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Office of Solid Waste

EPA

Asbestos Waste Management Guidance

- Generation
- Transport
- Disposal

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1 Introduction

The Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) have been concerned with the potential health hazards associated with exposure to asbestos since the early 1970s. The concern is based on medical evidence relating to exposure of airborne asbestos by asbestos workers and their families to various types of cancer as well as noncancerous respiratory diseases.

In recognition of these health hazards, this manual provides guidance on how best to handle asbestos-containing waste materials during generation, transport, and final disposal. Waste handling practices presented include not only those needed to meet current EPA and OSHA requirements, but also additional recommendations reflecting practices needed to further minimize exposure to asbestos. In most cases, the recommendations are consistent with state-of-the-art procedures currently being followed by most knowledgeable asbestos waste handling firms. However, because state and local requirements may be more restrictive than federal standards, these agencies should be contacted before handling asbestos containing materials.

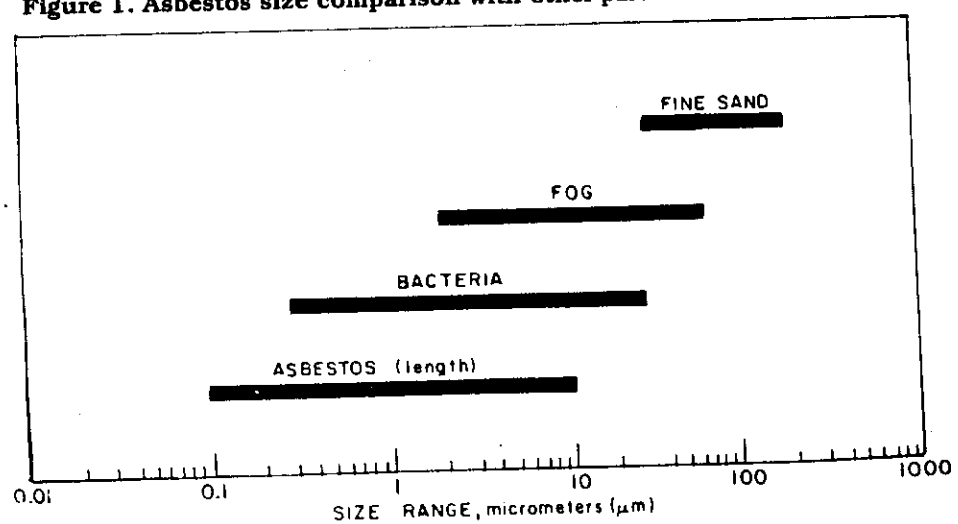
Description of Asbestos

Asbestos is a naturally occurring family of fibrous mineral substance. The typical size of asbestos fibers, as illustrated relative to other substances in Figure 1, is 0.1 to 10μ in length, a size that is not generally visible to the human eye. Somewhat longer fibers are used in making textile products. When disturbed, asbestos fibers may become suspended in the air for many hours, thus increasing the extent of asbestos exposure for individuals within the area.

EPA regulations identify the following types of asbestos: chrysotile, amosite, crocidolite, anthophyllite, actinolite, and tremolite. Approximately 95 percent of all asbestos used in commercial products is chrysotile. Asbestos became a popular commercial product because it is noncombustible, resistant to corrosion, has a high tensile strength, and a low electrical conductivity. However, asbestos had very little use until the early 1900's when it was employed as thermal insulation for steam engines. Since then, asbestos fibers have been mixed with various types of binding materials to create an estimated 3,000 different commercial products. Asbestos has been used in brake linings, floor tile, sealants, plastics, cement pipe, cement sheet, paper products, textile products, and insulation. The amount of asbestos contained in these products varies significantly, from 1 to 100 percent, depending on the particular use.

The potential of an asbestos-containing product to release fibers is dependent upon its degree of friability. Friable means that the material can be crumbled with hand pressure and, therefore, is likely to emit fibers. The fibrous or fluffy spray-applied asbestos materials found in many buildings for fireproofing, insulating, sound proofing, or decorative purposes are generally considered friable. Pipe and boiler wrap are also friable and found in numerous buildings. Some materials, such as vinyl-asbestos

Figure 1. Asbestos size comparison with other particles.



floor tile, are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations. Other materials, such as asbestos cement sheet and pipe, can emit asbestos fibers if the materials are subjected to breakage or crushing in the demolition of structures that contain such materials. For this reason, such materials are considered friable under the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations for the demolition of structures.

Identifying Asbestos

Only on rare occasions can the asbestos content in a product be determined from product labeling or by consulting the manufacturer, since most products as placed in use are no longer labeled. A description of common asbestos-containing products is presented in Section 2 of this manual. Further information on asbestos content of consumer products is available through the Consumer Product Safety Commission Hotline:

Continental United States	1-800-638-2772
Maryland only	1-800-492-8363
Alaska, Hawaii, Puerto Rico, Virgin Islands	1-800-638-8333

Positive identification of asbestos requires laboratory analysis of samples. Standard laboratory analysis using polarized light microscopy (PLM) may cost $30 to $60 per sample. For information on locating a laboratory capable of performing the analysis, contact any of EPA's Regional Asbestos Coordinators listed in Appendix B or call EPA's toll-free number for assistance:

Continental United States	1-800-334-8571 ext. 6741

For additional technical information and to obtain EPA's publication regarding sampling and analysis of asbestos entitled "Guidance for Controlling Friable Asbestos-Containing Materials in Buildings" (EPA 560/5-83-002), contact any of EPA's Regional Asbestos Coordinators listed in Appendix B or call EPA's toll-free TSCA hotline:

Continental United States	1-800-424-9065
Washington, DC only	554-1404

Health Concerns Related to Inhalation

Medical studies of asbestos-related diseases have revealed that the primary exposure route is inhalation. Also, the studies suggest that there does not appear to be a safe level of exposure (e.g., a threshold) below which there would be no chance of disease. The exposure may be classified as "occupational exposure" of workers involved, for example, in mining, milling, manufacturing, fabricating, construction, spraying, or demolition activities; "paraoccupational exposure" of workers' families due to asbestos on work clothes taken home; or "neighborhood exposure" of people living or working near such operations. The following diseases can result from inhalation of airborne asbestos fibers:

Asbestosis—A noncancerous respiratory disease that consists of scarring of lung tissues. Symptoms of asbestosis include shortness of breath and rales, a dry crackling sound in the lungs during inhalation. Advanced asbestosis may produce cardiac failure and death. Asbestosis is rarely caused by neighborhood exposure.

Lung Cancer—Inhaled asbestos particles can produce lung cancer independent of the onset of asbestosis. In most lung cancer patients, a cough or a change in cough habit is found. A persistent chest pain unrelated to coughing is the second most common symptom.

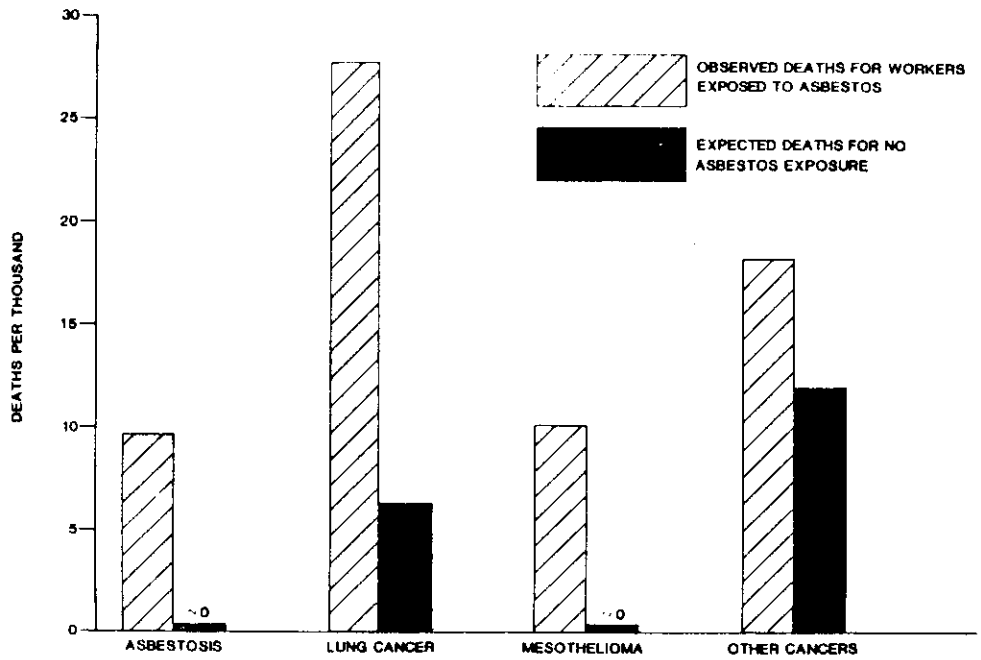
Mesothelioma—This is a rare cancer of the thin membrane lining of the chest and abdomen. Most incidences of mesothelioma have been traced directly to a history of asbestos exposure. The earlier in life that one begins inhaling asbestos, the higher the likelihood of developing mesothelioma in later life. Thus, there is concern over exposure of school children to asbestos. The common symptoms are shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma is always fatal.

Other Cancers—Some medical studies have suggested that exposure to asbestos is responsible for some cancers of internal organs including the esophagus, larynx, oral cavity, stomach, colon, and kidney. It is theorized that inhaled asbestos fibers are absorbed into the blood stream and carried to these other parts of the body.

Symptoms of asbestos respiratory disease generally do not appear for 20 or more years after the initial exposure to airborne asbestos. However, early disease detection is possible by a medical examination including a medical history, breathing capacity tests, and a chest x-ray.

Most health risk data pertain to groups of asbestos workers with relatively high exposures. A study of mortality for 17,500 asbestos insulation workers is summarized in Figure 2. The study compares death rates among insulation workers exposed to asbestos and other workers not exposed to asbestos. Based on this and other studies, the National Institute for Occupational Safety and Health (NIOSH) has reported that persons exposed to asbestos may have 5 times the chance of developing an asbestos- related disease, compared to similar nonexposed persons.

Figure 2. Expected and observed mortality among asbestos insulation workers.



Source: ASTM 834, PCN 04- 834000-17, July 1984.

Studies have shown that exposure to asbestos and cigarette smoking combine to create a significantly higher risk of developing an asbestos-related disease. Statistics compiled by NIOSH indicate that a smoker exposed to asbestos may have 50 times the chance of developing lung cancer compared to a nonexposed nonsmoker. Some information suggests that quitting smoking can reduce this high risk

Health Concerns from Ingestion and Contact with Skin

There have been no conclusive studies to date indicating that ingestion of asbestos in food or water may result in health hazards. However, because of concern that there may be potential health impacts not yet identified, there are federal regulations specifying asbestos limitations in ambient water and in products such as food processing filters.

With regard to asbestos contact with the skin, there is currently no evidence to indicate that asbestos fibers can penetrate the skin tissue. Some workers have indicated that asbestos fibers irritate the skin resulting in a rash similar to that experienced with handling of other fibrous materials such as fiberglass insulation.

Federal Regulatory Programs

EPA and OSHA have major responsibility for regulatory control over exposure to asbestos. Emissions of asbestos to the ambient air are controlled under Section 112 of the Clean Air Act, which establishes the National Emission Standards for Hazardous Air Pollutants (NESHAPs). The regulations specify control requirements for most asbestos emissions, including work practices to be followed to minimize the release of asbestos fibers during handling of asbestos waste materials. These regulations do not identify a safe threshold level for airborne asbestos fibers. For additional information about the NESHAPs regulations for asbestos, refer to the Code of Federal Regulations (40 CFR Part 61, Subpart M).

The OSHA regulations are established to protect workers handling asbestos or asbestos-containing products. The current OSHA regulations include a maximum workplace airborne asbestos concentration limit of 2 fibers/cc on an 8-hour time weighted average basis, and a ceiling limit of 10 fibers/cc in any 15-minute period. The standard includes requirements for respiratory protection and other safety equipment, and work practices to reduce indoor dust levels. For details regarding the OSHA regulations, refer to the Code of Federal Regulations (29 CFR Part 1910).

EPA has implemented a separate regulation under the Toxic Substances Control Act (TSCA) to handle the problem of asbestos construction materials used in schools. This regulation requires that all schools be inspected to determine the presence and quantity of asbestos and that the local community be notified as well as the building posted. Corrective actions, such as asbestos removal or encapsulation, are currently left to the discretion of the school

administrators. EPA provides technical assistance under this program through the Appendix B contacts or the toll-free TSCA hotline: 1-800-424-9065 (554-1404 in Washington, DC). The specific details of the TSCA program are contained in the Code of Federal Regulations (40 CFR Part 763, Subpart F).

The Asbestos School Hazard Abatement Act of 1984 (ASHAA) establishes a $600 million grant and loan program to assist financially needy schools with asbestos abatement projects. The program also includes the compilation and distribution of information concerning asbestos, and the establishment of standards for abatement projects and abatement contractors. Under this program, centers to train contractors on asbestos handling and abatement have been established at the Georgia Institute of Technology, Atlanta, GA, and are scheduled to open in June 1985 at both Tufts University, Medford, MA, and at the University of Kansas, Lawrence, KN. Additional information can be obtained through the toll-free ASHAA hotline: 1-800-835-6700 (554-1404 in Washington, DC).

Wastes containing asbestos are not hazardous wastes under the Resource Conservation and Recovery Act (RCRA). However, because state regulations can be more restrictive than the federal regulations under RCRA, some states may have listed asbestos-containing wastes as hazardous wastes. Since this will greatly impact on transportation and disposal of the waste, the state hazardous waste agency should be contacted. A list of state hazardous waste agencies may be obtained by calling the RCRA hotline: 1-800-424-9346 (382-3000 in Washington, DC). Current nonhazardous waste regulations under RCRA pertain to facility siting and general operation of disposal sites (including those that handle asbestos). Details concerning these RCRA requirements are contained in the Code of Federal Regulations (40 CFR Part 257).

Other federal authorities and Agencies controlling asbestos include: the Clean Water Act, under which EPA has set standards for asbestos levels in effluents to navigable waters; the Mine Safety and Health Administration, which oversees the safety of workers involved in the mining of asbestos; the Consumer Product Safety Commission; the Food and Drug Administration; and the Department of Transportation.

State and local agencies may have more stringent standards than the federal requirements; these agencies should be contacted prior to any asbestos removal or disposal operation.

2 Quantities and Uses of Asbestos

Asbestos has been mined and used commercially in the U.S. since the early 1900s. U.S. consumption of asbestos increased to a peak of 800,000 tons per year in the early 1970s. Since then, consumption has dropped by more than 70 percent. However, much of the material originally installed in buildings may still be present.

The potential existence of asbestos in commercial products can be assessed first by understanding the physical and chemical characteristics of asbestos-containing products and their uses. This section describes the appearance, composition, friability, use, and market share of the most common asbestos-containing products.

Table 1 summarizes information on these products, many of which are still being manufactured. However, because of the recognized health risk, the manufacture of a few asbestos products has been banned. In addition, the concern of industry for exposure of their workers and the public, and the increased availability of substitute products, has rapidly reduced the use of asbestos.

Friction Products

Asbestos is used in brake linings for automobiles, buses, trucks, railcars, and industrial machinery, and in vehicle or industrial clutch linings. Asbestos-containing brake linings include drum brake linings, disc brake pads, and brake blocks. In the past, asbestos linings have accounted for up to 99 percent of this market. Friction materials are generally tough and nonfriable, but they release asbestos dust during fabrication operations. In addition, accumulated dust in a brake drum from lining wear contains high levels of asbestos. Brake installation facilities (e.g., city bus service centers, tire and brake shops) may generate significant

quantities of asbestos waste. Substitute nonasbestos brake linings have been developed and are beginning to replace asbestos lining in some applications.

Plastic Products

Plastic products include resilient vinyl and asphalt floor coverings, asphalt roof coatings, and traditional molded plastic products such as a cooking pot handle or plastic laboratory sink. The products in this category are usually tough and inflexible. The asbestos in these products is tightly bound and is not released under typical conditions of use. However, any sawing, drilling, or sanding of these products during installation or removal would result in the release of asbestos dust.

Table 1. Summary of Asbestos-Containing Products

Product	Average percent asbestos	Binder	Dates used
Friction products	50	Various polymers	1910-present
Plastic products			
Floor tile and sheet	20	PVC, asphalt	1950-present
Coatings and sealants	10	Asphalt	1900-present
Rigid plastics	<50	Phenolic resin	?-present
Cement pipe and sheet	20	Portland cement	1930-present
Paper products			
Roofing felt	15	Asphalt	1910-present
Gaskets	80	Various polymers	?-present
Corrugated paper pipe wrap	80	Starches, sodium silicate	1910-present
Other paper	80	Polymers, starches, silicates	1910-present
Textile products	90	Cotton, wool	1910-present
Insulating and decorative products			
Sprayed coating	50	Portland cement, silicates, organic binders	1935-1978
Trowelled coating	70	Portland cement, silicates	1935-1978
Preformed pipe wrap	50	Magnesium carbonate, calcium silicate	1926-1975
Insulation board	30	Silicates	Unknown
Boiler insulation	10	Magnesium carbonate, calcium silicate	1890-1978
Other uses	<50	Many types	1900-present

Vinyl (linoleum) and asphalt flooring are used in many types of construction. Vinyl-asbestos flooring has about a 90 percent share of the resilient floor covering market. These materials are not friable, and asbestos is released primarily through sawing or sanding operations during installation, remodeling, and removal. Asphalt-asbestos coatings, used primarily as roof sealants, generally remain flexible and nonfriable, but can become friable or brittle as they age.

Cement Pipe and Sheet

Asbestos-cement (A-C) pipe has been widely used for water and sewer mains, and is occasionally used for electrical conduits, drainage pipe, and vent pipes. Asbestos-cement sheet, manufactured in flat or corrugated panels and shingles, has been used primarily for roofing and siding, but also for cooling tower fill sheets, canal bulkheads, laboratory tables, and electrical switching gear panels. Asbestos-cement products are dense and rigid with gray coloration, unless the material is lined or coated. The asbestos in these products is tightly bound, and would not be released to the air under typical conditions of use. However, any sawing, drilling, or sanding of these products during installation or renovation would result in release of asbestos dust. In addition, the normal breakage and crushing involved in the demolition of structures can release asbestos fibers from these materials. For this reason they are subject to the NESHAPs regulation during demolition operations. Also, normal use of A-C pipe for water or sewer mains has been shown to release asbestos fibers to the fluid being carried.

By the late 1970s, A-C pipe had a 40 percent share of the water main market and a 10 percent share of the sewer main market. However, since A-C pipe has only been in existence for 50 years, it only accounts for a small fraction of the total pipe in place in the United States.

Paper Products

Roofing felts, gaskets, and other paper products are manufactured on conventional papermaking equipment using asbestos fibers instead of cellulose. The raw asbestos paper produced in this process has a high asbestos content (~85 percent), but is typically coated or laminated with other materials in the final product. The asbestos fibers in most paper products are sufficiently bound to prevent their release during normal product use. Cutting or tearing the material during installation, use, or removal would result in the release of asbestos dust.

Asbestos-containing roofing felt has been widely used for application of "built-up" roofs. Built-up roofing is used on a flat surface, and consists of alternating layers of roofing felt and asphalt. The roofing felt consists of asbestos paper, saturated and coated with asphalt. Asphalt-asbestos roofing shingles for residential structures, made from roofing felt coated with asphalt, were reportedly used for only a short time between 1971 and 1974.

Other asbestos-containing paper products include pipeline wrap, millboard, rollboard, commercial insulating papers, and a variety of specialty papers. Pipeline wrap is used to protect underground pipes from corrosion, particularly in the oil and gas industry. Millboard and rollboard are laminated paper products used in commercial construction such as walls and ceilings. Commercial insulating papers are used for high temperature applications in the metals

Figure 3. Corrugated asbestos paper pipe wrap.