

APPENDIX A
BACKGROUND INFORMATION ON ASBESTOS IN BUILDING MATERIALS AND
HEALTH HAZARDS

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Occurrence and Types of Asbestos

Asbestos is not one mineral but a generic term used to describe a family of naturally occurring fibrous hydrated silicates. These are divided on the basis of mineralogical features into two groups; serpentines and amphiboles. The important property of asbestos as compared to non-asbestiform varieties of silicates is the presence of long, thin fibres that can be easily separated. According to some definitions, there are as many as thirty varieties of asbestos, but only six are of commercial importance. Chrysotile, which is by far the most abundant, is the only type that belongs to the serpentine group. Crocidolite and Amosite, the two other most commonly used fibres, together with Anthophyllite, Tremolite, and Actinolite belong to the amphibole group. The distinction between asbestos types is important due to the different degrees of severity of asbestos related disease with different asbestos types. Of the three commercially important types (Chrysotile, Amosite and Crocidolite), Chrysotile is considered the least hazardous. In general, Canadian regulations reflect this variation of health effects.



Chrysotile Asbestos



Amosite Asbestos

Health Effects of Asbestos

For many years asbestos has been recognized as a health hazard for workers employed in asbestos mining, processing and installing of asbestos products. Several serious, debilitating diseases that often end in death have been linked to the inhalation of fine asbestos fibres. It is not clear how asbestos fibres cause disease after they enter the lung. For each disease there is a period of latency, usually more than ten years, between first exposure to asbestos and the appearance of the disease. The diseases linked to asbestos exposure are described below.

Asbestosis

Asbestosis is a fibrosis (scarring) of the lung tissue, which makes breathing difficult. The most prominent symptom is breathlessness. Detection of asbestosis is by physical examination, X-ray examination and lung function testing. The disease is irreversible and may continue to progress even after exposure is stopped. Rarely a cause of death itself, asbestosis results in an appreciable reduction in life expectancy due to deaths from related illnesses. Asbestosis will develop only with chronic (long term) exposure to high levels of airborne asbestos.

Mesothelioma

This is a rare cancer of the cells of the pleura (lining of the chest cavity and lungs) and the peritoneum (lining of the abdominal cavity). The development of mesothelioma is characterized by a long latency period, usually at least 15 years and sometimes more than 40. There is no effective treatment for mesothelioma. Large proportions of mesothelioma patients die within a year of diagnosis; few survive longer than five years. The amphibole asbestos materials are considered more important than Chrysotile in the causation of mesothelioma. Although asbestos was once thought to be responsible for all mesothelioma, other causes have now been identified. Still, the chance of getting mesothelioma in the absence of asbestos exposure is considered to be extremely remote. Mesothelioma is a very rare cancer in the general population.

Lung Cancer

Unlike asbestosis and mesothelioma, lung cancer is not associated only with asbestos exposure. Cigarette smoking has been and continues to be the major cause of lung cancer. Furthermore, there is no basic difference between lung cancer caused by asbestos and that due to other causes. In general, the risk of getting lung cancer increases with the extent of asbestos exposure, in terms of both intensity and duration. This risk is also greatly enhanced by smoking; most asbestos workers who develop lung cancer are smokers. There is no difference in the risk for lung cancer between Chrysotile and the amphibole asbestos minerals.

Other Asbestos-Related Cancers

The relationship between asbestos exposure and asbestosis, mesothelioma and lung cancer has been clearly established and is beyond argument. Several other cancers have also been associated with inhalation of asbestos. Although the evidence is not as good as for the diseases discussed above, these cancers should be noted. They are gastrointestinal cancer affecting all sites in the gastrointestinal tract (oesophagus, stomach, colon and rectum) and cancer of the larynx. The elevated risks of these diseases in the most heavily exposed asbestos workers have always been much less than the elevated risk for lung cancer and mesothelioma. If asbestos exposures are controlled to prevent any increase in lung cancer or mesothelioma risk, the other potential cancer risks should also be well controlled.

Other Asbestos-Related Conditions

A number of less serious effects have been associated with asbestos exposure, namely pleural plaques and asbestos warts. Pleural plaques are areas of scarring of the pleural surfaces. In general, they are not associated with any functional abnormality and are merely an indicator of asbestos exposure. Asbestos warts are harmless skin growths that occur when asbestos fibres penetrate the skin. These will usually retract when exposure ceases.

Uses of Asbestos in Building Materials

Asbestos has been widely used in buildings and several uses continue today. The uses of asbestos are generally classed into two groups for purposes of hazard assessment; friable and non-friable products. A friable material is a material that when dry can be crumbled, pulverized or powdered by hand pressure. The use of friable materials in construction is banned today but due to the widespread use of friable materials in the past, these materials still are present in many buildings. In order to establish an asbestos management program, the possible uses of asbestos must be known. These are discussed below in the categories of non-friable, potentially friable and friable products.

Non-Friable Asbestos Materials

Asbestos-cement Products (Transite)

The largest use of asbestos, in terms of the tonnage of fibres employed, is as a reinforcing agent in cement products. Asbestos-reinforced cement is strong, durable, rigid and resistant to both fire and weather. Portland cement, water and asbestos are mixed to form a slurry from which end-products can be fabricated by a process similar to that used in paper making. Products include sheets, pipes and a wide variety of other shapes. The asbestos fibre content of asbestos cement products is usually about 15 percent.

Asbestos-cement sheet is produced in four basis forms: flat sheet, corrugated sheet, siding shingles and roofing shingles. The main use of asbestos cement sheet is for the roofing and cladding of buildings. Other uses are ceiling tiles, decorative panelling, electrical insulation, fume hood liners and laboratory tabletops. Asbestos-cement pipe is used for water supply, sewage, irrigation, drainage applications, the transport of corrosive chemical fluids, and electric and telephone conduits. Asbestos cement products are still in production. Non-asbestos substitute cement products are available for some though not all asbestos products.



Transite Drain Pipe



Corrugated Transite Siding/Roofing



Laboratory Bench Countertop



Transite Blocks in Elevator Switchgear

Gaskets and Packings

The combination of long asbestos fibres and high temperature rubbers has provided some of the best gasket materials. The asbestos, in bulk fibre, woven, or plaited form, provides strength and temperature resistance, while the rubber or synthetic compound acts as binder and sealing material. Asbestos yarns have been commonly used in the manufacture of braided and woven packing materials. Many of these uses, particularly in sheet forms are still in production and use.



Rope gasket



Rope gasket at boiler plate

Coatings and Sealants

Asbestos has been used in roof coatings and cement and, to a lesser extent, in sealants and caulks. Roof coatings consist of asphalt liquefied with solvents and asbestos fibre filler. Roof cements are similar, but are formulated to a thicker consistency so that they can be used to seal openings through which a liquid coating would flow. Some of these are still in production.



Asbestos Roof Cement



Caulking at Glazing

Paper Products

Asbestos paper products have been used in a wide variety of applications. Among the most important in construction are roofing felt, gaskets, pipe wrap, as building paper under roof tiles and wood flooring, tape at joints on ducts and duct insulation, as a finishing layer over fibreglass pipe insulation, as heat shields in incandescent light fixtures, as an underpad beneath vinyl sheet flooring, millboard and electrical insulation. Some of these applications are discussed under the headings "Insulation" and "Gaskets and Packings".



Paper heat shield on incandescent fixture



Paper on seams of duct



Vinyl sheet flooring with paper underpad



Building paper under roof tiles

Plastics

Asbestos has been used as a reinforcing agent in a wide range of asbestos/polymer composites. Applications include, floor tiles, engine housings, bins and containers, and a variety of coatings, adhesives, caulks, sealants, and patching compounds. Two areas dominated asbestos use in plastics: phenolic moulding compounds and vinyl-asbestos tile. Few of these products remain in production.



Vinyl asbestos tile

Asbestos Textiles

Asbestos textile materials are manufactured from Chrysotile fibres. Two types of yarn are produced: plain, possibly braced with organic fibres, and reinforced, which incorporates either wire or another yarn such as nylon, cotton or polyester. Major uses for asbestos textiles are gaskets, packings, vibration damper/duct connectors, friction materials, thermal and electrical insulation, and fire resistant applications, e.g. welding curtains, protective clothing, theatre curtains, hot conveyor belts and ironing board covers. These products may be considered or become friable in use. Asbestos textiles are no longer in widespread production.



Textile Vibration Damper/Duct Connector



High Voltage cable insulation

Friction Materials

Asbestos has been used in the manufacture of brake and clutch linings and pads. The asbestos fibres may be embedded in a phenolic resin with various mixtures of fillers or a woven asbestos cloth may be impregnated with the resin. Friction products are primarily used in vehicles but may be used in any rotating machinery, for example elevators or printing presses. They are still produced and used although not widely.

Drywall Joint Compound

Drywall joint compound also contained asbestos until the early 1980's. The concentration is quite low (near or less than 5%; always Chrysotile). The product in place is quite hard and is normally treated as non-friable.



Drywall joint compound on drywall



Drywall joint compound 1963-1965

Potentially Friable Asbestos Materials

Acoustic Ceiling Tiles

Some types of mineral wool type acoustic ceiling tiles were formulated with asbestos from the early 1960's. The use of asbestos in ceiling tiles was discontinued in the early 1980's. Analytical testing is required to distinguish the asbestos and non-asbestos ceiling tiles. From field experience at Pinchin Environmental Ltd., the fire-rated tiles are more likely to contain asbestos. Amosite was the predominant fibre type used. Acoustic tile, particularly if splined or glued on, can become friable or release dust when removed. They are usually considered non-friable as they are normally handled intact.



Glued on (laminated) ceiling tiles



Lay-in ceiling tile

Plaster

Asbestos was used in random fashion in the brown coat and surface coat of smooth plaster finishes. This has been used at a low level (less than 5% in most cases). In many instances the asbestos content is less than 1% or even less than 0.5%. This is often due to the presence of vermiculite in plaster. Vermiculite frequently contains Actinolite or Chrysotile as an impurity which contributes to the asbestos content. Only Chrysotile was ever intentionally added to plaster.

Plaster is non-friable in place but removal is impossible without causing it to become friable. This is significantly different than lay-in acoustic tiles or transite boards which can be removed intact.



Plaster on wood lath



Plaster on speed tile

Friable Asbestos Materials

Friable asbestos products are the main concern of the public and the asbestos management program due to the ease of fibre release. None of the products are still in production in North America or Europe.

Fireproofing or Sprayed Insulation

Several types of fireproofing or insulation were applied by spraying or trowel application in the period from the mid 1930's to 1974. Fibrous products were spray applied after being blown as a dry mix through an application gun. These products may contain up to 90% asbestos and any of the three major types (Chrysotile, Amosite or Crocidolite). Cementitious products were trowelled or sprayed as a wet slurry. These were harder products that did not contain more than 25% asbestos. Only Chrysotile asbestos was used in the cementitious type materials.



Cementitious sprayed fireproofing



Debris from fireproofing on top of ceiling



Fibrous sprayed fireproofing



Fibrous sprayed fireproofing (beam only)

Texture or Acoustic Plasters

The use of asbestos was widespread in trowelled or sprayed texture coats, stipple coats and acoustic plasters from the 1950's to the late 1970's (at least as late as 1980). These products always contain less than 25% Chrysotile. Some of the harder stipple coats may be considered non-friable in place and only become friable when disturbed by construction or demolition. Other products in this group can be very soft and extremely friable.



Sprayed limpet texture ceiling on lath



Texture coat ceiling

Mechanical Insulation

This is the most widespread use of friable asbestos in buildings. The use dates from the late 1800's to the late 1970's. The material can have a number of appearances and asbestos contents. The more prevalent types of asbestos mechanical insulations are:

- white, brown, pink or grey block (Magnesia block, Caposite)
- white or grey corrugated paper (Aircell)
- white, grey or brown layered paper (sweatwrap)
- grey trowelled or hand applied material (with the appearance of hard or granular, grey, dry mud) (Parging cement)

It is possible to find all asbestos types in mechanical insulation although Chrysotile is predominant and Amosite the next most common.



Aircell insulation (corrugated paper)



Caposite block insulation



Parging cement on pipe fitting



Parging cement on sweatwrap and Aircell

Vermiculite

Vermiculite, a mineral mined around the world, is used in a variety of commercial and consumer products. After crushing and processing, the raw ore was shipped to many plants in Canada for exfoliation or expanding. At these plants, the ore was heated to about 1000°C causing it to expand like popcorn into a lightweight granular material that is fire-resistant, absorbent, light weight and a good insulator. Vermiculite has been and continues to be used in a variety of building materials. It was made into a variety of insulation products, was used as a loose fill insulation inside masonry block walls (the largest volume use), stove pipe and stack insulation, fire separations, cold rooms and in walls and attics of buildings, mostly homes. It is important to understand not all vermiculite contains asbestos.



Vermiculite attic insulation



Libby vermiculite

Hazards of Asbestos Materials in Buildings

Beginning in the late 1970's, public health authorities, the media, and the public in general, became concerned about the health effect of these asbestos materials on building occupants. It was known that asbestos miners and factory workers and installers who handled asbestos materials suffered a higher incidence of several respiratory diseases. These groups had been exposed to very high levels of asbestos dust for prolonged periods. In order to assess whether the public anxiety over the current situation of asbestos materials and the hazard of in-place materials was justified, the Ontario Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario was established in 1981. This 3 year study considered all aspects of the asbestos problem, from production, through installation and use in-place, to maintenance and demolition. After considering all available data and commissioning several research studies, the Commission concluded in its final report (Chapter 9, Page 585):

"...The risk to occupants from asbestos in buildings is a small fraction of the risks faced by workers exposed to asbestos under the 1 f/cc control limit for Chrysotile (which was the current exposure limit for industrial asbestos use in Ontario at that time). It is less than 1/50 as great as the risk of commuting by car to and from those buildings. In concluding that this risk is insignificant, we conclude that the risk does not present a public health problem. While asbestos has caused serious health problems for workers and may present a problem for building maintenance, renovation, construction, and demolition workers, we conclude that it does not pose a significant problem for the general occupants of a building, except in the three situations outlined in Section D of this chapter, namely: (i) the occupant is in the immediate vicinity of work that disturbs friable asbestos-containing insulation; (ii) the occupant is within the range of air circulation of work that disturbs friable asbestos-containing insulation; or (iii) significant quantities of friable asbestos-containing insulation have fallen onto building surfaces and are being disturbed."

and in the overview to this section (Chapter 9, page 548):

"We will conclude that it is rarely necessary to take corrective action in buildings containing asbestos insulation in order to protect the general occupants of those buildings. On the other hand, construction, demolition, renovation, maintenance, and custodial workers in buildings containing asbestos may be exposed to significant fibre levels and may, during their work, cause elevated fibre levels for nearby occupants."

The general conclusions of the Royal Commission have been supported by independent testing by independent researchers, the Ontario Ministry of Labour, and authorities in other jurisdictions. Air sampling has shown that the airborne asbestos levels in buildings with sprayed asbestos are no higher than outdoor levels, unless the friable asbestos or asbestos debris is being disturbed at the time. Airborne levels in buildings are not elevated even when the ceiling space containing the sprayed asbestos or asbestos mechanical insulation functions as an air plenum.

The Ministry of Labour Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations was modelled on the Commission findings. Several other provinces have since issue regulations or guidelines similar to the Ministry of Labour Regulation. The Asbestos Management Program was prepared to be consistent with the recommendations of the Commission and to meet all requirements of the Regulation.