Asbestos and Asbestos-Cement Roofing and Siding

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Asbestos is a fibrous silicate mineral that has a chemical resistance—especially to alkalis—as well as mechanical strength due to the fibers' high length to diameter ratio, flexibility, good friction and wear characteristics, as well as fire resistance. Asbestos was used in building products as early as 1876, and its popularity in the building industry stemmed from its inexpensive processing and its special chemical and physical properties, which made it virtually indestructible; however, asbestos tended to be too coarse and abrasive to be useful by itself, and began to be used in composite mixtures beginning in the 1880s. Many experiments with asbestos fibers resulted in a variety of mixtures; however, the combination of asbestos and cement (typically Portland) proved most useful for the building industry.

Asbestos and cement were first successfully combined by Ludwig Hatschek, an Austrian engineer, to create an innovative new building material. The asbestos fibers were used to add strength to the concrete, and bound the two materials into a hard mass, resulting in a durable material. Hatschek first patented asbestos-cement in Austria in 1901 and named the product "Eternit" (meaning everlasting). His product used 90% cement and 10% asbestos fibers, which were mixed with water and were originally run through a cardboard machine. His invention made it possible to manufacture pre-formed asbestos-cement products. Hatschek brought his patented process to the United States in 1907, where his patent was reissued.

Asbestos-cement building products had many desirable material characteristics, such as its light weight, impermeability to water, durability, resistant to rot, termites, soiling, corrosion, warping, and fire, and it was easy to clean and maintain. It also possessed low thermal conductivity, making it a good electrical insulator. These highly desirable material characteristics sparked growth in the manufacturing of many different forms and styles to suit different needs. Between 1907 and 1940, a large number of patents for asbestos-cement products were issued in the United States, including for roofing and siding products. The proportion of cement to asbestos fibers varied over a range of ten to seventy-five percent by weight, depending on the desired characteristics.

H. W. Johns Manufacturing Company (later Johns-Manville) became one of the leaders in the development of cement products containing asbestos. The company initially marketed asbestos-cement coating as an agent for repairing roofs, and guaranteed it to stop all leaks when properly applied, making roofs serviceable for many years. It was also used in joints around chimneys, dormer windows, skylights, scuppers, shingles, and nail holes on roofs. Asbestos-cement was also used for protecting beams, posts, walls, and ceilings, especially in hotels and restaurant kitchens, or in places where it was desired to prevent the transmission of heat to adjoining rooms, such as boiler rooms.

With the refinement of the asbestos and cement mixture, as well as the forming and curing procedures, a wide range of asbestos-cement products became available, including water pipes, simulated ceramic bathroom tiles, facings of acoustical materials, electrical switchboard panels, laboratory tabletops, and electrical conduits. Synthetic roof and wall shingles, corrugated wall and roof panels, flat millboard, and decorative wall and ceiling moldings also became available.

Other early manufacturers included the Keasbey & Mattison Company, the Baltimore Roofing & Asbestos Manufacturing Company, Inc., the Philip Carey Manufacturing Company, and the Flintkote Company, producing a wide range of asbestos-cement products throughout much of the first half of the century. The principal manufactured products used in building construction were siding shingles, flat sheets, roofing shingles, and corrugated sheets. These asbestos-cement products lent themselves to rapid construction techniques and were particularly useful for housing and industrial buildings.

The successful early manufacturers of asbestos-cement shingles in the U.S. included Eternit, Johns-Manville, and the Asbestos Shingle Slate and Sheathing Company. Asbestos-cement shingles were lightweight, economical and fireproof, and the manufacturers promoted their shingles as substitutes for traditional roofing materials such as slate, wood, and clay. By the 1920s, large asbestos-cement roof shingles were available in a natural gray color, as well as red and blue-black colors that resembled tile and slate. There were many styles and sizes of asbestos-cement shingles available. The two primary designs produced were French method (hexagonal or diamond shape) and Dutch Lap (similar to wood shingles). The French method was particularly popular because it required minimal overlap. Other shapes included American, Poilite Straight Cover Slating (with square or chamfered corners), Scalloped (with three or five scales to a tile), Bell's Pan (an ogee shape or a skewed pan tile), and Endurol (a wave pan tile). Asbestos-cement roofing tiles shaped to imitate clay tiles found on French and Spanish-style buildings were also produced.

Asbestos-cement shingles were marketed not only for new construction, but also for roofing over existing roofs. Installing asbestos-cement shingles, whether on roofs or walls, was relatively easy, and the shingles could be punched, filed, or trimmed to size in the field by roofing contractors. Most shingles, typically 12 by 24 inches, were easy to handle and came drilled for nailing. Often, they were applied over existing materials using furring strips. Each shingle was held by two nails, with the addition of a storm nail at the apex of the hexagonal (French method) shingles. The shingles were much lighter than tile or slate, and weighed only a little more than wooden shingles, which allowed for a more economical roof substructure. The manufacturers claimed that when asbestos-cement roofing shingles were properly manufactured and installed, they were so durable that the roof would commonly outlast the functional lifespan of the building. As early as the 1920s, the National Board of Fire Underwriters, with its initiative to eliminate the fire hazards of wood shingles, promoted the use of asbestos-cement roofing.

Siding made of asbestos-cement, also known as transite, was another popular building material. Transite originated as a brand name created by Johns-Manville in 1929 for their line of asbestos-cement products, including boards and pipes. Eventually it became a generic term for other companies' similar asbestos-cement products, and later an even more generic term for the hard, fireproof composite material used as wall sheathing—asbestos-cement siding.

The surfaces of siding produced in the 1920s and early 1930s were smooth, and came in tones like gray-green, gray-pink, and white. Individual square, rectangular, and hexagonal wall shingles dominated the market, although long planks resembling lap siding were offered by the late 1930s. Textured finishes, such as grooved, wood-grained, or smooth were available beginning in 1937. A hydraulic pressing process enabled the shingles to be given a texture, which was pressed into the large asbestos-cement sheets, then cut to the profile of the design, such as Tapertex (flat horizontal lines), Thatched, or Waveline. Sears, Roebuck and Co. was one of the first suppliers to introduce asbestos-cement siding with a wavy bottom edge. Like asbestos-cement roofing, the siding shingles were available in sizes of twelve by twenty-four inches, and were predrilled for ease of installation, with two to three nails on the bottom of each shingle to secure the panels to the wall sheathing. Installation was executed from the bottom up—as one row of shingles was nailed, the bottom lip would secure the top of the shingle from the row below—which made replacing the shingles much easier than wood or slate shingles, which were secured at the top of each shingle.

Speckled patterns were produced in the 1940s by pressing granules of pigment into the surface. Manufacturers began offering deeper hues of brown, green, and coral during the booming post-World War II housing market, and by 1950 approximately one billion square feet of asbestos-cement products had been produced for use in the building industry. The idea of an "attractive home safeguarded with modern asbestos siding, fireproof, rot proof, termite proof" was embraced by many homeowners during this era. When a color change became desirable after installation, homeowners were encouraged to paint the asbestos-cement products.

By the time the Environmental Protection Agency (EPA) was established in 1970, the commercial world of asbestos-cement products had expanded into many markets. The annual use of asbestos-cement products in the United States continued to climb, reaching the peak of its popularity, until the EPA implemented the initial ban on asbestos in 1973. Some asbestos fibers, when inhaled, can constitute a health hazard leading to asbestosis, a form of lung cancer. These health risks led to the establishment of strict environmental regulations on working with asbestos. **The health risks were shown to be the greatest during mining and production processes, but minimal during installation and use of asbestos-cement products.**

After the ban on asbestos, fiber-cement products were developed as an alternative material. Fiber-cement siding shingles and roofing shingles available today, look like, perform similarly to, and are installed the same way as asbestos-cement shingles; however, the products produced today are free of asbestos. Fiber-cement products are reinforced with a variety of fibers, including fiberglass, and sometimes use a different aggregate (perlite) to replace the asbestos. The original U. S. producer of asbestos-cement siding, and later fiber-cement siding, was Supradur Manufacturing Corporation. The company was liquidated in bankruptcy proceedings in 1995, and was sold to GAF Premium Products Corporation. Primarily a producer of roofing products, GAF continues to produce and distribute fiber-cement siding, trademarked as *WeatherSide*, which is a perfectly-matching replacement for older asbestos-cement or fiber cement products originally produced by Supradur. Available in the three standard patterns, all

wood-grain surface patterns, with three different bottom-edge designs: straight, wavy, and thatched.

According to the GAF company's website, *WeatherSide* fiber cement siding contains NO asbestos, and it is virtually identical in size and shape to “millions of old siding shingles installed over the last 50 years” and it meets or exceeds UL approved non-combustible testing (ASTM E136 & UL 723). Fiber cement products, such as those sold by GAF, come with a factory-applied primer intended to be "ready for painting".

GAF Shingle Model	**Dimensions**	**Exposure**	**Weight Lbs/Square**	**Comments**
Purity™ Straight / Wavy Edge	12" x 24" x 11/64" thick	11"	168 lbs	
Purity™ Thatched Edge	12" x 24" x 11/64" thick	10 1/2"	186 lbs	
Profile™ Straight Edge	9" x 32" x 11/64" thick 12" x 24" x 11/64" thick 14 5/8" x 32" x 11/64" thick	8" 11" 13 5/8"	177 lbs 165 lbs 171 lbs	
Emphasis™ Thatched Edge	14 5/8" x 25" x 9/32"	13"	268 lbs	Extra Thick

The Regulation of Asbestos Products

The two primary institutions that regulate asbestos-containing materials are the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA). These regulations can change or be superseded by more stringent state and local codes. **Note that** t**he EPA does not consider asbestos-cement products to be friable** (easily crumbled), and does not consider them hazardous because the cement binds the asbestos fibers and prevents their release into the air under normal conditions. Asbestos-cement products can become friable if they are severely deteriorated, or if they have been mechanically disturbed by drilling, sawing, sanding, or grinding. Care should be taken to protect asbestos-cement materials, and prevent them from becoming friable, during any restoration project.

Laws established by federal agencies for non-friable materials are minimal. The National Institute for Building Science (NIBS) and the EPA have developed maintenance and management guidance for asbestos-containing materials. If a procedure that will disturb the

material is being implemented, the fibers in the air must be controlled below a visible tolerance. For asbestos-cement, visible emission can be controlled by keeping the material adequately wet so that dust does not form. When repairing or replacing, simply spray down the material first, keep the material wet during any abrasive procedures, or use high efficiency particle arresting (HEPA) equipment. If the material will not be disturbed, no hazard exists and no precautions are required.

In order to preserve this twentieth-century material, understanding what makes, or does not make, asbestos a hazard is very important. **No hazard is created when asbestos-cement building materials are sound and left in place, or when treatments incorporate non-abrasive means.** The primary conservation options for asbestos-cement building materials are to maintain and manage them in place, repair, replace in part, or abate. The level of deterioration determines the appropriate option to be employed. Abatement, including full removal or encapsulation, should only be used as a last resort. When repair is the necessary treatment for a deteriorated asbestos-cement product, the least amount of material should be discarded and the largest amount of original material as possible should be retained. The type and extent of deterioration of asbestos-cement products depends on the cause. When repairing the deteriorated materials the gentlest means possible should be used following applicable asbestos regulations, along with repair techniques sympathetic to the material.

Maintaining Asbestos-Cement Shingle Siding

Asbestos-cement siding can be cleaned if it is soiled or moldy, or has an algae coating. Trisodium phosphate (TSP) added to warm water in the proportions recommended by the manufacturer can be used to remove dirt or light stains. Bleach may be added to the mixture to remove moss or other fungi. Start at the bottom, cleaning a small section at a time. TSP may change the paint color if it contacts the surface for more than a couple of minutes. To avoid streaking, rinse each section and any drips, allowing drying time before cleaning the next section. Do not use strong TSP solutions on surfaces that have been covered with latex paint, unless you want to remove the paint. Wear rubber gloves, eye protection, long sleeve shirts, and long pants when mixing or using trisodium phosphate or bleach solutions, and be sure to the follow safety precautions printed on cleaner and bleach labels. The use of a power washer or mechanical methods for cleaning asbestos-cement can damage the surface, possibly allowing asbestos fibers to become airborne, and should not be used.

For stains such as rust, dissolve one part of sodium citrate in six parts of commercial glycerin. Mix part of this with inert dry clay, such as diatomaceous earth, to form a poultice and apply as a thick layer. When the paste is dry, replace with fresh paste or moisten with the remaining liquid. Complete removal of the stains may require a week or longer. A ten percent oxalic acid solution has also been found to successfully remove rust from cementitious products. If the substrate, metal fixtures, or other adjacent objects are causing staining they should be cleaned and coated or replaced.

Biological growth on the exterior of asbestos-cement can be a problem in sheltered environments or on northern exposures. Shade trees located close to a building can shield sunlight and result in

prolonged dampness of the asbestos-cement product and promote biological growth, such as moss and algae. Not only are the growths unsightly, but they can stimulate surface disintegration, dissolution, and staining. The presence of moss and other fungi growth signals that the moisture content of the material is high and therefore an attack by a more damaging biological species could occur. It is not only important to remove the growth from the asbestos-cement material, but also to remove the environment that is causing the growth. To eliminate biological growth, a mixture of weed killer and water could be tested. If unsuccessful, a solution of four parts bleach, one part TSP, and twelve parts warm water is recommended. After a week or so when the moss has turned brown and dry, it should be brushed off. In the case of ivy this technique is sometimes not helpful in removing the thousands of tiny roots left after the ivy has been pulled off; a stronger product may be needed (i.e., copper sulfate). It is important to remember that biological growths differ widely and so do the processes for their removal.

If stains cannot be removed, another option is painting the asbestos-cement products. Painting is an especially good solution if the material was originally painted, but adds a maintenance factor. Oil based paints and varnishes are not chemically compatible with cementitious materials. High quality alkali-resistant and weather resistant exterior paint (i.e., 100% acrylic coating) should be used on exterior asbestos-cement materials, or use pigmented shingle stain. Before being painted, asbestos-cement surfaces should be cleaned, then primed with an alkali-resistant primer.

Asbestos-cement products can be brittle and susceptible to cracking and chipping. Potential damage should be minimized or prevented. For example, shrubs or flower beds can planted around the foundation to prevent the siding from being damaged by lawn equipment, automobiles, etc., or a drip cap can be added below the bottom row of siding to serve as a bumper. Hairline cracks can be repaired with clear epoxy, and larger gaps can be patched with a thin grout made of Portland cement and water. For cracks larger than 1/8 inch, grout with a thicker consistency should be used, or sand should be added to the grout. After patching, keep the grout damp for about a week to keep it from drying so quickly that it cracks.

Asbestos-cement or transite shingle siding can be successfully removed from a building without causing the release of asbestos fiber into the air. Start at the highest point and look for exposed nail heads. Carefully remove the nails or nip the nail head so that the shingles can be removed without breaking. Weathering may cause asbestos fibers to be released from the shingle and collect in cracks, seams and joints. Keeping the shingles wet while removing them will help lock the fiber down to the shingle long enough to place it into a bag made from six-mil thick plastic, where any fibers released from the shingle will be contained inside the bag. Spray water inside the bag periodically to ensure the shingles stay wet. Place the shingles in the plastic bag and lower the bag carefully to the ground. Do not throw or drop the shingles to the ground.

Information from the Asbestos Hazard Management Program,
Health Hazards Control Unit, North Carolina Department of Health and Human Services

If this material is in good condition and can be removed substantially intact, with no small fragments or dust generated, then it is not considered a regulated asbestos-containing material and does not require the use of accredited personnel or an asbestos removal permit. Minor breakage that may occur during careful removal of the siding does not result in the material becoming regulated; however, if the siding is not removed substantially intact, it becomes regulated.

Common friable and non-friable asbestos-containing materials

- Asphalt roofing shingles or roll roofing are generally non-friable, and raise little dust even during renovation, and may be enclosed with a new layer.
- Flexible flashings are non-friable, but are difficult to enclose.
- Roofing felts are generally friable, especially under renovation, and may be enclosed with a new layer.
- Cement roofing shingles and tiles are non-friable.
- Cement sidings are non-friable and stable, especially with layers of paint in place.
- Fiber-cement boards (without asbestos) are available for small repairs.

Asbestos and Asbestos-Cement Roofing and Siding

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