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Standard Practice for Maintenance, Renovation, and Repair of Installed Asbestos Cement Products[1]

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ε[1] NOTE—Keywords were added editorially in January 2020.

1. Scope

1.1 This practice describes work practices for asbestos-cement products when maintenance, renovation, and repair are required. This includes common tasks such as drilling and cutting holes in roofing, siding, pipes, etc. that can result in exposure to asbestos fibers if not done carefully. These work practices are supplemented and facilitated by the regulatory, contractual, training, and supervisory provisions of this practice.

1.2 Materials covered include those installed in or on buildings and facilities and those used in external infrastructure such as water, wastewater, and electrical distribution systems. Also included is pavement made from asbestos-cement manufacturing waste.

1.3 The work practices described herein are intended for use only with asbestos-cement products already installed in buildings, facilities, and external infrastructure. They are not intended for use in construction or renovation involving the installation of new asbestos-cement products.

1.4 The work practices are primarily intended to be used in situations where small amounts of asbestos-cement products must be removed or disturbed in order to perform maintenance, renovation, or repair necessary for operation of the building, facility, or infrastructure.

1.5 The work practices described herein are also applicable for use where the primary objective is the removal of asbestos-cement products from the building or other location, particularly the use of wet methods and other means of dust and fiber control.

1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 **Warning—**Asbestos fibers are acknowledged carcinogens. Breathing asbestos fibers can result in disease of the lungs including asbestosis, lung cancer, and mesothelioma. Precautions in this practice should be taken to avoid creating and breathing airborne asbestos particles from materials known or suspected to contain asbestos. Comply with all applicable regulatory requirements addressing asbestos.

1.8 *This practice does not address safety hazards associated with working on asbestos-cement products such as falling through roof panels or trench cave-ins. The use of power tools presents possible electrical hazards, particularly in wet environments. These and other safety hazards must be considered and controlled in compliance with the employer's policies and applicable regulations.*

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.10 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E1368 Practice for Visual Inspection of Asbestos Abatement Projects

E2356 Practice for Comprehensive Building Asbestos Surveys

[1] This practice is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.07 on Sampling, Analysis, Management of Asbestos, and Other Microscopic Particles.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

2.2 *Other Standards:*
Guidance Manual Asbestos Operations and Maintenance Work Practices[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *amended water, n*—water to which a surfactant has been added to reduce surface tension.

3.1.2 *asbestos, n*—the asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite (amosite), anthophyllite, and actinolite-tremolite.

3.1.3 *asbestos-cement products, n*—materials containing asbestos fiber added during the manufacturing process to cement and other binders or fillers, including pavement made from waste material produced by this manufacturing process.

3.1.4 *asbestos-containing materials, n*—material containing more than one percent asbestos.

3.1.5 *dust and debris, n*—visible particles, fragments, or chunks of material, large enough to have settled in the work area by virtue of their weight, that are presumed to have originated from asbestos-containing material.

3.1.6 *friable material, n*—material easily crumbled or powdered by moderate (hand) pressure; also weakly-bound and low-density materials.

3.1.7 *non-friable material, n*—material not easily crumbled or powdered by moderate (hand) pressure; also strongly-bound and high-density materials.

3.1.8 *thickened substance, n*—a liquid with sufficient density and viscosity to capture dust and debris released from a material during one of the operations described in Section 7.

4. Summary of Practice

4.1 This practice describes the following aspects of maintenance, renovation, and repair operations involving installed asbestos-cement products:

4.1.1 The characteristics of asbestos-cement products commonly found in buildings, facilities, and external infrastructure such as utilities.

4.1.2 Maintenance, renovation, and repair operations that can result in the release of airborne asbestos fibers and the creation of asbestos-containing dust and debris.

4.1.3 Methods for controlling the release of airborne asbestos fibers and minimizing the creation of asbestos-containing dust and debris.

4.1.4 Methods of determining and minimizing worker and community exposure to airborne asbestos fibers from these materials and operations.

4.2 This practice accepts the premise that removal of asbestos-cement products is always the preferred approach because it eliminates the potential for exposure to asbestos fibers, but also acknowledges that removal is not always feasible or the most advantageous course of action. In situations where asbestos-cement products cannot be removed and replaced with asbestos-free materials, this practice provides techniques for maintenance, renovation, and repair operations that are most protective of worker and community health.

4.3 While the provisions of this practice can apply to abatement projects whose purpose is removal of the asbestos-cement products, such work may involve the handling of large, heavy pieces of material with mechanized equipment that is not discussed in this practice.

4.4 If the work can be done without disturbing any asbestos-cement products, that is the most desirable course of action to reduce the potential for exposure to asbestos fibers. Before commencing any work involving materials that are suspected of containing asbestos, ask if there is reliable information available to confirm the presence or absence of asbestos in the product. (See 8.1.1 and 8.1.2.)

4.5 This practice includes supporting information and general precautions applicable to the materials and work practices covered to enhance their understanding by the user. These sections are intended for users with a sufficient technical background to benefit from the material contained therein, and who are probably in a supervisory, management, or other official capacity within their organization. The appendices contain detailed step-by-step instructions for selected procedures and materials, and it is expected that these instructions will either be provided to workers in writing or explained to them verbally by their supervisors.

4.6 This practice does not require compliance with the regulations of any specific governmental agency, although excerpts and references are included. It is expected that users of this practice will comply with all applicable regulations in their country and other governmental jurisdiction thereof.

5. Significance and Use

5.1 The inhalation of airborne asbestos fibers has been shown to cause asbestosis, lung cancer, and mesothelioma.

5.1.1 The U.S. Environmental Protection Agency reports that "Effects on the lung are a major health concern from asbestos, as chronic (long-term) exposure to asbestos in humans via inhalation can result in a lung disease termed asbestosis. Asbestosis is characterized by shortness of breath and cough and may lead to severe impairment of respiratory function. Cancer is also a major concern from asbestos exposure, as inhalation exposure can cause lung cancer and mesothelioma (a rare cancer of the thin membranes lining the abdominal cavity and surrounding internal organs), and possibly gastrointestinal cancers in humans. EPA has classified asbestos as a Group A, known human carcinogen" (1).[4]

5.1.2 The World Health Organization states: "Exposure to asbestos occurs through inhalation of fibres primarily from contaminated air in the working environment, as well as from ambient air in the vicinity of point sources, or indoor air in housing and buildings containing friable asbestos materials. The highest levels of exposure occur during repackaging of

[3] Available from National Institute of Building Sciences (NIBS), 1090 Vermont Avenue, NW, Suite 700, Washington DC 20005-4905, https://www.nibs.org.

[4] The boldface numbers in parentheses refer to the list of references at the end of this standard.

asbestos containers, mixing with other raw materials and dry cutting of asbestos-containing products with abrasive tools" (2).

5.1.3 The World Bank states: "Health hazards from breathing asbestos dust include asbestosis, a lung scarring disease, and various forms of cancer (including lung cancer and mesothelioma of the pleura and peritoneum). These diseases usually arise decades after the onset of asbestos exposure. Mesothelioma, a signal tumor for asbestos exposure, occurs among workers' family members from dust on the workers' clothes and among neighbors of asbestos air pollution point sources" (3).

5.2 Extensive litigation has occurred worldwide as a result of the health effects of asbestos over the past century, resulting in considerable economic consequences. The regulatory response to asbestos hazards has resulted in civil sanctions and criminal prosecution of violators.

5.3 Regarding the production and use of asbestos fiber:

5.3.1 The U.S. Geological Survey (USGS) reports: "World consumption was relatively steady between 2003 and 2007, averaging 2.11 million metric tons (Mt). The leading consuming countries in 2007 were, in decreasing order tonnage, China (30 %), India (15 %), Russia (13 %), Kazakhstan and Brazil (5 % each), and Thailand, Uzbekistan, and Ukraine (4 % each). These eight countries accounted for about 80 % of world asbestos consumption in 2007. From 2003 through 2007, apparent consumption declined in most countries. However, there were significant increases in apparent consumption in China, India, and Uzbekistan between 2003 and 2007. In general, world asbestos consumption is likely to decline as more countries institute bans on its use" (4).

5.3.2 The World Health Organization also states: "Bearing in mind that there is no evidence for a threshold for the carcinogenic effect of asbestos and the increased cancer risks have been observed in populations exposed to very low levels, the most efficient way to eliminate asbestos-related diseases is to stop using all types of asbestos. Continued use of asbestos-cement in the construction industry is of particular concern, because the workforce is large, it is difficult to control exposure, and in-place materials have the potential to deteriorate and pose a risk to those carrying out alterations, maintenance, and demolition" (2).

5.3.3 The Chrysotile (formerly Asbestos) Institute reports that: "More than 90 % of the world production of chrysotile is used in the manufacture of chrysotile-cement, in the form of pipes, sheets, and shingles. These products are used in some sixty industrialized and developing countries" (5).

5.4 It follows that the installed base of asbestos-cement products worldwide is enormous and continues to grow. In other words, the problem of exposure to asbestos fibers from working with these materials is substantial and will remain significant for the foreseeable future.

5.5 The significance of this practice is that it provides work practices that protect worker and community health within the resources available in developing as well as industrialized countries. It relies as much as possible on tools, equipment, and supplies that are readily available without recourse to specialty suppliers. The techniques require careful and diligent workmanship but do not require the services of highly-skilled tradesmen.

5.6 This practice is intended to be used not only by construction workers and tradesmen in the performance of their work, but also by building owners and others as the basis for preparing contracts and tenders for activities included in the scope of this practice. It will also provide a foundation for government officials to develop regulations intended to protect worker and community health. Where such regulations already exist, of necessity they take precedence over this practice in event of a conflict.

5.7 The persons who are most at risk of exposure to airborne asbestos fibers are those who perform work on asbestos-cement products during maintenance, renovation, and repair operations. This practice places its primary emphasis on the protection of their health. However, other members of the community—other workers and individuals in a building being renovated, residents of a house undergoing repairs, and unsuspecting bystanders—are at risk to a lesser degree. By minimizing the risk to the worker performing the maintenance, renovation, and repair operations, the potential exposure of others is reduced as well.

5.8 It is expected that employers will comply voluntarily with the provisions of this practice in the interest of protecting worker and community health and reducing their own liability. However, the existence of a regulatory infrastructure for occupational and community health greatly enhances compliance with measures to reduce exposure to asbestos fibers and other toxic materials. In some countries, such a system is highly advanced, but in others it needs to be created or further developed. These efforts can be furthered by referencing this practice in laws and regulations and requiring compliance with its provisions.

5.8.1 Issuance of construction permits can be made contingent on showing evidence of worker training, experience in the use of these procedures, and adequate resources (manpower, equipment, and supplies) to use them properly.

5.8.2 A contractual framework that references this practice and requires use of its procedures ensures the building owner or other party securing construction services under a contract or tender arrangement that the responding offeror has been informed as to the expected level of performance when working with asbestos-cement products.

6. Uses and Characteristics of Asbestos-Cement Products

6.1 In order to apply the methods for controlling the release of airborne asbestos fibers and minimizing the creation of asbestos-containing dust and debris, it is necessary to understand the uses to which asbestos-cement products have been put, their physical characteristics and their composition including asbestos fibers and other constituents.

6.2 All asbestos-cement products are defined and regulated as non-friable asbestos-containing materials—that is, while some of them may be broken into smaller pieces by hand without the use of tools or mechanical equipment, the broken pieces cannot be crumbled into powder by hand pressure alone.

(See 3.1.6 and 3.1.7.) The materials are susceptible to being crushed into powder by the application of mechanically-multiplied force that may range from the use of pliers to the impact of construction equipment, creating dust and debris and releasing asbestos fibers. Asbestos-cement materials are also susceptible to weathering, chemical attack, corrosion and physical damage that may result in degradation of the surface. If any of these events occur the material is treated as friable asbestos-containing material.

6.3 Another common characteristic of all asbestos-cement products is their relative impermeability to water, which reduces the effectiveness of wetting agents that penetrate friable asbestos-containing materials and reduce fiber release when the matrix of the material is disturbed.

6.4 Asbestos-cement products may be installed in combination with other friable and non-friable asbestos-containing materials. For example, asbestos-containing soundproofing may have been sprayed on the underside of an asbestos-cement roof deck or inside walls made of asbestos-cement panels. Work practices for these associated asbestos-containing materials are outside the scope of this practice, but are discussed in Practice E1368 and the ASTM Manual on Asbestos Control (**6**).

6.5 Examples of common asbestos-cement products include the following. This list is by no means exhaustive.

6.5.1 *Roofing Materials*—The afore-mentioned resistance to water penetration resulted in widespread use of asbestos-cement corrugated sheets and flat shingles for roofing applications.

6.5.2 *Siding*—The afore-mentioned resistance to water penetration resulted in widespread use of asbestos-cement corrugated sheets and flat shingles for construction of exterior walls on buildings.

6.5.3 *Flat Panels*—Panels of various thickness and finishes were used inside and outside buildings as architectural materials, tile underlay, electrical and thermal insulation, and in greenhouses.

6.5.4 *Tanks*—Tanks for water and other liquids have been constructed from asbestos-cement panels, fabricated from preformed sections and molded from asbestos-cement.

6.5.5 *Cooling Towers*—Flat and corrugated panels are used for roofs, siding, and louvers on cooling towers, and exhaust vents are made of asbestos-cement.

6.5.6 *Pipe*—Pipe of various sizes is found in facilities and utility infrastructures for conveying water and wastewater in pressure and non-pressure applications, and are primarily located underground. Pressure pipe has been made with crocidolite to improve its strength.

6.5.7 *Ducts*—Thin-walled ducts are used to house electrical and communications cables and to convey heating and cooling air for the conditioning of occupied spaces and other purposes.

6.5.8 *Exhaust Flues*—Exhaust flues from furnaces and boilers are sometimes made with asbestos-cement.

6.5.9 *Pavement*—Powdered waste material containing cement and asbestos fibers that results from the manufacturing of asbestos-cement products has been used as a paving material in residences and communities near the plants.

6.5.10 *Other Products*—Gutters and downspouts, laboratory tabletops, fume hoods, garden and greenhouse fixtures, and furniture, etc.

7. Potentially Hazardous Maintenance, Renovation, and Repair Operations

7.1 All of the operations described below involve disturbing the matrix of the asbestos-cement material, which inherently causes some degree of fiber release and creation of dust and debris. This practice contemplates the use of wet methods as described in Section 8 to control the release of asbestos fibers and the creation of dust and debris.

7.2 *Cutting*—Cutting operations involve a penetration through the material in a straight or curved line or by making a large-diameter hole. An example of the former would be using a knife or saw to make a rectangular hole in a piece of siding for passing an exhaust duct through. A large-diameter hole, such as a tap into a water pipe, is defined as one requiring a hole saw with cutting teeth, as opposed to a drill bit. Thin material may be cut by scoring the surface with a knife, inserting the blade of a chisel in the groove and striking the chisel sharply with a hammer.

7.3 *Drilling*—Drilling operations are done with a twist drill bit to make through holes or blind holes. If a power drill is used it might have an impact action as well as rotary motion. Masonry bits may be used for their resistance to wear.

7.4 *Breaking*—Flat and corrugated sheets and siding may be broken by bending, with the location and precision of the break controlled by scoring the surface and appropriately restraining the material. A section of duct may be removed in a similar manner by using a chisel to break the material where it has been scored with a sharp-pointed knife.

7.5 *Sanding*—Edges or surfaces of materials that have been cut or broken may have to be sanded to obtain the desired quality of finish, or to prepare the surface for bonding to a non-asbestos material.

7.6 *Grinding*—If an asbestos-cement pipe has to be mated with a non-asbestos replacement section, the ends of the pipe may require bevelling or otherwise finishing the mating surface. This may require grinding the end of the pipe.

7.7 *Filing*—Finishing the edges and surfaces of asbestos-cement products remaining in place after maintenance, renovation and repair work may require removal of small amounts of material with a hand file or rasp.

7.8 *Dismantling*—Pieces of material may be removed intact, or as nearly so as possible, by removing the fasteners that hold the material to the substrate or framework (as with a roof or cooling tower), or that hold the pieces together. Instead of fasteners, the pieces may be held on, or together with, an adhesive (which may also contain asbestos).

7.8.1 Removal of the asbestos-cement material may leave an asbestos-containing residue on the substrate. The residue should be removed by Scraping, Sanding, Grinding or Filing, using the control methods in Section 8. Under no circumstances should residue be removed using the Prohibited operations in 7.11.

7.8.2 Pieces of dismantled asbestos-cement products should not be dropped or thrown to the ground, but should be lowered while wet in a controlled manner. Brown has shown that dropping sheets of roofing to the ground results in airborne concentrations of 0.03 to 0.27 fibers/mL, while careful handling and wetting of the sheets reduces the concentrations to ND (non-detected) to 0.07 fibers/mL (**7**).

7.9 *Surface Cleaning*—Surfaces of asbestos-cement products may be coated with substances such as paint or other sealants, or with mold or other organic growth. Removal of these coatings by blasting or scraping can release asbestos fibers from the substrate. Brown suggests that external surfaces of asbestos-cement sheets that have become weathered should not generally be coated because the coating will soon blister and peel due to poor surface adhesion (**8**). Asbestos fibers that adhere to the coating create a contaminated waste stream and disposal problem when the coating comes off the surface. (The health hazards of the coatings and any substances used to remove it are outside the scope of this practice.)

7.10 *Scraping*—Residue may be removed from a surface by scraping with a sharp-edged blade on a hand tool such as a putty knife or chisel, using the control methods in Section 8.

7.11 *Prohibited Operations*—The following operations are not endorsed by this practice because of the high probability of excessive airborne fiber concentrations or the generation of excessive amounts of dust and debris, or both. Some of the operations are prohibited by law or regulation in certain jurisdictions.

7.11.1 *Cutting with High-Speed Power Saws*—According to the UK Health and Safety Executive, use of a circular saw for cutting asbestos-cement sheet has been shown to produce airborne fiber levels as high as 20 fibers/mL and a jig saw as high as 10 fibers/mL (**9**). Use of band saws and powered hacksaws operating at high cutting speeds would be expected to have a similar result. The effectiveness of dust capture devices for these tools and their suitability for many working conditions contemplated by this practice must be confirmed by testing prior to sanctioning their use. The limitations of the dust capture devices should be stated, so people will be aware of them, with a warning that if there is visible dust escaping to the air the equipment should not be used until properly repaired.

7.11.2 *Grinding with High-Speed Abrasive Wheels*—According to Vanherle, this method has been shown to result in high levels of airborne dust when used to mitre edges of corrugated asbestos-cement sheets (**10**).

7.11.3 *Burnishing with High-Speed Wire Brushes and Cleaning with Compressed Air* are also prohibited.

7.11.4 *High Pressure Water Blasting*—This method of cleaning weathered asbestos-cement surfaces can propel asbestos-rich material onto the surrounding properties and their grounds, and also creates a contaminated waste stream and disposal problem.

7.12 *Re-Use and Re-Cycling*—The re-installation of asbestos-cement products that have been removed during maintenance, renovation, and repair operations for other purposes in any building, facility or infrastructure is not endorsed by this practice. The re-cycling of removed materials for the manufacture of new asbestos-cement products is also not endorsed.

7.13 *Excavation*—Excavation for construction related to sub-surface infrastructure may disturb buried asbestos-cement pipes and electrical ducts, rendering them friable, contaminating the worksite, and creating an exposure hazard and disposal problem. Inspection of the worksite to locate these materials is required and, if they are found, the work practices herein must be followed.

8. Dust, Debris, and Fiber Control

8.1 The ultimate goal of the following control methods is to minimize the amount of airborne asbestos fibers that could be inhaled by workers or members of the community. Minimizing the release of asbestos fibers into the air during the operation is a primary objective. A secondary objective is to minimize the amount of dust and debris created and to prevent the re-entrainment of asbestos fibers into the air.

8.1.1 If reliable information is available confirming that asbestos is present in the product, the precautions in this section and Section 9 are mandatory. If information is not available it may be either assumed that the product is asbestos-cement or the product may be submitted for analysis to confirm or refute the presence of asbestos. For example, cellulose-cement sheet products have been increasingly used in several countries since the mid-1980s. If reliable evidence is provided that the material is "asbestos-free," the work practices in this section are not required, but may be useful for general purposes of dust control.

8.1.2 There is no industry wide practice of labeling products to indicate that they contain asbestos, and the absence of such a label should not be taken as evidence that the product is asbestos-free. The presence or absence of asbestos in a material cannot be determined by looking at it with the unaided eye. A sample of the material must be collected and analyzed to determine if it contains asbestos fibers. For suspected asbestos-cement products analysis by Polarized Light Microscopy (**11**) should be sufficient. For sample collection techniques, see Practice E2356, Appendix X1.

8.1.3 If the presence of asbestos in the material is evident or cannot readily be disproved, determine if the work can be done without disturbing any asbestos-cement products. For example, wiring may be routed over a wall instead of through it, eliminating the need to drill a hole through an asbestos-cement panel. Instead of taking a vent pipe through an asbestos-cement roof, bring it out through a wall made of non-asbestos material. It may be possible to abandon asbestos-cement products in place and install a new component or system to perform their function.

8.2 *Wet Methods*—Water and other water-based liquids reduce the amount of airborne fibers released and control the spread of dust and debris. With friable asbestos-containing materials, the liquids penetrate the matrix to some degree. This does not happen with non-friable asbestos-cement products, where the liquid remains on the surface. Nonetheless, wet methods are still effective when used as follows.

8.2.1 *Water (with Surfactant):*

8.2.1.1 Water to which a surfactant has been added is called "amended water" and the surfactant is referred to as a "wetting agent." The surfactant reduces surface tension and allows the water to spread across the surface more readily. It also promotes penetration into friable material and "amended water" will penetrate cracks and pores in non-friable materials, including asbestos-cement products, to some extent.

8.2.1.2 A formulation of one ounce of a surfactant consisting of equal parts polyoxyethylene ester and polyoxyethylene ether mixed with five gallons of water has been used in the asbestos abatement industry as "amended water." Equally effective for the purpose of wetting the surface of asbestos-cement products is any liquid soap that will dissolve in water at room temperature.

8.2.1.3 "Amended water" is usually applied to friable asbestos-containing materials with an airless sprayer to minimize the release of fibers from the surface by the impact of the water droplets. For wetting small areas of asbestos-cement products for maintenance, renovation and repair work, a hand sprayer may be used or the water may be poured on the surface. For outdoor work, it may be more practical to use a disposable spray bottle instead of a wand sprayer, thus avoiding the problem of the nozzle getting plugged from being dropped in the dirt.

8.2.1.4 Control of the water is important because it becomes contaminated with asbestos fibers and debris from the operation. Provisions must be made for collecting the water in a plastic bag or other container, or for removing dirt contaminated by the run-off (see 8.5.2).

8.2.2 *Thickened Substances:*

8.2.2.1 Water by itself will not capture large amounts of dust and debris produced by some operations, particularly if power tools are used, and will evaporate or freeze in some climates. A heavy coating of a water-based substance is more effective, as its mass and viscosity traps dust and debris in addition to wetting the surface. The required thickness of the substance has to be determined through practice, and it is sometimes necessary to add more of the substance after the initial application if dust and debris are seen to be escaping from it.

8.2.2.2 The substance is collected with wet rags or paper towels after the operation is completed and placed in plastic bags for disposal (see 8.5.1). The asbestos-containing dust and debris remains entrained in the substance.

8.2.2.3 Most of these substances are viscous enough to retain their shape and consistency during the operation. For use on a vertical or overhead surface, it may be necessary to contain the substance in a paper, plastic, or thin metal cup. A disadvantage of some substances is their opacity, which obscures one's view of the surface being worked on. Using a clear substance, such as hair gel, overcomes this problem.

8.2.2.4 Thickened substances are particularly effective in containing large, non-respirable pieces of debris such as that generated by cutting with a chisel or breaking by bending ("score and snap"). Controlling the spread of this type of debris reduces the area to be cleaned up afterwards.

8.2.2.5 A thickened substance commonly used for controlling fibers, dust, and debris is shaving cream from a squeeze tube or pressurized can. Thick glue has also been used for this purpose. Any substance with sufficient density and viscosity that is otherwise compatible with the conditions of use (temperature, for example) and does not present a health hazard of its own is acceptable for this purpose.

8.2.2.6 Wet sponges serve a purpose similar to thickening agents for containing fibers, dust, and debris from some maintenance, renovation, and repair operations, in particular drilling holes through certain non-friable materials. The drill bit is driven through the sponge and placed on the mark, then the sponge is held against the surface while the hole is drilled. The sponge is disposed of as contaminated waste. Care must obviously be taken to avoid getting the sponge caught in the rotating drill bit or chuck, and the presence of water in the sponge creates a potential electrical hazard if a power drill is used.

8.2.3 *Liquid Adhesives*—A liquid with adhesive properties will bind the dust and debris into a solid matrix and entrain the fibers when it dries or cures. A wide variety of substances is available for this purpose, including paints, spray adhesives, glues and foams. The adhesive can be wiped from the surface being worked on while still in a liquid state and disposed of (see 8.5.1) or, if the material being worked on is to be disposed of, the contaminated adhesive can remain attached.

8.2.4 *Material Softening Agents*—Asbestos-cement being a highly caustic material, it will react readily with liquids of high acidity. Some common hypochlorite-based liquids such as household cleaners will soften the surface of an asbestos-cement product, making it easier to score, cut or break. It may be necessary to neutralize the excess liquid before disposal, but in the small amounts contemplated for maintenance, renovation and repair work, environmental contamination from disposal is not considered a major concern.

8.2.5 *Wet Wiping:*

8.2.5.1 The basic rule that asbestos-containing materials are never worked on dry applies to wiping the surface of asbestos-cement products. Removal of dust and debris from the surfaces is always done with wet rags, sponges or paper towels. It is not necessary to use "amended water" to wet the towels, although "amended water" sprayed or poured on a surface to be cleaned would spread more readily.

8.2.5.2 A second rule of wet-wiping is to wipe the surface with a paper towel only once and not to go back over it with the same towel, although the towel may be re-folded to expose a clean surface. Wet-wiping is done with the towel flat, not wadded up. If a rag or sponge is used, it is wet in a "clean bucket" and the water squeezed out into a "dirty bucket" after wiping the surface. The towels, rags, and sponges are disposed of after use.

8.3 *HEPA-Filtered Vacuum Cleaners:*

8.3.1 A household vacuum cleaner or a shop vacuum should never be used for work on any asbestos-containing material, including asbestos-cement products, because the bags and filters cannot capture the microscopic asbestos fibers. Use of such devices might contaminate the area worse than if no vacuum at all was used.

8.3.2 A High Efficiency Particulate Air (HEPA) filter is capable of trapping asbestos fibers. Vacuum cleaners with a