Chapter 2
Asbestos-Containing Materials

In order to conduct proper asbestos NESHAP compliance inspections, inspectors must be knowledgeable of the various commercial uses and applications of asbestos products and which of these are regulated under the asbestos NESHAP. Recognizing the various appearances, compositions, uses and application techniques can assist the inspector in determining the compliance status of an activity. The remainder of this section provides information that should assist inspectors in recognizing ACM, both in the intact and disturbed state.

Important Definitions

A number of regulatory definitions are important to the asbestos program. References in these definitions to "this subpart" are referring to the asbestos NESHAP regulation.

ACM - Asbestos-containing material.

Asbestos - The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite (amosite), anthophyllite and actinolite-tremolite.

Asbestos-containing waste materials (ACWM) - Mill tailings or any waste that contains commercial asbestos and is generated by a source subject to the provisions of this subpart. This term includes filters from control devices, friable asbestos waste material and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term also includes regulated asbestos-containing material waste and materials contaminated with asbestos including disposable equipment and clothing.

Category I nonfriable ACM - Asbestos-containing packings, gaskets, resilient floor covering and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR Part 763, Section 1, Polarized Light Microscopy.

Category II nonfriable ACM - Any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos as determined using the methods specified in Appendix A, Subpart F, 40 CFR Part 763, Section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Friable asbestos material - Any material containing more than 1 percent asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR Part 763, Section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10% as determined by a method other than point counting by polarized light microscopy (PLM), verify the asbestos content by point counting using PLM.

In poor condition - The binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material.

Regulated asbestos-containing material (RACM) – (a) Friable asbestos material, (b) Category I nonfriable ACM that has become friable, (c) Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations regulated by this subpart.

Resilient floor covering (RFC) - Asbestos-containing floor tile, including asphalt and vinyl floor tile and sheet vinyl floor covering containing more than 1 percent asbestos as determined using polarized light microscopy according to the method specified in Appendix A, Subpart F, 40 CFR Part 763, Section 1, Polarized Light Microscopy.

Asbestos Uses and Characteristics

Since asbestos minerals are fibrous and exhibit varying degrees of heat resistance, tensile strength, flexibility and chemical resistance, they have been incorporated into more than 3,000 products. These products include heat-resistant textiles, reinforced cement, special filters for industrial chemicals, thermal and acoustical insulation, floor tiles, gaskets and brake linings.

Of the six asbestos minerals, chrysotile use comprises approximately 93% of the total consumption of asbestos fibers. Chrysotile fibers are very thin, flexible and strong and have been used in fireproofing, cement products, asphalt and vinyl flooring, brake linings, clutch facings, gaskets, reinforced plastics and many other products.

The remaining 7% of the total asbestos fibers consumed consists primarily of amosite and crocidolite. Amosite, less flexible but more heat and acid resistant than chrysotile, is often found in high-temperature applications (e.g., block insulation and fire brick), but may also be found in small amounts as filter aids in pressure piping products and in spray-on fireproofing. Crocidolite, very resistant to acids and to the effects of outdoor exposure, may be found in combination with chrysotile in asbestos-cement pressure pipes, textile and filtration products.

Anthophyllite, actinolite and tremolite are used primarily in adhesives and cements. They are too brittle for textile products or for use as fibrous reinforcement.

The use of asbestos products has declined greatly since the late 1970s. However, the U.S. Department of Commerce reports that enormous quantities of asbestos and asbestos products are still imported and used in the United States (see Table 2-1).

The United States Geological Survey (USGS) produces an annual “Mineral Commodity Summaries” report, which includes information regarding asbestos. In its 2014 report, the USGS reported the following:

Events, Trends and Issues:

- U.S. exports decreased to an estimated 25 metric tons in 2013 from 47 tons in 2012.
- Imports into the U.S. decreased to an estimated 870 metric tons in 2013 from 1610 metric tons in 2012.
- The chloralkali industry accounted for an estimated 67% of U.S. consumption; roofing products, 30%; and unknown applications, 3%.

Table 2-1. 2012-2013 World Mine Production and Reserves

	Mine production		Reserves[4]
	2012	2013[e]	
United States	—	—	Small
Brazil	307,000	300,000	11,000,000
China	420,000	400,000	Large
Kazakhstan	241,000	240,000	Large
Russia	1,000,000	1,000,000	Large
Other countries	300	300	Moderate
World total (rounded)	1,970,000	1,940,000	Large

Source: Mineral Commodity Summaries 2014, U.S. Department of Interior, U.S. Geological Survey

Domestic Production and Use:

- Asbestos has not been mined in the U.S. since 2002, so the U.S. is dependent on imports to meet manufacturing needs.
- Chrysotile was the only type of asbestos used in the United States and was solely sourced from Brazil in 2013.

World resources:

- U.S. reserves are small and are composed mostly of short-fiber asbestos, for which use is more limited than long-fiber asbestos in asbestos-based products.
- The world has 200 million metric tons of identified resources of asbestos.

Asbestos Use in Buildings

The following categories of ACM are often found in buildings:

- Surfacing materials.
- Fireproofing materials.
- Thermal insulation/condensation control materials.
- Acoustical insulation.
- Decorative materials.
- Thermal system insulation.
- Miscellaneous materials.

Surfacing Materials

Asbestos-containing surfacing materials are coatings that were spray-applied or troweled onto steel I-beams, decks, concrete ceilings and walls and other surfaces. They were used for fireproofing, thermal insulation/condensation control, acoustical insulation and decorative purposes. Often a single application served more than one of these purposes (e.g., acoustical and decorative; fireproofing and thermal insulation).

Sprayed coatings may appear cementitious or fluffy, while troweled coatings have a smooth finish and may be covered with a layer of plaster or other non-asbestos material. Both sprayed and troweled asbestos coatings are friable in most applications. In 1973 the asbestos NESHAP regulation banned the spray application of asbestos-containing fireproofing and insulation materials to buildings, structures, pipes and conduits.

In its 1986 occupational exposure standards, OSHA banned all applications of asbestos-containing products through spray techniques. However, the U.S. Court of Appeals for the District of Columbia reviewed this ban and concluded that "the support for the ban plainly fails to meet the ‘substantial evidence’ standard” and stated that “the ban cannot stand."

Effective January 19, 1990, OSHA amended the regulatory text of the final asbestos standard by deleting the prohibition regarding the spray application of asbestos-containing products. It was believed that deleting this prohibition would not significantly increase the risk to employees.

Fireproofing Materials

Since high temperatures can result in a deterioration of ductility and tensile and compressive strengths in building materials, asbestos has been widely used by the construction industry to fireproof structural steel.

Thermal Insulation/Condensation Control Materials

Asbestos-containing materials exhibit very low thermal conductivity. For this reason they were often applied to steel, concrete, or other building surfaces to minimize heat loss or gain. Such use of ACM reduced the amount of energy needed to heat or cool buildings and controlled condensation which could result in ceiling and wall "sweating," metal corrosion and rotting of wood components.

Acoustical Insulation

Since asbestos is fibrous in nature and thus lacks a reverberant surface, it has proved to be an excellent soundproofing material. It was used extensively for this purpose in schools in such locations as hallways, stairwells, band rooms and gymnasiums as well as in restaurants, hotels and auditoriums.

Decorative Materials

Although the spray application of asbestos onto structural components was banned in 1973, architects continued to specify the use of asbestos for decorative purposes. In 1978 EPA banned this use of ACM.

Thermal System Insulation

Thermal system insulation includes a wide variety of materials applied to pipes, fittings, boilers, breechings, tanks, ducts and other structural components to prevent heat transfer or water condensation. The following examples of thermal system insulation are based on product categories.

Pipe Insulation

Preformed pipe insulation with an asbestos content of about 50% has been used for thermal insulation of steam pipes in industrial, commercial, institutional and residential applications. This product is usually white and chalky in appearance and typically was applied in 3-foot long, half-round sections held onto the pipe by a covering of plaster-saturated canvas and metal bands. Preformed insulation was applied on straight runs of pipe, while wet-applied coatings were used on elbows, flanges and other irregular surfaces. The installation of wet-applied and preformed asbestos insulation was banned in 1975.

Another type of asbestos-containing pipe insulation is known as "air cell" insulation. Air cell insulation is manufactured on conventional papermaking equipment using asbestos fibers rather than cellulose. The final product may contain up to 85 percent asbestos and is typically coated or laminated with other materials. AIR-CELL® is a protected trade name, but the term is often used in conversation to describe corrugated asbestos-containing pipe insulation.

Air cell insulation looks and feels like corrugated cardboard and is generally rolled onto the pipe in several layers. It is medium-gray or tan in color and commonly held in place with a canvas wrap and metal bands.

Pipes may also be insulated with an asbestos-containing felt. These felts are frequently joined together or adhered by a black, tar-like, asbestos-containing cement.

Boiler and Hot Water Tank Insulation

Asbestos-containing preformed block insulation has been used as thermal insulation on boilers, hot water tanks and heat exchangers in industrial, commercial, institutional and residential applications. The blocks are commonly chalky, white, 2 inches thick and from 1 to 3 feet square. They are often held in place around the boiler by metal wires or expanded metal lath. A plaster-saturated canvas was often applied as a final covering or wrap. EPA banned the installation of this type of asbestos insulation in 1975. Asbestos-containing fire brick and gaskets may also be found as heating system components.

Elbow, Valve and T-Fitting Insulation

Batch-mixed ACM has been trowel-applied to irregular joints (elbows, valves, T-fittings, etc.) on thermal systems. This insulation may be difficult to distinguish from adjacent pipe insulation since similar wrapping materials may cover both. It is not uncommon to find asbestos-containing "elbow mud" or "lagging" adjacent to straight-runs of non-asbestos pipe insulation. ACM may also be found in valve packings.

Fiber glass insulation may have been applied over existing asbestos insulation. Inspectors should check the entire depth of insulation when searching for suspect ACM.

Miscellaneous Materials

Miscellaneous building materials are materials not classified as surfacing or thermal system insulation. Miscellaneous materials include both friable and nonfriable forms of asbestos-containing materials. Friable materials include ceiling tiles (such as the 2' x 2' and 2’ x 4’ drop-in types), asbestos-containing paper (commonly found underneath wooden floor boards), plaster and joint compound. It is estimated that 5-10% of currently installed ceiling tiles contain asbestos.

The asbestos NESHAP describes the nonfriable asbestos-containing materials as “Category I” and “Category II.” Both Category I and Category II nonfriable ACM may be found in buildings. Category I materials include resilient floor covering, packing, gaskets and asphaltic roofing products. Category II materials include mastic, asbestos-cement (Transite) sheet and pipes, terrazzo flooring, siding shingles and laboratory table tops. Although the asbestos in these products is typically tightly bound and nonfriable, with age, or during the course of demolition or renovation, such materials may become friable. Because of this, inspectors must evaluate such materials on a case-by-case basis to determine their potential to become friable.

Table 2-2 contains information that will help asbestos program regulatory staff recognize trade names of asbestos building products. This list includes information received by EPA from previous and current manufacturers of asbestos products under the *Asbestos Information Act of 1988* but should not be considered all-inclusive.

Table 2-3 provides additional information concerning ACM found in buildings.

Table 2-2. Trade Names of Asbestos-Containing Products.

Product Type	Trade Names		
Block products, cements and pipe coverings	Aircel (Aircell) Alltemp Anti-Sweat Pipe Covering Aristo Insulation Asbestile Calsilite Caltemp (Caltherm) Carocel Carytemp Carytemp Finishing Cement Celebestos Cement (100, 303, 707, 7M-0, A-01, LF-0, MW-0, Super 606) Cement, Insulating (A, AA, A-11, HF, H.T., 115, 203, 214) Cement, Thermal Insulating (127, Colorok, Pabflex, Stonite, Stormlap) Corregated Wood Felt Air Cell Covering	Defendex Duplex Eagle “66” Enduro Excel Firelite Furnace Cement Frost-Proof Pipe Covering Glosscell Hi-temp Imperial Insulation Insulkote K-Fac 19 Kaylo Laptite LK Insulation LT Cork Covering Min-K Products Multi-Ply Nonpareil	One-Cote Insulating and Finishing Cement Pallite Porter Binding Mortar Prasco Pyrobestos Pyrocal Range Boiler Jacket Satin Finish Cement Super “66” Superex (M, 1900) Tempcheck Thermalite Thermasil Thermobestos Transite Products Vitricel Cement Watocel
Sprayed-on products	Armaspray Cover-Tex Econo-White 70 Fire-Shield Plaster Decorative Spray Coatings High-Sorb Acoustical Plaster Imperial “QT” Texture Finishes Improved Spray Texture B-8 K-Spray Ceiling Texture	Kaiser-Tex Litecast 30 Mono-K Mono-spray Perlcoustic Perltex Super-40 Perlite Prep Coat #3 Pyrospray QT Simulated Acoustical Spray Texture	Spray-Tex Spray-Wyt Spraycraft Super White Sprayolite Versakote White Spray-on Acoustical Plaster Z-tex Zonolite

Source: *Asbestos: Publication of Identifying Information (55 FR 5144), February 13, 1990*.

Table 2-3. Asbestos-Containing Materials Found in Buildings.

Category	Generic name	Asbestos (%)	Dates of use	Binder/sizing
Asbestos-containing compounds	Adhesive (cold applied)	5-25	1945-present	Asphalt
	Asphalt tile cement	13-25	1959-present	Asphalt
	Caulking putties	30	1930-present	Linseed oil
	Cement, finishing	55	1920-1973	Clay
	Cement, insulation	20-100	1900-1973	Clay
	Cement, magnesia	15	1926-1950	Magnesium carbonate
	Joint compound	5	1945-1975	Asphalt
	Mastics	5-25	1920-present	Asphalt
	Plaster/stucco	2-10	Unknown-present	Portland cement
	Roofing asphalt	5	Unknown-present	Asphalt
	Roof putty	10-25	Unknown-present	Asphalt
	Sealants, fire/water	50-55	1935-present	Castor oil or polyisobutylene
	Spackles	3-5	1930-1975	Starch, casein, synthetic resins
Asbestos ebony products	Not applicable	50	1930-present	Portland cement
Cementitious concrete-like products	Clapboard	12-15	1944-1945	Portland cement
	Extrusion Panels	8	1965-1977	Portland cement
	corrugated	20-45	1930-present	Portland cement
	flat	40-50	1930-present	Portland cement
	flexible	30-50	1930-present	Portland cement
	flexible, perforated	30-50	1930-present	Portland cement
	laminated (outer surface)	35-50	1930-present	Portland cement
	roof tiles	20-30	1930-present	Portland cement
	Pipe	15-20	1935-present	Portland cement
	Shingles, roofing	20-32	Unknown-present	Portland cement
	Shingles, siding	12-14	Unknown-present	Portland cement
Flooring tile	Tile, asphalt/asbestos	26-33	1920-present	Asphalt
	Tile, vinyl/asbestos	21	1950-present	Polyvinyl chloride
Paints and coatings	Air Tight	15	1940-present	Asphalt
	Roof coating	4-7	1900-present	Asphalt
Paper products	Corrugated			
	high temperature	90	1935-present	Sodium silicate
	moderate temperature	35-70	1910-present	Starch
	Indented	98	1935-present	Cotton/organic
	Millboard	80-85	1925-present	Starch, lime, clay
Roofing felts	Mineral surface	10-15	1910-present	Asphalt
	Pipeline	10	1920-present	Asphalt
	Shingles	1	1971-1974	Asphalt
	Smooth surface	10-15	1910-present	Asphalt
Sheet goods	Sheet goods, resilient	30	1950-present	Dry oils
Surfacing material	Sprayed- or troweled-on	1-95	1935-1970	Sodium silicate, portland cement, organic binders
Textiles	Cloth blankets (fire)	100	1910-present	None
	Cord/rope/yarn	80-100	1920-presennt	Cotton/wool
	Curtains (theatre, welding)	60-65	1945-present	Cotton
	Felts			
	blue stripe	90-95	1920-present	Cotton/wool
	green stripe	80	1920-present	Cotton
	red stripe	95	1920-present	Cotton
	Sheets	90	1920-present	Cotton
	Tape/strip	50-95	1920-present	Cotton/wool
	Tubing	90	1920-present	Cotton/wool
		80-85	1920-present	Cotton/wool
Thermal insulating products, preformed	Batts, blocks and pipe covering			
	85% magnesia	15	1926-1949	Magnesium carbonate
	Calcium silicate	6-8	1949-1971	Calcium silicate
Wallcovering	Wallpaper, vinyl	6-8	Unknown-present	

Source: *Guidance for Controlling Asbestos-Containing Materials in Buildings, June 1985, EPA-560/5-85-024.*