Chapter

16

Historical Insulation Products

Asbestos

Asbestos is a fibrous mineral found in rocks and soil throughout the world that has been used in more than 3000 different construction materials and manufactured products. Asbestos has been used in architectural and construction applications because it is strong, durable, fire retardant, and an efficient insulator. Alone or in combination with other materials, asbestos can be fashioned into a variety of products that have numerous applications within the building industry, such as flooring, walls, ceiling tiles, decorative spray-on ceiling treatments, exterior housing shingles, insulation or fire retardant for heating and electrical systems, etc.

Chrysotile, or white asbestos, is the most widely used mineral in the asbestos family and makes up approximately 95 percent of the world's asbestos supply, three-quarters of which is mined in Quebec, Canada. Prices can range from $200 to $1300 a metric ton, depending on the quality. (The longer the fiber, the more valuable it is.[1]) Amosite, known as brown asbestos, and crocidolite, known as blue asbestos, each account for less than 5 percent of all asbestos in buildings. The remaining three kinds of asbestos, anthophyllite, tremolite, and actinolite, are rare. In addition to the strip mines in Canada, mining operations continue in Russia, China, Zimbabwe, Brazil, and King City, California.

All types of asbestos are chemically inert, noncombustible, and tend to break into very tiny fibers. These individual fibers are so

small that many must be identified using a microscope. In fact, some individual fibers may be up to 700 times smaller than a human hair. Because asbestos fibers are so small, once released into the air, they may stay suspended there for hours or even days.

History

The first recorded use of asbestos was in Finland about 2500 B.C., where the material was used in the mud wattle for the wooden huts the people lived in as well as strengthening for pottery. Adverse health aspects of the mineral were noted nearly 2000 years ago when Pliny the Younger wrote about the poor health of slaves in the asbestos mines. Benjamin Franklin even carried a fireproof purse made from asbestos.[1] Although known to be injurious for centuries, the first modern references to its toxicity were by the British Labor Inspectorate when it banned asbestos dust from the workplace in 1898. Asbestosis cases were described in the literature after the turn of the century. Cancer was first suspected in the mid-1930s, and a causal link to mesothelioma was made in 1965. Because of the public concern for worker and public safety with the use of this material, several different types of analyses were applied to the determination of asbestos content.[2]

The first commercial asbestos mine, a chrysotile mine, was opened in Quebec, Canada, in the 1870s. Amosite asbestos and crocidolite asbestos were mined from Africa beginning in 1916 and 1980, respectively. Asbestos was first used in the United States in the early 1900s to insulate steam engines. While its fire-retardent and durability properties soon prompted this material's inclusion into a variety of household and construction products, the manufacturers of asbestos products were aware of the deadly dangers and health hazards by the 1930s. Workers in asbestos factories, including men, women, and children, were developing asbestos lung disease as soon as 5 or 6 years after first exposure to asbestos. By the early 1940s, medical and scientific articles were being published showing the connection between asbestos and the development of lung cancer. By the 1950s, the connection between asbestos and mesothelioma had been made, and by 1960, it was established that persons exposed to asbestos were developing mesothelioma at an alarming rate. Secret internal company documents reveal that the asbestos companies intentionally hid what they knew about the dangers and health hazards of asbestos so that workers and customers would not object to using asbestos products. In 1973, the United States used 795,000 metric tons of asbestos

in consumer products. Although some asbestos-containing materials were still being installed in buildings into the late 1980s, this number had dropped to 21,700 metric tons by 1996, with predominant uses in water pipes, brake linings, and roof coatings.[3]

Asbestos products

Asbestos is found in thousands of products, including many building materials. Asbestos is most commonly found in commercial applications as sprayed-on insulation, pipe and boiler insulation, and duct insulation. In residential dwellings, it can be found in roofing and siding shingles made with asbestos cement, vinyl floor tiles and adhesives, wall and ceiling acoustical tiles, sprayed "popcorn" coatings on ceilings and walls, insulation in attics and walls, and insulation blankets on furnace ducts and hot water and steam pipes, as well as boiler door gaskets on furnaces and wood stoves.

Products containing asbestos can be very difficult, if not impossible, to visually identify unassisted. There are some general descriptions one can go by. For example, sprayed-on asbestos insulation is usually a fluffy material sprayed onto ceilings or beams and sometimes covered by ceiling tiles. Asbestos pipe and boiler insulation may be covered with paper, cloth, or metal. The actual insulation can be a cardboard-like pipe wrap or cement on pipe elbows. Asbestos duct insulation is usually a thin layer of insulation that may be painted or covered with paper, cloth, or metal. Asbestos ceiling tiles, used for sound insulation or dropped ceilings, are very similar to nonasbestos tiles.

There is not a standardized assessment of asbestos use based on chronology either. For example, cement-asbestos board siding, a very dense, brittle product, was used primarily in the 1940s, 1950s, and into the 1960s. From the mid-1960s through the early 1980s, some spray-on "popcorn" ceiling treatments contained asbestos (asbestos used in this product was banned in 1977). The product most appropriate to the scope of this book, thermal insulation in attics and walls, was used primarily in homes built between 1930 and 1950. The amount of asbestos used in construction products varied as well. Asbestos insulation used between 1910 and the early 1970s may contain up to 74 percent or more asbestos by weight.

Asbestos thermal insulation

Although not as common as many other asbestos-containing materials (ACMs), loose blown-in and batt insulations infrequently have

been known to contain asbestos. These were used primarily as thermal insulation in homes built or remodeled between 1930 and 1950. Although the U.S. Environmental Protection Agency (EPA) has stated that many homes constructed in the United States during the past 20 years probably do not contain asbestos products, new discoveries have demonstrated that this may be inaccurate. As recently as February 2000, new disclosures revealed that there may be other thermal insulation products that were on the market as recently as the early 1980s that contained asbestos.

For example, W. R. Grace Company was hit with three class-action lawsuits, one filed in Boston on behalf of homeowners nationwide who have asbestos-tainted Zonolite attic insulation in their homes and the other two in Montana, where the company operated a mine and mill. The lawsuit, filed in U.S. District Court in Boston by Edward M. Lindholm, accuses W. R. Grace Company of fraud, deception, and enriching itself at the expense of homeowners by failing to warn the public that the Zonolite insulation it sold from 1963 through 1984 contained tremolite asbestos. Grace's Cambridge-based Construction Products Division oversaw its attic insulation line.[4] In 1984, the EPA estimated that this attic insulation had been installed in 940,000 homes.[5] Grace, which discontinued its attic insulation in 1984, knew as far back as 1963 about the asbestos but feared that disclosure would hurt sales, according to memos from high-ranking Grace officials.[4]

This asbestos presents a hazard only if renovation and repair work disturbs it. If asbestos-containing materials are discovered, be sure certified and/or qualified contractors/workers are consulted and hired so that asbestos fibers are not spread further throughout the home.

Identification

As mentioned earlier, asbestos fibers were added to a variety of products to increase durability, insulation properties, and fire resistance. There are several types of asbestos fibers that may be found in a home, and typically an ACM cannot be recognized simply by looking at it, unless it is labeled. Until a product is tested it is best to assume that the product contains asbestos, unless the label or the manufacturer verifies that it does not. If there is a possibility that the house contains asbestos, the only sure way to tell is to take a sample from the specific area in question and have it tested by an EPA-approved laboratory.

Unlike thermal insulation, pipe insulation typically is easier to identify. Asbestos pipe insulation looks white and chalky and is wrapped in a thin canvas. Another type looks like corrugated paper wrapped with tape or paper that has been cut to fit around the pipes or furnace ducts.

Removal

Asbestos removal has been called the biggest environmental cleanup project in the United States. It has cost over $50 billion over the past 20 years.[3] If the asbestos is in good condition, it is best not to remove it. If the material is friable, it could be a health hazard, and other steps needs to be taken. (The means test for friability suggests that when the material is dry, it may be crumbled, pulverized, or reduced to powder by hand pressure, flakes off, or is deteriorating.) Similarly, if the material has been sanded, cut, or sawed, it is also a hazard and needs to be removed or immobilized.

Although the reaction to the health hazards of asbestos workers initially accelerated public concerns, the EPA also has slowly changed its position. For example, in 1979 the EPA stated that the only permanent solution to asbestos in buildings was to take it out. In 1983, the EPA said "removal was always appropriate, never inappropriate." In 1985, the EPA issued an updated statement in the "Purple Book" that emphasized managing asbestos rather than removing it. The issue of asbestos removal was further downplayed in 1990. The EPA's "Green Book" noted that improper asbestos removal could increase exposure by stirring up dust unnecessarily.[3]

The EPA currently requires asbestos removal only to prevent significant public exposure to asbestos, such as during building renovation or demolition. In fact, an improper removal can create a dangerous situation where none existed previously. EPA does recommend in-place management whenever asbestos is discovered. Instead of removal, a conscientious in-place management program usually will control fiber releases, particularly when the materials are not significantly damaged and are not likely to be disturbed.

The EPA has produced many guidance documents on asbestos in buildings. Some of the most pertinent are

1. "Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book)," EPA 560/5-85-024.
2. "A Guide to Respiratory Protection for the Asbestos Abatement Industry (White Book)," EPA-560-OPTS-86-001.

3. "Managing Asbestos in Place: A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials (Green Book)," EPA 20T-2003.
4. *Asbestos Abatement and Management in Buildings: Model Guide Specifications,* 2d ed., August 1988. New sections on asbestos-containing resilient flooring and a new introduction and instructions-for-use section were published in early 1992.[6]

EPA also maintains an asbestos information "hot line" and publications ordering number: 202-554-1404. For school-related asbestos information, call 800-835-6700. Information is also available from the National Institute of Building Sciences (NIBS), Washington, D.C.: 202-289-7800.

Home inspection. If immediate identification of the material is not possible, one alternative is to hire a house inspector specifically trained in handling asbestos material. The house inspector should have an identification card that has been dated within the last year. The cost is typically $100 plus the laboratory fee.

A professional asbestos inspector also may be available depending on the locale. The homeowner should review several items prior to the hire. First of all, make sure that the inspection will include a complete visual examination and careful collection and laboratory analysis of samples. If asbestos is present, the inspector should provide a written evaluation describing its location and extent of damage and give recommendations for correction or prevention. The homeowner also should verify that the inspecting firm makes frequent site visits if it is hired to ensure that a contractor follows proper procedures and requirements. The inspector may recommend and perform checks after the correction to ensure that the area has been cleaned properly.

Asbestos contractor. If the asbestos product is in poor condition, it is highly recommended that the homeowner hire a state-certified asbestos contractor to minimize all health risks in removing or immobilizing it properly. Asbestos professionals can conduct an inspection, take samples of suspected material, assess their condition, and advise about what corrections, if any, are needed and who is qualified to make these corrections. Asbestos abatement contractors can be found in the Yellow Pages or at Web sites. The homeowner also should check with the local air pollution control board, the local agency responsible for worker safety, and the Better

Business Bureau. Ask if the firm has had any safety violations, and find out if there are legal actions filed against it. Each person performing such work should provide proof of training and licensing in asbestos work, such as completion of EPA-approved training. State and local health departments or EPA regional offices may have listings of licensed professionals in specific areas. The EPA also has published a summary guide in order to guarantee that homeowners are protected during any asbestos inspection or removal[6] (see the Appendix at the end of this chapter for regional offices).

Before work begins, the homeowner should receive a written contract specifying the work plan, cleanup, and applicable federal, state, and local regulations that the contractor must follow (such as notification requirements and asbestos disposal procedures). The homeowner also should contact the state and local health departments, the EPA's regional office, and the Occupational Safety and Health Administration's (OSHA's) regional office to find out what the regulations are. Be sure the contractor follows local asbestos removal and disposal laws. At the end of the job, the homeowner should get written assurance from the contractor that all procedures have been followed.

The homeowner needs to verify that the contractor avoids spreading or tracking asbestos dust into other areas of the home. The contractor should seal the work area from the rest of the house using plastic sheeting and duct tape, turn off the heating and air-conditioning system, and tape over all vents. For some repairs, such as pipe insulation removal, plastic glove bags may be adequate. They must be sealed with tape and properly disposed of when the job is complete.

The homeowner should verify that the contractor clearly marks the work site as a hazard area. Household members and pets will not be allowed into the area until work is completed. On completion, the homeowner should make sure that the contractor cleans the area well with wet mops, wet rags, sponges, or HEPA (high-efficiency particulate air) vacuum cleaners. A regular vacuum cleaner must never be used. Wetting helps reduce the chance of spreading asbestos fibers in the air. All asbestos materials and disposable equipment and clothing used on the job must be placed in sealed, leakproof, and labeled plastic bags. The work site should be visually free of dust and debris. Air monitoring (to make sure there is no increase in asbestos fibers in the air) may be necessary to ensure that the contractor's job is done properly. This should be done by someone not associated with the contractor.[6]

Homeowner sampling. Although not recommended, a homeowner may want to do his or her own sampling in order to save a lot of money in consulting fees. The EPA has presented a few guidelines:

1. Make sure no one else is in the room when sampling is done.
2. Wear disposable gloves or wash hands after sampling.
3. Shut down any heating or cooling systems to minimize the spread of any released fibers.
4. Do not disturb the material any more than is needed to take a small sample.
5. Place a plastic sheet on the floor below the area to be sampled.
6. Wet the material using a fine mist of water containing a few drops of detergent before taking the sample. The water-detergent mist will reduce the release of asbestos fibers.
7. Carefully cut a piece from the entire depth of the material using, for example, a small knife, corer, or other sharp object. Place the small piece into a clean container (e.g., a 35-mm film canister, small glass or plastic vial, or high-quality resealable plastic bag).
8. Tightly seal the container after the sample is in it.
9. Carefully dispose of the plastic sheet. Use a damp paper towel to clean up any material on the outside of the container or around the area sampled. Dispose of asbestos materials according to state and local procedures. (One should never vacuum loose asbestos because the vacuum cleaner will only distribute the very fine, virtually invisible fibers throughout the house, thus exposing the whole household to asbestos.)
10. Label the container with an identification number and clearly state when and where the sample was taken.
11. Patch the sampled area with the smallest possible piece of duct tape to prevent fiber release.[6]

The cost should be around $30 for the laboratory work. Send the sample to an EPA-approved laboratory for analysis. The National Institute for Standards and Technology (NIST) has a list of these laboratories (see the Appendix at the end of this chapter).

Health concerns

The Health Effects Institute, in an EPA-financed report ordered by Congress in 1991, conducted a comprehensive study on the risks of

asbestos in buildings. The study revealed that the lifetime risk of cancer for someone who works in a building containing asbestos is 1 in 250,000. Ironically, outdoor air in urban areas causes a 1 in 25,000 lifetime risk of cancer.[3]

As mentioned earlier, intact and undisturbed asbestos materials generally do not pose a health risk. ACMs, however, can become hazardous by releasing fibers due to damage or deterioration over time. These fibers can be up to 1200 times thinner than a human hair. When inhaled, they become trapped and aggravate the lung tissues, which causes the tissues to scar. Because the material is durable, it persists over tissue and concentrates as repeated exposures occur over time. Unfortunately, medical researchers state that up to 30 years after inhalation, asbestos fibers can cause diseases such as asbestosis, lung cancer, or mesothelioma. Disease generally occurs in workers and others who have experienced prolonged work-related exposure to asbestos; the health effects of lower exposures in the home are less certain. However, experts are unable to provide assurance that any level of exposure to asbestos fibers is completely safe.

Asbestosis. Asbestosis is a serious, chronic, noncancerous respiratory disease. Symptoms of asbestosis include shortness of breath and a dry crackling sound in the lungs while inhaling. In its advanced stages, the disease may cause cardiac failure. The risk of asbestosis is minimal for those who do not work with asbestos; the disease is rarely caused by neighborhood or family exposures. Those who renovate or demolish buildings that contain asbestos may be at significant risk, depending on the nature of the exposure and the precautions taken. There is no effective treatment for asbestosis; the disease is usually disabling or fatal.

Lung cancer. Lung cancer causes the largest number of deaths related to asbestos exposure. Asbestos exposure is responsible for 4 to 7 percent of lung cancer cases in the United States.[1] The most common symptoms of lung cancer are coughing and a change in breathing. Other symptoms include shortness of breath, persistent chest pains, hoarseness, and anemia. The incidence of lung cancer in people who are directly involved in the mining, milling, manufacturing, and use of asbestos and its products is much higher than in the general population. Research indicates that people who have been exposed to asbestos and are also exposed to some other carcinogen, such as cigarette smoke, have a significantly greater risk of developing lung cancer than people who have only been exposed

to asbestos. One study found that asbestos workers who smoke are about 90 times more likely to develop lung cancer than people who neither smoke nor have been exposed to asbestos.

Mesothelioma. Mesothelioma is a rare form of cancer that occurs most commonly in the thin membrane lining of the lungs, chest, abdomen, and sometimes the heart. About 200 cases are diagnosed each year in the United States. Virtually all cases of mesothelioma are linked with asbestos exposure. Approximately 2 percent of all miners and textile workers who work with asbestos and 10 percent of all workers who were involved in the manufacture of asbestos-containing gas masks contract mesothelioma.[7]

Evidence suggests that cancers in the esophagus, larynx, oral cavity, stomach, colon, and kidney may be caused by ingesting asbestos. For more information on asbestos-related cancers, contact the local chapter of the American Cancer Society.

Asbestos regulation

The EPA is responsible for developing and enforcing regulations necessary to protect the general public from exposure to airborne contaminants that are known to be hazardous to human health. Although most regulations refer to commercial projects and schools, the concerns for residential asbestos installations must not be overlooked. Primary federal asbestos regulations can be found in EPA's "Green Book." Many are summarized in the following text; however, people involved in asbestos work should obtain and must follow all applicable federal and state regulations.

National emission standards for hazardous air pollutants (NESHAP), 40 CFR 61, Subpart M. The Clean Air Act (CAA) of 1970 requires EPA to develop and enforce regulations to protect the general public from exposure to airborne contaminants that are known to be hazardous to human health. In accordance with Section 112 of the CAA, EPA established national emission standards for hazardous air pollutants (NESHAP). Asbestos was one of the first hazardous air pollutants regulated under Section 112. On March 31, 1971, EPA identified asbestos as a hazardous pollutant, and on April 6, 1973, EPA promulgated the asbestos NESHAP in 40 CFR Part 61, Subpart M. The asbestos NESHAP has been amended several times, most recently in November 1990.[6]

The asbestos NESHAP is intended to minimize the release of asbestos fibers during activities involving the handling of asbestos.

Accordingly, it specifies removal of asbestos and work practices to be followed prior to renovations and demolitions of buildings that contain a certain threshold amount of friable asbestos. Residential buildings having four or fewer dwelling units are generally exempt from the rules. Most often, the asbestos NESHAP requires action to be taken by the person who owns, leases, operates, controls, or supervises the facility being demolished or renovated (the "owner") and by the person who owns, leases, operators, controls, or supervises the demolition or renovation (the "operator"). The regulations require owners and operators subject to the asbestos NESHAP to notify delegated state and local agencies and/or their EPA regional offices before demolition or renovation activity begins. The regulations restrict the use of spray-on asbestos and prohibit the use of wet-applied and molded friable insulation (i.e., pipe lagging) that contains commercial asbestos. The asbestos NESHAP also regulates asbestos waste handling and disposal.[6]

Asbestos abatement projects, worker protection, final rule, 40 CFR 763, Subpart G. The EPA's worker protection rule extends the OSHA standards to state and local employees who perform asbestos work and who are not covered by the OSHA asbestos standards or by a state OSHA plan. The rule parallels OSHA requirements and covers medical examinations, air monitoring and reporting, protective equipment, work practices, and record keeping. In addition, many state and local agencies have more stringent standards than those required by the federal government. People who plan to renovate a structure that will result in disturbing a certain amount of asbestos or who plan to demolish any building are required to notify the appropriate federal, state, and local agencies and to follow all federal, state, and local requirements for the removal and disposal of regulated asbestos-containing material.[6]

TSCA. In 1979, under the Toxic Substances Control Act (TSCA), EPA began an asbestos technical assistance program for building owners, environmental groups, contractors, and industry. In May 1982, EPA issued the first regulation intended to control asbestos in schools under the authority of TSCA; this regulation was known as the *asbestos-in-schools rule.* Starting in 1985, loans and grants have been given each year to aid local education agencies (LEAs) in conducting asbestos abatement projects under the Asbestos School Hazard Abatement Act (ASHAA).[6]

Asbestos Hazard Emergency Response Act (AHERA), asbestos-containing materials in schools, final rule and notice, 40 CFR 763, Subpart E. In 1986, the Asbestos Hazard Emergency Response Act (AHERA) was signed into law as Title II of TSCA. AHERA is more inclusive than the May 1982 asbestos-in-schools rule. AHERA requires LEAs to inspect their schools for asbestos-containing building materials and prepare management plans that recommend the best way to reduce the asbestos hazard. Options include repairing damaged ACM, spraying it with sealants, enclosing it, removing it, or keeping it in good condition so that it does not release fibers. The plans must be developed by accredited management planners and approved by the state. LEAs must notify parent, teacher, and employer organizations of the plans, and then the plans must be implemented. AHERA also requires accreditation of abatement designers, contractor supervisors and workers, building inspectors, and school management plan writers. Those responsible for enforcing AHERA have concentrated on educating LEAs in an effort to ensure that they comply with the regulations. Contractors who improperly remove asbestos from schools can be liable under both AHERA and NESHAP.[6]

Asbestos ban and phaseout rule. In 1989, EPA published the "Asbestos: Manufacture, Importation, Processing, and Distribution in Commerce Prohibitions: Final Rule" (40 CFR Part 763, Subpart I). The rule eventually would have banned about 94 percent of the asbestos used in the United States (based on 1985 estimates). However, in 1991, the U.S. Court of Appeals, Fifth Circuit, vacated and remanded the majority of the rule. Currently, the manufacture, importation, processing, and distribution of most asbestos-containing products is still legal.

The Occupational Safety and Health Administration. OSHA is also responsible for regulating environmental exposure and protecting workers from asbestos exposure. Asbestos-related information and procedures can be found in OSHA's construction industry asbestos standard (29 CFR 1926.58 and 29 CFR 1926.1101). These standards apply to activities involving demolition, removal, or renovation.

Litigation

Recent studies have revealed that in many cases the government, the EPA, the media, and even the public may have overreacted to asbestos building products–related health hazards. The high-profile

cases involved workers who had spent years in clouds of asbestos dust. Nevertheless, the inexcusable fact that asbestos companies had actual knowledge of the dangers and health hazards of their asbestos products many years ago has formed the basis for the award of punitive damages against a number of asbestos manufacturing companies. These punitive damages are awarded by juries to punish the asbestos companies for their conduct of concealing the dangers and health hazards of asbestos from their workers, customers, the public, and the government, thereby bringing about unnecessary injury and death to a great number of people. Juries have awarded punitive damages against the following asbestos companies: Owens Corning, Owens Illinois, W. R. Grace, Armstrong World Industries, GAF, and U.S. Gypsum. To date, over 40,000 lawsuits have been resolved, with another 200,000 pending.[3]

Conclusion

In summary, it is well established that one should take every precaution necessary to avoid contact with asbestos materials. If asbestos-containing materials such as walls, ceilings, pipes, and boilers have been identified, the homeowner should perform routine inspections to verify that the material does not become damaged or friable. One government agency has assembled a simple checklist to use in the home.[2]

1. Do not touch or disturb asbestos material on walls, ceilings, pipes, or boilers.
2. Do not allow children to play near pipes or furnaces that have friable asbestos insulation around them. Just tossing a ball against asbestos material could release many invisible fibers.
3. Do not let the dog or cat run free in a basement with asbestos materials. The animal can pick up asbestos fibers on its fur and shake them off in other areas of the home.
4. Do not dust, sweep, or vacuum debris you think contains asbestos. (Remember: A regular vacuum cleaner allows asbestos fibers to pass right through it and reenter the room.)
5. Do not hang plants or other things from ceilings that may contain asbestos.
6. Do not tack or hammer nails into walls made from asbestos.
7. Do not allow curtain rods or room dividers hanging on ceiling tracks to bump or brush into walls or ceilings.

8. Do not brush, sweep, or sand ceilings and walls that contain asbestos insulation.
9. Do not knock the plaster or ceiling panels loose when replacing light bulbs or fixtures.
10. Do not saw or drill holes in asbestos materials.
11. Keep activities to a minimum in any areas having damaged materials that may contain asbestos.
12. Have analysis and corrective-type work performed by licensed asbestos professionals.
13. Do not dust, sweep, or vacuum debris that may contain asbestos. These actions will disturb tiny asbestos fibers and may release them into the air.
14. Change shoes before going back upstairs from the basement if there are damaged asbestos materials present in the basement.
15. Use a wet mop or wet cloth when cleaning areas that may contain asbestos fibers. Dispose of the mop or cloth when done.
16. Take care not to run into or hit the asbestos material with anything.[2]

Insulating Board

Structural insulating board, or insulating board, may have been a misnomer because it was more wallboard than insulating board. Nevertheless, most early wallboard products were used either as insulation or sheathing beneath exterior cladding or as a finish material for secondary spaces, such as attics and basements. The distinguishing characteristic of insulation board is that it combines strength with thermal and sound-deadening properties.[8] Although still available as an exterior sheathing product, it has largely been replaced by plywood, oriented strandboard, and other exterior sheathing products. Interior applications are also a far cry from its popularity experienced in the homebuilding industry during the 1940s and 1950s.

Since the generic term *insulating board* encompasses a wide variety of materials, the historical products discussed in the scope of this book will be limited to those also known as *fiber wallboards* or *interior fiberboard.* Popular manufacturers included Celotex, Insulite Division of M. & O. Paper Company, Homasote, and Upson Companies. Although structural fiberboard is a present-day

"cousin" to these interior products, the gypsum wallboard market appears to have replaced the once-popular use of insulating board.

Product description

Insulating board is made by processing wood, cane, or other vegetable fibers to a pulp and then reassembling the fibers into boards. Although there were a variety of manufacturing processes, the majority of fiberboard was formed by mechanical processing. Typically, sawmill waste or logs were processed into pulp chips and then sized and moved onto the grinder and exposed to steam pressure. Water was then used to soften the fiber bonds of the wood and permit better natural bonding in the consolidation stage. The pulp matter was allowed to flow in a current of water onto a screen, where heavy pressure was applied to remove excess water and form pulp sheets. The sheets were then compressed between platens with a uniform force generated by hydraulic rams. Platens contained either steam or hot water, and they provided plain, smooth surfaces against which the fiberboard was molded. Pressure reduced the mass of wood fibers to a stiff, strong, dense board of interlocked fibers. The last step included drying, trimming, and fabricating to produce special finishes, colors, beveling, kerfing, laminating, and packaging.

The greatest changes in the manufacturing process of insulation board related to the speed with which boards could be produced. In 1910, insulation boards $^1/_2$" thick needed 36 hours to dry; by 1947, the drying process had been reduced to 50 minutes.

According to a 1947 text on insulation products, the principal insulating board interior products were referred to as building board, tileboard (panels), and planks. Building board products were 4 ft in width and varied in length from 6 to 12 ft. Thicknesses were $^1/_2$ or 1". Tileboard was manufactured from the same basic stock as building board but in much smaller sizes. Insulating board planks were long, narrow units produced in several widths ranging from 8 to 16" and lengths up to 12 ft.

Low-density boards were generally of greater thickness and also used for thermal and sound insulating purposes. Products such as Celotex's building board were used as exterior finishes or as sheathing under roofing materials or wall veneers of brick, siding, wood shingles, or stucco. In 1937, Celotex introduced Cemesto, a fire-resistant insulation board surfaced on one or both sides with asbestos cement, which was used in low-cost housing,

service stations, and industrial drying plants, as well as for partitions in office and commercial buildings.

The post-World War II construction industry required mass production of insulation boards to meet American and international demand for this material. In turn, this encouraged continued research and development of rapid production and finishing techniques, including application of paints, lacquer, plastics, and metals to make boards better suited for interior and exterior finishing of houses.

Installation/details

Contractors generally applied insulation boards to the studs in any frame construction on 12 or 16" centers. Then 2 × 4 headers were inserted flush between the wood studs to provide a nailing surface for panel edges. Nails typically were spaced 3" apart and not less than $^{3}/_{8}$" from the panel edge. Wood battens often were used to cover the nails at the board edges unless finishing nails or brads were used inconspicuously. Building boards without a factory finish were stained or painted. Insulating board lath also was used when a plaster coat was to be applied as the interior finish.

Insulation board could be installed directly beneath the roofing material or between the structural framing members of the attic floor or both. When used with flat roofs, insulation board was installed over the roof deck and under the roofing; however, in some instances it was installed in the ceiling. When insulation board was used for sound conditioning, a suspended ceiling type of construction was recommended.

Urea Formaldehyde Foam Insulation

Formaldehyde is a naturally occurring substance that is found not only in forests but also as a necessary metabolite in our body cells. Commercially, it is a chemical used widely by industry to manufacture building materials and numerous household products. For example, formaldehyde is released into the air by burning wood, running kerosene space heaters and unvented fuel-burning appliances such as gas stoves, automobile exhaust, and cigarette smoke. Formaldehyde also can off-gas from some building materials when it is used in the production process. These include the glue or adhesive in pressed-wood products (particleboard, hardwood plywood, and fiberboard); preservatives in some paints, coatings, and cos-

metics; and the coating that provides permanent press-quality to fabrics and draperies.[9]

High levels of formaldehyde can be an irritant or even a health concern as well. When formaldehyde gas is present in the air at levels above 0.1 ppm, it can cause watery eyes; burning sensations in the eyes, nose, and throat; nausea; coughing; chest tightness; wheezing; skin rashes; and allergic reactions. It also has been observed to cause cancer in scientific studies using laboratory animals and may cause cancer in humans. Studies indicate that any risk of causing cancer is believed to be small at the level at which humans typically are exposed.[10]

Urea formaldehyde foam insulation (UFFI) is a low-density foam prepared at the construction site. It is produced from a mixture of urea formaldehyde resin, an acidic foaming agent solution, and a propellant, usually compressed air. This highly expandable foam-in-place insulation is machine-mixed and pumped through a tube, where it expands to fill a cavity. Until it hardens, it looks and feels like shaving cream. It is usually white or cream colored, although it may be tinted blue. After curing, UFFI looks and feels like dried-up shaving cream, resembling a crumbly structure with a powdery residue. A positive identification can only be made through laboratory testing.

This method of onsite preparation is potentially dangerous because the chemicals are not always combined in the right proportions. In many homes the foam ingredients were improperly mixed, which resulted in excessive formaldehyde gas being released in the house. If too much formaldehyde was used, gas would seep into the home. Some formaldehyde gas also is released during the onsite mixing and curing, which mandates adequate ventilation for the installer. Although formaldehyde is colorless, it has a very strong odor, which generally can be detected at concentrations above 1 ppm. It is this by-product of the curing of the foam that has become a controversial issue.

History

UFFI was first used in Europe but quickly became popular in Canada in the 1970s. The insulation was used most extensively from 1975 to 1978, during the period of the Canadian Home Insulation Program (CHIP), when financial incentives were offered by the government to upgrade home insulation levels. Although more than 100,000 Canadian homes were insulated with UFFI during this

time, health complaints started from the occupants of UFFI-insulated homes around 1978.[11] Although the Canadian Mortgage and Housing Corporation (CMHC) gave UFFI preliminary acceptance, provided that certain criteria were met, in 1977, it was found in 1979 that formaldehyde caused cancer in laboratory rats. UFFI subsequently was banned across Canada on December 17, 1980.[11] On June 15, 1981, a government removal assistance program for homeowners was announced that ran until September 1986.

Similar action was taken in the United States. By 1979, the Consumer Product Safety Commission (CPSC) had received several hundred complaints, the majority from Massachusetts homeowners. (It is believed that about 10,000 homes in Massachusetts also were insulated with UFFI.[12]) In February 1982, the CPSC ordered a ban on all sales of UFFI for homes and schools. The CPSC ruled that because formaldehyde gas often is released from the foam after installation, UFFI presents an "unreasonable health risk." In April 1983, however, a federal appellate court struck down this ban. The court ruled that there was not sufficient scientific evidence to justify the ban. Litigation in Canada yielded similar results. After the longest and most expensive civil case ever held in Canada, lasting 8 years and concluded in the Quebec Superior Court, not only was there no basis for a settlement found, but the plaintiffs also were obliged to pay for most of the costs.[13]

In 1985, Massachusetts enacted legislation that required sellers to disclose if UFFI had ever been installed at a property. Still in effect today, the seller has to provide the lending institution with a form disclosing any knowledge of the insulation's presence.[14]

Since the sale of urea formaldehyde foam insulation has largely stopped, the CPSC has modified the warnings against UFFI. The CPSC still believes that the evidence shows that risks are associated with UFFI; CPSC officials now advise consumers to leave insulation alone if they have not experienced any health problems.[15] In a 1990 technical document, the CPSC stated that formaldehyde released from UFFI decreases rapidly after the first few months and reaches background levels in a few years. Therefore, urea-formaldehyde foam insulation installed 5 to 10 years ago is unlikely to still release formaldehyde.[10]

History now shows that even though the U.S. Court of Appeals struck down the law because there was no substantial evidence clearly linking UFFI to health complaints, the marketability of UFFI already had been destroyed.[13] Even today, in many states, real estate agents must inform prospective buyers if a house con-

tains UFFI. Whether it is a problem in a particular house or not, it is going to be viewed as a liability.[16] UFFI is still used in Europe, where it was never banned and is considered by some as one of the better retrofit insulations.

Product identification

As mentioned earlier, UFFI is usually white, cream colored, or has a bluish tint. Resembling dried-up shaving cream, it has a crumbly structure and a powdery residue. If UFFI is suspected in a dwelling, more extensive testing should be undertaken by an environmental specialist. If the gases are below the prescribed levels of 0.1 ppm, no further remedial action is necessary. Formaldehyde gas levels typically decline rapidly to below this level after the first year. Since UFFI generally was installed years ago, any vapors from the insulation would be negligible.

Installation

Many of the problems eventually caused by UFFI were due to faulty installation. This was due in large part to the fact that the installed product could not effectively be standardized because it was prepared on site. Even though the foam's ingredients may have been of the highest quality, the composition of the installed material was largely dependent on the skill of the installer.

UFFI was installed by using a pumpset and hoses with a mixing gun to mix the foaming agent and the resin. Installed under air pressure up to 100 lb/in^2, UFFI was injected through $^1/_2$ to 2" holes in mortar joints, gypsum wallboard, wood siding, aluminum siding, concrete blocks, etc. UFFI was particularly suitable for use in cavities of existing buildings because it foamed to full dimension before injection into the cavity. The danger of expanding foam thereby was eliminated. Shrinkage of UFFI was common, usually between 1 and 3 percent. Canadian sources state that almost all types of construction had UFFI installed during the 1970s. UFFI was used in attics, common walls of row houses or semidetached homes, office walls, apartment buildings, condominiums, and garage ceilings where rooms are over garages. Applications also included sound insulation as well as air sealant in commercial and industrial structures.[17]

Once again, UFFI insulation should not be confused with other foam insulations that are often installed by homeowners as a sealant around windows, doors, and foundation sills. These foams,

usually urethane from aerosol cans, harden to tough, plastic materials, whereas UFFI sets to a friable material that turns to dust when touched.

Health considerations

Formaldehyde is currently considered by OSHA and the National Institute for Occupational Safety and Health (NIOSH) to be a category 1 potential occupational carcinogen, which means that formaldehyde potentially may cause cancer in humans. No federal standard has been set for formaldehyde; however, OSHA now regulates formaldehyde as a carcinogen. OSHA has adopted a permissible exposure level (PEL) of 0.75 ppm and an action level of 0.5 ppm. OSHA also requires labeling informing exposed workers about the presence of formaldehyde in products entering workplaces that can cause levels to exceed 0.1 ppm. Some states have established a standard of 0.4 ppm in their codes for residences; others have established much lower recommendations (e.g., the California guideline is 0.05 ppm). Based on current information, it is advisable to mitigate formaldehyde that is present at levels higher than 0.1 ppm.[18]

Formaldehyde is normally present at low levels, usually less than 0.03 ppm, in both outdoor and indoor air. (This number will vary because the outdoor air in rural areas has lower concentrations, whereas urban areas have higher concentrations.) By comparison, typical levels in the smoking section of a cafeteria are 0.16 ppm.[13] Products such as carpets or gypsum board do not contain significant amounts of formaldehyde when new, but they may trap formaldehyde emitted from other sources and later release the formaldehyde into the indoor air when the temperature and humidity change.

Residences or offices that contain products that release formaldehyde to the air can have formaldehyde levels of greater than 0.03 ppm. Products that may add formaldehyde to the air include particleboard used as flooring underlayment, shelving, furniture, and cabinets; MDF in cabinets and furniture; hardwood plywood wall panels; and urea-formaldehyde foam used as insulation. As formaldehyde levels increase, illness or discomfort is more likely to occur and may be more serious.[10]

A number of studies have been done examining the health effects of UFFI. In a study in Britain, people who worked in environments with high formaldehyde levels, such as morticians and

laboratory technicians, were studied for possible health effects. These subjects were found to have a less-than-average number of respiratory diseases and actually lived slightly longer, on average. Studies using a random sampling of UFFI and non-UFFI homes, done before the ban, showed no impact of UFFI on health. However, studies done after the ban showed increased reporting of symptoms, even for such things as constipation and deafness, which have no biologic basis.[13]

As mentioned earlier, formaldehyde emissions from building materials decrease as the materials age, particularly over the first 2 or 3 years. Older urea-formaldehyde building materials most probably will not be a significant source of formaldehyde emissions. If the presence of formaldehyde is suspected, a qualified building inspector should be hired to examine the home for the presence of formaldehyde-emitting materials. In addition, home monitoring kits are currently available for testing formaldehyde levels in the home. Be sure that the testing device will monitor for a minimum of 24 hours to ensure that the sampling period is truly representative.[18] Inexpensive passive samplers, which usually run for several days, and detector tubes also have been developed, whereas the more accurate method of collecting formaldehyde is by impingers. Technically known as the *chromatropic acid test,* it usually takes about 90 minutes. Testing should be performed when the relative humidity is over 50 percent and the temperature is above 70°F.[19]

Conclusion

UFFI has been referred to as the most thoroughly investigated and most innocuous building product in Canada. Whether this is true or not, it has certainly gained notoriety for all the wrong reasons. Its virtual elimination from the marketplace also may prove to have been for "the wrong reason"; however, when it comes to a question of personal health, few homeowners are willing, or should be forced, to take unnecessary risks.

Appendix

For further information on asbestos and UFFI, contact

U.S. Consumer Product Safety Commission
Washington, DC 20207
800-638-2772
http://www.cpsc.gov

The regional offices of the EPA are perhaps the best sources of additional information about environmental hazards in specific states and local areas. Each EPA regional office has information on states and areas within a single geographic area.

U.S. Environmental Protection Agency
Public Information Center
401 M Street, SW
Washington, DC 20460
202-475-7751

EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont)
John F. Kennedy Federal Building
Room 2203
Boston, MA 02203
617-565-3715

EPA Region 2 (New Jersey, New York, Puerto Rico, and the Virgin Islands)
26 Federal Plaza
New York, NY 10278
212-264-2515

EPA Region 3 (Delaware, Maryland, Pennsylvania, Virginia, Washington, D.C., and West Virginia)
841 Chestnut Street
Philadelphia, PA 19107
800-438-2474

EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee)
345 Courtland Street, NE
Atlanta, GA 30365
800-282-0239 in Georgia
800-241-1754 in other Region 4 states

EPA Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin)
230 South Dearborn Street
Chicago, IL 60604
800-572-2515 in Illinois
800-621-8431 in other Region 5 states

EPA Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas)
1445 Ross Avenue
Suite 1200
Dallas, TX 75202
214-655-2200

EPA Region 7 (Iowa, Kansas, Missouri, and Nebraska)
726 Minnesota Avenue
Kansas City, KS 66101
913-236-2803

EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming)
999 18th Street
Suite 500
Denver, CO 80202
800-759-4372

EPA Region 9 (Arizona, California, Hawaii, and Nevada)
215 Fremont Street
San Francisco, CA 94105
415-974-8076

EPA Region 10 (Alaska, Idaho, Oregon, and Washington)
1200 Sixth Avenue
Seattle, WA 98101
206-442-5810

J. May Home Inspections, Inc.
1522 Cambridge St
Cambridge MA 02139
617-354-0152
Fax: 617-354-0749
E-mail: *jmhi@shell.cybercom.net*

NCI Public Inquiries Office
Cancer Information Service
Building, 31, Room 10A03
31 Center Drive, MSC 2580
Bethesda, MD 20892-2580
301-435-3848

Laboratory Accreditation Administration
NIST
Gaithersburg, MD 20899
301-975-4016

Restoration Environmental Contractors (REC)
Don Bremner
Vice President of Operations and Project Manager
Box 746
10 Stalwart Industrial Drive, Unit 5
Gormley, Ontario, Canada
L0H 1G0
800-894-4924
http://www.environmentalhazards.com/contact/index.htm

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