



# Standard Practice for Maintenance, Renovation and Repair of Installed Asbestos Cement Products<sup>1</sup>

This standard is issued under the fixed designation E 2394; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 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.

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 described herein are not intended for use where the primary objective is the removal of asbestos-cement products from the building or other location. The work practices are 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 values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *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.*

1.7 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

E 631 Terminology of Building Constructions

E 1368 Practice for Visual Inspection of Asbestos Abatement Projects

### 2.2 Other Standards:

Guidance Manual: Asbestos Operations and Maintenance Work Practices<sup>3</sup>

ISO 7337 Asbestos Reinforced Cement Products—Guidelines for On-site Work Practices<sup>4</sup>

## 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 serpentine (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. Pavement made from waste material produced by this manufacturing process is considered an asbestos-cement product.

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.

<sup>2</sup> 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.

<sup>3</sup> Available from National Institute of Building Sciences (NIBS), 1090 Vermont Avenue, NW, Suite 700, Washington DC 20005-4905.

<sup>4</sup> Available from International Organization for Standardization (ISO), 1 rue de Varembé, Case postale 56, CH-1211, Geneva 20, Switzerland.

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

3.1.7 *non-friable material, n*—material not easily crumbled or powdered by moderate (hand) pressure. Alternate terms are 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 standard 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 standard 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 standard practice provides techniques for maintenance, renovation and repair operations that are most protective of worker and community health.

4.3 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.

4.4 This standard 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.

4.5 This standard practice does not reference the regulations of any governmental agency, although excerpts therefrom may be included. It is expected that users of this standard 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. 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)<sup>5</sup>. The World Health Organization states: “Exposure to chrysotile asbestos poses increased risks for asbestosis, lung cancer and mesothelioma in a dose-dependent manner. No threshold has been identified for carcinogenic risks” (2).

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, the U.S. Geological Survey (USGS) reports that “Production declined from 5.09 million metric tons (Mt) in 1975 to about 1.93 Mt in 1999. Several Western European countries have banned some or all asbestos products.” The USGS report continues, however: “In other regions of the world, there is a continued demand for inexpensive, durable construction materials. Consequently, markets remain strong for asbestos-cement (A/C) products, such as A/C panels for construction of buildings and A/C pipe for water-supply lines” (3). The World Health Organization also states “Construction materials are of particular concern for several reasons. The construction industry workforce is large and measures to control asbestos are difficult to institute” (2).

5.4 The Asbestos Institute reports that “Chrysotile cement represents between 85 % and 90 % of the market for chrysotile asbestos...” and that 23 million metric tons of asbestos was used in Europe for post-war reconstruction (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 standard 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.

<sup>5</sup> The boldface numbers in parentheses refer to the list of references at the end of this standard.

5.6 This standard 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 standard 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 standard 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 standard 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 standard 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 standard 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 standard 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 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 a pile-driver, in which case the dust and debris created is treated as friable asbestos-containing material. These materials are also susceptible to

weathering, chemical attack, corrosion and physical damage that may result in degradation of the surface. The asbestos-containing dust and debris that is released must be 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 standard practice, but are discussed in Standard Practice E 1368 and the ASTM Manual on Asbestos Control (5).

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 pre-formed 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.

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 standard 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 (6).

**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 (7). (The health hazards of the coatings and any substances used to remove it are outside the scope of this standard 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 standard practice because of the high probability of excessive airborne fiber concentrations and/or the generation of excessive amounts of dust and debris. 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 U K 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 (8). 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 standard 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 (9).

**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.

**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 standard practice. The re-cycling of removed materials for the manufacture of new asbestos-cement products is also not endorsed.

## 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.

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, Styrofoam 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 HEPA-rated final filter are available in hand-held and backpack models with sufficient suction and capacity for asbestos-cement products maintenance, renovation and repair work.

8.3.3 HEPA-filtered vacuums are commonly used for asbestos Operations and Maintenance work and for abatement work in conjunction with wet-wiping for final cleaning of surfaces, with and without brushes or other devices attached to the nozzle. Prior to starting a maintenance, renovation and repair operation, a HEPA-filtered vacuum could be used to remove visible dust from an asbestos-cement surface that has been deteriorated by weathering (as with roofing and siding) or debris from physical damage. To reduce the frequency of bag and filter changes required, and to minimize the pressure drop (and airflow) caused by accumulation of dust on the HEPA filter, the device should be used sparingly and only after other methods of physically collecting dust and debris have been used as much as possible.

8.3.4 There are disadvantages to using HEPA-filtered vacuums, and they should be used only if wet methods (see 8.2) are not sufficient to pick up dust and debris and clean surfaces. Even if a HEPA-filtered vacuum is used, large pieces of asbestos-cement debris should be wetted and picked up by hand, as the suction of the vacuum may not be sufficient to capture the pieces and transport them through the hose to the collection bag.

8.3.4.1 The worker must be trained in the use of the HEPA-filtered vacuum, including cleaning and maintenance of

the unit. This includes changing the bag and filters, storing the hose and ensuring that the latches and connections are tight to prevent leaks.

8.3.4.2 Once the HEPA-filtered vacuum is used to pick up asbestos dust and debris it becomes a contaminated piece of equipment that must be properly accounted for. Opening the unit to change the bag or filter, or for other maintenance, must be done by a worker wearing a respirator and protective clothing in a location where the surrounding area will not be contaminated. The used bags and filters must be disposed of as contaminated waste.

8.4 *Tools and Equipment*—Tools and equipment used for maintenance, renovation and repair work on asbestos-cement products must be suitable for performing the operations in Section 7 on a material that is by its very nature hard and abrasive. In addition, the tools and equipment must not release excessive asbestos fibers or dust and debris. The use of hand tools is preferred whenever possible and power tools, when required, must be operated at low speed.

#### 8.4.1 *Hand Tools:*

8.4.1.1 A description of numerous hand tools for asbestos-cement work is contained in AIA RCP2A, Catalogue of Tools for Working with Asbestos-cement Products on Site (10). The devices shown in the section of RCP2A on hand-operated tools are manually-powered and are no different from similar tools available from numerous commercial suppliers. Except for a set of parallel shears that appears intended for cutting and punching holes during installation of large sheets, all of the tools shown in this section of RCP2A seem applicable to work covered by this standard practice.

8.4.1.2 The American Water Works Association Work Practices for Asbestos-Cement Pipe (11) describes tools for cutting and trimming, including hand tools resembling those in the section of RCP2A on low-speed dry-operating tools. Such tools would be used for removing small sections of damaged asbestos-cement pipe, insertion of non-asbestos fitting in a straight run of asbestos-cement pipe, or making holes in asbestos-cement pipe for any purpose. However, the tools should be used with wet methods in accordance with Section 8.

8.4.1.3 The Underground Contractors Association of Illinois (UCA) Best Practices for Removing Asbestos-Cement Pipe (12) describes a “wheel cutter” for removing underground non-pressure pipe. While no illustration is provided, the description matches three devices shown in the section of RCP2A on low-speed dry-operating tools. A modified version of the UCA procedure is provided as Appendix X2 to this standard practice, again requiring the use of wet methods.

#### 8.4.2 *Low-speed Power Tools:*

8.4.2.1 Power tools can be electrically or pneumatically driven, the former requiring batteries, line power or a generator and the latter requiring an air pressure supply or a powered compressor. Because wet methods will be used, electric power tools must be on a Ground Fault Circuit Interruption device to prevent electric shock to the workers. Tools powered by rechargeable battery packs are preferable for this reason.

8.4.2.2 RCP 2A show power tools with and without dust collection attachments that are all portable with the exception of table-mounted cutting units. Some of the tools, such as the