Salud y Seguridad para trabajos con materiales que contienen amianto

UOCRA

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Occupational Safety and Health Asbestos containing materials abatement Manual

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editora

Occupational Safety and Health Asbestos containing materials abatement Manual
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We dedicate this book to future male and female workers. To the women and men who work and contribute to their experience and knowledge.

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CHAPTER 1 // BACKGROUNDS

The first recorded asbestos use was in 2500 BC in the region now known as Finland where the Anthophyllite variety was extracted from a local deposit and used to strengthen clay utensils and pottery. There are other references, also ancient, which describe the use of asbestos fibres for the manufacturing of lamp wicks and clothes to work with fire (fire-resistant).
At the end of XVII century, Peter the Great of Russia started the manufacturing of asbestos paper using the Chrysotile variety extracted from the Ural Mountains Deposits. Asbestos fibres trade at industrial level started in Italy at the end of XIX Century with the development of Asbestos Textile Industry.
By the end of XIX Century, significant asbestos deposits had been identified throughout the world and their exploitation had begun in Canada (1878), South Africa (1893, 1908-1916), and the Ex-Soviet Union (1885).

Asbestos Mineral

At the beginning of XX Century, the demand for asbestos fibres grew in an exponential way due to their multiple applications, in particular for thermal insulation. In 1900, the development of Hatschek machine for the continuous manufacturing of sheets-plates from an asbestos-cement composite also opened an important field of industrial application for asbestos fibres as did the development of the automobile industry for asbestos brake pads, clutches, gears and joints.

Second World War favoured the growth of Asbestos industry with military purposes (thermal insulation and protection against fire). After war and during several decades, those applications were used in general constructions (Residential, commercial, industrial and others).

At the end of the 1960s, the discovery of linking aspects between the development of lung diseases and long term exposure to Asbestos fibre concentrations present in the air resulted in an abatement in their use. In most of current applications, asbestos fibres are contained within a matrix, typically cement or organic resins.

The world asbestos Fibre production reached its maximum level in 1977 with 4.8 x 106 tons. The greatest producer countries of Chrysotile Variety are Russia, Canada and Brazil.

Asbestos Fibres

MINING AND GRINDING

Magnetometric soundings are usually made to find and route Chrysotile Variety asbestos fibre deposits, since the Magnetite is associated with Asbestos natural deposits, unless the deposit is placed in lands with sedimentary formations.

Terraced Deposits

The election of the method for deposit exploitation depends on a number of parameters, generally, the physical properties of the matrix that contains the mineral, the content of mineral fibres, the amount of sterile material, the presence of polluting agents and the scope of fibres potential degradation during operations. Most operations for asbestos fibres extraction are made outdoors in the open air using staggered perforation techniques.

In Dry Grinding operations, which are the most used, mineral is grind into a certain size and then dried. After that, fibre extraction starts and is assisted by a series of grinding operations, each one followed by an aspiration of released mineral. Due to their aerodynamic properties, asbestos fibres are easily captured by means of a vacuum aspiration system and taken to a separator (cyclone), where the air of suspended fibres is filtered. All fibre Extraction and Classification operations are made under negative pressure conditions to minimise the presence of polluting agents in the workstations.

Terraced deposits

Wet Grinding operations, where asbestos is immersed into water and not dried until the completion of final separation process, provides bring a better dust control and other advantages regarding the contaminated agents separation from asbestos fibres. However, this wet technology is only used in small operations.

Industrial Applications

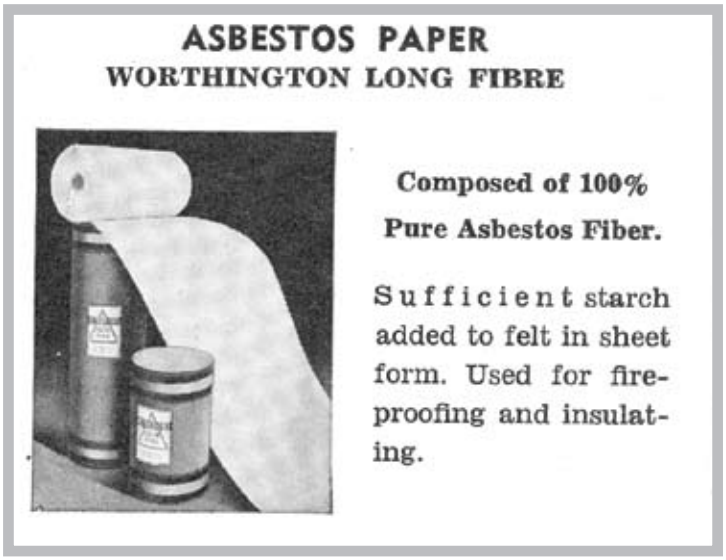
The following properties of asbestos fibres can be exploited in several industrial applications:

- Thermal, electrical, and sound insulation
- Inflammability
- Adsorption Capability
- Friction and Abrasion Resistance
- Chemical inertia

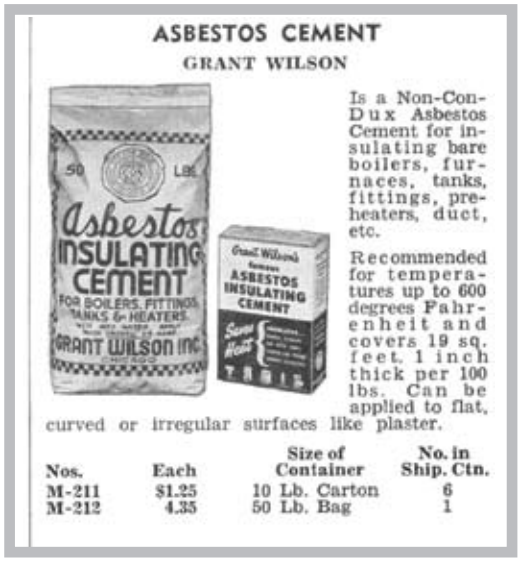
Mortar projection containing asbestos fibres was widely used in building industry for fire protection and heat or sound insulation during and following World War II. Such applications used mainly Crocidolite variety in North America and were discontinued in the 1970s when the danger of working with asbestos fibres was widely known.

Asbestos fibres have been also used for paper manufacturing and felts for flooring and roofing products, pipeline wrapping, electrical insulation, etc.

Asbestos textile industry (comprising yarn, thread, cloth, tape, or rope) was also used in the manufacturing of thermal and electrical insulation as well as friction products such as brake pads, clutches and car joints.



Asbestos Paper



Asbestos cement

The mechanic properties of Asbestos fibres have been widely exploited in Asbestos-Cement products mostly by building industry and as part of water conduction systems. Asbestos-cement products such as plates, pipes, and sheets represent the largest worldwide industrial consumption of asbestos fibres, an estimated 80% of the market in 1988.

Fibrous cement plates

Asbestos fibres have also been used to reinforce plastic made products (PVC, Phenolics, polypropylene, nylon, etc). Reinforcement of resins by asbestos fibres has been used to develop products for the automotive, electronic, and printing industries. However, except for some rare products, the use of asbestos in plastics has essentially ceased.

The combination of asbestos fibres with several types of natural or synthetic resins has led to the development of a variety of products and applications. The incorporation of Chrysotile variety asbestos fibres into rubber matrixes enabled their use to replace materials that have been used for manufacturing of packing, gaskets, joints, etc.

Complex formulations, comprising short asbestos fibres (usually chrysotile variety), resins, and other fillers and modifiers, have been developed as friction materials for automobile brake linings and pads.

Asbestos fibres have also found broad application as reinforcing agents in coatings, sealants, and adhesive formulations.

Asbestos fibres

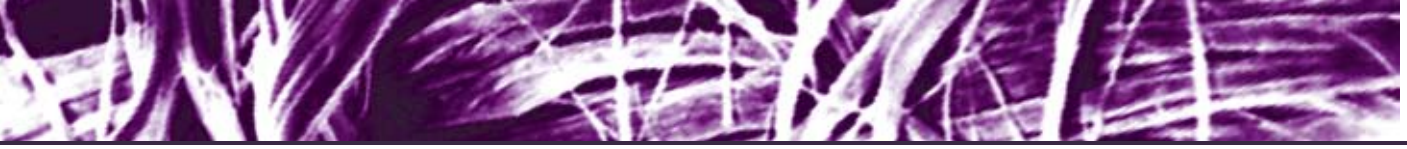
Finally, the combined action of reinforcing and high abrasion-erosion capacity of asbestos fibres was used to increase dimensional stability to vinyl and asphalt plates, and in the application of asphalt mortars as road surfacing. Asbestos fibres are no longer used as additive.

Alternative Materials

Several reasons led to the search of materials to replace asbestos in its multiple applications. At the beginning it was due to its availability and cost, and then because of its effects on workers' health.

During World War II, some countries lost their asbestos fibres suppliers and had to develop substitute materials. Also, in the manufacturing of cementitious products reinforced by asbestos fibres, many developing countries focussed their attention in cellulose fibres (immediate availability and low cost) as an asbestos alternative.

Since the 80s, in some industrialised countries, the search for asbestos fibres alternative materials for industrial application becomes systematic due to an increase in the public opinion consciousness about the health risks they represent.



The replacement of asbestos fibres by other type of fibres or minerals should fulfil, at least, 3 conditions:

Technical Viability of Replacement
The Gain in Occupational Safety when using Asbestos-free Materials comparing them with products that do contain it
Substitute Material availability and Comparative Cost

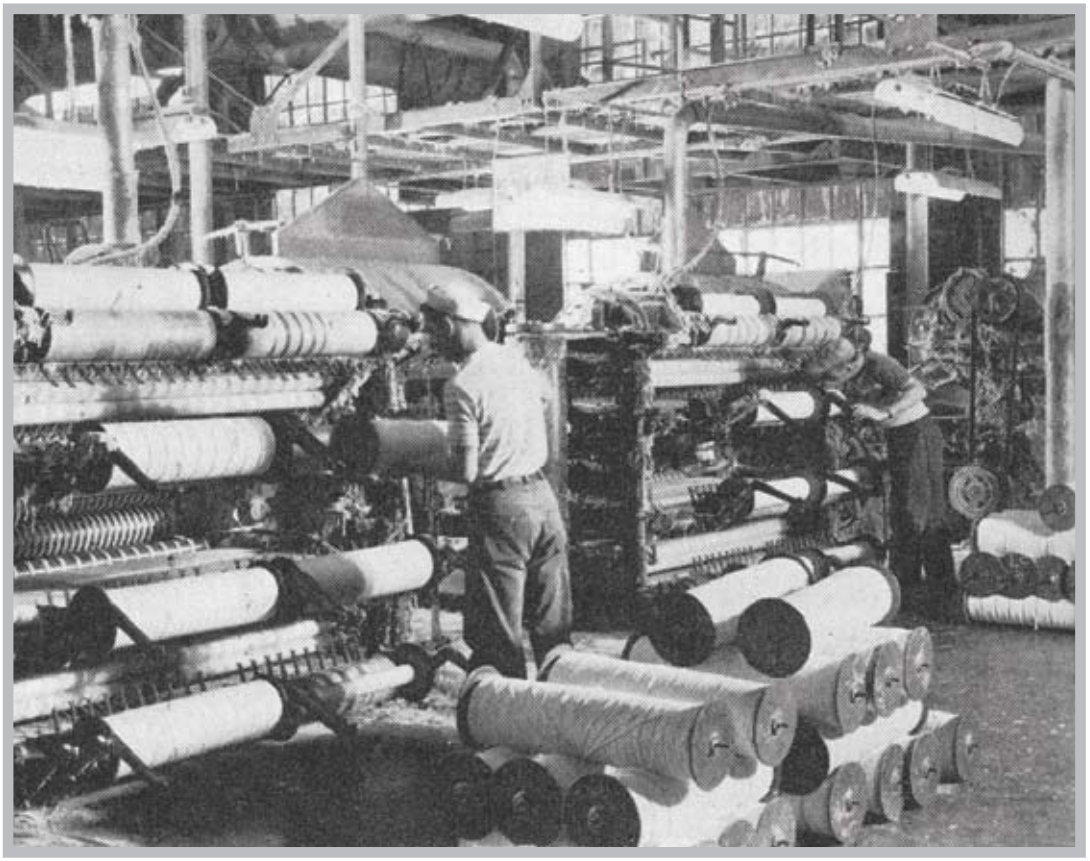
In some applications, especially in those depending on several asbestos fibres particular characteristics, their substitution represents a considerably difficult challenge. For example, in fibrous cement composites, fibres should have high pulling resistance, good dispersion in Portland cement mortars and high degradation resistance in alkaline conditions.

A wide range of asbestos-free products were developed due to the application of several substitution strategies. For instance, for thermal insulation activities (installation of insulation wool masses or insulating products projection) the synthetic mineral fibres (glass fibres or slag fibres) or cellulose fibres replace asbestos. In the same way, Aramid fibres and aluminised glass fibres substitute asbestos in textile industry. Asbestos fibres contained in floor tiles were changed for a combination of synthetic fibres and several kinds of filling materials without fibres (fillers).
Asbestos packaging was replaced by a combination of aramid and glass fibres, graphite mixtures and cellulose fibres.

Different strategies are used in the case of building materials with fibrous cement. In some cases, products with cellulose fibres or synthetic organic fibres such as polypropylene or other products as PVC or cast iron are applied.
The efforts to replace asbestos have been quite successful as the peak level of asbestos world production shows: 4.8×10^6 tons in 1977, being reduced to 9×10^6 tons in 2000. These figures represent an abatement of about 60 % in the use of asbestos although the growth of each market that used it in a term of 25 years. The availability of suitable substitute materials, the cost-performance relationship of these products, and the uncertainty about if they could or could not be long term health dangerous limit their use in some industrial applications.

CHAPTER 2 // HEALTH ASPECTS

The relationship between the occupational exposure to asbestos fibres in the environment and respiratory diseases is one of the most investigated topics by modern epidemiology. The first concerns about health problems related to asbestos arose at the beginning of last century in the United Kingdom, which seems to be the first country in regulating industries that use asbestos fibres in their processes. It was not until the beginning of the 1960s, that the researchers established a close correlation between worker's excessive exposure to asbestos fibres and carcinogenic diseases in the respiratory tract. This discovery led to significant efforts to reveal important questions such as: the influence of the particle size, shape, crystalline structure, and chemical composition; the relationship between exposure levels and diseases; the consequences of asbestos fibres exposure in different kinds of industries, or from different products; and the development of technologies to reduce worker's exposure.



Asbestos textile industry

Previously mentioned researches resulted in a consensus about some topics, while about in some others, the controversy still exists. Generally, it is acknowledged that fibre inhalation with the following characteristics: long (more than 5 μm), thin and biopersistent (see definition in page 16) in high concentrations and for long terms may induce or favour lung cancer. It is also widely accepted that asbestos fibres may be associated with 3 kinds of diseases; Asbestosis: pulmonary fibrosis resulting from a long term exposure to high concentrations of fibres in the environment: Lung cancer: generally resulting from long exposures to high concentrations of fibres and related to asbestosis; Mesothelioma: a rare kind of cancer that affects the tissue that covers thoracic and abdominal cavities.

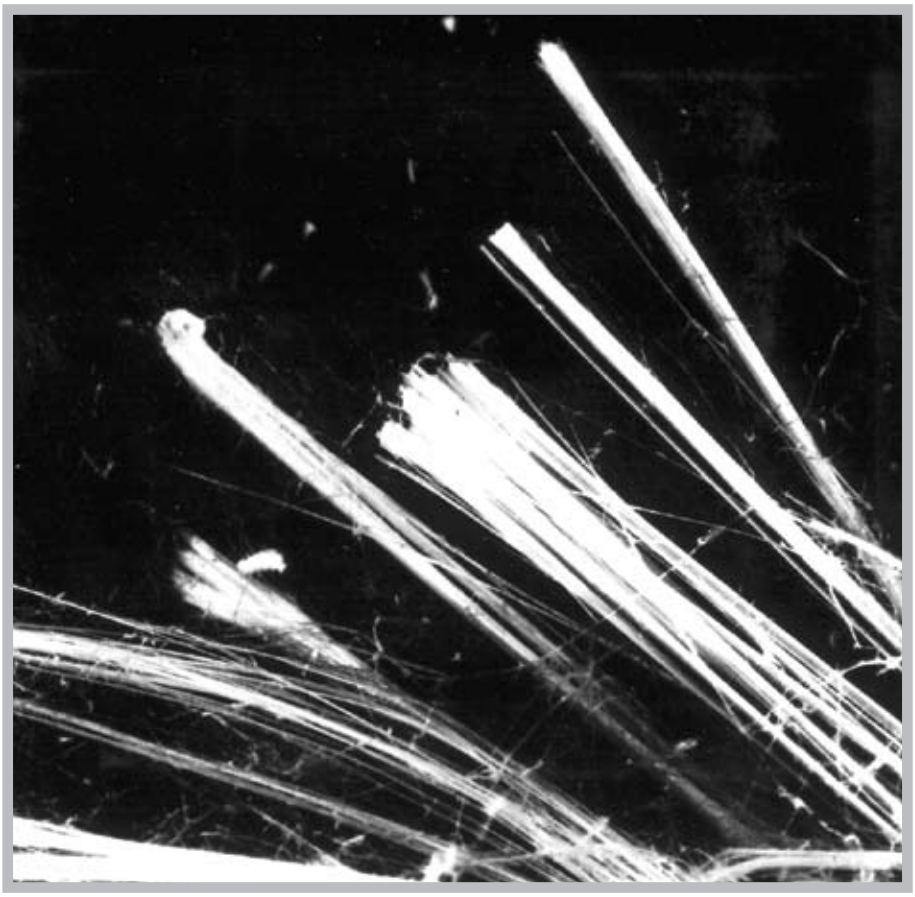
After analysing a lot of evidence, the scientific community inferred that potential genotoxics (DNA toxic) and

carcinogens (causing or inducing cancer) from different varieties of asbestos fibres are not identical: particularly mesotheliomas are strictly related with some variants in amphiboles family.

Asbestos fibres replacement materials are also being investigated about health effects they may cause. However, lung cancer has a latency period of about 25 years and the levels of exposure to substitute fibres are far lower than those that prevailed with asbestos half century ago. Consequently, epidemiologic information from most of substitute products is not enough to establish statistically significant correlations between exposure and pulmonary diseases. Asbestos substitute products toxicity is a delicate issue that requires exhaustive studies.

In Argentina, chemical substances internationally known as carcinogenic for human beings are imported, produced and commercialised. Asbestos is one of them. Even though the exploitation in our country is minimum (it was not more than 320 tons a year according to the Secretariat of Industry, Commerce and Mining for 1998), a substantial amount of asbestos enters the country through Customs as fibres or contents in the composition of other products for diverse industries (fibrous cement, friction products, automotive industry, fire-resistant textiles, hydric insulation for walls and roofs, etc).

When sawing, piercing, drilling, nailing, cutting, knocking or breaking an element that contains Asbestos, it is released a great amount of extremely aerodynamic flexible fibres having 3 to 5 micron long and less than 3 micron diameter (μm), which are so light that travel in the air.



Blue asbestos

A **BREATHABLE FIBRE** is understood as a particle in which the relationship between length/diameter is 3:1. The carcinogenicity of a fibre depends on this relationship and on its Biopersistence, understanding by Biopersistence the term that a fibre can remain in the lung, and it depends on length/diameter relationship as well as on the lung ability to expel it.

Once the fibres are breathed, they lodge into lungs and as exposure increases, the possibility of acquiring some diseases also increases. Most important exposures take place in building industry (Occupational Exposure), especially in traditional demolitions, implosions, catastrophic events and in the extraction-manufacturing of products that contain Asbestos (Thermal Insulation, Textiles, Friction Products, Building Materials, Automotive Industry, Naval Industry, Asbestos - Vinyl Production, Fibrous Cement Production).

Example of its Use in Building Industry

- **As insulation coating it is used for:**

1. Thermal Insulation of Boilers.
2. Fire Protection for Steel Structures.
3. Thermal and Acoustical Insulation of Buildings.

Conductions of boilers shielded by asbestos coating

• **As Asbestos Cardboard used in different places, such as**:

1. Fire protection in Doors, Gates, Steel Structures, etc.
2. Coating of Walls, Ceilings, etc.
3. Internal and Dividing Walls.
4. False Ceiling Tiles.

Insulating plates

• **As Asbestos Cement, it is found in:**

1. Corrugated Plates (for Building Roof and Coating).
2. Plain Plates (for Dividers, Coating and Doors).
3. Roof Gutters and Drainpipes.
4. Drinking water tanks.

Asbestos fibrous cement plates

We can also be exposed in our houses due to the aging of the materials they were built with (if they contain asbestos) or if a person directly exposed to asbestos at work brings fibres on clothing or hair, in the latter case it is considered that the Exposure is Paraoccupational. Even if we live (Environmental Exposure, Community) in the proximity of some industrial extraction-manufacturing focus of Asbestos based products or by drinking Asbestos-contaminated water due to the aging of aqueducts.

Asbestos cement pipes

This situation represents a wide range of exposed population that mainly comprises workers of those activities where asbestos is present, but also, though in a smaller amount, the indirectly exposed population (worker's family, environmental pollution of industry neighbours, or domestic contamination because of the use of asbestos containing products).

Single-family house with fibrous cement plates

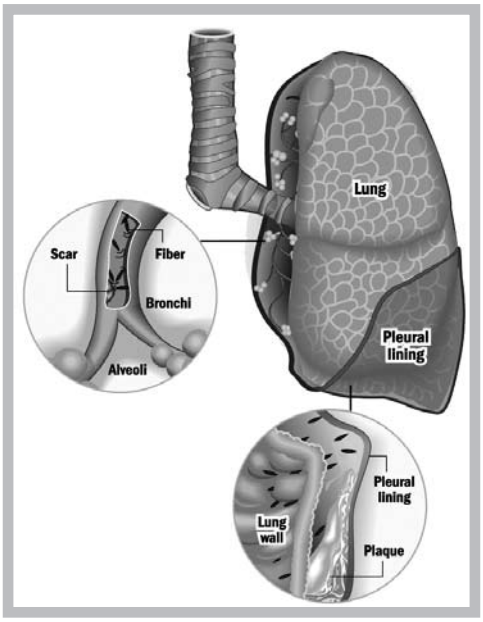
Asbestosis

Asbestosis is a respiratory disease caused by a long term inhalation of asbestos fibres.
Due to their small dimensions, fibres may reach alveolar level of lungs and once lodged there they cause irritation and inflammation. The Body tries to neutralise these strange elements in different ways and as it cannot do it, they generate more inflammation and cellular damage. Subsequently, a Fibrosis is developed (scars and adipose tissue formation) in alveolar zone, which makes the affected lung rigid and prevents the proper interchange of oxygen and carbon dioxide with blood flow. Breathing loses efficiency and makes heart pump more blood to supply the required amount of oxygen for the whole body. The higher the effort, the higher the possibility of suffering a heart attack.
Once inflammatory process starts, it continues even after exposure has ceased.

Asbestosis is a slow development disease that can be detected by X-rays, respiratory exams or extraction of samples form lung tissue (Biopsy). Symptoms appear between 10 and 20 years after having been exposed: Shortness of breath, Coughing, Breathing abnormal sounds, Chest pain. To reduce the disease progress it is recommendable: Stopping Asbestos exposure and Smoking (Due to asbestosis lungs are more susceptible to suffer lung cancer).

Lung Cancer

Lung cancer takes approximately between 15 to 25 years to develop, depending on exposure frequency and duration. An exposure to asbestos fibres for 4 to 6 months may be sufficient to cause lung cancer. Similarly, the combination of smoking and occupational asbestos exposure is extremely hazardous for health.
Lung cancer can exist for some time without causing perceptible symptoms. First symptoms could include coughing, asthmatic wheezing or chest pain. These symptoms are easily ignored, especially by the smoker who has had cough or difficulty to breathe for years.
Other symptoms include recurring pneumonia attacks or bronchitis, hoarseness, swollen lymphatic nodules in the neck, swallowing difficulty and persistent pain in chest, shoulders or arms.



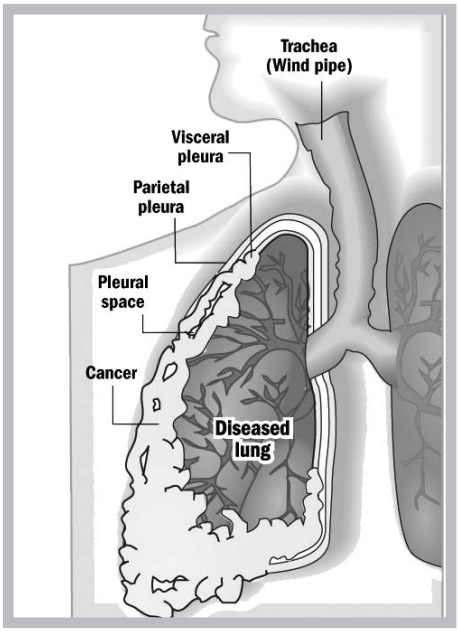
DAMAGES CAUSED BY ASBESTOS OVER TIME.
The exposure takes place when asbestos fibres present in environment and coming from working with asbestos containing materials are inhaled, and also because of these products natural degradation and other factors. Years after exposure, the disease can adopt several forms.

Asbestosis
Fibres accumulate in lung alveoli, inflaming and creating scars in respiratory tract.
The disease causes chronic coughing and chest pain.

Pleural Plaques
Asbestos fibres are needle shaped and this condition facilitates their migration from lung to Pleura.
As Pleura inflames, it also gets rigid and starts to generate Pleural Plaques, which accumulate making breathing difficult and restricting it.

Asbestos and Tobacco
The risks of suffering from Lung Cancer or Mesothelioma (pleura cancer) caused by the exposure to Asbestos increase significantly with smoking.

MESOTHELIOMA
The Mesothelio is a membrane that lines and protects most body internal organs. Its two cell layers and lubricating fluids facilitate organ movement, for example: heart and lungs. The membrane that covers lungs is known as "Pleura". When Mesothelioma occurs, mesothelio cancer, cells turn abnormal and divide themselves without control or order. Asbestos operations are an important risk factor since it is possible to develop cancer as a consequence of only one short exposure. The symptoms are usually breathing difficulty and chest pain.



Pleural and Peritoneal Mesothelioma

Malignant Mesothelioma is a rare type of cancer that affects 7 or 8 people in a million inhabitants. Since the 60s it is known that the exposure to asbestos fibres increases the risk of mesothelioma of the pleura (membranes that line lungs) and of the peritoneum (membrane that lines abdomen). Malignant Mesothelioma has no effective treatment and it is always fatal, half the population affected by this disease dies during the first year following diagnosis; few patients survive longer than 2 years. The disease development does not appear to be related to the amount of asbestos inhaled. Some individuals may develop it after a non-occupational exposure. Latency period between exposure to asbestos and the Terminal phase of the disease ranges from 15 and 55 years, with a mean of 40 years for long- and short-term exposures.

Other types of cancer related to asbestos
Other cancers related to asbestos include larynx, trachea, stomach, colon, and rectum cancer.
While these types of cancer are much rarer than asbestos-induced lung cancer, their true incidence is unknown. However, autopsies do show the presence of asbestos in the cancerous tissues.

CHAPTER 3 // INTRODUCTION TO ASBESTOS ABATEMENT METHODS

The first step to properly managing asbestos is to conduct a building survey to confirm the location of asbestos-containing materials, the types of asbestos present and the condition of the materials.
If asbestos-containing materials are identified and exposure is occurring or is likely to occur, corrective actions must be taken. In deciding which actions provide the most efficient long-term solution, consideration should be given to the following aspects: The present condition of the asbestos-containing materials, the location of these materials, their function and the cost of the proposed method for controlling asbestos exposure.

There are four basic approaches to controlling exposure:

1. **Removal**: Asbestos containing materials are completely removed and properly disposed of.
2. **Encapsulation**: Asbestos containing materials are coated with a bonding agent called a "Sealant".
3. **Enclosure**: Asbestos containing materials are separated from the building environment by barriers.
4. **Management Plan**: The area is inspected periodically for changes in exposure potential and maintenance staff are correctly notified and trained to deal with asbestos-containing materials. A management plan can be used to deal with asbestos-containing materials that do not pose a risk or for materials remaining after remedial actions have reduced the potential for exposure.

Removal, encapsulation and enclosure are corrective methods that can be used separately or in combination. Removal completely eliminates the source of exposure and therefore offers a permanent solution. Both Encapsulation and Enclosure are containment methods that do not remove the potential source of Asbestos exposure. If asbestos-containing materials remain in place (even if Encapsulation and/or Enclosure have been implemented), a management plan will be required for the building.

Since asbestos-containing materials remain within the building following Encapsulation and/or Enclosure, these approaches should only be considered as temporary control measures. The expected length of time before a building is to be demolished or undergo major structural changes will be a factor in deciding which method to use. If a building is later renovated or demolished, encapsulated and enclosed asbestos-containing materials must be REMOVED and disposed of by acceptable methods.

Removal

During removal, all asbestos-containing materials are taken off the underlying surface and collected and placed in containers for being disposed of properly.
This process is the most expensive control method in the short-term and may require the interruption of building activities.
Removal is a necessary pre-requisite for demolition of a building containing asbestos-containing materials or when planned renovations will disturb the asbestos.
Fireproofing material that has been removed must be replaced to maintain compliance with fire and building codes (except in the case of a building that is to be demolished). If the asbestos-containing materials fulfilled insulation functions, the replacement material should have similar characteristics.
Where asbestos had been used to protect structural members from fire conditions, it is important that precautions be taken to maintain an adequate level of fire safety in the building during removal process and subsequent application of fire protection materials.

Asbestos Removal

Asbestos Encapsulation

Removal advantages

- Eliminates the source of Asbestos.
- Eliminates the need for an ongoing surveillance programme.

Removal Disadvantages

- In general, the most costly and complicated method of controlling asbestos exposure.
- In general, the most time consuming method.
- The removed material should be replaced.
- Highest potential for worker exposure during removal.

Comments

- Removal is mandatory prior to demolition or major renovations.
- Removal is significantly cheaper if combined with renovation or demolition activities.

Encapsulation

During encapsulation, Asbestos-containing materials are coated with a bonding agent called "Sealant". Sealants penetrate and harden the material ("penetrants") and/or cover the material surface with a protective coating.

Sealants are applied over the surface of the material using projection equipments at a low pressure setting, reducing the force of the stream and its impact on the friable (that is easily crumbled) asbestos material surface, thus reducing the potential for fibre release during application.

When a sealant is applied, the person doing so must ensure that it penetrates through the material to the underlying support (i.e.: Pipes, Ducts, etc.). Otherwise, the potential for delamination of the asbestos-containing material increases due to the additional weight of the Sealant. In some cases, a test application may be recommended to ensure sufficient penetration of the sealant into the material.

Sealants must form a tough thin skin that can withstand moderate impact, be flexible and flame retardant, resist deterioration over time and is non-toxic.
Encapsulation should be limited to areas where asbestos-containing material will not be subject to further damage by contact. Encapsulation should also be limited to material that is capable of supporting the additional weight of the sealant. In addition, the fire rating of the material must be considered before applying a sealant.
Encapsulated material needs to be routinely inspected for deterioration or damage signals.
Although the method may be less costly than removal in the short term, the long term cost will be greater due to increased Management Plan surveillances and removal will eventually be required.

Encapsulation Advantages

- Can be a more rapid and economical method of controlling exposure.
- Reduces the potential of fibre release.

Encapsulation Disadvantages

- The asbestos source remains.
- If material is damaged or deteriorating, the additional weight of the sealant may cause delamination.
- A continuous monitoring system is required. Precautions are necessary to prevent damage during maintenance or removal.
- It requires the maintenance of the encapsulated or damaged surfaces.
- The encapsulated materials may complicate the removal.

Comments

- Encapsulation is only a temporary measure - the encapsulated asbestos will eventually require removal.
- Encapsulation must be performed using High Risk Work Procedures.
- Encapsulation is difficult to do where access to the asbestos material is awkward.

Enclosure

Enclosure requires that a physical barrier be placed between asbestos-containing materials and the building environment. A drywall covering is normally an acceptable enclosure. A suspended ceiling is too easily entered and does not provide a reliable barrier.
If a suspended ceiling must be saved, the tiles should be labelled to indicate that asbestos is present behind the tiles and will be disturbed if a tile is removed. Their position must not be altered to prevent fibres from entering the property.
Since the asbestos has not been removed, fibres will continue to be released and will accumulate behind the barrier. If the enclosure is damaged or entered for maintenance, the fibre accumulation may be released into the building environment. Although the abatement method may be less costly than removal in the short term, the long term cost will be greater due to the increased Management Plan and removal will eventually be required.

Enclosure Advantages

- May be a rapid, economical, uncomplicated method of controlling Exposure.

Enclosure Disadvantages

- The asbestos source remains.
- Fibre fallout may continue behind the Enclosure.

- May be costly if the enclosure disturbs the function of others systems.
- A continuous Management plan is required. Precautions are necessary for entry into the enclosure when performing maintenance or renovation activities.

Comments

Enclosure is a very cost effective method of repairing damage to mechanical systems.
Enclosure is a temporary measure only. Eventually, removal can be required.
Depending on the location and condition of the asbestos, enclosure must be performed using Moderate or High Risk Work Procedures.

Management Plan

When asbestos-containing materials remain in place, a monitoring plan must be implemented. This plan should be in writing and address the following:

1. Inventory of all asbestos-containing materials in the building;
2. Inspection frequency and procedures;
3. Training requirements for maintenance staff and others who may come into contact with the materials or work in proximity to the materials;
4. Response procedures to follow in Emergency situations;
5. Procedures to follow should the Condition of the Materials change or Work routines be altered;
6. Notification Procedures for occupants and others in the building;
7. Labelling of asbestos-containing materials.

The cost of a monitoring plan can vary greatly, but may result in a cost savings if work can be deferred to a later renovation or demolition.
It is important to recognise that the risk of hazardous asbestos exposure may increase as a result of changing conditions in the building. For example, materials can be damaged by maintenance, repairs or renovation tasks, causing further fibre release. Consequently, a Monitoring Plan should be implemented to ensure that asbestos is not released as a result of these activities. All people involved in such activities must be informed that asbestos-containing materials are present and be trained in work procedures. They also must abide by and enforce the work procedures for the activity to be performed.

Monitoring Plan Advantages

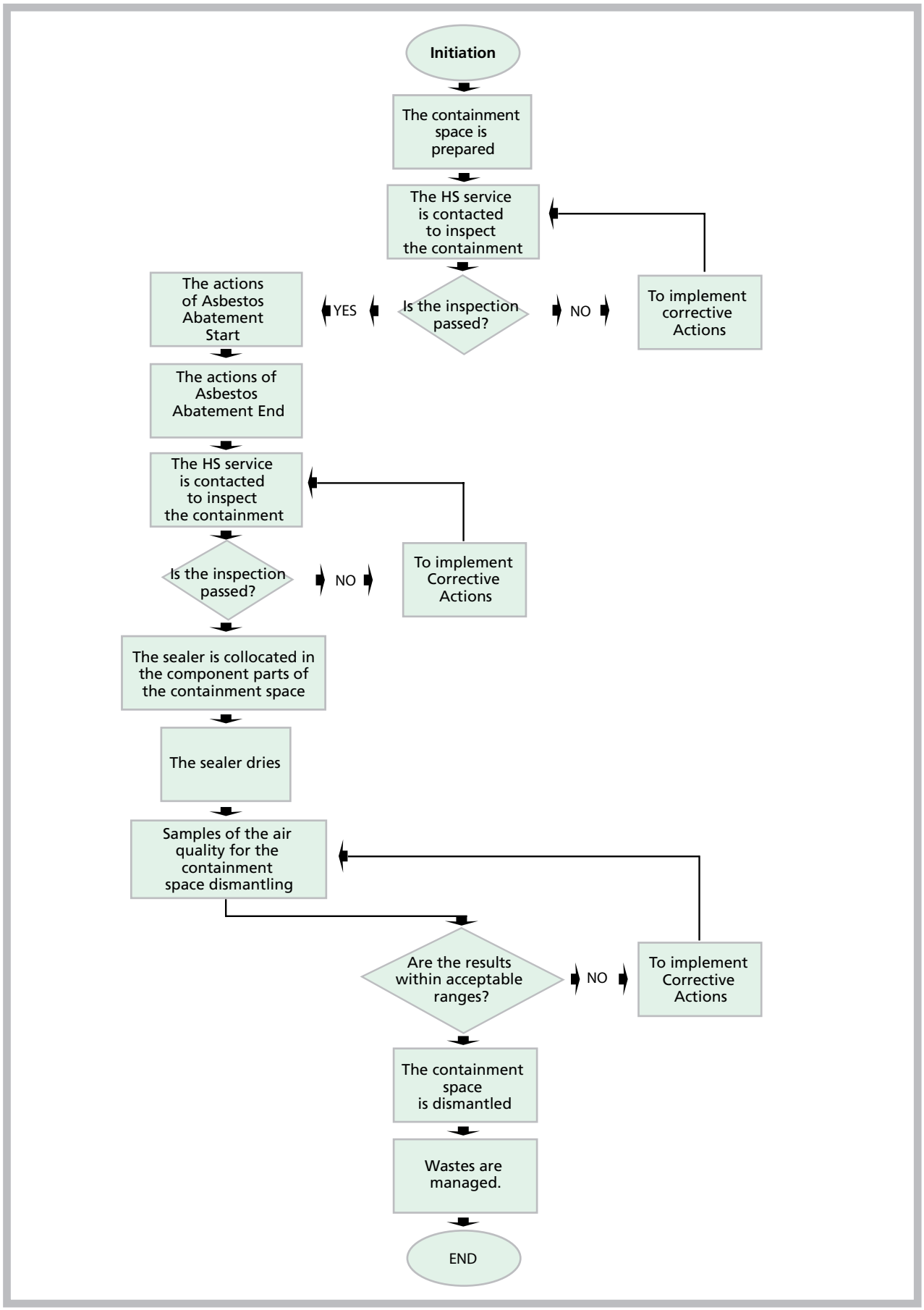
- Initial cost lowest and minimum disruption to building operation.

Monitoring Plan Disadvantages

- The asbestos source remains.
- The potential for Exposure may Increase over time.
- Precautions are necessary to prevent damage during maintenance or renovation activities.
- Continuous Inspection and Re-evaluation are necessary.

Comments

- A monitoring plan may be very difficult and costly to implement and enforce.
- The Enclosure is a temporary measure. Removal will eventually be required.


Initiation
The containment space is prepared
The HS service is contacted to inspect the containment
Is the inspection passed?
YES
NO
To implement corrective Actions
The actions of Asbestos Abatement Start
The actions of Asbestos Abatement End
The HS service is contacted to inspect the containment
Is the inspection passed?
NO
To implement Corrective Actions
The sealer is collocated in the component parts of the containment space
The sealer dries
Samples of the air quality for the containment space dismantling
Are the results within acceptable ranges?
NO
To implement Corrective Actions
The containment space is dismantled
Wastes are managed.
END

CHAPTER 4 // ASBESTOS ABATEMENT PROCEDURES

Introduction

The Asbestos abatement procedures vary depending on the fibre type, quantity and location of the asbestos. In general, the procedures are divided into 3 categories (Low risk, Moderate risk, and High risk) according to their potential of generating airborne Asbestos fibres.

All procedures follow the same four principles:

1. Isolate the Work area
2. Protect Workers
3. Minimise the release of Asbestos fibres
4. Ensure adequate clean-up and decontamination.

This Chapter presents **minimum procedures** for Asbestos Abatement activities with low, moderate, and high risks. The information presented should be used only as a guide; you could suit the procedures to every building site or worksite adopting measures that give equal or greater protection to the workers.
In spite of the provided examples, in any work area that may become a "restricted area", high risk procedures must be followed.

Asbestos Abatement Activities // Risk: Low

Description

Operations classified as "low risk" have a minimum risk of releasing asbestos fibres into the air and the preventive measures to protect workers properly are quite simple and of easy application.

"Low risk" activities include:

- Installing or removing non-friable products (that are in good conditions) manufactured from asbestos-containing materials, without cutting, breaking, sanding or vibrating them. This includes handling products such as: asbestos cement Products and Piping, Vinyl Asbestos Floor Tiles, etc.;
- Work done in the proximity of friable Asbestos that does not require contacting the material;
- Using non-powered hand tools designed to cut, drill or abrade non-friable manufactured product containing asbestos, as long as water is used to control fibre release and waste products are properly controlled;
- The transportation or handling of asbestos-containing materials in sealed containers.

Equipment

Required equipment should include the following:

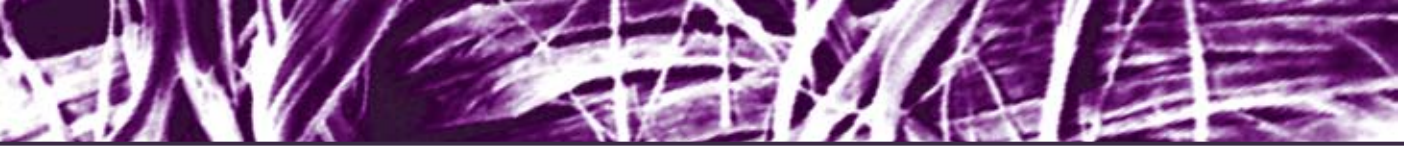
- Vacuum cleaner fitted with a High Efficiency Particulate Air (HEPA) filter;
- Polyethylene drop sheets with a nominal thickness of 160 micron;
- Labelled disposal bags with a nominal thickness of 200 micron;
- Hand sprayers to wet Asbestos;
- Collective Protections and Warning Signs;
- Hand powered tools;
- Mops, rags and water for clean-up;
- Fire Extinguishers;
- First Aid Kit.

Removal of asbestos dusts

Personal Protective Equipment

Workers who may be exposed to asbestos fibres should wear:

- A NIOSH-approved half mask air purifying respirator equipped with a P100 (At least a 99.97% efficiency in the Filtering of solid-based particles, liquid aerosols and oil-based Particles), R100 (Resistant to oil-based Particles) or N100 (Non-resistant to oil-based Particles);



- Disposable overalls that cover worker's clothes in order to prevent their contamination;
- Additional Personal Protective Equipment according to the risks related to the working area.

Previous Activities

- Establish Work procedures to be followed and control the equipment required to perform the activities;
- Ensure workers are adequately trained in the hazards and proper methods of working with asbestos;
- Emergency Response procedures should be defined for the working area before the beginning of the tasks.

Site Preparation

- Put collective protections (barriers) and Warning Signs in areas where access needs to be restricted until the work is completed.

Work Procedures

- Dry removal of asbestos-containing material is not permitted. Localised wetting of the material must be done to minimise fibre release;
- Remove all visible dust on work surfaces with a damp cloth or a vacuum cleaner fitted with HEPA filter;
- Where necessary, use drop plastic sheets or similar materials in order to prevent the spread of asbestos dust to other work areas;
- When hand tools are used to cut, shape or drill non-friable manufactured product containing asbestos, the product should be wetted whenever possible to minimise the release of airborne fibres. If the material cannot be wetted, the work must be classified as moderate risk and moderate risk Abatement procedures followed;
- No person may eat, drink, smoke or chew gum at the work site except in a designated clean area. Workers must remove personal protective equipment and clothing and clean their hands and faces prior to any of these activities.

Working clothing

Decontamination

1. During and immediately upon completing the work:

• Clean up dust and waste by vacuuming with a vacuum cleaner fitted with HEPA filters, by wet sweeping or by damp mopping.

• Drop plastic sheets must be wetted and folded in on themselves so as to contain dust, properly bagged and disposed of as asbestos waste.

2. Compressed air must not be used to clean up or remove dust from work surfaces or clothing. Cleaning must be done with a vacuum cleaner fitted with HEPA filter, by wet sweeping or by damp mopping.

3. Non-disposable overalls and other clothing contaminated with asbestos must be laundered following proper procedures. Footwear should be properly decontaminated.

Disposal

Asbestos waste, including contaminated disposable clothing, must be placed in sealable containers that are labelled as containing asbestos waste.

Once filled, containers of asbestos waste must be sealed and external surfaces cleaned by wiping with a damp cloth that is also to be disposed of as asbestos waste, or by using a vacuum cleaner fitted with HEPA filter. The cleaned containers must then be removed from the work area.

Air Monitoring

Air monitoring is useful in determining asbestos exposure levels during abatement activities. The results should be below 0.01 fibres per cubic centimetre (Res. MTSS 295/03) during all phases of the work. In the case of Low Risk projects, a baseline measurement of all the phases should be taken.

Site Inspection

Upon completion of the work, the work area must be visually inspected to ensure that all the visible asbestos-containing debris has been properly cleaned up.

Asbestos Abatement Activities // Risk: Moderate

Description

Activities where there is a moderate risk of exposure to airborne asbestos fibres include:

- Using non-powered hand tools designed to cut, drill or remove non-friable manufactured product containing asbestos if water is not used to control fibre release;
- Using a mechanical or electrically powered tool, fitted with HEPA filter dust collector, to cut, shape or grind non-friable manufactured products containing asbestos;
- Removing all or part of a false ceiling used as enclosure of an area containing asbestos where it is supposed or known that the asbestos fibres of friable products are placed on its panels;
- Removing, encapsulating, enclosing or disturbing minor areas of friable asbestos-containing material during the repair, alteration, maintenance, demolition or dismantling of a building, structure, machine, tool or equipment, or parts of it;
- Performing Glovebag operations;
- Dry buffing and stripping of Vinyl Asbestos tile;
- Renovation or hand demolition involving drywall joint compound, block mortar, stucco or brick mortar products containing asbestos;
- Removal of 9.3 m2 or less of contiguous ceiling tile containing asbestos or vinyl floor tiles having asbestos backing;
- Dry removal of non-friable asbestos material where the material may be cut, broken, or otherwise damaged during the removal.

Equipment

Required equipment should include the following:

- Vacuum cleaner fitted with a HEPA (High efficiency particulate air) filter;
- Polyethylene drop sheets with a nominal thickness of 160 micron;
- Labelled Asbestos disposal bags with a nominal thickness of 200 micron;
- Hand sprayers to wet Asbestos;
- Collective protections and Warning Signs;
- Appropriate tools;
- Mops, rags, water and others supplies for clean-up;
- Fire Extinguishers;
- First Aid Kit

Personal Protective Equipment

1. Workers exposed to asbestos fibres should wear, over the working clothes, protective clothing that:

- Should be made of material such as Tyvek that resists penetration by asbestos fibres
- Should cover the whole body and fits snugly at the neck, wrists and ankles
- Should cover the head and feet (laceless rubber boots are recommended)
- Should be immediately replaced if torn.

• The wearing of disposable overalls is recommended.

2. A NIOSH-approved respirator equipped with a P100 (At least a 99.97% efficiency in the Filtering of solid-based particles, liquid aerosols and oil-based Particles), R100 (Resistant to oil-based Particles) or N100 (Non-resistant to oil-based Particles). Disposable respirators (face masks) should not be used. The respirator selected must have a sufficient protection factor to provide adequate protection for the fibre levels that are present in the environment.

3. Additional Personal Protective Equipment according to the risks related to the working site.

Previous Activities

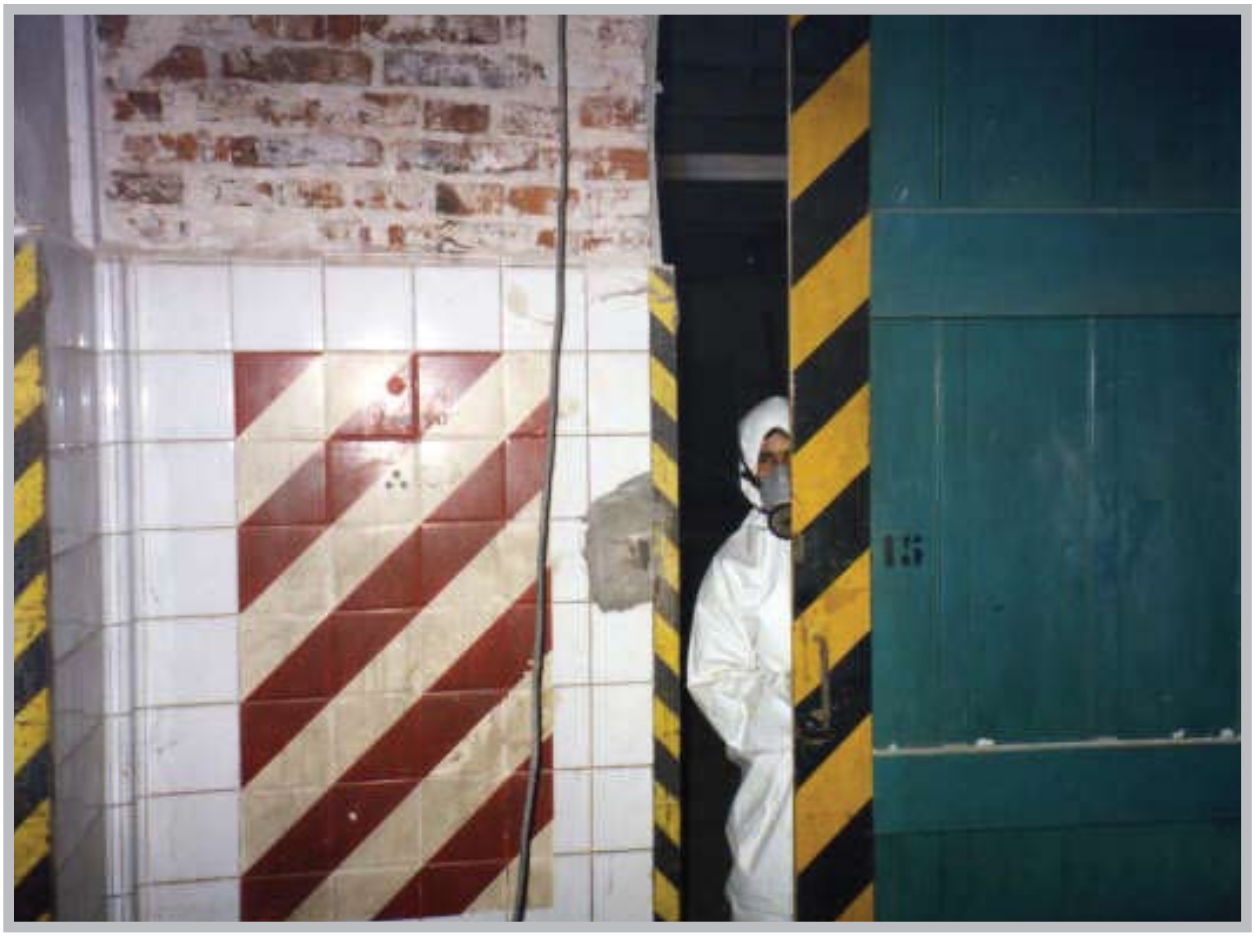
• Establish Work procedures and control the equipment required to perform the activities.

• Ensure all equipment fitted with HEPA filters has been tested before the beginning of the activities

• Ensure workers are adequately trained in asbestos hazards and proper methods of working with asbestos.

• Ensure that building occupants, trades people, etc. are notified, in advance, of the location, duration, and type of work to be performed.

• The Emergency Response procedures should be defined by the working area prior to the beginning of the tasks. If the working site could be considered as a confined space, then the Emergency Response Procedure for confined spaces will be followed.



Site Preparation

• Barriers and Warning Signs should be posted in areas where access to unauthorised people needs to be restricted until the work is completed.

Caution
Asbestos Dust Hazard

Avoid Breathing Dust
Wear Protective Elements

Breathing Asbestos Dust may cause Cancer

Entry is prohibited except to Authorised People

Eating, Drinking, and Smoking are prohibited in this area.

• Clearly mark the boundary of the work area by placing barricades, fencing or similar structures around it;
• Prior to starting any work that is likely to disturb friable asbestos-containing materials, the working area must be cleaned by damp wiping or vacuuming with a vacuum cleaner fitted with HEPA filter;
• All air handling ventilation systems that could cause asbestos fibres to be distributed, disturbed or become airborne as a result of the work should be shut down before work begins;
• All mechanical and electrical equipment should be locked out and identified with cards within the work area;
• Electrical power for Asbestos abatement activities should be supplied through a Ground Fault Circuit Interrupter;
• If required, a containment should be constructed using 6 mil (160 micron) thick polyethylene sheeting. The containment should not be greater than 9 m2. A ventilation system with negative pressure and fitted with HEPA filters will be connected to the containment during the tasks. If a larger containment is needed, the project may require re-classification as high risk;
• A worker decontamination room should be attached to the containment.

Work Procedures

• Wet material thoroughly before and during the work unless such wetting creates hazard to workers. Material should be wet but not saturated to avoid delamination or disintegration of the material.

Area Humidification

• Do not use compressed air to clean up or remove dust from work surfaces or clothing. Techniques which generate excessive fibre levels should be avoided. Clean-up techniques should include vacuuming with a vacuum cleaner fitted with HEPA filters, wet sweeping, or damp mopping.
• Use plastic drop sheets and barriers to prevent the spread of asbestos containing dust to other work areas.
• Do not allow asbestos waste to accumulate or dry out before final bagging.
• Once abatement work is completed, seal all rough edges or surfaces containing asbestos-containing material at the edges of the work area with an encapsulant.
• If a containment is constructed, apply a slow drying sealant such as glue spray to its surfaces prior to

dismantling it. This measure ensures that the non-visible asbestos fibres are bonded to the surfaces of the containment.

- If a containment is used, complete a final air test after a minimum drying period of four hours.
- No person may eat, drink, smoke or chew gum in the work site, except in a designated clean area. Workers must remove personal protective equipment and contaminated clothing and clean their hands and faces prior to any of these activities.

Decontamination

1. During and immediately upon completing the work:
   - Clean-up dust and waste by vacuuming with a vacuum cleaner fitted with HEPA filter, by wet sweeping, or by damp mopping.
   - Plastic drop sheets must be wetted, folded in on themselves to contain dust, properly bagged and disposed of as asbestos waste.

2. Before leaving the work area:

3. Clean personal protective equipment and work clothing with a vacuum cleaner fitted with HEPA filter, or wipe them with a damp cloth.

4. Leave all disposable protections in the working areas, preferably in the decontamination areas.

5. Place overalls and Work Clothing that will not be re-used in a sealable container and dispose of them as Asbestos Waste.

6. Non-disposable overalls and other asbestos-contaminated clothing must be laundered and cleaned using proper procedures. Safety shoes should also be decontaminated properly.

7. Workers should wash all exposed skin areas prior to removing respiratory protections. All people in the working area should decontaminate properly, prior to leaving the work area. This is to be done under all circumstances, including prior to eating, drinking or using the bathroom.

Decontamination Showers

Disposal

Asbestos wastes, included contaminated disposable clothing, should be disposed of in properly identified containers.
Once filled, containers should be sealed and their surface should be cleaned by wiping with a damp cloth that is also to be disposed of as asbestos waste, or by using a vacuum cleaner fitted with HEPA filter. Cleaned containers should be removed from the working area.

Air Monitoring

Proper air monitoring requires that samples are taken prior to work starting (baseline or background samples), during abatement activities and upon completion of the job if required. Air monitoring must be performed by competent personnel following specified measurement protocols.

1. If fibre levels inside the work area exceed the protection factor of the respiratory protective elements being used, work must stop until appropriate respirators are supplied and airborne fibre levels can be controlled.

2. If fibre levels measured just outside the barriers exceed 50% of the Occupational Exposure Limit (OEL), work practices must be reviewed. If high levels continue, work must stop until the reasons for high levels are identified and corrected. If fibre levels outside the work area approach the OEL, work must immediately stop until the reasons from high levels are identified and corrected. Fibre levels outside the work area must never exceed the OEL. If fibre levels are approaching the OEL, the work area may need to be re-classified as high risk.

3. Air monitoring test results should be less than 0.01 fibres per cm3 (Res. MTSS 295/03) during all work phases. When working in a containment, the final air monitoring should be carried out in Aggressive Sampling conditions (Sampling Technique that involves agitating the air to create a "worst-case-scenario" of asbestos fibre exposure).

Site Inspection

A visual inspection of the integrity of the containment, if one is used, must be performed prior to work commencing. If the Project continues for more than one shift, the containment should be checked for damage at the time of the shift change and repaired immediately.
Upon completion of the work, the work area must be visually inspected to ensure all visible asbestos-containing debris has been properly cleaned up and removed.

Asbestos Abatement Activities // Risk: High

Description

Activities where there is a high risk of exposure to airborne asbestos fibre include:

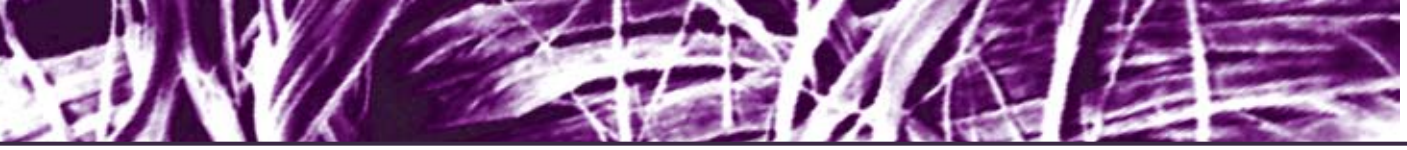
- Removing, encapsulating or enclosing areas with friable asbestos-containing materials during the repair, alteration, demolition or dismantling of a building, structure, machine, tool or equipment, or part of it;

- Cleaning, maintaining or removing air-handling equipments in buildings where sprayed fireproof asbestos-containing material has been applied to airways or ventilation ducts;

- Repairing, altering or dismantling a boiler, furnace, kiln or similar device, or part thereof, where asbestos-containing materials have been used or applied;

- Demolishing, dismantling, altering or repairing any buildings or structure, or part of it, in which insulated material containing asbestos was used or in which asbestos products were manufactured;

- Removal of more than 9.3 m2 of contiguous ceiling tile containing asbestos or sheet vinyl flooring having an asbestos backing;



- Dry removal of friable asbestos-containing materials;

- Abatement activities involving any type of project where there is a reasonable chance of the concentration of airborne asbestos exceeding the OEL: i.e. a "Restricted Area".

Equipment

Required equipment should include the following:

- Portable HEPA-filtered Exhaust Units with extra fuses;
- Replacement HEPA filters;
- Flexible or Rigid Ducts;
- Vacuum Cleaner fitted with a HEPA filters;
- Portable ground fault circuit interrupter;
- Portable electrical panel fitted with Differential Circuit-breaker;
- Garden hose;
- Hand pump garden sprayers to wet Asbestos;
- Wetting agents;
- Scrapers, nylon brushes (soft and hard bristles), shovels, and others;
- Scaffolds with railings;
- Duct tape or an alternative tape with similar or better adhesive qualities;
- Polyethylene sheeting having a nominal thickness of 6 mil (160 micron);
- Thick labelled Asbestos disposal bags with a nominal thickness of 6 mil (160 micron);
- Barriers and Warning Signs;
- Mops, rags, water and other supplies for clean-up;
- Encapsulant for sealing edges and corners;
- Manometer, bomb and smoke generator;
- Fire Extinguishers;
- First Aid Kit.

Personal Protective Equipment

1. Workers exposed to asbestos fibres should wear, over the working clothes, a protective clothing that:

- Should be made of material such as Tyvek that resists penetration by asbestos fibres.
- Should cover the body and fits snugly at the neck, wrists and ankles.
- Should cover the head and feet (laceless rubber boots are recommended).
- Should be immediately replaced in case of tearing.
- The wearing of disposable overalls is recommended.

2. If contaminated clothing is to be laundered, it must first be vacuum cleaned, wetted down and placed in plastic bags. Then the bags should be sealed and labelled prior to being sent to laundry facilities. Machines and facilities equipped with HEPA filters must be used to clean asbestos-contaminated clothing. On-site facilities are preferred. Workers who launder the clothes must be informed about the Asbestos exposure hazards and the precautions required when handling contaminated clothing. Workers must NEVER take home contaminated clothing for laundering.

3. During high risk abatement activities, acceptable respiratory protection is a Powered Air Purifying Respirator (PAPR) equipped with P100 filters (at least a 99.97% efficiency in the Filtering of solid particles, liquid aerosols and oily-based particles), R100 filters (oily-based Particles Resistant), or N100 (oily-based Particles Non-resistant). PRAP Systems are distinguished by a motor ventilator and a high- efficiency particle filter (HEPA) assembled in a full-face piece. Air is purified whether by a filter, cartridge or a combination of both. The duration of motor ventilator is subject to the load and duration of the battery included in each PAPR model. Positive pressure supplied air respirators may be required if wet removal is impossible (autonomous equipment). In some cases, dual cartridge half and full face respirators fitted with HEPA filters are acceptable for high- risk exposure activities. The appropriate level of Respiratory Protection can only be determined by conducting air monitoring tests and calculating the protection factor needed. However, where a level of protection lower than PAPR is chosen for a high-risk operation, the suitability of such equipment must be assessed for the duration of the project. If fibre concentrations increase, workers will need to switch to respiratory protective equipment with a higher protection factor. Disposable respirators should not be used.

Respiratory protection

4. A half mask air purifying respirator equipped with P100 filters (At least a 99.97% efficiency in the Filtering of solid particles, liquid aerosols and oily-based particles), R100 filters (oily-based Particles Resistant), or N100 (oily-based Particles Non-resistant) can be used for the set-up and dismantling phases of the Removal activities.

5. Protective Clothing and respiratory protective equipment must be provided for authorised visitors.

6. Workers must use Additional Personal Protective Equipment according to the risks related to the working area.

Previous Activities

1. Establish the Work procedures and control the equipment required to perform the activities;

2. Have the following documentation available:

- Required Permits;
- Written Lock-out Procedures;
- Proof of each worker Training;
- Names of Supervisory Personnel;
- Shop drawings of work area layout and Decontamination Facility;
- Construction schedule;
- Certification of HEPA-filtered equipment;
- Instructions for proper Respiratory Protection;

3. Ensure all equipment fitted with HEPA filters has been tested before the beginning of the activities.

4. Ensure workers are adequately trained in asbestos hazards and proper methods of working with asbestos.

5. Ensure that building occupants, tradespeople, etc. are notified, in advance, of the location, duration, and type of work.

6. The Emergency Response procedures should be defined by the working area prior to the beginning of the tasks. When working with contentions, one worker, who is appropriately trained, must be stationed outside the containment to respond to emergencies and contact rescue personnel if required. Workers inside the containment should have some form of communication with the worker outside it. Emergency exits should be clearly marked, both inside and outside of containment.

Site Preparation

• Barriers and Warning Signs should be posted in areas where access needs to be restricted while the work is being performed;

• Clearly mark the boundary of the work area by placing barricades, fencing or similar structures around it;

• The entire work area should be enclosed-insulated to prevent the escape of asbestos fibres. It may be necessary to erect a temporary wooden or metal frame to which the plastic barrier can be attached at least 6 mil (160 micron) thick polyethylene sheeting. All the joints should be 30 cm overlapped and double taped to ensure the area sealing;

• A HEPA-filtered exhaust unit must create a negative air pressure of approximately 5 Pascal within the enclosure relative to the surrounding area. This exhaust unit must provide at least four complete air changes per hour. In this arrangement, the major and usually only route of air into the removal area is through the Decontamination Unit;

• Negative air pressure in the enclosed space relative to the surrounding area must be maintained so that air flow is always from clean outside areas. Negative pressure must be maintained in the enclosed space until site decontamination work is complete and air monitoring tests confirm fibre levels are low enough to permit dismantling of the enclosure. Exhaust air from the enclosure must be discharged to the outdoors through a HEPA filter. The airflow pattern in the work area must ensure that the clean room and shower room are safe for workers who are not wearing respirators. The HEPA-filtered Exhaust Unit must remain in continuous operation to maintain negative pressure in the enclosure while the removal is in progress and during clearance procedures after the removal;

• HEPA-filtered exhaust units should be positioned to allow access to the filters from within the removal area, while the units themselves are kept outside the removal area. This makes decontamination of the units easier. Where it is not possible to change the filter while within the removal area, a temporary enclosure should be constructed around the unit during filter replacement;

• HEPA filters must have a minimum filtration efficiency of 99.97 %. A pre-filter should be installed upstream of the HEPA filter to prolong its life. Where practical, the discharge point for any exhaust unit should be to the outside air, away from other work areas, heat sources, air-conditioning inlets or air compressors.

In the cases where exhaust air cannot be discharged to the outside, or where it must be discharged to areas close to previously mentioned situations, the discharge must be routinely monitored for airborne asbestos;

Zone protection

• Testing of exhaust units must take place completely on-site, before the start of the job, and at least once a month or as required to ensure the integrity of the HEPA unit. The best way to inspect the filter and seal fittings is by using a static pressure alarm which indicates a failure in the system;

• If a complete enclosure cannot be constructed, cover any windows and doors leading into the area with a plastic sheeting barrier, which should overlap the framework of the window or door by 10 to 15 cm. Ensure a good seal by wiping the area around the window or door with a moist cloth so that the tape sticks, favouring thus the properties of the tapes and other bonding elements;

• Seal off stairways and elevators. Where asbestos is removed from an entire floor of a multi-storey building, all passenger elevators must be prevented from stopping at that floor. Removal workers may gain access to the floor via the fire staircase or from an elevator dedicated for this purpose;

• Seal heating and ventilation ducts and close dampers to eliminate air flow. Aside from specific asbestos exhaust units, all ventilation and air conditioning equipment that services the removal area must be shut down for the duration of the removal job. All vents must be sealed to prevent asbestos dust from getting into the dust network. Upon completion, and after final cleaning of the removal area, all mechanical ventilation filters for recirculated air should be replaced if possible;

Zone protection

• Use a layer of seamless or seam-sealed, fibre-reinforced polyethylene sheeting on the floor of the containment, covered by a second layer of polyethylene sheets or similar material with a nominal thickness of at least 160 micron. Use double-sided tape to prevent movement between layers.

Moderate level cleaning

A turn-up of 30 cm should be used where the floor joins the walls, while sheeting covering the walls should overlap the floor sheeting to prevent leaks of asbestos-contaminated water running outside of the containment. Extra strength in the containment floor can be achieved by running the double layers of plastic at 90 degrees to one another;

• Power sources with ground fault circuit interrupters must be used to protect workers against electric shock from electrical equipment operated in the presence of water inside the enclosure. All existing electrical circuits must be blocked and labelled to prevent unintentional start-up;

• Remove all movable furniture, equipment and others from the asbestos removal area. Immovable items should be carefully wrapped and sealed in suitable plastic sheeting so they are effectively isolated from the removal area.

• Where set-up operations may release asbestos fibres, all personnel in the removal area must wear appropriate personal protective equipment, including respiratory protective equipment approved for use with asbestos. Main prior activities that should be completed are: isolation of the work area;
Shut down of the heating, ventilation and air conditioning system; Installation of HEPA-filtered exhaust units and the Worker Decontamination Facility must be completed first. The need for appropriate respiratory protective equipment is particularly important when removing barriers or partitions such as false ceilings. Where asbestos-containing materials have fallen onto a false ceiling, the ceiling should only be removed by following at least the procedures required during moderate risk abatement activities. Any service line which hangs down into the ceiling space should be sealed up if it cannot be sealed from outside the removal area;

• Care should be taken to ensure that asbestos fibres cannot escape at points where pipes and conduit leave the removal area. So that end, additional preventive measures should be taken to assure the sealing;

• When planning and building an asbestos removal containment, special consideration must be given to the impact on: the fire rating of the building, and to the provision of fire fighting facilities and emergency lighting;

• Power, telephone and fire alarm cables may lie beneath asbestos insulation. To prevent workers from being damaged, the cables must be clearly identified prior to commencing the tasks. Cables should be re-routed or disabled during the removal period;

• The containment and material transfer rooms may be fitted with a clear acrylic panel or some other form of window so that the work within may be monitored from outside;

• A decontamination facility must be attached to the work area to allow workers to remove contaminated clothing and properly shower before leaving the area. The decontamination facility consists of a series of connected rooms separated by Airlocks (Device that allows personnel to access from one room to another with a minimum air interchange). Curtained Doorways are constructed by placing overlapping sheets of plastic -on the framed doorway and vertical side of the doorway- on both sides of the wall allowing movement of people from one room to another. Two distanced curtained doorways create an airlock. An additional decontamination facility should be attached to the containment for waste transfer.

Work Procedures

• Unless more imminently dangerous hazards dictate, asbestos-containing materials must be handled and removed only when wet. Wetting agents can be used with water to assist in thoroughly wetting asbestos-containing materials. To wet the surfaces of asbestos-containing materials a spray jet gun can ONLY be useful for: spraying from a pistol-grip garden hose fed from a fresh water supply. High pressure water spray should never be used;

Area Humidification

• Dry sweeping or compressed air must NOT be used to clean up waste materials;

• Exhaust air from the containment must pass through a HEPA filter and be discharged outdoors;

• Vacuum cleaners used to clean up asbestos materials must be fitted with a HEPA filter;

• Asbestos-containing materials near workers performing bulk removal activities should be continually misted with water, if practicable.

Cloth cleaning

• All surfaces exposed to asbestos fibres must be effectively cleaned by vacuum cleaning or damp wiping;

• If asbestos is encapsulated, the sealant must penetrate the material and effectively bind the asbestos fibres together;

• After completing the removal of asbestos-containing materials, exposed surfaces must be washed or vacuum cleaned and treated with sealant;

• The pressure from streams of water, sealants or encapsulants must be controlled to prevent excessive generation of airborne asbestos fibres. Use of low pressure application systems is recommended;

• Workers must not eat, drink or smoke in the asbestos removal area as doing so requires workers to remove their respirators, exposing them to high concentrations of asbestos dust. Workers must leave the work area and fully decontaminate themselves prior to performing any of these activities;

• Power tools should be selected carefully since not all types are appropriate for use in dusty and wet conditions. In general, power tools driven by compressed air or hand tools are preferable;

Decontamination

- For high risk removal jobs, the only satisfactory method of providing an appropriate decontamination facility is with a mobile or specially constructed on-site unit, which is located immediately adjacent to, and joined to, the enclosed asbestos removal area. The facility is divided into three distinct rooms: Dirty Room, Shower Room and Clean Room;

- The decontamination facility's three rooms are separated from one another by means airlocks. This airlock defines the boundary between each segment of the decontamination facility. The airlock allows personnel to access the removal area and restricts the flow of air between areas. Partitions between rooms must be self-closing so that each room functions as an airlock (plastic sheets hanging from a doorframe functioning as curtains);

- Generally, no more than 10 people should use one decontamination facility so that adequate access to shower and cleaning facilities is provided and line ups are avoided;

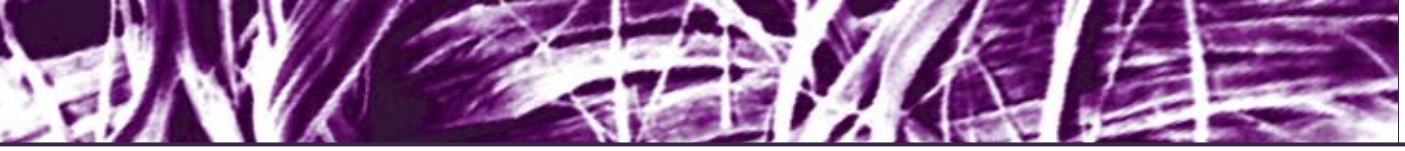
- The dirty room should have provision for:
  - Facilities for the cleaning of contaminated clothing and footwear with water or a vacuum cleaner fitted with a HEPA filter.
  - Storage of contaminated clothing and footwear
  - Bins for waste materials
  - Airflow towards the asbestos removal area;

- The shower room should have provision for:
  - A shower area with an adequate supply of soap, shampoo and hot and cold water
  - Airflow towards the dirty decontamination area;

- The clean room should have provision for:
  - Storage of individual respirators in lockers
  - A mirror to assist in donning respiratory protective equipment
  - Storage for clean clothing;
  - Separate storage of clean and dirty towels
  - Airflow towards the shower area;

- All water from the decontamination facility should pass through a 10 micrometre filter before it passes into the sewer mains;

- The worker enters the clean room and removes all street clothes and personal belongings, leaves these in the clean room and changes into clean work clothes. A respirator is put on and checked for fit and proper operation. He then passes through the shower room into the dirty room. Alternatively, work clothing which is worn throughout the job may be stored and put on in the dirty room (this clothing is stored in separate lockers). Respirators must ALWAYS be placed in the Clean Room;



• On leaving the contaminated work area but before entering the dirty room, asbestos material on the worker or their protective equipment should be removed with a vacuum cleaner fitted with a HEPA filter;

• In the dirty room, the worker removes all protective clothing and equipment EXCEPT the worker's respirator; Any waste material must be placed in plastic bags or bins for disposal;

• The worker then enters the shower room and showers while wearing their respirator. After the worker's head and the respirator's facepiece and associated harness have been thoroughly rinsed, the respirator may be removed and the shower completed. An adequate supply of hot/cold water, soap and shampoo should be provided;

• After showering, the worker enters the clean room and dresses in street clothes. The respirator is then thoroughly cleaned, disinfected and stored until required;

• Hand tools and supplies are kept in an equipment transfer room associated with the dirty room, and transferring asbestos waste containers or any equipment that has been decontaminated;

• In circumstances where the decontamination unit cannot be located adjacent to and joined to the removal area, enclosure procedures to minimize Asbestos contamination must be implemented. Usually this requires workers to discard their Contaminated Protective Equipment in an isolated changing area attached to the removal area enclosure and thereafter change into fresh outer clothing for the journey to the decontamination facility. Following initial cleaning, the worker enters the dirty room, removing coveralls, boots and any other clothing. While still wearing a respirator, the worker proceeds to the shower room and follows the personal decontamination procedures, the worker passes through the second airlock or buffer zone into the clean change area. Here the worker changes into conventional work or street clothing stored in the locker provided;

• A final decontamination, including wash down and cleaning with a vacuum cleaner fitted with a HEPA filter removes all visible signs of asbestos. This decontamination must be completed before dismantling the enclosure barriers;

• An appropriate slow drying sealant should be applied to the containment walls prior dismantling work. This measure ensures that any invisible asbestos fibre is bonded to the containment walls and does not remain in the environment. Once verified the effective decontamination of the space by final air tests, dismantling work can start and it should be completed following at least Asbestos Abatement Low Risk work procedures;

• All tools and electrical equipment must be left in the removal area until completion of the removal job. Before any tool or equipment is removed, it should be wiped with a damp cloth or with a vacuum cleaner fitted with HEPA filters. Where tool decontamination is not possible, the item should be plastic wrapped and sealed and only opened when inside the containment area of another asbestos removal tasks;

• On completion of asbestos removal jobs, all tools and equipment not needed for the final clean-up should be thoroughly washed and removed from the site;

Disposal

• Waste material from within the enclosed asbestos work area must be placed in doubled polyethylene bags with a nominal thickness of at least 200 micron each, then sealed and clearly labelled with the following information:
  • The contained material is Asbestos
  • Asbestos is carcinogenic (It causes cancer)
  • Asbestos fibres should not be inhaled

If the waste materials are likely to puncture the polyethylene bags, suitable rigid containers must be used;

• Clean the external surfaces of sealed containers by wiping with a damp cloth (it is also to be disposed of as asbestos waste), or by using a vacuum cleaner fitted with a HEPA filter, before the containers leave the contaminant area or transfer room;

• In the equipment transfer room, sealed containers must be packaged to withstand handling and transportation to the disposal site without being punctured or otherwise damaged;

• A continuous clean-up and disposal program must be in place to prevent unnecessary accumulation of asbestos-containing waste materials at the work site. At the end of each work shift, all asbestos waste material must be properly contained. Prior arrangements must be made with appropriate authorities to deliver asbestos-containing waste to assigned dump sites. Transport drivers must be informed of the precautions that must be taken and transport vehicles may be required to carry signs or placards specifying the nature of the cargo.

Air Monitoring

• Air sampling to determine airborne asbestos fibre concentration is required before and during the abatement work, and prior to dismantling the containments. They must be completed by competent personnel. Where possible, results should be made available to workers on the same day (or as soon as possible). Sampling should include:
  • Before work starts - Background samples to establish baseline airborne fibre levels.
  • On a daily basis and outside the containment - Sample taking when there are unprotected workers in the immediate vicinity of the containment. In some cases, sampling may be required in other areas such as the floors above or below, or in adjacent rooms, depending on the set-up of the work site and occupancy of these areas.

• During initial and subsequent stages of Asbestos abatement project - personal sampling of workers conducting removal. Ensure that results are within acceptable limits for the respiratory protection selected. Personal samples should be collected at least daily, but can be collected more frequently depending on work conditions. Filters must be analysed and results provided to workers within 24 hours.

• On a daily basis in the Clean Room - Sample taking during bulk removal operations. Sampling must cover at least half of the work shift and at least one shift of decontamination. Samples must be analysed and results provided to workers within 24 hours.
• Before the enclosure is dismantled - the air inside the enclosure must be sampled.

• At a minimum, one sample should be collected for every 450 m2 of enclosure area to determine suitability for re-occupancy. The final air test should be completed using "Aggressive Sampling Techniques".

The following criteria should be applied when reviewing airborne fibre test results:

1. If fibre levels exceed the protection factor of the type of respiratory protective equipment being used, work must stop until appropriate respirators are supplied and airborne fibre levels can be controlled.

2. If fibre levels measured outside the containment exceed 50 % of the asbestos OEL, work practices should be reviewed. If high levels continue, work must stop until the reasons for the high levels are identified and corrected. If fibre levels outside the containment approach the asbestos OEL, work must immediately stop until the reasons for the high levels are identified and corrected. Fibre levels outside the work area must never exceed the OEL. If the fibre concentration approaches the OEL, the work area should be re-classified as high risk.

3. Air monitoring test results should be less than 0.01 fibres per cm3 (Res. MTSS 295/03) during all phases of the work. Final air monitoring test results should be carried out under Aggressive Sampling Techniques conditions (Sampling Technique that involves agitating the air to create a "worst-case-scenario" of asbestos fibre exposure). If the final air test fails, the containment cannot be dismantled and the work area should be conditioned again and re-tested.

Site Inspection

A competent person must perform the following checks regularly during the project:

• Perform a smoke test to check the integrity of the removal area enclosure before any asbestos removal begins and before the exhaust units begin operating.

• Visually inspect the enclosure before the start of removal work and at the beginning of each work shift. Any defect revealed must be remedied immediately. Where necessary, additional air monitoring might be required to assess the impact of defect(s) noted.

• Inspect all equipment used for the removal of asbestos material before the removal job begins, following repair and at least once a week where continually used. Maintain a record containing details of the equipment inspection and any repairs.

• Inspect the temporary enclosure and the entire decontamination facility at least daily for gaps and breaks. This inspection includes a visual check as well as smoke testing to ensure that air flows from clean areas into contaminated areas. A record of these inspections should be kept.

• Continuously measure and record air pressure differentials between clean and contaminated areas during the asbestos abatement tasks. Pressure differentials should be maintained at a minimum of 5 pascal.

• Complete a walk-through inspection after the removal is completed and before sealant spray is applied to ensure that all visible asbestos in the area has been removed and the clean-up is satisfactory.

• To ensure the site is adequate for re-occupancy by unprotected workers, complete a final walk-through inspection after the containment has been removed, but before the contractors complete demobilisation.

CHAPTER 5 // OTHER PROCEDURES

Special Cases

The removal of asbestos-containing products from various types of facilities, under a wide variety of circumstances, creates special cases requiring non-standard approaches.
However, the four basic principles for asbestos handling should always be followed:

- **Isolate the work areas**
- **Protect workers**
- **Minimise the release of fibre**
- **Ensure an adequate clean-up and decontamination**

Dry removal

Dry removal should only be done where wetting the asbestos-containing materials would create high risk situations for workers as well as for the equipment present in the working area. Examples: Working adjacent to electrical power sources that cannot be suitable protected from moisture or working around very sensitive equipment where the risk of water damage is unacceptable.

Zone protection

Workers must wear supplied-air respiratory protective equipment during dry removal of friable asbestos.
For dry removal of non-friable materials, the respirator selected must provide adequate protection to ensure that worker exposure is below the OEL. Potential non-asbestos-related hazards such as electrical contact should be reviewed and appropriate steps taken to prevent an incident.

The dry removal area should be continually cleaned to prevent the accumulation of waste, with vacuuming preferred over dry sweeping. Barriers should be inspected regularly to ensure there are no breaks or holes.

Advanced level cleaning

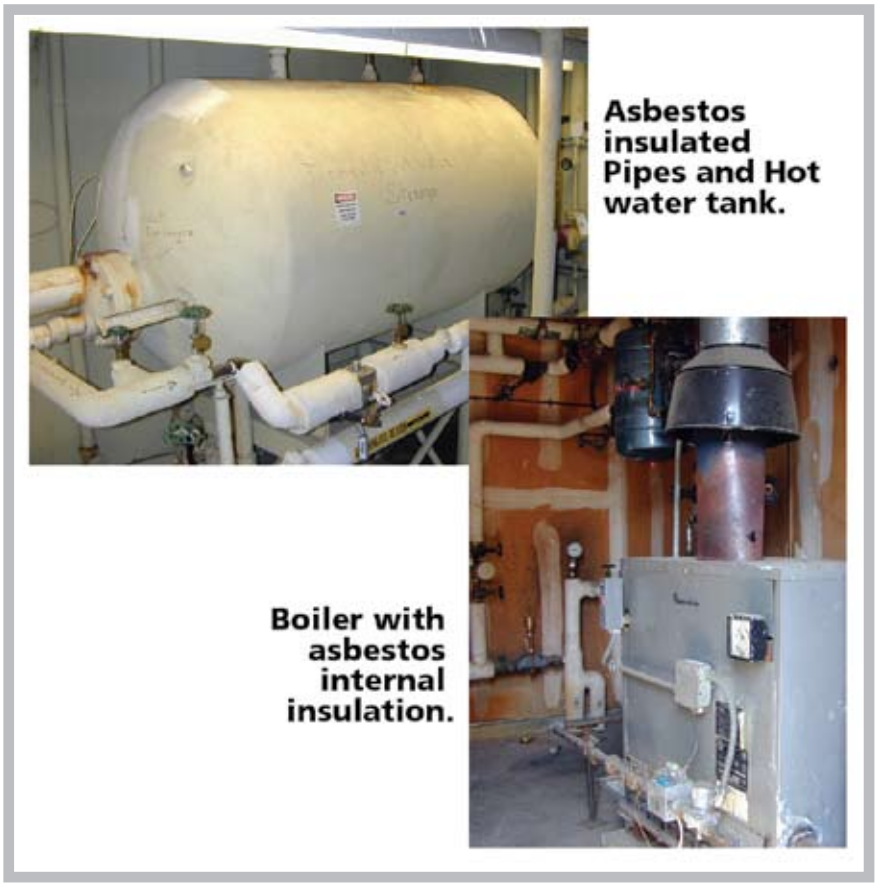
Waste must be immediately placed in proper containers. Where possible, use a high velocity local exhaust system at the point of removal to capture fibres released at the source. Where very small quantities of Waste are involved, direct vacuuming with a vacuum cleaner fitted with a HEPA filter will greatly reduce fibre levels.
Since dry removal results in much higher airborne fibre levels within the containment, frequent and more intensive monitoring and more stringent procedures are required to minimise fibre release.

Outdoor Removal

Weather conditions (Heat, cold, wind blows, etc.) may determine whether or not work can be performed. Mobile decontamination facilities, special work platforms and other specialized equipment may be required for outdoor removal.
Air samples to monitor its quality should include: samples from the air downwind of the removal area, samples from around workers in the removal area and personal sampling of workers performing the removal.
Personal samples should be taken at least once per day.

Removal at high temperatures

Hot removal should be avoided unless the circumstances do not allow for the shut down of equipment and cooling off of the work area and equipment. When this is not possible, many of the standard high risk procedures are blended with special equipment and techniques to allow the removal of asbestos from pipes, vessels or systems at high ambient temperatures. Standard GLOVEBAG system can be effectively used up to 65° C. Where boilers, vessels or other large systems are involved, hoardings must be erected to contain asbestos fibres. Fire resistant polyethylene is recommended where very high temperatures are encountered. The circulation of cooled air into the enclosure and very high rates of air exhausted through HEPA units will assist in controlling ambient temperatures. Only encapsulants with a temperature rating equivalent to the surface temperatures encountered should be used. Workers should wear heat resistant clothing (gloves, aprons, etc.) to protect themselves from burns. It is better to wear natural fibre clothing rather than those made of synthetic fibres.



Asbestos in pipes

The containment must be capable of withstanding and compensating for expected heat loads. Appropriate fire extinguishers and first aid supplies for burns and heat stress must be available in the work area.

When possible, a localised exhaust at the point of removal activities should be used to minimise the spread of airborne fibres released. Thorough wetting of asbestos-containing materials may be difficult when working next to extremely hot surfaces. Dry removal techniques are recommended. The work area should be inspected to ensure that combustible materials cannot come in contact with hot surfaces.

The employer must have an Emergency Response Plan, the work area must have appropriate fire fighting equipment and personnel must be able to respond quickly.

Heat Stress and Burn Hazards are potential problems. Therefore:

- Heat stress monitoring should be done;
- A plentiful source of cool drinking water outside the work area should be available for break periods;
- The fulfilment of the workers' resting times should be controlled to avoid Thermal Stress. Shifts between breaks can be shortened depending on the working conditions;
- Cool lunchrooms or break areas should be provided.

Crawl Spaces and Attics

Work with reduced spaces may present unique problems such as the presence of dirt floors and confined space entry hazards. Wheeled dollies to allow greater mobility may be needed, as well as extra lighting, knee-pads and hard hats.

Where practicable, GLOVEBAG removal is recommended. If not, removal practices are required. Examples of such situations include: where the asbestos is mixed into dirt floor of a reduced space, where there are space constraints, among others.

The employer must have a Preparation and Emergency Response Plan to deal with workers who get stuck in tight spots or with getting them out in the event of an injury. The use of a buddy system and two-way radios may be appropriate. Areas considered confined spaces require stringent site-specific procedures and a written code of practice for confined space entry. Where high risk procedures are followed and the dirt floor is contaminated, polyethylene sheeting on the floor is not required. Any openings in the floor or walls should be sealed.

Where dirt floor reduced spaces are encountered, any asbestos mixed in with the dirt must be removed. Contaminated dirt must not be spread around either within or outside of the work area. Generally, it is not practical to remove contaminated dirt, in this case it is possible the application of a sealant to the surface to trap asbestos fibres. However, if the dirt is left in place, a Monitoring Plan is required.

After removal of the contaminated dirt, the reduced space should be checked to verify that all gross contamination has been removed. This can be done by digging through the dirt in several test spots, taking samples and checking them for asbestos.

Removal with GLOVEBAG system

GLOVEBAG system allows the removal of asbestos-containing materials from mechanical components such as: piping, valves, fittings and small dimension duct work without constructing an elaborate containment. Its application is optimal when removing small asbestos amounts from a big area, eliminating the need to

completely hoard the area. The removal of asbestos-containing materials is considered a moderate risk project unless the work area meets the definition of a "Restricted Area".
GLOVEBAGS come in a variety of types and styles; some are multi-use, meaning they can be moved along a pipe as removal progresses. Other glovebags are taped (and sealed) in a place and used only in that one location before being discarded.

Removal with GLOVEBAG system

Other equipment required for GLOVEBAG removal includes:

- Vacuum cleaner fitted HEPA filters
- Polyethylene sheets with a Nominal Thickness of 160 micron
- Labelled Asbestos waste bags with a Nominal Thickness of 200 micron
- Spray bottle or hand pump garden sprayer to wet asbestos
- Water and wetting agents
- Duct tape or tape having similar or better strength
- Utility knife with retractable blade
- Pliers and other cutting hand tools

Determine the type, style and quantity of bags needed for the job. If possible, work should be performed when building occupants or other workers are not present in the immediate vicinity of the work area. In any event, the work area should be cordoned off using banner tape and warning signs to inform about hazards.

GLOVEBAGS must not be used on pipe insulation that is not prepared for their application, because when they are placed or moved along the pipes they could release asbestos fibres in the air.

Work Procedures

Before working with a particular type of GLOVEBAG, workers should read and understand the manufacturer's instructions for use. In general:

- Place a polyethylene drop sheet beneath the area where GLOVEBAGS are being used.
- Prior to applying the bag, seal any loose insulation by wrapping it with polyethylene sheets.
- Prior to starting the removal, clean up any loose asbestos waste on the pipe with a vacuum cleaner fitted with HEPA filters.
- Assemble all the required tools and equipment.
- Place the tools inside in the GLOVEBAG and seal the bag to the pipe, insert the nozzle of the garden sprayer into the bag and seal the opening. Similarly, insert the nozzle of the vacuum cleaner fitted with a HEPA filter into the bag and seal the hole. Ensure that the weight of the hose does not pull the bag off the pipe.
- Place hands into the gloves and using tools, cut and remove any jacketing. Wet exposed insulation material to reduce fibre release and, after removal, arrange it in the bottom of the bag.
- Using a wire brush or other abrasive element clean asbestos residue off of the pipe or fittings.
- Wet and seal the exposed ends of the insulation. The sealant should also be applied to the inside upper section of the bag prior to removal of the bag.
- Invert the gloves position and leave them pointing to the outside. Place the tools in the glove and pull the glove of the bag so the tools are inside the glove. Twist and double tape the glove to create a pouch that can be cut off. The tools may now be placed into the next GLOVEBAG or into a pail of water for cleaning (the pouch opening will be done under the water).
- Suck the air out of the bag using the vacuum cleaner. Twist the lower section of the bag containing the waste and seal it with tape. Slowly, remove the tape connecting the bag to the pipe. Place the bag into an asbestos waste disposal bag and seal it. Disposable work clothing and polyethylene sheets must also be disposed of as asbestos waste.
- All work equipment, including work clothing, should be cleaned by damp wiping or with a vacuum cleaner fitted with HEPA filters.
- Workers should wash their hands and face before leaving the work area. GLOVEBAGS are to be used and then discarded (except for the multi-use ones). They must not be cleaned and reused. In general, GLOVEBAGS must not be used on piping at temperatures exceeding 65°C. Check with the manufacturer for the recommended range of temperatures in which the bag can be used.

At least once in each shift, air quality in the working area should be monitored to ensure that the work is being performed without the release of asbestos fibres. The surfaces from which asbestos has been removed should be visually inspected after removal of the GLOVEBAG to ensure that there is no remaining asbestos residue.

CHAPTER 6 // PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment (PPE)
Every person working at an Asbestos Abatement project must wear appropriate Personal Protective Equipment:

- Respiratory Protective Equipment during all construction or maintenance work around friable asbestos where fibre levels are not controlled;
- Protective clothing to reduce the contamination risk of worker's clothing, skin and hair;
- Other Protective equipment such as: Eye Protection, Hard Hats, Hearing Protection; Safety Shoes and other protections as site conditions or Legal Regulations require.

The employer must be sure that the personal protective equipment provided to workers will not cause medical problems, i.e.: latex allergies, respirators and breathing difficulties, etc.

Respiratory Protection
For protection against airborne asbestos, three main types of Respiratory Protective Equipment are available:

- Air Purifying Respirator
- Supplied Air Respirators
- Self Contained Breathing Apparatus

The Respiratory Protection Equipment purpose is to provide clean air to the person wearing it and it ONLY functions properly when it is selected, used, maintained, and cared for in the proper manner.
Only approved respirators may be used. Approved respirators are those that have undergone testing and have been granted NIOSH approval.

Types of respiratory protection elements
Air Purifying Respirator
Air purifying respirators clean contaminated air by passing the air through a filter before it is inhaled. A mechanical filter for particulates or fumes, a chemical cartridge filter for vapours, mists, and gases, or a combination of the two can be used. Air is drawn through the filter when the person wearing it breathes in or, in the case of a powered air respirator, by a battery-powered blower. Dual cartridge respirators are classified as air air purifying respirators.

Air purifying respirators do not protect the wearer against an atmosphere deficient in oxygen. The air must have an oxygen concentration higher than 19.5 %. Air purifying respirators are also not intended for use in an atmosphere that is Immediately Dangerous to Life or Health (IDLH).

Respiratory Protection

Filters used for asbestos fibres must be high efficiency (99.97 %) as classified by NIOSH, which approves three kinds of High Efficiency Particulate Respirator: N, R and P.

N Class Respirator Filters may only be used where the work area is free of oil. **R Class** Filter Respirators are oil resistant and can only be used for a total of eight hours. **P Class** Filter Respirators are effective against all airborne particles and can be used for more than one work shift.

Supplied Air Respirators

These respirators provide breathable air from an external air source free from contaminants. The connection between the respirator and the air is made through an air hose. **Supplied Air Respirators** provide better protection than Air purifying respirators against higher levels of airborne contaminants.

Self Contained Breathing Apparatus

The air supplied in this system is contained in a cylinder which the wearer usually carries on the back. The wearer's air is completely independent of the ambient atmosphere. Self Contained Breathing Apparatus are used in areas where very high levels of protection are required and they may not be practical for the majority of Asbestos Abatement Projects.

Self Contained Breathing Apparatus

Protection Factor

Respiratory protection elements offer varying degrees of protection against airborne contaminants. The degree of protection is described by the concept of Protection Factor (PF). Protection factor is defined as the concentration of an airborne contaminant in the worker's breathing zone outside the respirator facepiece divided by the concentration of contaminant inside the respirator facepiece:

$$PF = \frac{\text{Concentration of Fibres in the Work Environment (outside the Respiratory Protection)}}{\text{Concentration of Fibres inside the respirator facepiece}}$$

The higher the Protection Factor, the greater the degree of Protection provided by the Respiratory Protection. Likewise, the Actual Protection Factor achieved by a respirator is greatly dependent on the fit of the mask to the wearer's face, varying this with the worker's activities, facial movements, beard or moustache.
Assigned Protection Factors (APF) have been developed for different Respirators based on extensive research. These protection factors can be used to select a respirator that will maintain the asbestos fibre concentration inside the facepiece at an acceptable level.

Factors affecting the Respirator fit

The effectiveness of the seal between the facepiece and the wearer's skin assures that the respirator provides the Protection Factor indicated by the manufacturer.
Before entering the work area, it should be verified that the Respiratory Protection is properly sealed, and to do so two types of seal checks are used:

Negative Pressure Check:

- Put on the respirator and fit it comfortably. Do not press the mask more than needed.
- Cover completely the filters or the inhalation points with the two hands.
- Try to breath and keep your breath for 10 seconds.
- If the seal is properly done, the respirator will fit snugly to the face and will keep in this way.
- If the air enters, fit it again and repeat the check.

Positive Pressure Check:

- Put on the respirator and fit it comfortably. Do not press the mask more then needed.
- Cover the exhalation valve with the palm of your hand. The valve is generally placed in the lower part of the respirator.
- Try to exhale again. Wait some seconds.
- If there are not air escapes, the respirator will separate just a little from your face but the air will not escape.
- If the air escapes, fit it again and repeat the check.

Various Factors affect the facial seal of a respirator, including:

Beard and moustache

Beard, moustache, even a 3-day-beard can seriously reduce the effectiveness of the facial seal and cause leakage. For this reason, the person wearing a respirator must be clean shaven at least where the respirator contacts the face.

Respirator Design

Since respirators are designed and constructed differently, they tend to fit differently. A proper fit can be difficult to achieve if the facepiece material is too soft or too hard, if the facepiece straps are improperly adjusted, or if the wrong size of facepiece is selected.

Headstrap Tension

Some respirator wearers tighten the headstraps as much as possible in the belief that doing so provides a better seal and fit. Frequently, the exact opposite is often the result, since the shape of the facepiece becomes distorted in such a way as to favour the failures in the seal. The headstraps should be snug, yet comfortable, and fit testing will demonstrate just how tight or loose they must be.

Facial Shapes

The size and shape of human heads vary widely. High cheek bones, narrow faces and broad noses, among others, ensure that one size and one design of respirator cannot possible fit everyone.

Inspection, Cleaning, Storage and Maintenance

Inspection

Regular cleaning and inspection of respirators is extremely important and must be done according to the manufacturer's instructions.

Respirators must be cleaned and inspected:

- Daily by routine users.
- Before and after each use by occasional users.

Besides, if the same respirator is shared by different people, it must be sanitized between uses.

Prior to cleaning a respirator, each part of it should be inspected. Defective parts must be replaced before the respirator is used. The facepiece must be checked for cuts, tears, stiffening or signs of deterioration. If the unit is damaged, it must be immediately replaced. Headstraps must be checked for breaks, tears and/or loss of elasticity.

Cartridge sockets are inspected by paying special attention to the rubber joints located at their bottom (They should have no cracks or flaws).

The cover on the exhalation valve should be removed and the rubber valve carefully examined to ensure it seals properly and has not become brittle. The edges of the valve should be examined for holes, cracks and dirt. The exhalation valve is a critical component of the respirator and must be replaced if there is any doubt about its ability to function properly. The valve cover is also important, it must not be damaged and it must be tightly fitted.

Finally, the interior of the facepiece and inhalation valves should be examined. Dust or dirt accumulating on the inhalation valves can interfere with their proper operation. Inhalation valves should be free from tears and cuts and they should be soft and flexible.

Cleaning

The respirator should be cleaned according to the manufacturer's instructions. Strong detergents, solvents and/or hot water must not be used because they may deteriorate the rubber parts. A stiff bristle brush (NOT wire) can be used to remove dirt if necessary.

The respirator should then be rinsed with warm water to remove the rests of detergents and/or cleaners that could dry on the rubber parts and then may cause skin irritation to the wearer. The respirator should be tested to ensure all parts work properly prior to being used in workstations.

Storage

Respirators should be stored in a clean location, preferably in a plastic bag in a locker or on a shelf. They should be stored away from sunlight, solvents and other chemicals, extreme cold or heat, and excessive moisture. They must not be left out on a workbench or hanging on a nail in the shop where they can get dirty or be damaged.

Maintenance

All respiratory protective equipment manufacturers suggest a regular preventive maintenance. Mixing and matching of parts from one respirator brand or model to another must never be allowed. Makeshift parts for respirators must never be installed.

Working Clothes

Working clothes for asbestos removal work usually consist of disposable and impermeable materials that cover the whole body, foot, hands and head. This protective clothing reduces contamination of the worker's body-hair and makes decontamination much easier.

The best protection is provided by protective clothing that consists of the body protection (overall kind), a hood and protective foot covering forming an indivisible whole. Alternatively, laceless rubber boots can be worn as long as they are properly decontaminated before leaving the work site. Disposable types of protective clothing are made of products such as TYVEK. Permeable clothing is not recommended for asbestos abatement works as fibres can penetrate it, contaminating the clothes worn beneath it and also the worker's skin.

Protective clothing does not include the one used daily for non-occupational activities, including: T-shirts, socks, blue jeans, etc. If any of these items are used inside the work area, they should remain there and be disposed of as asbestos waste at the end of the project. Protective clothing that is reused must be collected, handled and washed in a manner that prevents the spread of asbestos fibres in the air and ensures that the clothing is free from asbestos.

Workers must never take contaminated clothing or towels home for laundering. The clothes used and the towels must be collected at the work stations and sent to a laundry that specialises in cleaning clothing contaminated with asbestos fibres.

Working clothes may also need additional protections because of the risks present in the Work station (head protection, eye protection, hearing protection, etc.). If asbestos-containing materials have wire mesh or other sharp objects, heavy gloves should be given to the workers to protect their hands. The worker must also wear safety footwear that provides him protection from sharp or heavy objects and gives him good adherence to wet or slippery surfaces.

ANNEX // LEGAL

The Resolution 823/2001 of the Ministry of Health (that forbids the production, importation, commercialisation and use of Chrysotile asbestos fibres and products containing them in the whole territory of the country from 1st January 2003) is a health and development policy that enables the application of strategies in favour of the life quality of people and their families.
The Ministry of Labour and Social Security incorporated asbestos within the First Group (sufficient evidence of carcinogenicity in human beings), for Disposition Nº 1/95 of updating the List of Carcinogenic Substances and Agents. In 1991, Resolution 577/91 was dictated, xxxxx the use and handling and final disposal of asbestos. It establishes the industrial process methodology, giving great importance to labelling, signalling, information and workers' training.
By means of Decree Nº 658/96 asbestos was incorporated to the List of Occupational Diseases because of its capacity of producing mesothelioma and lung cancer in exposed workers.
Through Resolution Nº 845 of the Ministry of Health, asbestos amphibole variety was forbidden in the whole country on 10th October 2000.
Moreover, since the formulation of Resolution 823/2001, there have been not regulations for household products elaborated on base of or with asbestos in any of its chemical presentations.

Decree 658/96 / List of Occupational Diseases – AGENT: ASBESTOS

DISEASES	OCCUPATIONAL ACTIVITIES THAT MAY GENERATE EXPOSURE
Asbestosis: Pulmonary fibrosis radiologically diagnosed with specific signs, identified according to ILO International Classification of Radiographs of Pneumoconiosis, with or without respiratory functional compromise. **Respiratory complications:** Acute respiratory insufficiency Chronic respiratory insufficiency **Cardiac complications:** Right ventricular insufficiency PLEURAL BENIGN LESIONS: • with or without functional respiratory modifications; • exudative pleurisy; • pleural plaques, with or without classifications, parietal, diaphragmatic and mediastinic; • pericardial plaques; • pleural bilateral engrossment, with or without diaphragm irregularities. PRIMITIVE MALIGNANT MESOTHELIOMA: of pleura, peritoneum or pericardium. PRIMITIVE BRONCHOPULMONARY CANCER	List of activities in which exposure is possible: Works exposing to asbestos fibre inhalation, specially: Minerals and asbestic rocks extraction, grinding, treatment; Raw asbestos handling and use in manufacturing and usage operations of: asbestos cement, asbestos plastic, asbestos rubber, carding, spinning, weaving and manufacture of asbestos textile, cardboard, asbestos paper and felt, asbestos sheets and gaskets, brake tapes and pads, clutch discs, moulding and insulating products. Application, destruction and elimination of asbestos or asbestos-containing products and goods: insulation protective asbestos, asbestos flake application or other thermal insulation products, asbestos thermal insulation maintenance, asbestos scraping in constructions, asbestos-containing building demolitions.

The Resolution Nº845/2000 Ministry of Health BUENOS AIRES,

According to Resolution Nº 845 dated 10th October 2000, issued by the MINSTRY OF HEALTH, published in the Official Bulletin Nº 29.505 dated 17th October 2000, IT IS INSTRUCTED: that from 16th December of the current year, it is forbidden the importation of Amphibole variety asbestos fibres (Crocidolite, Amosite, Actinolite, Anthophyllite and Tremolite) and products containing it protected by parties: S.A 25.24, 39.20, 39.21, 39.25, 68.11, 68.12, 68.13, 84.84 and 94.06; and by sub-parties: 3926.30, 3926.90, 7308.90, 8483.60, 8708.31, 8708.39 and 8708.93.
Furthermore, it is outlined that the above mentioned is not an economic prohibition, in conformity with the established in Article 610 of the Customs Code.

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