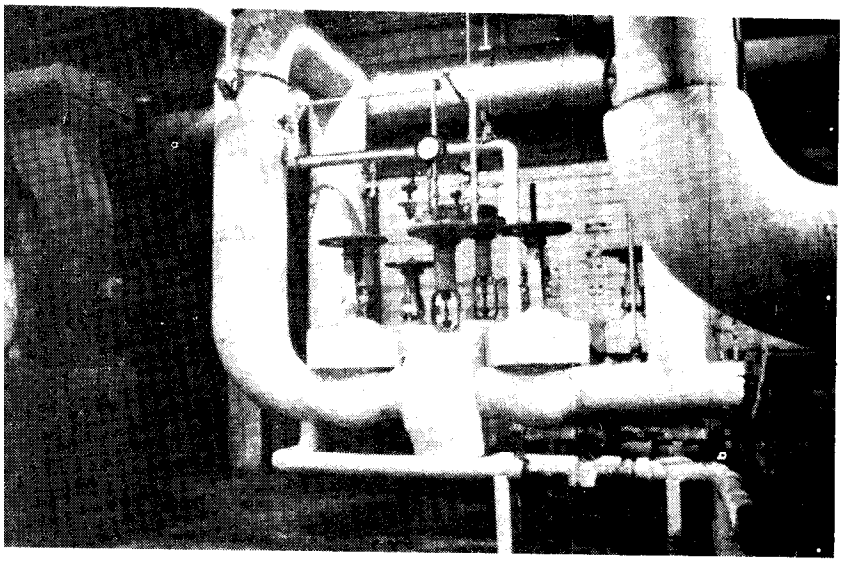
The first type may involve routine cleaning of shelves and counter tops or other surfaces in a building (provided ACM debris is not present). Generally, such

An example of spray-applied surfacing ACM on a metal deck above a suspended ceiling.



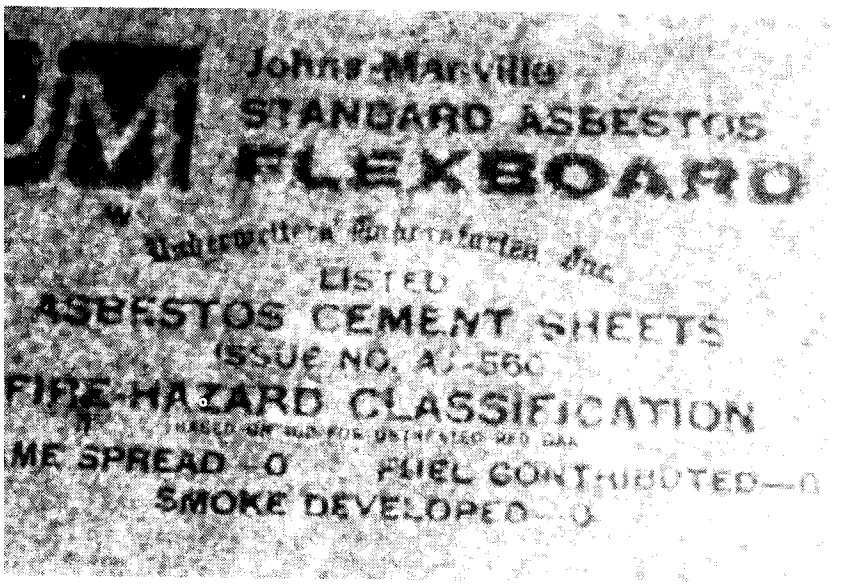
activities would not be expected to disturb ACM. The second type of project could include maintenance work above a suspended ceiling in an area that may have surfacing ACM overhead. The third type of project — small-scale, short-duration maintenance, repair, or installation projects involving minor disturbances of ACM — includes activities such as installation of new light fixtures on or in an ACM ceiling. A single glovebag operation to remove a small amount of ACM to repair a pipe in a boiler room is another example of intentional small-scale, short-duration disturbance.

An example of asbestos-containing thermal system insulation on pipes in a building's mechanical room.



Larger projects involving more complex procedures for the intentional removal of ACM are considered asbestos abatement projects. These require asbestos control and abatement procedures that are outside the scope of an O&M program. Before taking action, building owners should consult qualified professionals for advice and alternative solutions. Guidance for building owners on the management of abatement projects is included in EPA's "Guidance for Controlling Asbestos-Containing Materials in Buildings," June 1985, also known as the "Purple Book."

An example of an asbestos-containing cement sheet product (miscellaneous ACM).



Chapter Summary

The purpose of an Operations and Maintenance Program is to minimize exposure of all building occupants to asbestos fibers. Through supervised work practices, ACM can be managed in place. Important points to remember are:

ACM can be classified into three categories:

- Surfacing Material
- Thermal System Insulation (TSI)
- Miscellaneous Material

O&M Programs can be divided into three types of projects:

- Unlikely to involve direct contact with ACM.
- Accidental disturbance of ACM.
- Small-scale, short-duration maintenance or repair activity, which may involve intentional disturbance of ACM.

How Does the Program Start?

Laying the Foundation for an Effective O&M Program

A comprehensive asbestos control program for a building should include these basic steps:

Appoint an Asbestos Program Manager and develop an organizational policy.

Conduct a physical and visual inspection of the building and take bulk samples of suspect materials to determine if ACM is present, establish an ACM inventory, and assess the ACM's condition and potential for disturbance.

If ACM is located, develop an O&M program, based on the inspection and assessment data.

Implement and manage the O&M program conscientiously.

Select and implement abatement actions other than O&M when necessary.

This chapter provides information about each of these basic steps. In addition, see Appendix F for a chart of references outlining existing EPA guidance for each of these steps.

The position of Asbestos Program Manager (APM) is frequently held by the building engineer, superintendent, facilities manager, or safety and health director. In a small organization, the building owner may have this role. Regardless of who holds this position, EPA stresses the need for the Asbestos Program Manager to be properly qualified, through training and experience, and to be *actively involved* in all asbestos-control activities. EPA accreditation under the Asbestos Hazard Emergency Response Act (AHERA) or state certification as a Building Inspector/Management Planner would be typical of the requisite training.

If the person selected is not adequately prepared, he or she should receive the training necessary to develop and manage an asbestos control program prior to beginning the job. If for some reason this is not possible, the building owner should strongly consider hiring a properly trained, experienced, and credentialed outside consultant or firm to provide direction to the owner or the Asbestos Program Manager.

In general, the Asbestos Program Manager should have the authority to oversee all asbestos-related activities in the building, including inspections, O&M activities, and other abatement actions. The Asbestos Program Manager will either train building workers in O&M techniques or ensure that such worker training takes place. In addition, he or she should oversee the custodial and maintenance staffs, contractors, and outside service vendors with regard to all asbestos-related activities.

To determine whether an asbestos control and management program should be implemented, the owner should have an initial building inspection performed to locate and assess the condition of all ACM in the building. A trained, experienced and qualified inspector, who is able to perform the sampling of suspect ACM for laboratory analysis, should conduct the inspection. If an inspection is not performed, then certain suspect materials should be assumed to contain asbestos, and treated accordingly. (Refer to Appendix G for a sample list of suspect ACM.)

EPA guidance on how to take "bulk" samples of suspect ACM is contained in several publications (see Appendix H) and from EPA Regional Asbestos Coordinators (listed in Appendix D).

The building inspection by a qualified professional serves as the basis for establishing an effective overall plan for dealing with the asbestos in the building. The inspector should advise the owner and the Asbestos

A properly trained and protected building inspector collecting a bulk sample of suspected asbestos-containing thermal system insulation.

Program Manager of inspection findings. Of course, the inspection may show that ACM is *not* present and that an asbestos-control program is not required.

If ACM *is* found, the material's characteristics, condition, quantity, and location within the building, as well as building use, will affect how the building owner should deal with the ACM. For example, operations and maintenance procedures may be appropriate and sufficient in a particular building for ACM in good condition. But O&M procedures alone are not sufficient for ACM that the inspector determines is significantly damaged, and may not be sufficient for some types of ACM situated in highly accessible areas; in these instances, some form of full scale abatement — repair, encapsulation, enclosure, encasement, or removal — will be necessary. Removal of the ACM may also be appropriate when performed in conjunction with major building renovations, or as part of long-term building management policies (such as staged removal in conjunction with renovation over the life of the building, as covered by the EPA NESHAP requirements for removal before demolition or renovation).

If ACM is found, the building owner should have an O&M program developed as soon as possible. Either the Asbestos Program Manager or a qualified consultant should develop the O&M program. The written O&M program should state clearly the O&M policies and procedures for that building, identify and describe the administrative line of authority for that building, and should clearly define the responsibilities of key participants, such as the Asbestos Program Manager and custodial and maintenance supervisors and staff. The written O&M program should be available and understood by all participants involved in the management and operations of the building.

In general, the O&M program developed for a particular building should include the O&M program elements discussed in the next chapter. However, the building owner should make sure that the O&M program developed is site-specific and tailored for the building. The O&M program should take into account use, function, and design characteristics of a particular building.

A well-developed O&M program is ineffective unless the building owner is committed to implementing it properly. The building owner should convey this commitment to key personnel involved in a building's management and operations — particularly the Asbestos Program Manager and custodial and maintenance supervisors and staff. The O&M program's success is contingent upon key personnel understanding the O&M program and committing themselves to implementing it effectively.

To the greatest extent possible, the building owner should incorporate the O&M program into the existing system for managing a building's operations. Each building owner, therefore, will determine the appropriate organizational structure on a case-by-case basis. Two possible arrangements are suggested in Figures 1 and 2 in Appendix C.

When managing an O&M program, the Asbestos Program Manager should oversee all asbestos-related activities. In instances where a building owner hires a contractor to perform custodial and maintenance work, the Asbestos Program Manager should ensure that the contractor is qualified to conduct work that may involve ACM. Before hiring a contractor, the Asbestos Program Manager should investigate to determine whether the contractor's staff is qualified, trained and equipped to deal with O&M asbestos activities. Thoroughly checking the references of a contractor is a good recommended practice.

The Asbestos Program Manager should also monitor the work performed in the building by other contractors, such as electricians and plumbers, who might inadvertently disturb ACM. Instituting a work permit system, as discussed in the next chapter, may prevent accidental disturbances of ACM. Under this system, a

contractor must receive a work permit from the Asbestos Program Manager before commencing work. At that time, the Asbestos Program Manager will inform the contractor whether the project could disturb ACM and provide any special instructions to make sure the work is done properly. *Communication between the Asbestos Program Manager and tenants occupying the building is essential to prevent activities that might compromise the O&M program.*

In addition, the Asbestos Program Manager should routinely and frequently check the work being performed in the building by contractors and custodial and maintenance staff to see if their work is disturbing ACM. By maintaining close surveillance over these activities, the Asbestos Program Manager can help ensure that work which may disturb ACM is being done safely. Tenants should be required (by legal agreement or understanding) to notify the building owner or the Asbestos Program Manager before conducting even small planned renovations. This would help prevent building tenants from unknowingly disturbing ACM. For both the work permit system and the renovation notification requirement, clear and effective communications to workers and tenants are crucial to the success of the O&M management program.

The Asbestos Program Manager should periodically review the written O&M plan to determine whether it should be updated. For example, if all ACM were removed from some areas of the building during a recent renovation, or if some ACM was damaged, the O&M program should be revised accordingly. The O&M program should remain in effect as long as there is ACM present in the building.

The costs associated with implementing and managing an O&M program may vary significantly depending on the types of ACM, building-specific factors, actual O&M procedures adopted, types of equipment used, and the useful life of the building. Owners may find it more cost-effective to continue a well-supervised and managed O&M program than to incur the costs of immediate, large-scale removal. In addition to the direct costs of removal, other costs related to ACM removal include moving building occupants, arranging alternative space for building occupants during the removal work, and restoring the building after the removal is completed.

Clearly, many factors enter into the decision. Only by conducting a cost-effectiveness analysis of the long-term options (e.g., comparing (a) immediate removal with (b) phased removal plus O&M with (c) removal just before demolition plus lifetime O&M) will owners be truly able to determine which option is most cost-effective for their buildings. The prudent owner may need to consult one or more qualified consultants or firms for advice, if such expertise does not exist within the owner's organization.

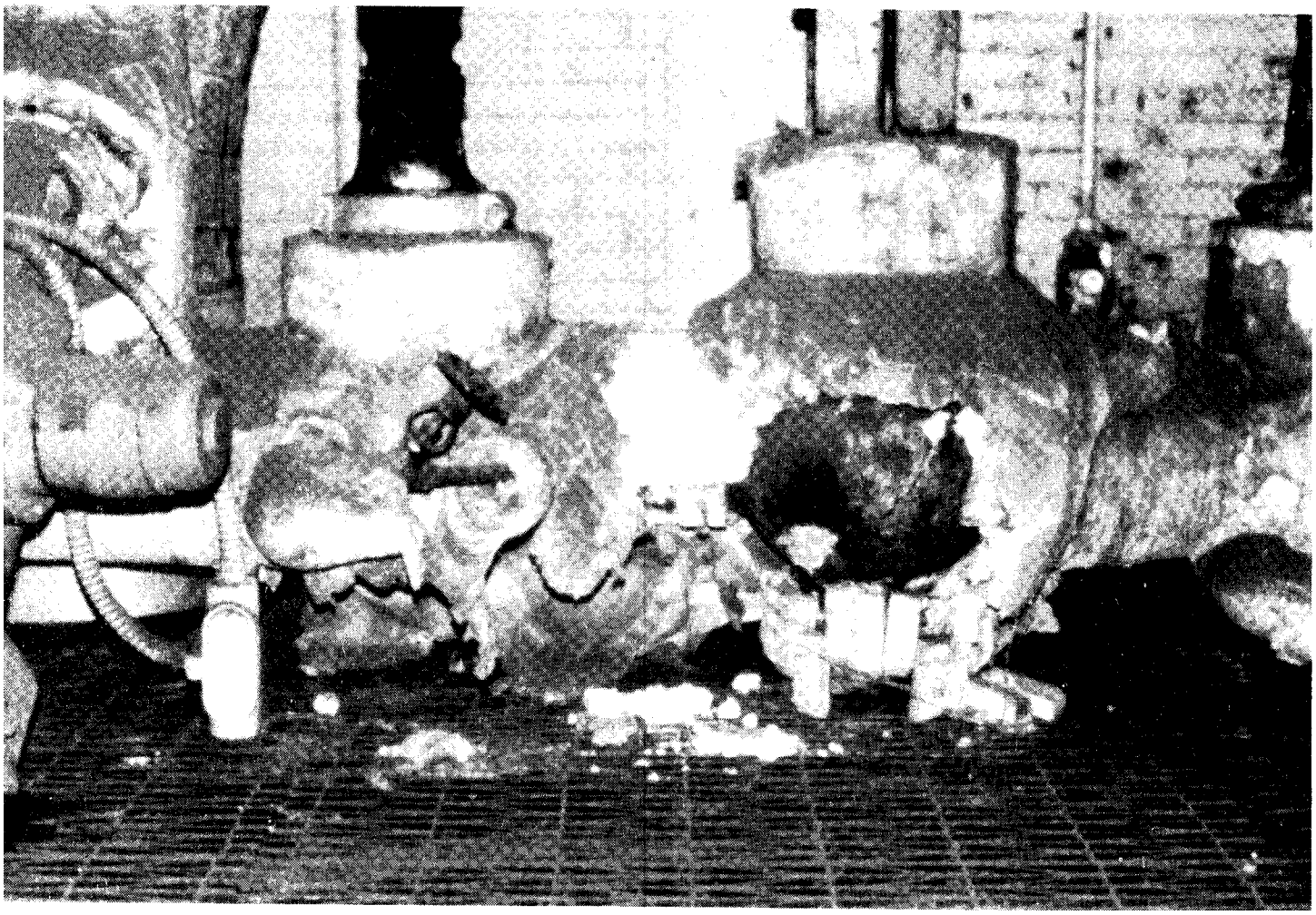
In some instances, due to the condition of ACM or upcoming building renovations, a building owner may decide to take other abatement actions to deal with ACM in the building. These response actions could include encapsulation (covering the ACM with a sealant to prevent fiber release), enclosure (placing an air-tight barrier around the ACM), encasement (covering the ACM with a hard-setting sealing material), repair, or removal of the ACM. Qualified, trained, and experienced contractors should be used for any of these actions. EPA's Purple Book discusses most of these alternatives in some detail. In general, repair, encapsulation, enclosure, and encasement, are intended to help prevent the release of asbestos fibers. As aspects of O&M, these techniques manage ACM in place. See Appendix F of this document for additional federal reference sources on asbestos response actions.

When determining which response alternative to select, the building owner and Asbestos Program Manager may consider seeking advice from qualified, independent consultants with specific training and experience in asbestos management.

Asbestos consultants should have a background in engineering, architecture, industrial hygiene, safety, or a similar field. Experts who are Registered and/or with Board Certified backgrounds are recommended. *To help ensure that no "conflict of interest" exists, consultants should not be affiliated with the abatement contractors who may be used on a recommended ACM control project, nor with analytical laboratories which perform sample analyses.* As with other similar business decisions, building owners should interview several consultants and check references.

Renovations (including remodeling or redecorating) of buildings or replacement of utility system increases the potential for disturbing ACM. Before conducting any renovation or remodeling work, the building owner should have the Asbestos Program Manager review asbestos inspection and assessment records to determine where ACM may be located, visually reinspect the area, and evaluate the likelihood that ACM will be disturbed. Any suspect or assumed ACM that could be disturbed during the renovation work should either be sampled and analyzed to determine whether it contains asbestos, or the work should be carried out as if the materials did contain asbestos. The Asbestos Program Manager should also ensure that no new ACM is introduced into the building as part of the renovation work.

Removal of the ACM before renovation begins may be necessary in some instances. Removal is required by the Asbestos NESHAP regulations for projects which would break up more than a specified minimum amount of ACM; specifically, at least 160 square feet of surfacing



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or miscellaneous material or at least 260 linear feet of thermal system insulation (40 CFR 61.145–147). Building owners and managers are encouraged to contact their state or local health or environmental department for further clarification of these requirements (also, see Chapter 6 of this document). It is important to ensure that new materials placed in the building do not contain asbestos in order to comply with the recent EPA Asbestos Ban and Phase Out rule (see Chapter 6).

In general, building owners should thoroughly consider any decision to remove ACM. *O&M, encapsulation, encasement, enclosure, or repair may be viable alternatives to removal.* Building owners should assess these in-place management techniques carefully before deciding to remove undamaged ACM.

Under certain circumstances, however, such as when some ACM must be removed during building renovations, when the ACM has sustained a great deal of damage, or ACM disturbance will be difficult to manage properly, the building owner may decide to remove ACM in parts of the building.

When removal must occur, only qualified, trained and experienced project designers and contractors should be permitted to design and perform the work. Building owners might consider contacting local, state, and federal asbestos regulatory agencies to see if prospective contractors have received citations for violating asbestos regulations in the past. In addition, if the building owner and Asbestos Program Manager are not properly qualified themselves, they should retain a qualified and independent project designer and a project monitor with training and experience in asbestos abatement to oversee and ensure that the asbestos abatement work is done safely. When these precautions are taken, asbestos removal is more likely to proceed safely and effectively.

Proper completion of the ACM removal is best evaluated by means of the analytical procedures using transmission electron microscopy (TEM). (These are described in 40 CFR Part 763, Appendix A to Subpart E.) Clearance protocols for statistically comparing asbestos fiber levels inside the work area with outside levels are available. If the measured levels inside are not statistically higher than the average airborne asbestos concentration measured outside the abatement area, the cleanup is considered successful, and the space is judged ready for reoccupancy. (For reference, see Appendix H, U.S. EPA "Guidelines for Conducting the AHERA TEM Clearance Test . . . .")

Chapter Summary

Laying the foundation for a comprehensive asbestos control program for a building includes some basic steps. Important points contained in this discussion are the following:

An Asbestos Program Manager needs to be properly qualified through training and experience, and be actively involved in all asbestos control and disturbance activities.

An Asbestos Program Manager should have authority to oversee and to direct custodial/maintenance staff and contractors with regard to all asbestos-related activities.

An initial building inspection should be performed by a trained, qualified, experienced inspector to locate and assess the condition of all ACM in the building.

The inspection results serve as the basis for establishing an O&M program. O&M procedures may not be sufficient for certain ACM that is significantly damaged or in highly accessible areas.

An Asbestos Program Manager or qualified consultant should develop the written O&M program that is site-specific and tailored for individual buildings. The O&M program should take into account use, function and design characteristics of a building.

The success of any O&M program lies in the commitment by the building owner to implement it properly.

When outside contractors are used for asbestos-related activities, their references and training should be thoroughly checked and their subsequent work monitored.

Periodically review written O&M programs.

Alternatives or control options that may be implemented under an O&M program include:

- repair
- encapsulation
- enclosure
- encasement
- removal (minor)

Removal of ACM before renovations may be necessary in some instances. (See NESHAP and State/Local regulations discussion in Chapter 6.)

What Does an O&M Program Include?

O&M Program Elements

To achieve its objectives, an O&M program should include seven elements. Although these should appear in any O&M program, the extent of each will vary from program to program depending on the building type, the type of ACM present, and the ACM's location and physical condition. For example, if only nonfriable ACM is present, minimal notification might be needed, and custodial or maintenance staff would most likely have fewer work practices to be followed. If friable ACM is present, a more detailed O&M program should be prepared and followed. Each of the first six elements listed below is described in this chapter to provide an illustration of a basic O&M program. The seventh program element, training of the Asbestos Program Manager and custodial and maintenance staff, is very important. If staff are not adequately trained, the O&M program will not be effective. Chapter 5 is devoted exclusively to O&M training topics.

A successful O&M program should include the following elements:

Notification: A program to tell workers, tenants, and building occupants where ACM is located, and how and why to avoid disturbing the ACM. All persons affected should be properly informed.

Surveillance: Regular ACM surveillance to note, assess, and document any changes in the ACM's condition.

Controls: Work control/permit system to control activities which might disturb ACM.

Work Practices: O&M work practices to avoid or minimize fiber release during activities affecting ACM.

Recordkeeping: To document O&M activities.

Worker Protection: Medical and respiratory protection programs, as applicable.

Training: Asbestos Program Manager, and custodial and maintenance staff training.

Building owners should inform building workers, occupants, and tenants about the location and physical condition of the ACM that they might disturb, and stress the need to avoid disturbing the material. Occupants should be notified for two reasons: (1) building occupants should be informed of any potential hazard in their vicinity; and (2) informed persons are less likely to unknowingly disturb the material and cause fibers to be released into the air.

Building owners can inform occupants about the presence of ACM by distributing written notices, posting signs or labels in a central location where affected occupants can see them, and holding awareness or information sessions. The methods used may depend on the type and location of the ACM, and on the number of people affected. Some states and localities have "right-to-know" laws which may require that all occupants, workers, and visitors in buildings with ACM be informed that asbestos is present.

In service and maintenance areas (such as boiler rooms), signs such as "Caution -- Asbestos -- Do Not Disturb" placed directly adjacent to thermal system insulation ACM will alert and remind maintenance

workers not to inadvertently disturb the ACM. In most cases, all boilers, pipes, and other equipment with ACM in service areas where damage may occur should have prominent warning signs placed next to the ACM. As an alternative, color coding can be used to identify the ACM in certain situations provided that all potentially involved parties understand the coding system.

Information sessions reinforce and clarify written notices and signs, and provide an opportunity to answer questions. All employees and tenants or tenant representatives likely to disturb ACM should be included in the notification program on a continuing basis. Building owners should inform new employees about the presence of ACM before they begin work. Owners should provide additional signs and information sessions in languages other than English where a significant number of workers, occupants, or visitors do not speak English. It may be necessary to make special provisions for illiterate workers, such as providing clear verbal information or signs, about potential hazards of disturbing ACM and showing them where ACM is located.

The specific information given to types of building occupants will vary. For example, since service workers carry out certain tasks that office workers or tenants do not perform, they should receive additional information. Most important, O&M workers should receive the training necessary for them to perform their tasks safely.

Whatever its form, the information given to building occupants and workers should contain the following points to the extent they reflect building conditions:

ACM has been found in the building and is located in areas where the material could be disturbed.

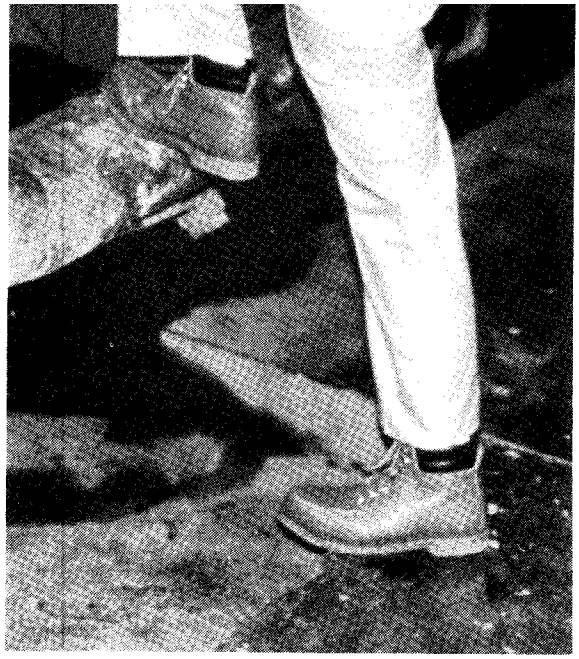
The condition of the ACM, and the response which is appropriate for that condition.

Asbestos only presents a health hazard when fibers become airborne and are inhaled. The mere presence of ACM does not represent a health hazard.

The ACM is found in the following locations (e.g., ceilings in Rooms 101 and G-323, walls in the lobby, above suspended ceilings in the first floor corridor, on columns in the main entry, on pipes in the boiler room).

Do not disturb the ACM (e.g., do not push furniture against the ACM, do not damage TSI).

Report any evidence of disturbance or damage of ACM to (name, location, and phone number of Asbestos Program Manager).



Routine maintenance activities can cause disturbance of ACM if workers are not properly trained in operations and maintenance procedures. Here, a worker carelessly contacts ACM, possibly damaging it.

Report any dust or debris that might come from the ACM or suspect ACM, any change in the condition of the ACM, or any improper action (relative to ACM) of building personnel to (name, location, and phone number of Asbestos Program Manager).

Cleaning and maintenance personnel are taking special precautions during their work to properly clean up any asbestos debris and to guard against disturbing ACM.

All ACM is inspected periodically and additional measures will be taken if needed to protect the health of building occupants.

An example of an asbestos caution sign placed directly on a section of asbestos-containing duct insulation. Signs such as this help to ensure that workers will not inadvertently disturb ACM.

It is important to undertake an honest and open approach to the ACM notification procedure. Owners should strive to establish clear lines of communication with all building occupants regarding asbestos issues. People who are informed of the presence, location and condition of ACM in a building where they work or live, who understand that the mere presence of ACM is not necessarily hazardous to them, and who accept that ACM can often be managed effectively in place, can be

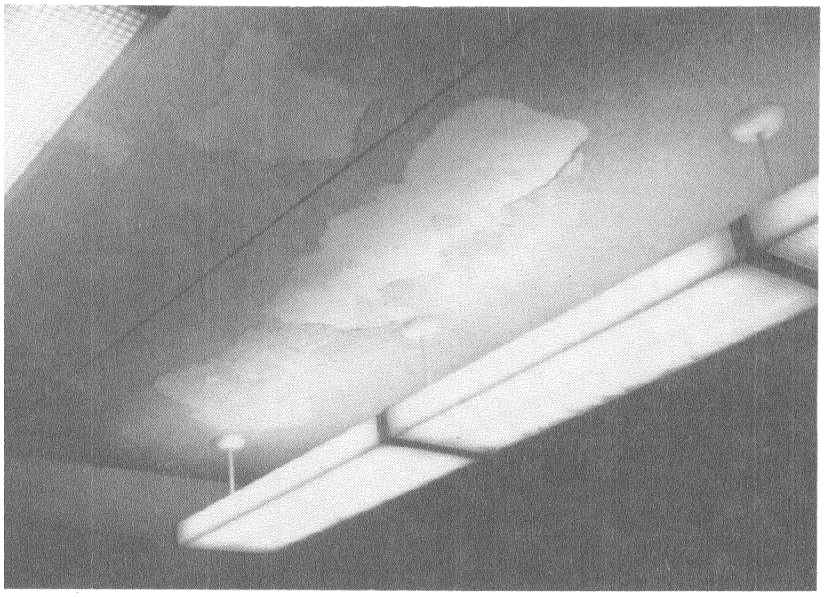
very helpful to the owner in eliminating or reducing hysteria on the part of other less informed building occupants. On the other hand, if occupants suspect the building owner is not being honest about asbestos activities in the building, that owner's credibility may be questioned and the situation can become far more difficult to manage. *If and when asbestos incidents occur, it is especially important for the building owner to deal with occupants and contractors openly and honestly, for that is the best way to maintain occupant/tenant confidence in both the owner and the building's asbestos program.*

ACM Surveillance

Visual reinspections of asbestos materials at regular intervals can detect changes in material condition. Here, surfacing ACM has delaminated from a ceiling in a building; O&M routines can keep small problems from becoming big problems.

Reinspection and Periodic Surveillance

A visual reinspection of all ACM should be conducted at regular intervals as part of the O&M program. Combined with ongoing reports of changes in the condition of the ACM made by service workers, the reinspections should help ensure that any ACM damage or deterioration will be detected and corrective action taken.



According to recent EPA regulations covering schools (the Asbestos Hazard Emergency Response Act, "AHERA"), an accredited inspector must reinspect school buildings at least once every three years to reassess the condition of ACM. The AHERA regulations for schools also require a routine surveillance check of ACM every six months to monitor the ACM's condition. The AHERA Rule permits this surveillance to be conducted by a trained school custodian or maintenance worker. While these intervals are mentioned here as a guide, they may also be appropriate for other buildings. The Asbestos Program Manager should establish appropriate intervals, based on consultation with the building owner and any other qualified professionals involved in the O&M program.

EPA recommends a visual and physical evaluation of ACM during the reinspections to note the ACM's current condition and physical characteristics. Through this reinspection, it is possible to determine both the relative degree of damage and assess the likelihood of future fiber release. Maintenance of a set of visual records (photos or video tape) of the ACM over time can be of great value during reinspections.

Some asbestos consultants recommend examining settled dust for accumulations of asbestos fibers as another surveillance tool in an O&M program. While no universally accepted standardized protocols currently exist for sampling and analysis of settled dust, positive results (i.e., ACM is present in the dust) may indicate the need for special cleaning of the affected area, or other action. Because the results of this testing are difficult to interpret and evaluate at this time, building owners should carefully consider the appropriateness of this testing to their situation.

Supplement to Visual/Physical Evaluation

As part of an O&M program, a carefully designed air monitoring program to detect airborne asbestos fibers in the building may provide useful supplemental information when conducted along with a comprehensive visual and physical ACM inspection and reinspection program. If the ACM is currently in good condition, increases in airborne asbestos fiber levels at some later time may provide an early warning of deterioration or disturbance of the material. In that way, supplemental air monitoring can be a useful management tool. If an owner chooses to use air monitoring in an "early warning" context, a knowledgeable and experienced individual should be consulted to design a proper sampling strategy. Appendix H contains a reference to a useful guide to monitoring airborne asbestos, which can be consulted for further discussion of this subject.

If supplemental air monitoring is done, a baseline airborne asbestos fiber level should be established soon after the O&M program is initiated. Representative, multiple air samples should be collected throughout the building during periods of normal building operation. This should be done over a long enough period of time to be representative of existing conditions, in order to adequately characterize prevailing fiber levels in the building. *This air monitoring should supplement, not replace, physical and visual inspection.* Visual inspection can recognize situations and anticipate future exposure (e.g., worsening water damage), whereas air monitoring can only detect a problem after it has occurred, and fibers have been released.

Note that the collection of air samples for supplementary evaluation *should not* use aggressive air sampling methods. Aggressive sampling methods, in which air is deliberately disturbed or agitated by use of a leaf blower or fans, should be used at the completion of an asbestos removal project when the building or area is unoc-

cupied, not for routine monitoring.

The most accurate and preferred method of analysis of air samples collected under an O&M program would require the use of transmission electron microscopy (TEM). Phase contrast microscopy (PCM), which is commonly used for personal air sample analysis and as a screening tool for area air monitoring, cannot distinguish between asbestos fibers and other kinds of fibers which may be present in the air. PCM analysis also cannot detect thin asbestos fibers, and does not count short fibers. TEM analysis is approximately ten times more expensive than PCM analysis. However, the more accurate information on actual levels of airborne asbestos fibers should be more beneficial to the building owner who elects to use supplemental air monitoring in the asbestos management program. TEM analysis is most reliably performed by laboratories accredited by the National Institute for Standards and Technology (NIST; see Appendix D for telephone number), and who follow EPA's quality assurance guidelines. (Appendix H, U.S. EPA, Dec. 1989, "Transmission Electron Microscopy Asbestos Laboratories: Quality Assurance Guidelines.")

Selection of a reliable and experienced air monitoring firm and analytical laboratory is important, if the building owner elects to conduct supplemental air monitoring under the O&M program. A consultant knowledgeable in air sampling and analysis protocols can be contacted for recommendations if the building owner or Asbestos Program Manager has limited knowledge in this area.

Periodic air monitoring, conducted simultaneously with the visual reinspections or surveillance, would then be used to see if asbestos levels have changed relative to the baseline. Some building owners may wish to present current air monitoring results to building occupants in addition to information regarding the physical reinspections. Although this supplemental use of air monitoring as part of an O&M program may provide useful information, it is likely to be very expensive, particularly if the more accurate and recommended TEM analysis is used. Use of only a small number of measurements or measurements taken only at one time may be misleading (i.e., overestimate or underestimate of fiber levels), and can lead to inappropriate decisions.

It should be noted that some of the exposures of persons to airborne asbestos fibers in buildings may result from episodic events, such as repair work or the accidental disturbance of the ACM or of ACM debris by maintenance activities inside the building. Air monitoring may not be done frequently enough to include such episodic events; this can lead to a misleading interpretation of air sampling results. In particular, air sampling may underestimate the exposure of O&M workers and building occupants. A good reference sourcebook for additional information on air sampling and analysis for asbestos fibers is "A Guide to Monitoring Airborne Asbestos in Buildings" (see Appendix H).

The O&M program should include a system to control all work that could disturb ACM. Some building owners have had success using a "work permit" program, which requires the person requesting the work to submit a Job Request Form to the Asbestos Program Manager (Appendix B, Form 2) before any maintenance work is begun. The form gives the time and location of the requested work, the type of maintenance needed, and available information about any ACM in the vicinity of the requested work. The contractor or other person authorized to perform the work should be identified on the work request.

An example of a maintenance worker conducting activities near a friable asbestos-containing ceiling. Under a proper permitting system, the building Asbestos Program Manager would evaluate and authorize projects such as this prior to beginning work.

Upon receiving a pre-work Job Request Form, the Asbestos Program Manager should take the following steps:

Refer to written records, building plans and specifications, and any building ACM inspection reports to determine whether ACM is present in the area where work will occur. If ACM is present, but it is not anticipated that the material will be disturbed, the Asbestos Program Manager should note the presence of the ACM on the permit form and provide additional instruction on the importance of not disturbing the ACM.

If ACM is both present and likely to be disturbed, the Asbestos Program Manager or a designated supervisor qualified by training or experience, should visit the site and determine what work practices should be instituted to minimize the release of asbestos fibers during the maintenance activity.

This determination should be recorded on the Maintenance Work Authorization Form (see example in Appendix B, Form 3), which is then sent to the in-house maintenance supervisor or to the maintenance contractor to authorize the work.

The Asbestos Program Manager should make sure that a copy of both the request and the authorization forms (if granted) are placed in the permanent file.

Where the task is not covered by previously approved standard work practices, the Asbestos Program Manager should make sure that the appropriate work practices and protective measures are used for the job.

For all jobs where contact with ACM is likely, the Asbestos Program Manager or a designated supervisor qualified by training or experience should visit the work site when the work begins to see that the job is being performed properly. For lengthy jobs where disturbance of ACM is intended or likely, periodic inspections should be made for the duration of the project.

The Asbestos Program Manager's observations should be provided on an *Evaluation of Work Form* (see Appendix B, Form 4). Any deviation from standard and approved work practices should be recorded immediately on this form and the practices should be immediately corrected *and reported to the Asbestos Program Manager.*

Upon completion of the work, a copy of the evaluation form should be placed in the permanent asbestos file for the building.

Building owners should consider using asbestos O&M work control forms similar to those which already may be in use for non-ACM work in their facilities, or expanding the existing forms to include the content of the request, approval, and evaluation forms illustrated in Appendix B.

The O&M management system should also address work conducted by outside contractors. Many building owners contract for at least some custodial and maintenance services. A building's asbestos work control/permit system, as described above, should also cover contract work.

At a minimum, contracts with service trades or abatement companies should include the following provisions to ensure that the service or abatement workers can and will follow appropriate work practices:

Proof that the contractor's workers have been properly notified about ACM in the owner's building and that they are properly trained and accredited (if necessary) to work with ACM.

Copies of respiratory protection, medical surveillance, and worker training documentation as required by OSHA, EPA and/or state regulatory agencies.

Notification to building tenants and visitors that abatement activity is underway (performed by owner).

Written work practices must be submitted by the vendor or contractor for approval or modification by the Asbestos Program Manager. The vendor or contractor should then agree to abide by the work practices as finally accepted by the Asbestos Program Manager.

Assurance that the contractor will use proper work area isolation techniques, proper equipment, and sound waste disposal practices.

Historical air monitoring data for representative examples of the contractor's previous projects, with emphasis on projects similar to those likely to be encountered in the building.

Provisions for inspections of the area by the owner's representative to ensure that the area is acceptable for re-entry of occupants/tenants.

A resume for each abatement contractor/supervisor or maintenance crew chief, known as the "competent person" in the OSHA standard and EPA Worker Protection Rule.

Criteria to be used for determining successful completion of the work (i.e., visual inspections and air monitoring).

Any other information deemed necessary by the owner's legal counsel.

Notification to EPA (and other appropriate agencies) if the abatement project is large enough (see Chapter 6).

The O&M program focuses on a special set of work practices for the custodial, maintenance, and construction staff. The nature and extent of any special work practices should be tailored to the likelihood that the ACM will be disturbed and that fibers will be released. In general, four broad categories of O&M work practices are recognized:

Worker Protection Programs — These work practices help ensure custodial and maintenance staff are adequately protected from asbestos exposure.

Basic O&M Procedures — Basic procedures are used to perform routine custodial and maintenance tasks that may involve ACM.

Special O&M Cleaning Techniques — Special techniques to clean up asbestos fibers on a routine basis.

Procedures for Asbestos Fiber Release Episodes — If moderate to relatively large amounts of ACM are disturbed, the building owner should use these procedures to address the hazard.

A brief synopsis of worker protection and O&M work practices follows. *(Note: A more detailed, technically oriented O&M "work practices" manual specifically addressing topics such as work practices, worker protection, and specific information on how to carry out O&M plans, is being developed, with publication expected in 1991.)*

A worker protection program includes engineering controls, personal exposure monitoring, medical surveillance, and personal protection. While engineering controls are the preferred method of worker protection, there are few engineering control options available for O&M work. This section discusses two key aspects of personal protection: use of respiratory protection and protective clothing for workers in an asbestos O&M program. According to OSHA regulations (see Chapter 6), a written respiratory protection program is necessary whenever an O&M program specifies that service workers wear respirators, or where respirators are made available to employees. OSHA regulations also require a respirator program whenever workers are exposed, or are likely to be exposed, to fiber levels above OSHA's "permissible exposure limits" such as the 8-hour time weighted average (TWA) limit or the 30-minute "excursion limit" (EL). The 8-hour TWA limit and the EL are described in more detail in Chapter 6. In addition, OSHA requires workers to wear special protective clothing under the same circumstances.

Respiratory Protection/Worker Protection Programs The selection of approved respirators, suitable for the hazards to which the worker is exposed, is only one aspect of a complete respiratory protection program. Other elements include written operating procedures for respirator use; outlining personnel responsibilities for respirator cleaning, storage, and repair; medical examination of workers for respirator use; training in proper respirator use and limitations; respirator fit testing; respirator cleaning and care; and work-site supervision. All of these are described in detail in the OSHA respirator standard, 29 CFR 1910.134. The O&M respirator program can be administered by the facility safety and health manager or the Asbestos Program Manager, if properly qualified.

Proper respiratory protection is an integral part of all custodial and maintenance activities involving potential exposure to asbestos. When in doubt about exposure during a certain work operation, building owners should provide respiratory protection to custodial and maintenance workers. OSHA specifies general types of respirators for protection against airborne asbestos during "construction" activities, which include abatement, renovation, maintenance, repair, and remodeling.

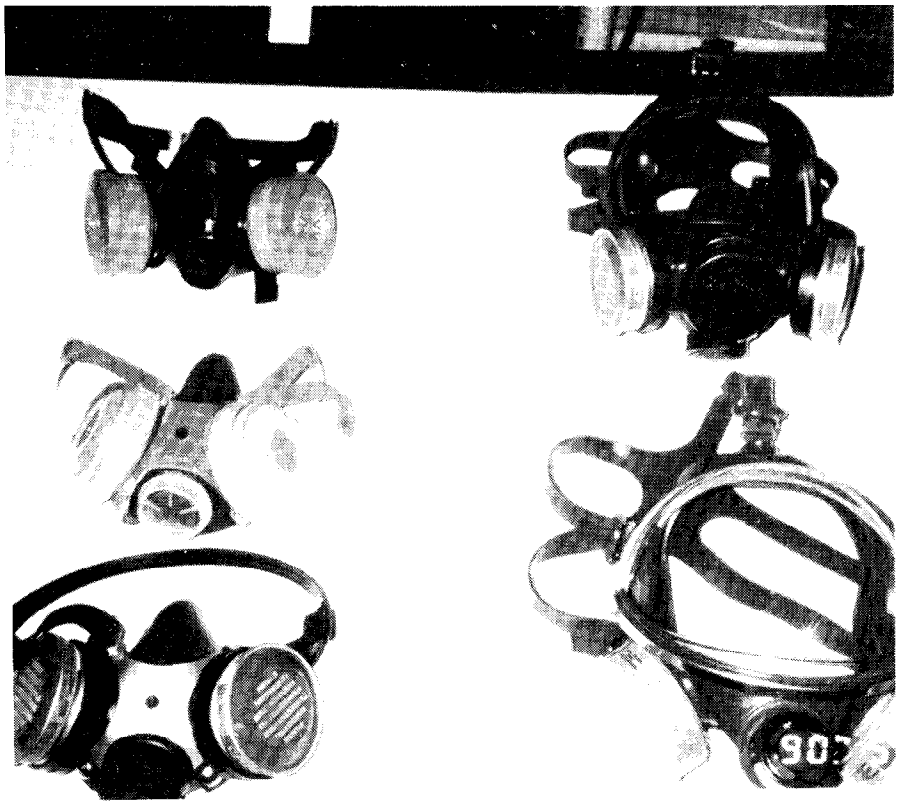
Personal air sampling is not the same as area air monitoring. Personal air sampling (required by OSHA) is designed to measure an individual worker's exposure to fibers while the worker is conducting tasks that may disturb ACM. The sampling device is worn by the worker and positioned so that it samples air in the worker's breathing zone. In contrast, area (or ambient) air sampling is conducted to get an estimate of the numbers of airborne asbestos fibers present in a building. It is used as an assessment tool in evaluating the potential hazard posed by asbestos to all building occupants. (See the previous discussion of area air monitoring on page 14.)

When adequate care is taken to prevent or minimize and control fiber release, routine, small-scale/short-duration maintenance or custodial tasks are not likely to generate high levels of airborne asbestos compared to large asbestos removal projects; and respirators which filter breathing air may be used. **OSHA, EPA, and NIOSH are on record as *not* recommending single use, disposable paper dust masks for use against asbestos; in fact, OSHA has *disallowed their use* against airborne asbestos fibers.**

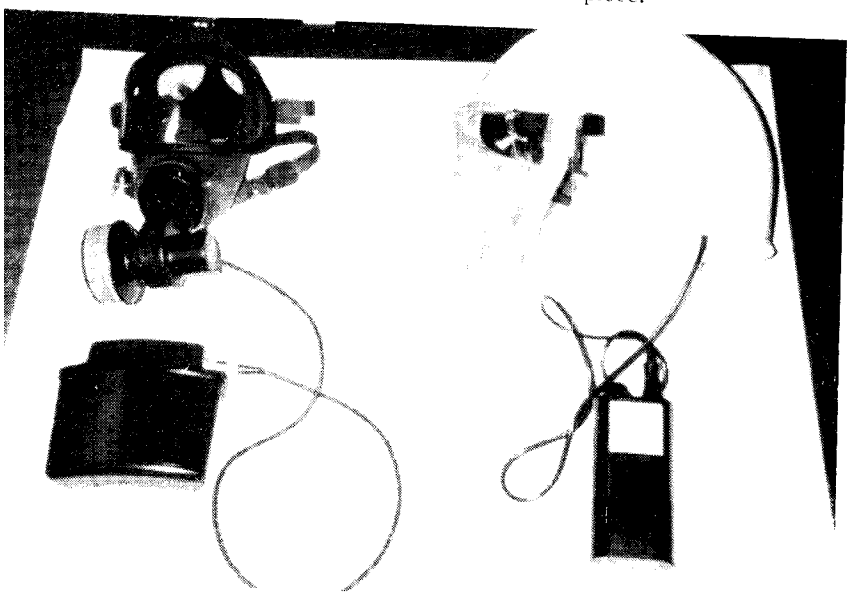
The options that may be used include:

A half-face or full facepiece, negative pressure, air-purifying respirator with replaceable high-efficiency filters.

Pictured below are different examples of air-purifying, negative pressure respirators equipped with high-efficiency cartridges which can be used to protect workers against asbestos exposure. On the left are examples of half-mask facepieces equipped with high-efficiency cartridges, and on the right are examples of full facepiece, high-efficiency masks.



A half or full facepiece powered air-purifying respirator (PAPR) with replaceable high-efficiency filters. This has a battery powered pump which assists breathing and provides positive pressure in the facepiece.



Pictured above are two different types of powered air-purifying respirators (PAPR's) equipped with high-efficiency filters. On the left is an example of a tight fitting, full facepiece PAPR, and on the right is an example of a loose-fitting helmet style PAPR.

Under the OSHA standards for asbestos, any employee required to wear a negative pressure respirator can request a powered air-purifying respirator, and the employer is required to provide a fully functional and approved unit, provided it will afford the worker at least equal protection.

Currently, only respirators approved by NIOSH and the Mine Safety and Health Administration (MSHA) are permitted for use. If they are air-purifying respirators, the filtration device(s) must be rated as "high-efficiency."

Selecting the most appropriate respirator for each O&M task requires knowledge of the levels of airborne asbestos fibers and other possible air contaminants generated by the task or likely to be present where the task is performed. This knowledge is best gained through personal air monitoring conducted during worker performance of the actual task. (Obviously, the workers must have respiratory protection while this initial personal air sampling is carried out.) In fact, OSHA and EPA require air monitoring under certain circumstances (see Chapter 6). To learn more about the different types of respirators available and the degree of protection they provide, see Appendix E. Owners may also wish to contact the nearest OSHA office, a local trained and qualified industrial hygienist (preferably Certified), or an occupational health professional for more information on respirators. The expertise of these specialists should be used to ensure proper selection, fit testing, and training of workers in respirator use.

Building owners and other facility managers may not be familiar with some of the terms used in discussions of respirators, airborne fiber levels, and related topics. Appendix E contains more information on these topics, and gives the *minimum* EPA-recommended levels of respiratory protection to be provided during typical O&M tasks.

For additional information on respirator programs, respirator types, and respirator use, the building owner or Asbestos Program Manager may want to use the following references:

"Respiratory Protection: An Employer's Manual," NIOSH, October 1978;

"A Guide to Respiratory Protection for the Asbestos Abatement Industry," EPA/NIOSH, 1986;

OSHA respirator standard (29 CFR 1910.134);

OSHA asbestos regulations (29 CFR 1910.1001 and 1926.58);

"Occupational Exposure Sampling Strategy Manual," NIOSH #77-173, January 1977.

"Respirator Decision Logic," NIOSH, May 1987; and

"NIOSH Guide to Industrial Respiratory Protection," September 1, 1987.

Protective Clothing/Worker Protection Programs In addition to the use of respirators, some O&M procedures may require workers to wear protective clothing. Most often, protective clothing is disposable and consists of coveralls, a head cover, and foot covers made of a synthetic fabric which does not allow asbestos fibers to pass through. This type of clothing prevents workers' regular clothing from becoming contaminated with asbestos fibers. Contaminated clothing could be taken home, creating a possible risk to the worker's family members.

OSHA and EPA regulations require workers to wear protective clothing whenever they are exposed, or likely to be exposed, to fiber levels above OSHA's permissible levels (see Chapter 6). It is important that workers be properly trained in the use, removal and disposal of protective clothing after use. All O&M activities may not require the use of protective clothing. It is important for the Asbestos Program Manager to assess this need on a case-by-case basis.

Basic O&M procedures to minimize and/or contain asbestos fibers may include wet methods, use of mini-enclosures, use of portable power tools equipped with special local ventilation attachments, and avoidance of certain activities, such as sawing, sanding,

and drilling ACM. Maintenance activities can be divided into three categories with regard to their potential for disturbing ACM:

Those which are unlikely to involve any direct disturbance of ACM; for example, cleaning shelves or counter tops with a damp cloth.

Those which may cause accidental disturbance of ACM; for example, working on a fixture near a ceiling with surfacing ACM.

Those which involve intentional small-scale manipulation or disturbance of ACM; for example, removing a small segment of TSI ACM to repair a pipe leak.

The O&M program should include work practices for each type of ACM that is present in the building (surfacing, TSI, and miscellaneous) as well as for each type and category of maintenance activity performed (e.g., general cleaning, electrical work, plumbing).

Special work practices such as wet wiping, area isolation, and HEPA vacuuming, and the use of personal protective equipment such as respirators and protective clothing, may be needed where disturbance of ACM is likely. The need for these practices varies with the situation. For example, removing light fixtures located near surfacing ACM may disturb the material and might involve the use of special cleaning, possibly area isolation, and respiratory protection. Periodic emptying of a trash can near heavily encapsulated asbestos-containing plaster may not disturb the material at all, so no special work practices would generally be necessary. These work practices and procedures are intended to ensure that disturbance of any ACM during O&M activities should be minimized, or carried out under controlled conditions when the disturbance is required by the nature of a specific O&M task.

In addition, ACM may readily release asbestos fibers into the air when certain mechanical operations are performed directly on it. For example, fiber releases can occur when workers are drilling, cutting, sanding, breaking, or sawing vinyl asbestos floor tile.

The *action* of drilling, cutting, abrading, sanding, chipping, breaking, or sawing is the critical factor here, since it is likely to cause a release of fibers. Maintenance or repair operations involving those actions should be eliminated or carefully controlled with basic O&M procedures in order to prevent or minimize asbestos fiber release.

Certain activities that occur in the vicinity of ACM can also cause damage which may result in asbestos fiber release. For example, maintenance and custodial staff may damage ACM accidentally with broom handles, ladders, and fork lifts while performing other tasks. Activities performed in the vicinity of ACM should always be performed cautiously to prevent fiber release.

To summarize, if in doubt about the possibility of disturbing ACM during maintenance activities, adequate precautions should be taken to minimize fiber release; these will protect workers as well as the building environment. Basic O&M procedures, including use of wet methods and specially equipped tools, should be used to protect building occupants.

Special cleaning practices are appropriate for a building with exposed surfacing or thermal system insulation ACM, especially if the ACM is friable. If gradual deterioration or damage of ACM has occurred or is occurring, asbestos-containing dust or debris could be present. If the building inspection has determined that asbestos-containing dust or debris is present in some areas, then the O&M program should include special cleaning practices to collect residual asbestos dust. Routinely cleaning floors using wet methods is an example of one such practice. Custodial and maintenance workers in the course of normal work can also identify and report areas which are in need of special cleaning or repair. *Special cleaning techniques should supplement, not replace, repair or abatement actions for damaged, friable ACM.* The cleaning program should include an initial cleaning followed, as needed, by subsequent periodic or episodic cleanings.

Building owners and custodial and maintenance staff should ensure that special O&M cleaning is done correctly. Proper cleaning is important for two reasons:

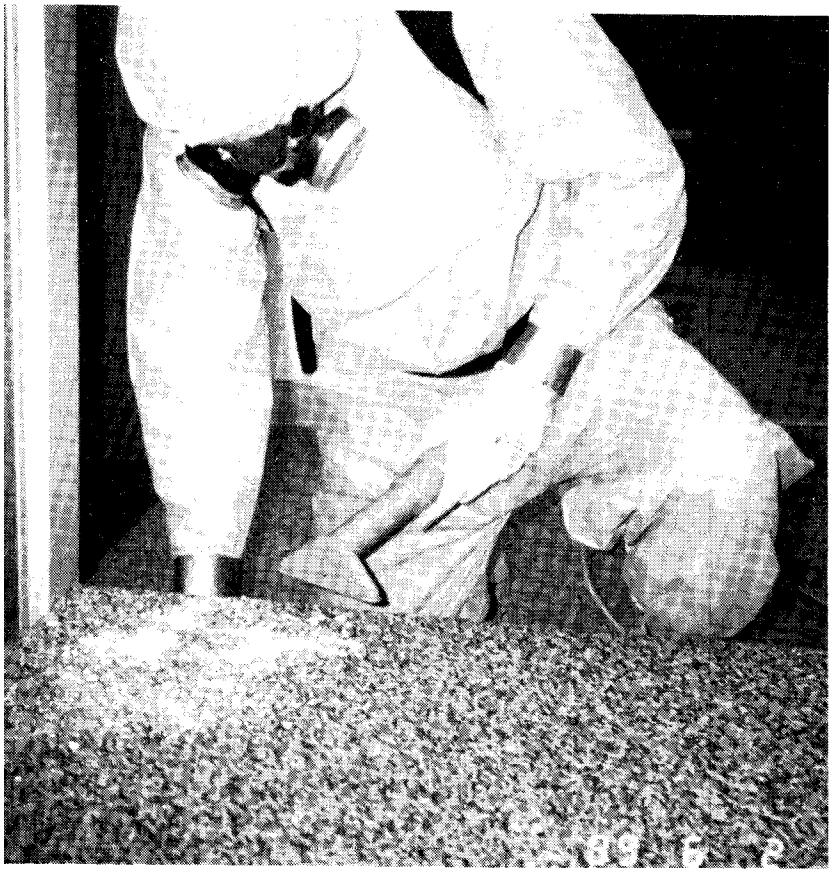
The use of improper techniques to clean up asbestos debris caused by previous deterioration or damage may result in widespread contamination, and potentially increase airborne asbestos fiber levels in the building.

Improper cleaning may cause damage to the ACM, thus releasing more airborne asbestos fibers.

Proper O&M cleaning will involve the use of wet cleaning or wet-wiping practices to pick up asbestos fibers. Dry sweeping or dusting can result in asbestos fibers being re-suspended into the building's air and therefore should not be used. Once wet cloths, rags, or mops have been used to pick up asbestos fibers, they should be properly discarded as asbestos waste while still wet. They should not be allowed to dry out, since the collected fibers might be released at some later time when disturbed. The use of special vacuum cleaners, commonly referred to as HEPA vacuums, may be preferable to wet cleaning in certain situations. These vacuums are equipped with filters designed to remove very small particles or fibers — such as asbestos — by filtering those particles from the air passing through the vacuum. Since the exhaust air from an ordinary vacuum cleaner is not filtered sufficiently, it is possible for tiny asbestos fibers to pass through the filter and back into the building air.

It is important for O&M workers to use caution when emptying HEPA vacuums and changing the filters. Exposures could result from such activities. Workers should move the HEPA vacuum to a physically isolated area of the facility and put on proper personal protective equipment before emptying the dust and debris into properly labeled, sealed, and leak-tight containers for disposal as asbestos-containing waste. When custodial workers do not work with ACM, trained maintenance workers can be used to empty the HEPA vacuums and change their filters. Decisions regarding special cleaning practices should be based on the building inspection and ACM assessment data, including the potential for ACM disturbance. In general, the building would not need special O&M cleaning when the building contains only nonfriable (not easily crumbled) ACM; ACM which has been encapsulated, encased, or enclosed behind airtight barriers; or ACM known to be undamaged/undisturbed since the last special cleaning. Furthermore, where ACM is confined to a single room or area, special cleaning of just that area rather than other parts of the building may be sufficient.

If ACM has been released onto a carpeted area of a building, it may not always be possible to adequately clean the carpeted area. "Steam" cleaning and HEPA vacuuming methods are sometimes employed for this purpose. A preliminary study carried out by EPA in 1989 showed that hot water vacuums were more effective in carpet cleaning than HEPA vacuums, under the test conditions. Further field studies are planned to confirm these findings.



Here, a worker uses a HEPA vacuum (backpack type) to clean ACM debris from one of several carpeted areas in a room where surfacing material had fallen.

For carpets, successful cleaning will likely depend on factors such as the amount of ACM released onto the carpet, how long the situation has existed, traffic over the area, as well as the structure and composition of the carpet itself. It is prudent to evaluate individual situations on a case-by-case basis. The Asbestos Program Manager should consider the need for workers engaged in cleaning asbestos fiber-contaminated carpets to wear proper respiratory protection. It may also be prudent to arrange for this type of cleaning to be done after normal working hours or when the facility is less occupied. Additionally, it may be more cost effective to properly dispose of contaminated carpets and other fabrics as asbestos-containing waste if a permanent asbestos control option is being undertaken in the building.

Where the ACM is damaged and located in an "air plenum" — where fibers can be transported by the heating, ventilation, or air conditioning (HVAC) system throughout the building — special cleaning practices may be extended to the entire building, including the HVAC system itself.

Special procedures are generally needed to minimize the spread of fibers throughout the building after asbestos fiber releases occur, such as the partial collapse of an ACM ceiling or wall. These procedures are needed whether the ACM disturbance is intentional or unintentional. To provide building owners with some guidance, under EPA regulations for schools a "major fiber release" is defined as one involving more than three square or linear feet of ACM. The procedures to be followed will vary according to the site of the major release episode, the amount of ACM affected, the extent of fiber release from the ACM, the relationship of the release area to the air handling systems, and whether the release site is accessible to building occupants. Depending on the severity of the episode, asbestos abatement consultants and contractors may be needed to develop a strategy for conducting the cleanup operations.

In general, for major fiber releases, the area should be isolated by closing doors and/or erecting temporary barriers to restrict airflow as well as access to the site. Signs should be posted as necessary immediately outside the fiber release site to prevent persons not involved in the cleanup operation from inadvertently entering the area. If asbestos fibers could enter the HVAC system, the system should be modified to prevent fiber entry, or should be shut down and sealed off. The final step should be to employ thorough cleanup procedures to properly control the ACM, a careful visual inspection, and final clearance air monitoring to verify satisfactory cleanup.

Similar procedures can be used for much smaller fiber release events; where the amount of ACM is on the

order of three square or linear feet or less. The HEPA vacuuming, wet wiping, and worker protection procedures outlined in this guidance document, as well as wetting ACM wastes and properly placing them in an appropriate leak-tight container (such as a properly labeled, 6-mil-thick plastic bag), are examples of some of the procedures which could be used for both major and minor fiber releases.

It is important to recognize that different levels of training are needed for workers involved with fiber release episodes. A major release will generally require "asbestos abatement worker training," rather than the degree of training considered adequate for O&M workers.

EPA suggests that building owners and Asbestos Program Managers consult with state and local regulatory officials before establishing formal training procedures for each type of situation.

The following table should be useful in determining when to apply certain O&M work practices in buildings. The table illustrates the O&M work practices that should be used by custodial and maintenance staff, depending on the likelihood of ACM disturbance.

Summary of When to Apply Key O&M Work Practices

	Likelihood of ACM Disturbance		
	Contact Unlikely	**Accidental Disturbance Possible**	**Disturbance Intended or Likely**
Management Responsibilities			
Need Pre-Work Approval from Asbestos Program Manager	Review by Program Manager	Yes	Yes
Special Scheduling or Access Control	No	Yes	Yes
Supervision Needed	No	Initial, At Least	Yes
HVAC System Modification	None	As Needed[1]	Shut Down[1]
Area Containment	None	Drop Cloths, Mini-enclosures	Yes[2]
Personal Protection			
Respiratory Protection	Available For Use	Yes	Yes
Protective Clothing	None	Review by Asbestos Program Manager	Yes
Work Practices			
Use of Wet Methods	No	As Needed	Yes
Use of HEPA Vacuum	Available For Use	Available For Use	As Needed

[1] To the area where work takes place
[2] Type of containment may vary. For example, small-scale, short-duration tasks may not require full containment

All the building asbestos management documents discussed in this Guide (inspection and assessment reports, O&M program plan, work practices and procedures, respirator use procedures, fiber release reports, application for maintenance work and work approval forms, evaluations of work affecting ACM, and reinspections/surveillance of ACM) should be stored in permanent files. In addition, for employees engaged in asbestos-related work, federal regulations (see Chapter 6) require that employers retain:

personal air sampling records, for at least 30 years. Personal air samples are those collected in the worker's breathing zone during performance of work involving asbestos exposures.

objective data used to qualify for exemptions from OSHA's initial monitoring requirements for the duration of the exemption.

medical records for each employee subject to the medical surveillance program for the duration of their employment plus 30 years.

all employee training records for one year beyond the last date of each worker's employment.

In addition, OSHA requires that employers provide to each employee their record of exposure and medical surveillance under the Records Access Standard (29 CFR 1910.20) and the Hazard Communication Standard (29 CFR 1910.1200). See the OSHA Construction Rule (29 CFR 1926.58) or the EPA Worker Protection Rule (40 CFR 763 Subpart G) for more details of recordkeeping requirements.

EPA recommends that building owners make available all written elements of the O&M program to the building's O&M staff as well as to tenants and other building occupants, if applicable. Building owners are also encouraged to consult with their legal counsel concerning appropriate recordkeeping strategies as a standard part of their O&M programs. Additionally, state and local regulations may also require additional recordkeeping procedures.

Chapter Summary

Although the elements discussed in this chapter should appear in any O&M program, the extent to which each applies will vary depending on the building type, the type of ACM present, and the ACM's location and physical condition. To achieve its objectives an O&M program should include the following:

A notification program to inform building occupants, workers, and tenants about the location of ACM and how to avoid disturbing ACM.

Periodic surveillance and reinspection of ACM at regular intervals by trained workers or properly trained inspectors. Air monitoring to detect airborne asbestos fibers in the building may provide useful supplemental information when conducted along with a comprehensive visual and physical ACM inspection/ reinspection program. Air samples are most accurately analyzed using transmission electron microscopy (TEM).

A "work control/permit" system, which some building owners have used successfully to control work that could disturb ACM. This system requires the person requesting work to submit a Job Request Form to the Asbestos Program Manager before any work is begun.

O&M work practices to avoid or minimize fiber release during activities affecting ACM.

Recordkeeping. OSHA and EPA have specific requirements for workers exposed to asbestos.

What O&M Training Is Necessary?

Types of Training

Training of custodial and maintenance workers is one of the keys to a successful O&M program. If building owners do not emphasize the importance of well-trained custodial and maintenance personnel, asbestos O&M tasks may not be performed properly. This could result in higher levels of asbestos fibers in the building air and an increased risk faced by both building workers and occupants.

OSHA and EPA require a worker training program for all employees exposed to fiber levels (either measured or anticipated) at or above the action level (0.1 f/cc, 8-hour *time-weighted average* — the TWA) and/or the excursion limit (1.0 f/cc, 30-minute TWA — see Chapter 6). According to the EPA regulations governing schools, all school staff custodial and maintenance workers who conduct any activities that will result in the disturbance of ACM must receive 16 hours of O&M training. Some states and municipalities may also have specific training requirements for workers who may be exposed to asbestos, or who work in a building with ACM present.

With proper training, custodial and maintenance staff can successfully deal with ACM in place, and greatly reduce the release of asbestos fibers. Training sessions should provide basic information on how to deal with all types of maintenance activities involving ACM. However, building owners should also recognize that O&M workers in the field often encounter unusual, "non-textbook" situations. As a result, training should provide key concepts of asbestos hazard control. If these concepts are clearly understood by workers and their supervisors, workers can develop techniques to address a specific problem in the field. Building owners who need to provide O&M training to their custodial and maintenance staff should contact an EPA environmental assistance center (see Appendix D) or equally qualified training organization for more information.

At least three levels of maintenance worker training can be identified:

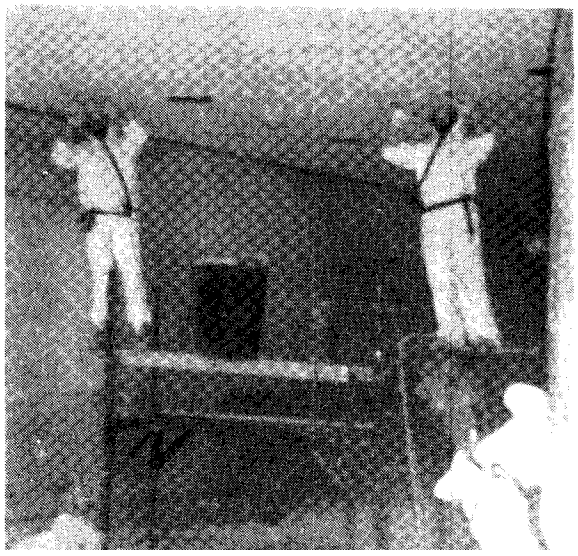
For example, fixing a light fixture in a ceiling covered with surfacing ACM. Such training may range from two to eight hours, and may include such topics as:

- Background information on asbestos.
- Health effects of asbestos.
- Worker protection programs.
- Locations of ACM in the building.
- Recognition of ACM damage and deterioration.
- The O&M program for that building.
- Proper response to fiber release episodes.

A properly protected and trained worker conducts a glovebag removal job on a section of thermal system insulation. Under a proper operations and maintenance program, any worker involved in such activities would have Level 1 and 2 training.

For example, a repair or removal of a small section of damaged TSI, or the installation of electrical conduit in an air plenum containing ACM or ACM debris. Such training generally involves at least 16 hours. This level of training usually involves more detailed discussions of the topics included in Level 1 training as well as:

- Federal, state, and local asbestos regulations.
- Proper asbestos-related work practices.
- Descriptions of the proper methods of handling ACM, including waste handling and disposal.
- Respirator use, care, and fit-testing.
- Protective clothing donning, use, and handling.
- Hands-on exercises for techniques such as glovebag work and HEPA vacuum use and maintenance.
- Appropriate and proper worker decontamination procedures.



This is an example of a large-scale asbestos removal project (note missing scaffold safety rails). Such projects are well beyond the scope of an O&M program. The EPA NESHAP regulations require that asbestos materials be removed from buildings prior to demolition or renovation when the asbestos will be disturbed.

For example, conducting a removal job, constructing an enclosure, or encapsulating a surface containing ACM. This work involves direct, intentional contact with ACM. The recognized "abatement worker" training courses approved by EPA or states, under the EPA AHERA model accreditation plan for schools, which involve 24 to 32 hours of training, would fulfill this level of training.

If this level of training is provided to in-house staff, it may save time and money in the long run to use these individuals to perform such activities. This level of training is much more involved than Levels 1 and 2, although it should include some of the same elements (e.g., health effects of asbestos). It will typically include a variety of specialized topics, such as:

- Pre-asbestos abatement work activities.
- Work area preparation.
- Establishing decontamination units.
- Personal protection, including respirator selection, use, fit-testing, and protective clothing.
- Worker decontamination procedures.
- Safety considerations in the abatement work area.
- A series of practical hands-on exercises.
- Proper handling and disposal of ACM wastes.

The Asbestos Program Manager should consider conducting the training program for Levels 1 and 2 if he or she has sufficient specific asbestos knowledge and training. If the Asbestos Program Manager does not conduct the training, the building owner should hire an outside consultant or send workers to an appropriate O&M training course. A trained (preferably Certified) industrial hygienist or equally qualified safety and health professional should conduct the training on respirator use and fit-testing. A health professional should conduct the training on health effects.

OSHA or EPA Regional Offices, as well as state and local agencies and professional associations, may be able to suggest courses or direct you to listings of training providers for each of the three levels. Appendix D provides the addresses and/or phone numbers for OSHA, EPA, and EPA-sponsored training providers.

Where custodial and maintenance services are performed by a service company under contract, or where some installation or repairs are performed by employees of trade or craft contractors and subcontractors, those workers may need to have training at level 1, 2, or 3 as appropriate for their work. The Asbestos Program Manager or building owner should verify that these employees receive appropriate training before they begin any work.

In summary, good training is crucial to the success of an O&M program. Strong support for O&M training by the building owner should convince custodial and maintenance workers that following the appropriate work procedures is critical to protecting their own health as well as the health of other building occupants.

Chapter Summary

Properly trained custodial and maintenance workers are critical to a successful O&M program. The following items are highlighted training requirements:

OSHA and EPA require worker training program for all employees exposed to fiber levels at or above the action level (0.1 f/cc, 8-hr. TWA) and/or the excursion limit (1.0 f/cc, 30-minute TWA — see Chapter 6).

Some states and municipalities may have specific worker training requirements.

At least three levels of maintenance worker training can be identified:

Level 1 Awareness training for workers involved in activities where ACM may be accidentally disturbed. May range from 2-8 hours.

Level 2 Special O&M training for maintenance workers involved in general maintenance and incidental ACM repair tasks. At least 16 hours.

Level 3 Abatement worker training for workers who may conduct asbestos abatement. This work involves direct, intentional contact with ACM. "Abatement worker" training courses that involve 24 to 32 hours of training fulfill this level of training.

What Regulations Affect Asbestos Management Programs in Buildings, Especially O&M Programs?

Federal, State, and Local Regulations Affecting O&M Programs

Building owners are governed by a variety of federal, state, and local regulations which influence the way they must deal with ACM in their facilities. Some of these regulations, particularly at the state and local level, may change frequently. Building owners should contact their state and local government agencies, in addition to organizations such as the National Conference of State Legislatures (NCSL), the National Institute of Building Sciences (NIBS), or EPA environmental assistance centers, for updated information on these requirements. (Appendix D lists phone numbers for these organizations.)

There are several important Occupational Safety and Health Administration (OSHA) and EPA regulations that are designed to protect workers. They are summarized here, as guidance. OSHA has specific requirements concerning worker protection and procedures used to control ACM. These include the OSHA construction industry standard for asbestos (29 CFR 1926.58), which applies to O&M work, and the general industry asbestos standard (29 CFR 1910.1001). State-delegated OSHA plans, as well as local jurisdictions, may impose additional requirements.

For most operations and maintenance activities in building areas where only non-friable ACM is present or where friable ACM is in good condition, applicable OSHA permissible exposure limits are not likely to be exceeded. However, it is possible that some O&M activities will disturb ACM to such an extent that the OSHA limits are exceeded, unless good work practices are followed.

The OSHA standards generally cover private sector workers, and public sector employees in states which have an OSHA state plan. Public sector employees, such as city or county government employees, or certain school employees, who are not already subject to a state OSHA plan are covered by the EPA "Worker Protection Rule" (Federal Register: February 25, 1987; 40 CFR 763 Subpart G, Asbestos Abatement Projects: Worker Protection, Final Rule). *Note: As this document goes to press, OSHA is considering a substantial number of changes to its regulations.*

The OSHA standards and the EPA Worker Protection Rule require employers to address a number of items which are triggered by exposure of employees to asbestos fibers. Exposure is discussed in terms of fibers per cubic centimeter (cc) of air. A cc is a volume approximately equivalent to that of a sugar cube.

Two main provisions of the regulations fall into the general category of "Permissible Exposure Limits (PELs)" to airborne asbestos fibers. They are:

8-Hour Time-weighted average limit (TWA) — 0.2 fiber per cubic centimeter (f/cc) of air based on an 8-hour time-weighted average (TWA) sampling period. This is the maximum level of airborne asbestos, on average, that any employee may be exposed to over an 8-hour period (normal work shift).

Excursion limit (EL) — 1.0 f/cc as averaged over a sampling period of 30 minutes.

These levels trigger mandatory requirements, which include the use of respirators and protective clothing, the establishment of "regulated areas," the posting of danger signs as well as the use of engineering controls and specific work practices.

OSHA regulations also establish an *"Action Level"*: 0.1 f/cc for an 8-hour TWA. Employee training is required once the action level of 0.1 f/cc and/or the "Excursion Limit" is reached. This training must include topics specified by the OSHA rules. If an employee is exposed at or above the action level for a period of 30 days or more in a calendar year, medical surveillance is required according to the OSHA construction industry asbestos standard.

OSHA also requires medical examinations under its "General Industry Standard" for any employee exposed to fiber levels in the air at or above the OSHA "action level" (0.1 f/cc) and/or the "excursion limit" (1.0 f/cc). In both cases — the action level and excursion limit — the OSHA medical examination requirement applies if the exposure occurs for at least one day per year.

The OSHA "Construction Industry Standard" (29 CFR 1926.58) for asbestos, is generally applicable for the workers who carry out the kinds of work discussed in this O&M guidance document. The OSHA construction industry asbestos standard applies to demolition and asbestos removal or encapsulation projects, as well as to repair, maintenance, alteration, or renovation if ACM is involved. ACM spills or emergency clean-up actions are also covered by this regulation.

According to those regulations, participation in a medical surveillance program is required for any employee who is required to wear a negative pressure, air-purifying respirator. Preplacement, annual, and termination physical exams are also required for these employees. However, a termination exam is only necessary under the construction industry standard (which applies to custodial and maintenance employees) if a physician recommends it. While not mandatory, EPA and NIOSH recommend physical examinations, including cardiac and pulmonary tests, for any employee required to wear a respirator by the building owner. These tests determine whether workers will be unduly stressed or uncomfortable when using a respirator.

Additional requirements of the OSHA asbestos standards, such as the use of air filtration systems and hygiene facilities, involve procedures which are most applicable to large-scale asbestos abatement projects. However, these rules also include a number of recommendations for procedures which might be appropriate for a variety of O&M programs for buildings.

"Appendix G" which is specified as a non-mandatory section to the OSHA regulation 29 CFR 1926.58, may become mandatory under certain circumstances where "small-scale, short-duration" asbestos projects are conducted. These projects are not precisely defined in terms of either size or duration, although their nature and scope are illustrated by examples presented in the text of the regulation. Properly trained maintenance workers may conduct these projects. Examples may include removing small sections of pipe insulation or covering for pipe repair, replacing valves, installing electrical conduits, or patching or removing small sections of drywall. OSHA issued a clarification of the definition of a "small-scale, short-duration" (SS/SD) project in a September 1987 asbestos directive. The directive focuses on intent, stating that in SS/SD projects, the removal of ACM is not the primary goal of the job. If the purpose of a small-scale, short-duration project is maintenance, repair, or renovation of the equipment or surface behind the ACM — not abatement of ACM — then the appendix provisions may apply. If the intent of the work is abatement of the ACM, then the full-scale abatement control requirements apply.

In any event, this appendix section of the OSHA construction standard outlines requirements for the use of certain engineering and work practice controls such as glovebags, mini-enclosures, and special vacuuming techniques. Similar information on these procedures may be found in the EPA's AHERA regulations for schools. (See final AHERA rule, Appendix B, for SS/SD projects.)

EPA's rules concerning the application, removal, and disposal of ACM, as well as manufacturing, spraying and fabricating of ACM, were issued under the asbestos NESHAP. The asbestos NESHAP regulation governs asbestos demolition and renovation projects in all facilities. The NESHAP rule usually requires owners or operators to have all friable ACM removed before a building is demolished, and may require its removal before a renovation. For renovation projects where friable ACM will be disturbed, the NESHAP rule may require appropriate work practices or procedures for the control of emissions. It is prudent to note that any ACM which may become friable poses a potential hazard that should be addressed. The building owner should consider that in many instances, the removal of friable ACM prior to demolition could be less expensive than removals while the building is still occupied and being used. *Some revisions to the current NESHAP rule are anticipated by the end of 1990.*

EPA or the state (if the state has been delegated authority under NESHAP) must be notified before a building is demolished or renovated. The following information is required on the NESHAP notice:

Name and address of the building owner or manager;

Description and location of the building;

Estimate of the approximate amount of friable ACM present in the facility;

Scheduled starting and completion dates of ACM removal;

Nature of planned demolition or renovation and method(s) to be used;

Procedures to be used to comply with the requirements of the regulation; and

Name, address, and location of the disposal site where the friable asbestos waste material will be deposited.

The notification requirements do not apply if a building owner plans renovation projects which will disturb less than the NESHAP limits of 160 square feet of friable ACM on facility components or 260 linear feet of friable ACM on pipes (quantities involved over a one-year period). For renovation operations in which the amount of ACM equals or exceeds the NESHAP limits, notification is required as soon as possible.

The NESHAP asbestos rule prohibits visible emissions to the outside air by requiring emission control procedures and appropriate work practices during collection, packaging, transportation or disposal of friable ACM waste. All ACM must be kept wet until sealed in a leak-tight container that includes the appropriate label. The following table provides a simplified reference for building owners regarding the key existing NESHAP requirements.

Under expanded authority of RCRA, a few states have classified asbestos-containing waste as a hazardous waste, and require stringent handling, manifesting, and disposal procedures. In those cases, the state hazardous waste agency should be contacted before disposing of asbestos for approved disposal methods and recordkeeping requirements, and for a list of approved disposal sites.

Friable asbestos is also included as a hazardous substance under EPA's CERCLA regulations. The owner or manager of a facility (e.g., building, installation, vessel, landfill) may have some reporting requirements. Check with your EPA Regional Office for further information. (See Appendix D for telephone numbers.)

In October 1987, EPA issued final regulations to carry out the Asbestos Hazard Emergency Response Act of 1986 (AHERA). The AHERA regulatory requirements deal *only with public and private elementary and secondary school buildings.* The regulations require schools to conduct inspections, develop comprehensive asbestos management plans, and select asbestos response actions to deal with asbestos hazards. The AHERA rules *do not* require schools to remove ACM.

A key element of the AHERA regulations requires schools to develop an O&M program if friable ACM is present. The AHERA O&M requirements also cover non-friable ACM which is about to become friable. For example, drilling through an ACM wall will likely result in friable ACM. Under the AHERA O&M provisions, schools must carry out specific O&M procedures which provide for the clean-up of any ACM releases and help ensure the general safety of school maintenance and custodial workers, as well as all other school building occupants. The AHERA regulation's O&M requirements mandate that schools employ specific work practices including wet wiping, HEPA vacuuming, proper waste disposal procedures, and specific training for custodial and maintenance employees who work in buildings with ACM.

Bans on some uses and applications of asbestos under the Clean Air Act were briefly described in Chapter 1. In July 1989, under the Toxic Substances Control Act (TSCA), EPA promulgated an Asbestos Ban and Phaseout Rule. The complete rule was published in the *Federal Register* on July 12, 1989.

Beginning in 1990 and taking effect in three stages, the rule prohibits the importation, manufacture, and processing of 94 percent of all remaining asbestos products in the United States over a period of seven years.

Existing NESHAP Requirements Summary*

	Demolition		Renovation	
AMOUNT* (in 1 yr.)	≥260 ln.ft. or ≥ 160 sq. ft.	<260 ln.ft. or <160 sq.ft.	≥260 ln ft. or ≥ 160 sq. ft	<260 ln. ft. <160 sq. ft.
NOTIFICATION	YES	YES	YES	NOT REQUIRED
HOW FAR IN ADVANCE*	10 DAYS	20 DAYS	AS SOON AS POSSIBLE	NOT REQUIRED
EMISSION CONTROLS (Work Practices)	YES	NOT REQUIRED	YES	NOT REQUIRED
DISPOSAL STANDARD	YES	NOT REQUIRED	YES	NOT REQUIRED

*May be changed on promulgation of Revised NESHAP Rule in 1990

Chapter Summary

A variety of federal, state, and local regulations govern the way building owners must deal with ACM in their facilities. State and local regulations may be more stringent than federal standards and often change rapidly. Building owners should periodically check with the appropriate Federal, State, and local authorities to determine whether any new asbestos regulations have been developed or whether current regulations have been amended. Specific federal regulations that may affect asbestos-related tasks and/or workers are highlighted here:

OSHA Construction Industry Standard for Asbestos (29 CFR 1926.58).

OSHA General Industry Standard for Asbestos (29 CFR 1910.1001).

OSHA Respiratory Protection Standard (29 CFR 1910.134).

EPA Worker Protection Rule (40 CFR 763 Subpart G).

EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61 Subpart M).

EPA Asbestos Hazard Emergency Response Act (AHERA) Regulations (40 CFR 763 Subpart E).

EPA Asbestos Ban and Phaseout Rule (40 CFR 763 Subpart I).

Appendix A.

ACM	Asbestos-Containing Material. Any material containing more than one percent asbestos.
Asbestos Program Manager	A building owner or designated representative who supervises all aspects of the facility asbestos management and control program.
Air Plenum	Any space used to convey air in a building or structure. The space above a suspended ceiling is often used as an air plenum.
Asbestos Abatement	Procedures to control fiber release from asbestos-containing materials in a building or to remove it entirely. These may involve removal, encapsulation, repair, enclosure, encasement, and operations and maintenance programs.
Delamination	Separation of one layer from another.
EPA	U.S. Environmental Protection Agency
Friable Asbestos	Any materials that contain greater than one percent asbestos, and which can be crumbled, pulverized, or reduced to powder by hand pressure. This may also include previously non-friable material which becomes broken or damaged by mechanical force.
Glovebag	A polyethylene or polyvinyl chloride bag-like enclosure affixed around an asbestos-containing source (most often, TSI) so that the material may be removed while minimizing release of airborne fibers to the surrounding atmosphere.
HEPA Filter	High-Efficiency Particulate Air Filter. Such filters are rated to trap at least 99.97% of all particles 0.3 microns in diameter or larger.
Industrial Hygienist	A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards.
Medical Surveillance	A periodic comprehensive review of a worker's health status. The required elements of an acceptable medical surveillance program are listed in the Occupational Safety and Health Administration standards for asbestos.
Miscellaneous ACM	Interior asbestos-containing building material on structural components, structural members or fixtures, such as floor and ceiling tiles; does not include surfacing material or thermal system insulation.
NESHAP	National Emission Standard for Hazardous Air Pollutants—EPA Rules under the Clean Air Act.
NIOSH	The National Institute for Occupational Safety and Health, which was established by the Occupational Safety and Health Act of 1970. Primary functions of NIOSH are to conduct research, issue technical information, and test and certify respirators.
Personal Air Samples	An air sample taken with a sampling pump directly attached to the worker with the collecting filter and cassette placed in the worker's breathing zone. These samples are required by the OSHA asbestos standards and the EPA Worker Protection Rule.
Prevalent Level Samples	Air samples taken under normal conditions (also known as ambient background samples).
Surfacing ACM	Asbestos-containing material 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.
TSI	Thermal system insulation — asbestos-containing material applied to pipes, fittings, boilers, breeching, tanks, ducts or other interior structural components to prevent heat loss or gain or water condensation.
TWA	Time-weighted Average. In air sampling, this refers to the average air concentration of contaminants during a particular sampling period.

Appendix B.

Form 1. A sample form for recording information during ACM reassessment.

Location of asbestos-containing material (address, building, room, or general description):

_____

_____

_____

_____

1. Sprayed- or troweled-on ceilings or walls
2. Sprayed- or troweled-on structural members
3. Insulation on pipes, tanks, or boiler
4. Other (describe):

_____

_____

1. The material has been encapsulated _____, enclosed _____, neither _____, removed _____.

1. Evidence of physical damage: _____

_____

2. Evidence of water damage: _____

_____

3. Evidence of delamination or other damage: _____

_____

4. Degree of accessibility of the material: _____

_____

5. Degree of activity near the material: _____

_____

6. Location in an air plenum, air shaft, or airstream: _____

_____

7. Other observations (including the condition of the encapsulant or enclosure, if any): _____

_____

_____

_____

Signed: _____ Date: _____
(evaluator)

Form 2. A sample application form for maintenance work approval.

Name:_____ Date:_____

Telephone No._____ Job Request No. _____

Requested starting date:_____Anticipated finish date:_____

Address, building, and room number(s) (or description of area) where work is to be performed:

_____

_____

_____

_____

Description of work:

_____

_____

_____

_____

_____

Description of any asbestos-containing material that might be affected, if known (include location and type):

_____

_____

_____

_____

_____

Name and telephone number of requestor:

_____

Name and telephone number of supervisor:

_____

Submit this application to:

_____

(The Asbestos Program Manager)

NOTE: An application must be submitted for all maintenance work whether or not asbestos-containing material might be affected. An authorization must then be received before any work can proceed.

_____ Granted (Job Request No._____)
_____ With conditions*
_____ Denied

*Conditions: _____

_____

Form 3. A sample maintenance work authorization form.

No._____

AUTHORIZATION

Authorization is given to proceed with the following maintenance work:

_____

_____

_____

_____

_____

_____

_____

_____

PRESENCE OF ASBESTOS-CONTAINING MATERIALS

_____ Asbestos-containing materials are not present in the vicinity of the maintenance work.

_____ ACM is present, but its disturbance is not anticipated; however, if conditions change, the Asbestos Program Manager will re-evaluate the work request prior to proceeding.

_____ ACM is present, and may be disturbed.

Work Practices if Asbestos-Containing Materials Are Present

The following work practices shall be employed to avoid or minimize disturbing asbestos:*

_____

_____

_____

_____

_____

Personal Protection if Asbestos-Containing Materials Are Present**

The following equipment/clothes shall be used/worn during the work to protect workers:

_____

_____

_____

_____

(manuals on personal protection can be referenced)

Special Practices and/or Equipment Required:

_____

_____

Signed: _____ Date: _____

(Asbestos Program Manager)

Form 4. A sample work evaluation form

This evaluation covers the following maintenance work:

Location of workd (address, building, room number(s), or general description):

_____

_____

_____

_____

Date(s) of work: _____

Description of work: _____

Work approval form number: _____

Evaluation of work practices employed to minimize disturbance of asbestos:

_____

_____

_____

_____

_____

Evaluation of work practices employed to contain released fibers and to clean up the work area:

_____

_____

_____

_____

_____

Evaluation of equipment and procedures used to protect workers:

_____

_____

_____

_____

_____

Personal air monitoring results; (in-house worker or contract?)

Worker name _____ Results: _____

Worker name _____ Results: _____

Handling or storage of ACM waste: _____

Signed: _____ Date: _____
(Asbestos Program Manager)

Appendix C.

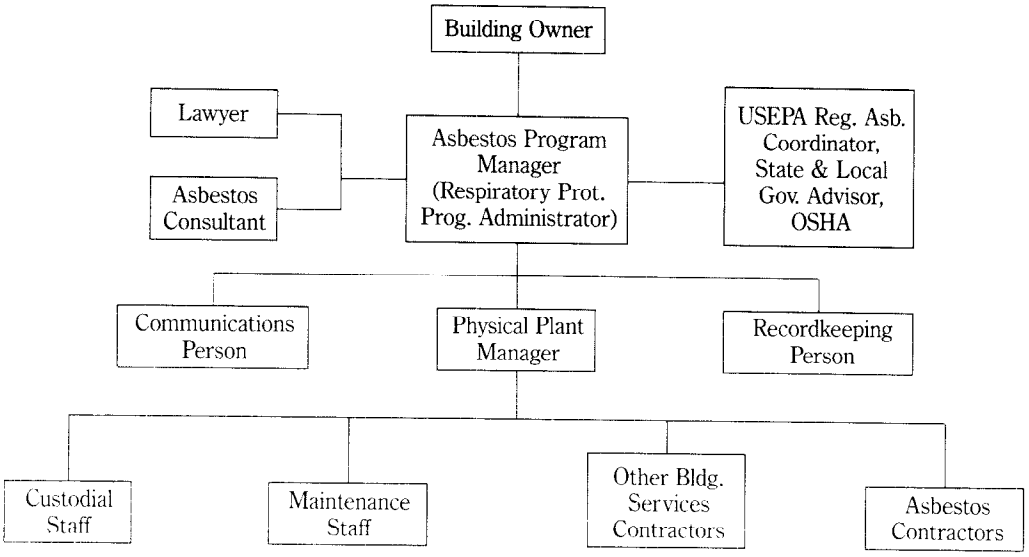


Figure 1. *A sample* organization for a building owner with a large in-house management staff. Shaded boxes indicate outside assistance.

IN-HOUSE STAFF (FIGURE 1)

Asbestos Program Manager: Has authority and overall responsibility for the asbestos control program. May develop the O&M program. Coordinates all activities. May also administer the respiratory protection program.

Physical Plant Manager: (may also be the Asbestos Program Manager) Participates in establishing work practices for cleaning and maintenance activities, and in training custodial and maintenance staff to use them. Assists in implementing the O&M program and in conducting periodic reinspections of the ACM. Ensures that outside contractors follow O&M procedures.

Communications Person: (Public Affairs Officer, Nurse, Physician, Industrial Hygienist) Assists in preparation and distribution of information about ACM in the building. Person should be a good speaker and communicator.

Recordkeeping Person: (Executive Assistant, Secretary) Responsible for maintaining records.

OUTSIDE ASSISTANCE

EPA Regional Asbestos Coordinator, NESHAP Coordinator and State/Local Government Advisors: Provide general guidance and answer specific questions.

OSHA Regional Office: May be helpful in answering questions about existing regulations, and providing guidance for worker protection.

Asbestos Consultant(s)*: (Industrial Hygienists, Health Professionals, Architects, Engineers, and others) May assist in various aspects of the asbestos O&M program, including its development and implementation. May also conduct material inspections and provide work practice recommendations.

Lawyer: Provides advice on legal requirements (such as laws and statutes) and liability aspects of the program.

Asbestos Contractor*: May provide services for ACM abatement and for building decontamination following a fiber release episode.

*It is important for owners and Asbestos Program Manager's to consider potential "conflict of interest" issues pertaining to those persons or firms used to sample, inspect, assess, analyze, recommend response actions, design response actions, and conduct asbestos response actions.

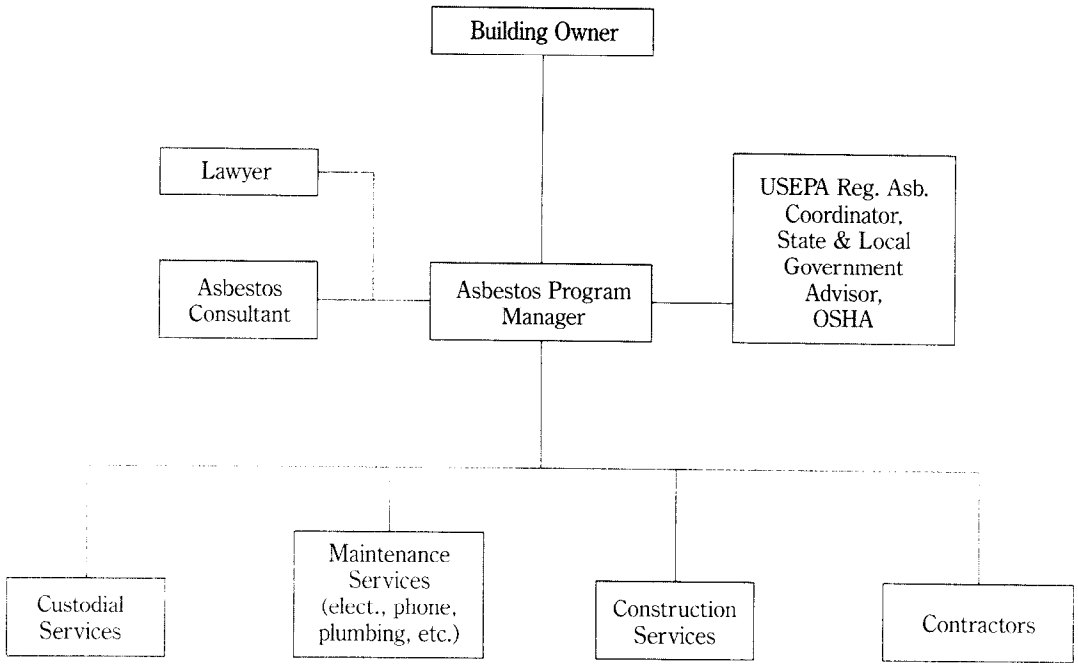


Figure 2. *A sample* organization for owners of buildings where services are provided by contract. Shaded boxes indicate outside assistance.

IN-HOUSE STAFF (FIGURE 2)

Asbestos Program Manager: Has overall responsibility for the asbestos control program. May develop and implement the O&M program. Establishes training and experience requirements for contractor's workers. Supervises and enforces work practices with assistance of work crew supervisors. Conducts periodic reinspections and responsible for recordkeeping. This person should be properly trained in O&M program development and implementation (see Chapter 5).

OUTSIDE ASSISTANCE

EPA Regional Asbestos Coordinator and State/Local Government Advisors: Provide general guidance and answer specific questions.

OSHA Regional Office: May be helpful in answering questions about existing regulations and providing guidance for worker protection.

Asbestos Consultant(s)*: (Industrial Hygienists, Health Professionals, Architects, Engineers, and others) May assist Asbestos Program Manager in various aspects of the asbestos O&M program, including development and implementation. May also conduct the inspection and provide work practices recommendations.

Lawyer: Provides advice on legal requirements (laws and statutes) and liability aspects of the program.

Asbestos Contractor*: May provide services for ACM abatement and building decontamination following a fiber release episode.

*It is important for owners and Asbestos Program Manager's to consider potential "conflict of interest" issues pertaining to those persons or firms used to sample, inspect, assess, analyze, recommend response actions, design response actions, and conduct asbestos response actions.

APPENDIX D.

Additional assistance can be obtained from your U.S. EPA Regional Asbestos Coordinators, NESHAP Regional Coordinators, and OSHA Regional Offices. Their telephone numbers are listed below:

EPA Region I: (CT,ME,MA,NH,RI,VT)
Asbestos Coordinator (617) 565-3835
NESHAP Coordinator (617) 565-3265

EPA Region II: (NJ,NY,PR,VI)
Asbestos Coordinator (201) 321-6671
NESHAP Coordinator (212) 264-6770

EPA Region III: (DE,DC,MD,PA,VA,WV)
Asbestos Coordinator (215) 597-3160
NESHAP Coordinator (215) 597-6550

EPA Region IV: (AL,FL,GA,KY,MS,NC,SC,TN)
Asbestos Coordinator (404) 347-5014
NESHAP Coordinator (404) 347-2904

EPA Region V: (IL,IN,MI,MN,OH,WI)
Asbestos Coordinator (312) 886-6003
NESHAP Coordinator (312) 353-2088

EPA Region VI: (AR,LA,NM,OK,TX)
Asbestos Coordinator (214) 655-7244
NESHAP Coordinator (214) 655-7229

EPA Region VII: (IA,KS,MO,NE)
Asbestos Coordinator (913) 551-7020
NESHAP Coordinator (913) 551-7020

EPA Region VIII: (CO,MT,ND,SD,UT,WY)
Asbestos Coordinator (303) 293-1442
NESHAP Coordinator (303) 294-7685

EPA Region IX: (AZ,CA,HI,NV,AS,GU)
Asbestos Coordinator (415) 556-5406
NESHAP Coordinator (415) 556-5526

EPA Region X: (AK,ID,OR,WA)
Asbestos Coordinator (206) 442-4762
NESHAP Coordinator (206) 442-1757

Region I — Boston, MA: (617) 223-6710
Region II — New York, NY: (212) 944-3432
Region III — Philadelphia, PA: (215) 596-1201
Region IV — Atlanta, GA: (404) 347-3573
Region V — Chicago, IL: (312) 353-2220
Region VI — Dallas, TX: (214) 767-4731
Region VII — Kansas City, MO: (816) 374-5861
Region VIII — Denver, CO: (303) 844-3061
Region IX — San Francisco, CA: (415) 995-5672
Region X — Seattle, WA: (206) 442-5930

Toxic Substances Control Act (TSCA) Assistance Hotline

Copies of the EPA Guidance Documents, Technical Bulletins, and other publications cited here can be obtained by calling the TSCA Assistance Hotline, in Washington, D.C., at: (202) 554-1404.

Approved Training Centers

Certain training centers and satellite centers were initially funded by EPA to develop asbestos training courses. They, and other training providers approved by EPA or states, offer courses for professionals such as asbestos inspectors and management planners involved with ACM detection and control, for asbestos abatement project designers, project supervisors and abatement workers, and others. In general, qualified professionals trained as inspectors and asbestos management planners would be good choices to design an O&M plan. Original training centers are located at the following sites:

Georgia Institute of Technology
GTRI/EDL/ESTD
29 O'Keefe Building
Atlanta, GA 30332
(404) 894-3806

University of Kansas
Asbestos Training Center
6600 College Blvd. Suite 315
Overland Park, KS 66211
(913) 491-0181

Pacific Asbestos
Information Center
University CA/Extension
2223 Fulton St.
Berkeley, CA 94720
(415) 643-7143

Tufts University
Curtis Hall
Asbestos Information Center
474 Boston Avenue
Medford, MA 02155
(617) 381-3531

University of Illinois at Chicago
Midwest Asbestos Information Center
Box 6998
Chicago, IL 60680
(312) 996-6904

Additional training providers are listed in the *Federal Register* on a regular basis. Call (202) 554-1404 for information. In addition, information on how to receive a copy of an O&M Course produced by an EPA contractor may be obtained at the same number.

National Conference of State Legislatures (NCSL)
Denver, CO — (303) 623-7800
National Institute of Building Sciences (NIBS),
Washington, D.C. — (202) 289-7800
American Board of Industrial Hygiene (ABIH),
Lansing, MI — (517) 321-2638
National Institute for Standards and Technology (NIST),
Gaithersburg, MD — (contact for lab accreditation) —
(301) 975-4016

APPENDIX E:

EPA recommends that the following guidelines be followed for respiratory protection during various custodial and maintenance tasks. These guidelines are issued to cover tasks that do not always create routine fiber levels high enough to trigger OSHA respiratory protection requirements. Therefore, building owners should note they go *beyond* OSHA requirements.

Routine maintenance where contact with ACM is unlikely. No respiratory protection required. (Air-purifying respirator with high-efficiency filters should be available if needed; half-face or full facepiece).

Routine maintenance where there is reasonable likelihood of ACM disturbance. Air-purifying respirator with high-efficiency filters (half-face or full facepiece).

Maintenance or repair involving intentional small-scale disturbance of ACM. Powered air-purifying respirator with high-efficiency filters, or air-purifying respirator with high-efficiency filters (half-face or full facepiece). If glove bags are used to contain the ACM during disturbance, either half-face or full facepiece air-purifying respirators with high-efficiency filters may be used.

Any O&M activity requiring sawing, cutting, drilling, abrading, grinding, or sanding ACM. (NOTE: specially equipped tools with local exhaust ventilation should be used for these activities. See 29 CFR 1910.) Powered air-purifying respirator with high-efficiency filters, or full facepiece, air-purifying respirator equipped with high-efficiency filters should be used.

Cleanup after a minor asbestos fiber release. Air-purifying respirator with high-efficiency filters (half-face or full facepiece).

Cleanup after a major asbestos fiber release. Air-supplied respirators, either the "Type C" airline respirator equipped with a backup high-efficiency filter or SCBA (Self-Contained Breathing Apparatus).

The U.S. EPA, in collaboration with NIOSH, has issued a guidance document, "A Guide to Respiratory Protection for the Asbestos Abatement Industry," which recommends levels of respiratory protection for those engaged in large-scale asbestos abatement projects that are beyond routine O&M procedures. Air-supplied self-contained, and "type C" airline respirators are the focus of the EPA/NIOSH document. These respirators allow workers to breathe fresh air supplied through hoses and face masks, and are generally used only by asbestos abatement workers engaged in large-scale asbestos removal projects. They are usually not considered either practical or necessary for most custodial and maintenance jobs.

An industrial hygienist or environmental/occupational health professional should assist workers with respirator selection and fitting, and train them in respirator use. Fit-testing (which means determining whether a particular brand and size of respirator properly fits an individual worker) is essential, since respirators which leak at the face seal provide significantly less protection. OSHA requires fit-testing initially and every six months for employees required to wear a negative pressure respirator for protection against asbestos, or for individuals exposed at or above the OSHA-specified limits.

A respirator's effectiveness is also influenced by how it is handled, cleaned, and stored. Custodial and maintenance staff should clean their respirators after each use, and disinfect their respirators at the end of a day's use. This improves comfort, and also reduces the chances of skin irritation or infection. After cleaning the respirator, custodial and maintenance staff should place the respirator (with the worker's name) in a clean and sanitary location and store the unit in a secure place for future use. Respirators should be visually inspected by the user before and after each use, during cleaning and at least monthly when not in use. Inspection records should be maintained accordingly. When the respirator's high-efficiency filters are discarded, they should be disposed of as asbestos waste.

APPENDIX F

Appoint Asbestos Program Manager and Develop an Organizational Policy.	"Guidance for Controlling Asbestos-Containing Materials in Buildings" ("Purple Book") EPA publication number: 560/5-85-024
Inspect the facility to determine if ACM is present. Take bulk samples of suspect ACM and assess the material's condition.	"Guidance for Controlling Asbestos-Containing Materials in Buildings" ("Purple Book", chapter 2) EPA publication number: 560/5-85-024
	"Simplified Sampling Scheme for Surfacing Materials" ("Pink Book") EPA publication number: 560/5-85-030a
	"Asbestos-Containing Materials in Schools; Final Rule and Notice" (Asbestos Hazard Emergency Response Act, or AHERA). *Federal Register*— October 30, 1987. (sections 763.85 to 763.88)
	Model training course materials for accrediting asbestos building inspectors in accordance with AHERA (inspection/assessment materials).
Establish an O&M program.	"Purple Book", Chapter 3
	AHERA regulations, sections 763.91 and 763.92
	EPA Guidance for Service and Maintenance Personnel. EPA publication number 560/5-85-018
Implement and Conscientiously Manage the O&M Program; Assess the Potential for Exposure to Asbestos and Select Response Actions.	"Purple Book", Chapter 4
	Model training course materials for accrediting asbestos management planners in accordance with AHERA (assessment materials).
	AHERA regulations, section 763.88 and 793.92
Select and Implement Abatement Actions Other Than O&M When Necessary.	"Purple Book", Chapter 6
	AHERA regulations, section 763.93 (including 763.85 through 763.92)
	AHERA regulation, appendix A; Determining Completion of Response Actions-Methods.
	"Abatement of Asbestos-Containing Pipe Insulation" U.S. EPA; Asbestos-in-Buildings Technical Bulletin 1986-2.
	U.S. EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) Regulations (40 CFR 61)
	Model training course materials for accrediting asbestos management planners in accordance with AHERA (assessment materials).

*Most of these guidance materials are available through EPA's TSCA Assistance Hotline, at (202) 554-1404.

APPENDIX G:

- Cement Pipes
- Cement Wallboard
- Cement Siding
- Asphalt Floor Tile
- Vinyl Floor Tile
- Vinyl Sheet Flooring
- Flooring Backing
- Construction Mastics (floor tile, carpet, ceiling tile, etc.)
- Acoustical Plaster
- Decorative Plaster
- Textured Paints/Coatings
- Ceiling Tiles and Lay-in Panels
- Spray-Applied Insulation
- Blown-in Insulation
- Fireproofing Materials
- Taping Compounds (thermal)
- Packing Materials (for wall/floor penetrations)
- High Temperature Gaskets
- Laboratory Hoods/Table Tops
- Laboratory Gloves
- Fire Blankets
- Fire Curtains
- Elevator Equipment Panels
- Elevator Brake Shoes
- HVAC Duct Insulation
- Boiler Insulation
- Breeching Insulation
- Ductwork Flexible Fabric Connections
- Cooling Towers
- Pipe Insulation (corrugated air-cell, block, etc.)
- Heating and Electrical Ducts
- Electrical Panel Partitions
- Electrical Cloth
- Electric Wiring Insulation
- Chalkboards
- Roofing Shingles
- Roofing Felt
- Base Flashing
- Thermal Paper Products
- Fire Doors
- Caulking/Putties
- Adhesives
- Wallboard
- Joint Compounds
- Vinyl Wall Coverings
- Spackling Compounds

NOTE: This list does not include every product/material that may contain asbestos. It is intended as a general guide to show which types of materials may contain asbestos.

APPENDIX H:

USEPA. 1984. U.S. Environmental Protection Agency. *National Emission Standards for Hazardous Air Pollutants.* 40 CFR 61. April 5, 1984.

USEPA. 1985. U.S. Environmental Protection Agency. *Measuring airborne asbestos following an abatement action.* Washington DC: USEPA. EPA 600/4-85-049. ("Silver Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Asbestos in buildings: Simplified sampling scheme for surfacing materials.* Washington DC: USEPA. EPA 560/5-85-030A. ("Pink Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Guidance for controlling asbestos-containing materials in buildings.* Washington DC: EPA 560/5-85-024. ("Purple Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Asbestos in buildings: Guidance for service and maintenance personnel.* Washington DC: EPA 560/5-85-018. ("Custodial Pamphlet")

USEPA. 1986. U.S. Environmental Protection Agency. *Abatement of asbestos-containing pipe insulation.* Washington DC: Technical Bulletin No. 1986-2.

USEPA. 1986. U.S. Environmental Protection Agency. *A guide to respiratory protection for the asbestos abatement industry.* Washington DC: EPA 560/OPTS-86-001.

USEPA. 1987. *Asbestos Abatement Projects; Worker Protection, Final Rule.* 40 CFR 763. February 1987.

USEPA. 1987. U.S. Environmental Protection Agency. *Asbestos-Containing Materials in Schools; Final Rule and Notice.* 40 CFR 763. *Federal Register,* October 30, 1987.

USEPA. 1988. *EPA Study of Asbestos-Containing Materials in Public Buildings: A Report to Congress.* February, 1988.

USEPA. 1989. *Asbestos Ban and Phaseout Rule.* 40 CFR 763.160 to 763.179. *Federal Register,* July 12, 1989.

USEPA. 1989. *Guidelines for Conducting the AHERA TEM Clearance Test to Determine Completion of an Asbestos Abatement Project.* Washington DC: EPA 560/5-89-001.

USEPA. 1989. *Transmission Electron Microscopy Asbestos Laboratories: Quality Assurance Guidelines.* Washington DC: EPA 560/5-90-002.

U.S. Department of Labor: OSHA Regulations. 29 CFR 1910.1001 — *General Industry Asbestos Standard* and 29 CFR 1926.58 — *Construction Industry Asbestos Standard.* June 1986; Amended, September, 1988.

U.S. Department of Labor: OSHA Regulations. 29 CFR 1910.134 — *Respiratory Protection Standard.* June, 1974.

Keyes, Dale L. and Chesson, Jean. 1989. *A Guide to Monitoring Airborne Asbestos in Buildings.* Environmental Sciences, Inc., 105 E. Speedway Blvd., Tucson, Arizona 85705.