GUIDE

Guide for Asbestos Management

SAFE WORK MANITOBA™

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INTRODUCTION

Who should read this?

This guide provides general information and minimum requirements to building owners, employers, maintenance and custodial staff consultants, all contractors (including abatement contractors), workers, building occupants (workplaces occupying space in the building) and others concerned with the presence of asbestos and asbestos containing materials (ACMs) in workplaces, workplace locations, buildings and infrastructure.

Objectives

The objective of this guide is to provide information:

a) to prevent the release of airborne asbestos fibres, worker exposure and the known chronic health effects of asbestos

b) for best abatement practices

c) for the minimum practices used in preventing the release of asbestos fibres for maintenance, repair, renovation and demolition activities where ACMs are present at a workplace

d) for working with and abating ACMs.

Application

This guide applies to all workplaces, workplace locations, buildings and structures:

a) where ACMs are suspected to be present

b) where ACMs are determined to be present

c) where ACMs may be used, stored, handled, removed or otherwise disturbed

d) where airborne asbestos fibres are produced, or

e) where asbestos waste is produced, stored or disposed of, and may include:

- custodial and service activities in buildings containing asbestos
- maintenance, repair and renovation projects (e.g., ductwork/HVAC, pipe wrap, friable sprayed asbestos material)
- maintenance, repair or removal (abatement) of ACMs
- demolition of a building or structure with ACMs
- waste disposal facility practices
- manufacture of materials or products containing ACMs
- use or application of ACMs.

What is asbestos?

Asbestos is a naturally occurring fibrous mineral silicate once widely used in the construction industry. Its strength, flexibility, ability to withstand high temperatures and resist chemical degradation made it useful in hundreds of applications. Materials in which asbestos is commonly found include chrysotile (serpentine form), amosite, tremolite and actinolite (amphibole form); less commonly, asbestos is found in crocidolite and anthophyllite (amphibole form). Asbestos in all forms is recognized as being carcinogenic to humans by the American Conference of Governmental Industrial Hygienists (ACGIH) and the International Agency for Research on Cancer (IARC).

Where is asbestos found?

Asbestos and ACMs are commonly found in building materials used and installed in homes, workplaces, buildings and infrastructure up until approximately 1990.[4] For ease of reading, from now on, "asbestos and ACMs" will be referred to as ACMs. Although the use of asbestos has become limited, it has never been completely banned and it may still be found in some new products.

The main properties that make asbestos useful are its incombustibility, chemical resistance, strength and flexibility when separated into fibres. It is effective as a reinforcing or binding agent when combined with cement or plastic. In addition to its well-known application as thermal insulation, ACMs were commonly used in interior finishes (walls, ceilings, floors), exterior finishes (roofing, stucco, siding) and mechanical and air handling systems, among other materials. A list of some of the typically known ACMs by year of installation, provided in *Appendix A*, has been derived from the Guidance for Asbestos Control EPA (Environmental Protection Agency),1985, number 560/5-85-024 (purple book). In addition, a list of some of the commonly known building supplies, sprayed and insulation materials, and other products and processes known to contain ACMs, is provided in *Appendix B*.

Any construction or renovation carried out before 1990 is suspected of containing asbestos in some of the building materials. **These suspect materials must be handled as though they contain asbestos until it is shown through laboratory analysis that they are asbestos-free.**

Why is asbestos hazardous?

Exposure to asbestos fibres through inhalation can lead to chronic disease for some individuals. Some of these chronic diseases include mesothelioma (cancer of the lining of the abdominal or chest cavity), lung cancer and asbestosis (scarring of the lungs, making breathing difficult). An asbestos-related illness may not develop until 15 to 20 years after an initial exposure. Some factors increasing the risk of disease development include the concentration of asbestos fibres in the inhaled air and the frequency and duration of a person's exposure. Smoking will also greatly increase the risk of developing an asbestos-related illness.

Asbestos fibres can become airborne (released into the air) as a result of poor asbestos maintenance practices, disturbance of asbestos or ACMs during renovations, repairs, and/or inadequate containment procedures during removal or work processes.

Asbestosis

Asbestosis is a lung condition associated with exposure to high concentrations of airborne asbestos. It is an irreversible, fatal disease without effective treatment. The lungs may develop inflammation and a buildup of scar tissue around the fibres in an attempt to protect themselves. This causes the lungs to stiffen and leads to symptoms of coughing, difficulty in breathing, weight loss and eventually death. The disease is similar to silicosis (from rock and sand dust) and black lung disease (from coal dust) commonly associated with work in mines. These occupational lung diseases are all preventable. While elimination of further exposure to asbestos will not stop or reverse the disease, it may help to slow down the rate at which the disease progresses. Early symptoms of the disease, including shortness of breath, often accompanied by a dry cough, usually develop 10 to 20 years after initial exposure.

Lung Cancer

Lung cancer takes approximately 15 to 25 years to develop, depending on the frequency and duration of exposure. Exposure to asbestos fibres for four to six months may be sufficient to cause lung cancer. The risk of disease from asbestos exposure increases with smoking.

Pleural and Peritoneal Mesothelioma

Research has shown that exposure to asbestos increases the risk of mesothelioma of the pleura, the membranes that line the lungs, and of the peritoneum, a membrane that lines the abdomen.

Malignant mesothelioma has no effective treatment and is always fatal. One half of all patients die during the first year following diagnosis; few patients survive longer than two years. Development of the disease does not appear to be related to the amount of asbestos inhaled. Some susceptible individuals develop the disease following exposure in non-occupational settings.

Development of the disease has been found to occur in individuals exposed to asbestos for as little as two months, and for as long as 50 years. The latency period between exposure to asbestos and the onset of terminal illness ranges from 15 to 55 years, with a mean of 40 years for both long- and short-term exposures.

Other Cancers Related to Asbestos Exposure

Other cancers related to asbestos exposure include cancer of the larynx, trachea, stomach, colon and rectum. 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.

REGULATORY INFORMATION

All employers, owners and persons acting on behalf of owners (i.e., contractors, property managers, consultants) and workers have legal responsibilities under the *Manitoba Workplace Safety and Health Act and Regulation*.

This guide is intended to provide general guidance with respect to the management and disturbance of asbestos. The information contained within is not exhaustive. The interpretation and extent of its applicability may require the assistance of a person competent in recognized occupational hygiene practice for working with asbestos in workplaces.

General duties

Employers must inform prime contractors and subcontractors of safety and health hazards at the workplace. The employer must ensure that, as much as is practicable, all workers at the workplace, including those not under the employer's direct control, perform their work according to requirements of the *Manitoba Workplace Safety and Health Act and Regulation*. Contractors and subcontractors can also be considered employers. They are also responsible to inform their workers of hazards and to ensure they perform their work according to the *Manitoba Workplace Safety and Health Act and Regulation*.

Owners and persons acting on behalf of the owners must ensure that the land or premises used at a workplace that is under their control is provided and maintained in a manner that does not create a risk to the safety and health of any person. They must communicate the required information regarding potential hazards at the site.

Workers have responsibilities under the *Manitoba Workplace Safety and Health Act and Regulation*. They must follow the safe work procedures they have been trained to use, report unsafe work and inform management of any changes in work processes that may result in exposure to asbestos fibre.

Workplace Safety and Health regulatory requirements related to work with asbestos

The *Manitoba Workplace Safety and Health Act and Regulation* Parts 2, 6, 33, 35, 36 & 37 contain provisions requiring owners, employers and contractors to take specific actions when a potential health risk of asbestos exposure is present in the workplace.

In reference to these parts of the regulation, this guide outlines the best practices required when:

- asbestos is suspected to be present and there is a requirement to prepare an asbestos inventory – Parts 37.2(1) and (2)
- asbestos is confirmed by laboratory analysis or assumed to be present and the following are required:
  - a written control plan – Part 37.5
  - general duties – Part 37.6(1) and 37.8(1)
  - labelling – Parts 37.4, 35.1(4), 35.10(1)
  - instruction and training – Part 37.6(2), 35.3, 36.3; asbestos work must only be carried out by competent workers. Safe work procedures must be developed and followed to prevent potential asbestos exposure
  - periodic inspection – Part 37.2(1)(c)
  - procedures for working with or abating ACMs; repairs, removal, handling and decontamination – Part 37.7
  - removal of ACMs prior to any demolition – Part 33.4(1), 37.8(1)(b)
  - personal protection – respirators and clothing – Parts 6.15 and 6.9

- asbestos exposure air sampling – Part 36
- waste disposal – Part 35.1(4)
- medical surveillance for asbestos workers working with asbestos – Part 37.6(2) and the Fibrogenic Dust Exposure (Silica & Asbestos) Workers Medical Screening Guideline, 2008
- Notification to the director of the Workplace Safety and Health (WSH) Branch – Part 37.8(2) for work projects that may release ACMs into the atmosphere. The notification form is accessible on the WSH website: **www.manitoba.ca/labour/safety**. Where Internet access is not available, notification can be made by calling 204-957-SAFE or 1-855-957-SAFE (7233) (toll-free in Manitoba) and pressing 1 for WSH. Notification may also be required for asbestos project setup activities that have potential to cause fibres to be released (e.g. the removal of barriers or partitions such as false ceilings behind or on which asbestos-containing materials may have accumulated containment installations).

ASBESTOS MANAGEMENT

Asbestos management is required at all sites (workplaces, workplace locations, buildings or structures) where ACMs are present, or suspected to be present, including:

- sites where ACMs are to remain in place and the ACM must be maintained in good condition to prevent a fibre release; this will be accomplished with an **asbestos inventory**, and carefully developed **asbestos control plan**.
- sites where workers are required to work with ACMs (after an accidental fibre release, when performing a large repair, demolishing a structure or removing ACMs); this will be accomplished by following the **procedures for working with asbestos**.

Effective asbestos management requires commitment from all levels of management.

Building owners and employers are responsible to determine if ACMs are present, or suspected to be present, at sites where work is to be carried out.

Contractors engaged to conduct work activities at sites where ACMs are suspected are responsible to assume that a site contains ACMs in the absence of any information.

Owners, employers and contractors are responsible to communicate findings respecting ACMs to anyone who could be affected by work activities at their site.

Key components to effective asbestos management include:

1. the preparation of an asbestos inventory
2. the development of an asbestos control plan
3. the development of procedures for working with asbestos
4. worker training.

In all asbestos management practice, for sites where ACMs are to remain in place and be maintained in good condition, or for projects which involve working with asbestos and a potential for release (repair, demolition or removal), **the first step is to properly identify the presence, or suspected presence, of ACMs at the site by conducting an asbestos inventory.**

1. ASBESTOS INVENTORY

An asbestos inventory must be prepared for all workplaces, workplace locations and structures where ACMs are **known to be, and/or suspected to be, present.** Asbestos inventories are required **prior to any work** being carried out at a site.

> Part 37 of the *Workplace Safety and Health Regulation*, section 37.1 (2), states that any material suspected of containing asbestos is considered to contain asbestos until it is determined to be asbestos-free.

For many materials, the presence of asbestos cannot be ruled out on sight because the end product appears the same whether asbestos is included or not. Analysis techniques identify the presence of asbestos in material by visual examination under a microscope to identify the fibres; the amounts reported are based on a standardized visual area estimate of the field of view.

Manufacturers of ACMs must make available any information they have that could result in the foreseeable use and misuse of their product.

As per the *Workplace Safety and Health Regulation* (MR 217/2006) ACM is defined as:

- 0.1 per cent*, or greater, asbestos in a friable material (can be crumbled with hand pressure)
- 1 per cent*, or greater, asbestos in a non-friable material (cannot be crumbled with hand pressure)
- vermiculite insulation that contains asbestos.

*Bulk analysis techniques typically identify the presence of asbestos in a material by visual examination under a microscope. Fibre quantity and type are reported based on a standardized visual area estimate of the field of view. The laboratory will report asbestos as an index of content. For composite structures (e.g. roof or wall assembly) the asbestos content of a sample should be interpreted on a case-by-case basis by a competent person.

Vermiculite containing asbestos – Note that any asbestos fibres (sometimes denoted as a trace amount, small amount, few fibres) observed in a vermiculite sample will confirm it is ACM. The competent person collecting bulk samples for analysis should know to ensure the selected, accredited (discussed below) laboratory reports trace amounts.

The ACM inventory must identify the location of all ACM at the site, whether it is suspected or confirmed by laboratory. In accordance with recognized occupational hygiene practice, an ACM inventory will also include, but not be limited to, the:

- amount of ACMs (e.g., area, linear length)
- type (e.g. insulation, surfacing materials, floor tiles)
- percentage of asbestos present, if known (materials are assumed to be ACM when no laboratory sampling has been carried out)
- *in situ* **friability***
- condition (good, fair, poor, debris present, contained, encapsulated, etc.)
- accessibility (can workers reach it or make contact with it?)
- type of asbestos present (e.g. chrysotile, amosite, crocidolite)

***Friability** – a friable material easily crumbles with hand pressure. The more friable the material, the more likely it is to release fibres into the air.

Suspected ACMs

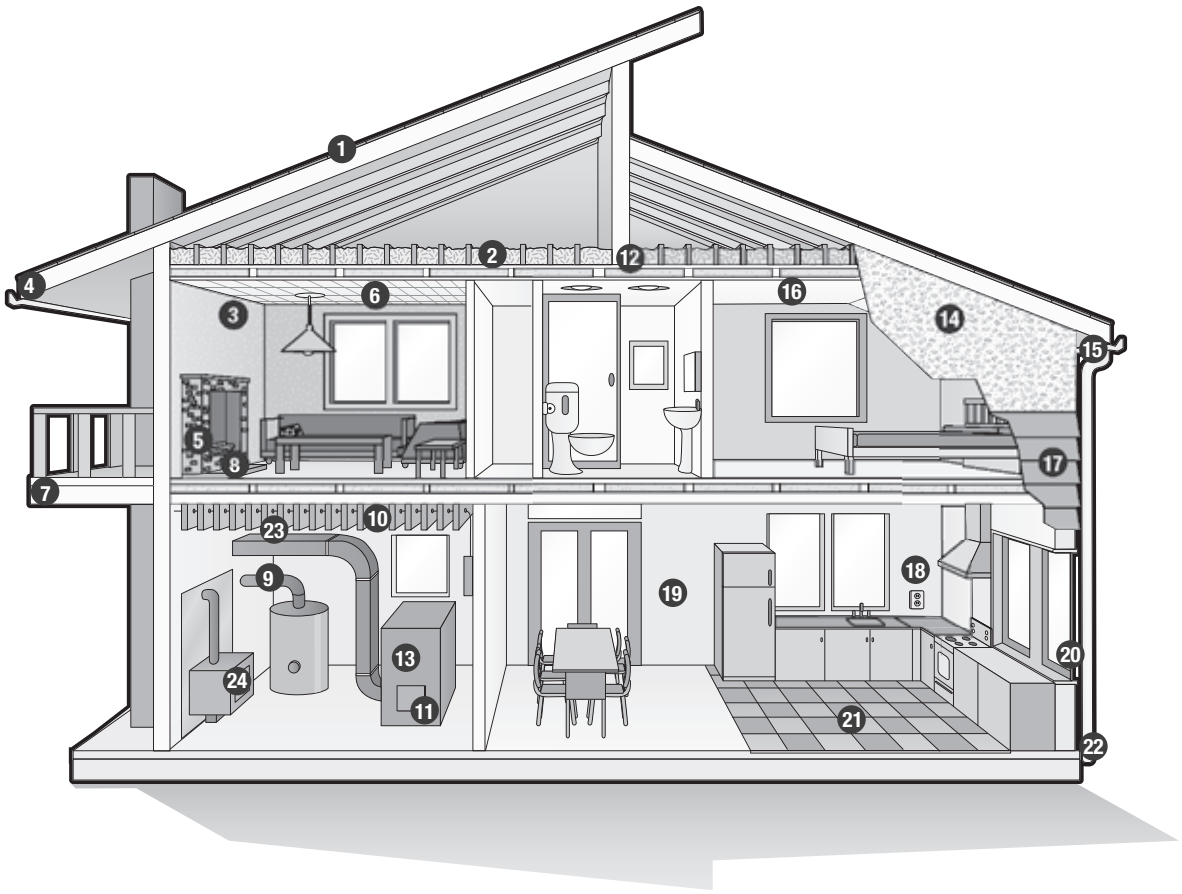
ACMs were widely used and installed during construction and renovations prior to 1990 in residential, commercial and industrial applications. Therefore, these structures are suspected to contain ACMs.

All sites suspected of containing ACMs require an asbestos inventory.

The site's history, date of construction and periodic renovations, and professionals competent in the practice of recognizing suspect ACMs, can assist responsible parties (owners, employers and contractors) to determine if ACMs are, or are suspected to be, present at their sites, visible or hidden, in the preparation of an asbestos inventory.

The wide range of ACMs and the variety of their appearances means it is impossible to confirm by eye, or from building plans, if a product contains asbestos. The only way to be sure is to have the product properly analyzed in a laboratory.

Wherever building materials are suspected to contain asbestos or ACMs, they must be managed and handled as if they contain ACMs until analytical laboratory testing confirms they are asbestos-free.



1. Roof felt and shingles
2. Loose, blown-in insulation, such as vermiculite
3. Incandescent light fixture backing
4. Roof gutters can be made of asbestos cement
5. Artificial fireplace logs and ashes
6. Acoustic tiles
7. Deck under-sheeting
8. Asbestos pad under the fireplace hearth
9. Pipe insulation
10. Main panel and fuse box; each fuse wire has an individual asbestos flash guard
11. Door and gasket covers
12. Backing behind recessed lighting
13. Boiler and furnace insulation
14. Asbestos can be found in stucco
15. Soffit boards can be made of asbestos cement or asbestos insulating board
16. Textured or stipple-coated walls and ceilings
17. Asbestos cement (transite) board siding and undersheeting
18. Outlets and switches
19. Gypsum board filling compound, and patching and joint compound for walls and ceilings
20. Window putty
21. Flooring: vinyl tiles and linoleum sheet flooring; flooring adhesive
22. Downpipes can be made of asbestos cement
23. Insulation on electrical wires
24. Heat reflector for wood stove

Competent person

In accordance with the WSH regulation, an employer or owner must ensure that the ACM inventory is prepared by a person who is competent in the practice of conducting asbestos inventories. The competent person must have the demonstrated knowledge, experience and training for recognizing suspect ACMs, sample collection techniques, laboratory data interpretation, inventory preparation and reporting.

Examples of competency designations may include, but are not limited to, Certified Canadian Registered Safety Professionals (CRSP), Certified Industrial Hygienists (CIH), Registered Industrial Hygienists (ROH), certified AHERA (Asbestos Hazard Emergency Response Act) building inspectors (U.S. EPA-accredited course), among others.

The most important part of the competency is the person's demonstrated knowledge and experience preparing asbestos inventories.

1.1 SOURCES OF ASBESTOS

Sources of asbestos include, but are not limited to, the following materials (also see *Appendix A and B*):

- asbestos cement pipes, wallboard, shingles, siding, roofing
- floor tiles, vinyl and asphalt flooring, including backing and mastics
- acoustic or decorative wall and ceiling plaster (for example, popcorn & stipple ceilings), paints, spackles, coatings
- ceiling tiles, lay-in panels
- spray-applied, blown-in, boiler, breeching, pipe, tank, vessel and other thermal insulation
- fireproofing material including blankets, curtains, countertops, gloves, electrical wiring insulation, cloth and structural insulation
- flexible fabric duct connections and insulation
- packing materials, gaskets, felts, caulking, putties, mastics, adhesives
- brake shoes
- interior surfaces of ductwork in buildings contaminated with asbestos
- mechanical insulation (parging cement, air cell, mag block)
- drywall joint compound
- vermiculite (not asbestos, however, assumed to be contaminated with asbestos fibres).

1.2 INVENTORY METHODOLOGY

In accordance with recognized occupational hygiene practice, the preparation of an asbestos inventory includes, but is not limited to:

- a review of the site`s history, construction and renovations
- a complete walkthrough inspection of the building's interior; floor by floor, room by room, including facilities servicing each area and overall structure (electrical, plumbing, ventilation equipment), architectural and finishing details (ceilings, walls, floors, sealers or caulking)
- a complete examination of the building's exterior; architectural finishing (stucco, parging, cementitious materials, siding, caulking), roofing
- comments regarding hidden or concealed materials that are not practical to access or sample but are suspected to exist and contain asbestos
- studying architectural plans for the building when available
- submitting samples of all materials, including suspect materials for analysis at an accredited laboratory
- preparing a report of findings, including nil findings
- photographs.

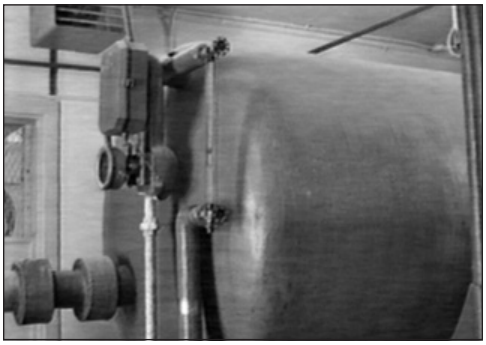
Note: The asbestos inventory must be updated, at a minimum, on a yearly basis and modified when items contained within are repaired and/or removed. Documentation with regards to the repairs or removal should also be retained with the inventory document to indicate the work was done properly.

Resources

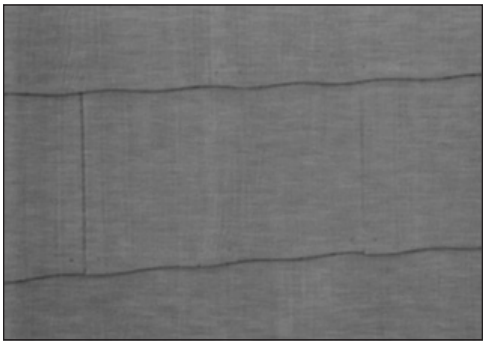
The American Society for Testing and Materials (ASTM) – Standard Practice for Comprehensive Building Asbestos Surveys (E 2356) is one example of a recognized resource for preparing asbestos inventories.

Examples of materials containing asbestos

Pipe insulation



Boiler or vessel insulation



Exterior wall siding

Structural insulation

1.3 BULK SAMPLE COLLECTION

Sampling is required in order to confirm the presence of asbestos and must be carried out by a competent person. If sampling is not conducted, suspect materials must be handled as though they contain asbestos throughout maintenance, repair, renovation, removal and demolition activities. Outlined below are some of the recognized occupational hygiene practices for sampling suspect materials for the presence of ACMs.

Bulk sampling precautions

In order to prevent potential exposure to asbestos while collecting samples:

- Avoid collecting samples when occupants are present.
- People taking samples should wear a NIOSH*-approved respirator appropriate to the risk.
- Suspect materials must be sprayed with a **light mist** of water to prevent fibre release during sampling.
- Suspect material must not be disturbed more than necessary; if possible, sample from a location with existing damage.
- Contact the laboratory performing the analysis for the minimum sample size requirements for the materials being sampled.
- If more than one layer of material is present (for example, a boiler covering) the sample must include material from each layer.
- Contact the laboratory performing the analysis for the minimum sample size requirements for the materials being sampled.
- If more than one layer of material is present (for example, a boiler insulation and covering), ensure that sampling penetrates the full depth to capture all layers of the material.
- Place each sample collected in a separate, properly labelled container.
- The sample container (sealable plastic bag or container) should be held away from the face during sampling.
- Number and record the collection locations of each sample container.
- Where material is damaged during sampling, implement control measures (for repairing as soon as possible, e.g. patch) to prevent fibre release.

*National Institute for Occupational Safety and Health (see glossary)
**high-efficiency particulate air (see glossary)

Number of samples

As outlined by ASTM, a practical number of samples are to be obtained for each kind of material or area of the building. A sample collection practice is presented below:

Item	Type of material	Size of area of homogeneous material	Minimum number of bulk material samples to be collected
1	Surfacing material, including without limitation to material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings and fireproofing materials on structural members	Less than 90 square metres	3
		90 or more square metres, but less than 450 square metres	5
		450 or more square metres	7
2	Thermal insulation, except as described in item 3	Any size	3
3	Thermal insulation patch	Less than 2 linear metres or 0.5 square metres	1
4	Less than 2 linear metres or 0.5 square metres	Any size	3

In accordance with recognized hygiene practice:

- Manufactured products that are homogeneous (such as floor tiles, linoleum, identical ceiling tiles, cement board) may only require one sample to show that a specific material is asbestos free (example of “specific” – a green patterned tile will be considered different from a yellow patterned tile).
- Batch-mixed materials (such as drywall joint compound, stucco, textured coating), may not have been uniformly mixed when they were applied and sections may vary in concentrations (i.e. they may not be homogeneous).
- A single positive finding confirms the presence of asbestos. Further sampling cannot deny its presence at the location of the positive finding.
- Best practice is to sample, at a minimum, in accordance with the table above.

Laboratory Analysis

When selecting a laboratory to perform the analysis, first confirm that the laboratory (the actual laboratory that will conduct the analysis – not the head office alone) is accredited for asbestos analysis. For example, laboratory accreditation by the AIHA (American Industrial Hygiene Association), NVLAP (National Voluntary Laboratory Accreditation Program), CALA (Canadian Association for Laboratory Accreditation) or any other ILAC MRA (International Laboratory Accreditation Cooperation Mutual Recognition Arrangement) signatory would be acceptable.

In the case of an individual performing their own analysis, this individual should be accredited by a certifying body as noted above.

Measurement method for bulk samples

An accredited laboratory will cite the method for bulk sample analysis. Those may include:

a) NIOSH method 9002, or

b) U.S. EPA method 600/R-93/116 for bulk asbestos sampling, or

c) an alternate method established and recognized occupational hygiene practice, and

d) U.S. EPA method 600/R-04/004 for vermiculite.

For sampling and analysis of an asbestos bulk sample, the competent person will also have demonstrated knowledge and experience in laboratory data interpretation and reporting, and current Manitoba regulatory requirements respecting asbestos.

1.4 RECORD KEEPING

The inventory is an important record that must be maintained by the employer (or an asbestos program manager designated by the employer). **The inventory must be kept on site** (in the boiler room, front office, by maintenance personnel, as examples) and be accessible at all times to workers, workplace maintenance personnel, supervisors, contractors in a workplace. All trained personnel must know where it is, review the inventory before conducting maintenance, repairs, renovation or demolition work on, or near, materials containing asbestos.

Once it is determined that ACMs are present, or suspected to be present, at a site, an asbestos control plan must be developed and implemented prior to any maintenance, renovation, repair or demolition work carried out at that site. The control plan is developed to prevent asbestos fibres from becoming airborne in the workplace and to protect workers if fibres become airborne.

2. ASBESTOS CONTROL PLAN

An asbestos control plan must be developed and implemented when ACMs are present, or are suspected to be present, in a workplace, workplace location, building or structure (site).

This section presents the minimum actions for persons engaged in maintenance, repairs and renovations at a site, in accordance with regulatory requirements and recognized occupational hygiene practice.

The objectives of the asbestos control plan are to:

- prevent release of asbestos fibre by minimizing disturbance or damage of material containing asbestos
- protect the safety and health of workers if an asbestos fibre release occurs in a workplace.

The objectives are achieved by maintaining ACMs in good condition and implementing control measures where required.

Responsibilities

Building owners and employers are responsible to develop and follow all components of the asbestos control plan developed for the site. Contractors engaged in activities at a site are responsible to find out if a site has an asbestos control plan prior to carrying out work and to follow it.

The asbestos control plan must be developed to ensure that any process carried out in the workplace will prevent ACMs from becoming airborne while they remain at that site. The control plan gives direction to maintenance and custodial staff, contractors and people of all trades performing work activities at that site.

If the site has multiple tenants (workplaces with workers), the owner must ensure that each tenant engaging contractors or having workers who are likely to carry out maintenance, custodial duties or repairs are informed of the presence or suspected presence of asbestos, the inventory and the control plan. Each employer is responsible to ensure that workers receive training for the control plan as may be required.

It is recommended that a site owner or employer appoint an asbestos control plan manager. The control plan manager must be properly trained for asbestos awareness and asbestos work practices. The manager may include, but not be limited to, a health and safety coordinator, risk manager, physical plant administrator, maintenance manager, maintenance lead hand or supervisor, building and grounds manager or superintendent, facility manager or an external consultant involved in ongoing building project management for that site. The asbestos control plan manager, maintenance and custodial staff are key participants in the asbestos control plan.

All workers at a workplace subject to a control plan must be trained about the presence of ACMs, the hazards associated with ACMs, how to identify ACMs at the workplace, the use of personal protective equipment and safe work procedures, as may be required for their duties. Workers must also be trained in the prohibited activities (as per the MR 217/2006 are detailed below) and limitations of their duties respecting working with ACMs and the significance of any health monitoring that may be provided by the employer to identify early signs of disease related to ACMs.

2.1 CONTENT OF AN ASBESTOS CONTROL PLAN

An asbestos control plan must be implemented, updated and revised as necessary until all ACMs are removed from the building.

In accordance with recognized occupational hygiene practice, an effective asbestos control plan clearly identifies persons responsible, procedures and timelines for each element or action required by the plan. An asbestos control plan should include, but not be limited to, the following elements:

- roles and responsibilities of personnel involved in actions to manage ACMs at the site, plan manager, inventory preparation, training, inspections, repairs or maintenance, etc.
- periodic and long-term actions put in place to protect the health and safety of building occupants (workers in workplaces occupying space in the building) and others
- an inventory of all ACMs; list of all buildings with inventories
- where the asbestos inventories will be kept
- description of how ACMs will be labeled or identified
- description of how building occupants (workplaces occupying space in the building), maintenance staff, external contractors and others will be informed of the presence of asbestos
- description of how and when periodic inspections of ACMs will be performed
- written procedures for ACM repairs and/or working near ACMs
- procedures to be followed in the event of fibre release
- training requirements for:
  - asbestos awareness
  - workers and supervisors of workers who work with asbestos
  - emergencies involving fibre release (site isolation)
  - when the training is to be conducted, and
  - who is to conduct the training.
- identification of staff trained in the procedures involving fibre release and for working with asbestos
- circumstances whereby an area shall be secured, work stopped and an external consultant or contractor engaged to perform tasks involving working with ACMs
- asbestos waste disposal procedures
- records-keeping requirements.

2.2 NOTIFICATION OF OCCUPANTS

Building occupants (i.e. workplaces occupying space in the building), maintenance and custodial staff, outside contractors and others are less likely to disturb the materials if they know that the materials contain asbestos. Residential occupant requirements are covered under other legislation.

If materials containing asbestos are found at a site, all occupants (workplaces occupying space in the building) who may be affected by the ACMs must be informed of its presence and provided with information on how to avoid the potential health hazard in the building. Building occupants (workplaces occupying space in the building) and other users can be informed by distributing notices, holding information meetings, making the inventory available and, where reasonable and practical, identifying the presence of ACMs by labelling the materials if there is a risk of an occupant disturbing the material to cause a fibre release.

For contractors and any worker involved in maintenance or custodial duties, the presence of ACMs must be available in an inventory. The inventory and control plan information should be provided at the time of tendering and/or with the drawings provided to contractors. All outside contractors must be notified of the exact location of the ACMs they are to work on, or may potentially disturb, prior to any work being done.

Prohibited uses and activity

The following uses and activity respecting asbestos are prohibited in new or existing buildings in Manitoba as per MR 217/2006:

(a) application of friable asbestos-containing materials in any location at a workplace

(b) spraying of asbestos-containing material at a workplace

(c) introduction of crocidolite asbestos or material containing crocidolite asbestos into a workplace

(d) use of pressure spraying equipment of any type to remove asbestos-containing material

(e) use of compressed air to clean up asbestos-containing material

(f) dry sweeping or dry mopping of asbestos-containing material.

In existing buildings where there is risk of exposure to airborne asbestos fibres (i.e. ACMs in poor condition), control measures must be implemented to eliminate risk (e.g. materials repaired, removed, enclosed, encapsulated, area restricted).

Building occupants (workplaces occupying space in the building) need to know the:

- contact information of the asbestos control plan manager
- exact location of materials containing asbestos; though it may not be necessary to inform every occupant (workplaces occupying space in the building) of all locations throughout the building, each occupant (workplaces occupying space in the building) must be made aware of the locations of ACMs that may affect them
- condition of the existing ACM that may affect them
- intended action for each location where asbestos is found (e.g., abatement, leave intact, regular maintenance)
- health hazards associated with asbestos exposure and the conditions upon which it can create a hazard (i.e., when it is disturbed)
- directions for not disturbing or damaging any ACMs
- directions to report any disturbance or change in the condition of the material containing asbestos, such as damage, dust or debris accumulation, to the asbestos program manager.

2.3 LABELLING AND SIGNAGE

Labels and signs provide a final line of defence to warn occupants (workplaces occupying space in the building) and others, and to prevent unprotected or unauthorized people from the risk of exposure to asbestos.

All ACMs must be clearly identified with signs, labels or other effective means in accordance with Part 37.4. Other effective means will be workplace- and process-specific, and workers must be educated and trained for any alternative mode of identification of ACM. Information on warning labels and signs must be understandable to the workers and may include:

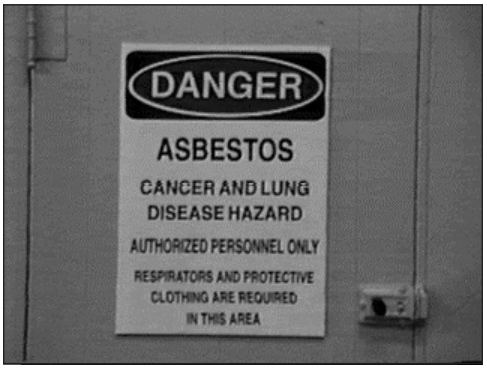
- the risks associated with exposure to asbestos fibres
- cautionary statement to not disturb materials containing asbestos
- cautionary statement respecting entering an area where repair or renovation activities involving these materials are underway.

Labelling and signage format

Usually in the form of a posted sign:

- attached directly to materials containing asbestos
- at the entrance to an area where material containing asbestos is present
- at entrances to areas where asbestos is being cleaned up or removed.

An appropriate sign displayed at the entrance and around the perimeter of a room that contains asbestos is shown (right) and represented in the following text, and should be represented in both official languages.



Warning sign for a type 2 asbestos work project outside of a mechanical space containing asbestos

An appropriate label for material containing asbestos could be as follows:

DANGER

CONTAINS ASBESTOS FIBRES

CANCER AND LUNG DISEASE HAZARD

DO NOT DISTURB

Report damage

2.4 PERIODIC INSPECTION

Periodically inspecting all ACM identified in the inventory is essential to the asbestos control plan. Regular inspection and damage reporting by competent, trained personnel should allow corrective action to begin as soon as minor deterioration is observed and **before** any exposure risk occurs.

Inspections must be performed **at least once a year.** Inspections should be conducted prior to and following any planned nearby work activities and if there are any conditions that may have altered the site conditions (for example, water infiltration). The inspection may occur more frequently if damage potential is high. In accordance with recognized occupational hygiene practice, the inspection of ACMs identified in an inventory may include, but not be limited to:

- the location of the ACM, address, building room(s), location or general description
- the type of ACM (ceiling tile, floor tiles, pipe wrap insulation, joint compound, other)
- the present abatement status, if any (encapsulated, enclosed, removed or other)
- evidence of physical damage and approximate size (length, width, volume) without coming into contact with the damaged ACM
- evidence of water damage
- evidence of delamination or other deterioration
- the ACM accessibility for workers
- any work activity near the material, including but not limited to maintenance and retail activities
- the location of nearby air plenums, air shafts or air streams, if any.

A sample form (Form 1) for recording the results of periodic inspection is included at the back of this guideline.

If ACMs are found to be in good condition, and are unlikely to be disturbed or eroded, proper maintenance and periodic inspection is appropriate. When poor condition or damage on ACMs is discovered, asbestos fibre release and exposure is prevented by immediate reporting for corrective actions to be taken as soon as possible.

Air monitoring, either area or personal, can be done in addition to the physical examination, but should not be the only basis for decisions on cleanup, control or other corrective measures. Though effective air monitoring will provide information about building occupant exposure to asbestos, one-time readings can be unreliable. Airborne fibre concentration can change significantly in a short time. It is possible to obtain low readings even when material containing asbestos is in poor condition and eminent risk is still present. Using a combination of monitoring and inspection methods is best. Preventive measures must be considered well before exposure levels reach the occupational exposure limit of 0.1 fibres/cubic centimetre (f/cc) for all forms of asbestos.

Within a control plan, low-risk maintenance or custodial tasks may intermittently involve working near or with ACMs (for example custodial tasks such as installing or removing shelving or a light fixture, repairing minor damage to drywall in a suite or office, isolating an area in the event of a spill).

Only properly trained and appropriately protected workers may perform custodial or maintenance tasks that involve working with or near asbestos, including minor cleanup duties, minor renovations and incidents involving fibre release (covered in the following three subsections).

Worker training should be carried out in accordance with *Section 3 – Worker Training* in keeping with the level of risk presented by the task as discussed in *Section 4 – Working with Asbestos*.

2.5 CLEANING PROCEDURES

Only wet mopping/wiping or specialized vacuuming should be used to clean surfaces that may be contaminated with asbestos.

- **Wet mopping/wiping** – is performed by gently spraying surfaces with **amended water** before cleaning. Amended water is a mixture of water and commercially available soap or chemicals that allows water to penetrate more easily into the material containing asbestos. Wetting surfaces reduces the potential for asbestos fibres to become airborne.

  Surfaces, such as walls, non-carpeted floors, light fixtures, exteriors of air handling ducts and filing cabinets should be cleaned using mops and dust cloths or rags that are wetted with amended water.

- **Vacuuming** of areas contaminated by ACMs is performed with a vacuum cleaner that is equipped with a high-efficiency particulate arresting (HEPA) filter to prevent fibres from becoming airborne in the workplace. A HEPA vacuum has an efficient filter that traps the most microscopic asbestos fibres responsible for human health effects. Ordinary vacuum cleaners may allow tiny asbestos fibres to pass through the filter or bag, re-enter the work area and be spread to other areas of the workplace. The HEPA vacuum system must be inspected and maintained in accordance with manufacturer's specification and at intervals sufficient to ensure the integrity of the system, including all its components (seal, gaskets, etc.), to filter out asbestos fibres. Efficiency testing of HEPA vacuums is discussed further in *Section 4 – Working with Asbestos*.

- **HEPA vacuum** – Irregular surfaces (curtains, books, furniture and carpeting) should be discarded or cleaned using a HEPA vacuum if the effectiveness of the vacuuming can be established.

  DO NOT USE – dry brooms, mops, dust cloths and standard household or shop vacuum cleaners for asbestos cleanup as they may create a risk of airborne exposure to asbestos fibres.

Additional information on cleaning procedures is provided in *Section 4 - Working with Asbestos*.

2.6 MINOR RENOVATIONS WHERE ASBESTOS IS PRESENT

Renovations or alterations at a site where the ACMs are not intended to be removed or affected, but may be accidentally disturbed, as part of the renovation activity, may include but are not limited to:

- partial building demolition
- moving interior walls
- replacing window coverings
- removing or replacing ceiling tiles
- building or removing book shelves
- remodeling where the activities may contact the material containing asbestos
- some electrical or mechanical upgrades or changes.

When ACMs are to be removed or disturbed, employers are required to develop and implement safe work procedures for the safe handling and disposal of ACMs in order to prevent the release of fibres. These procedures must be in place before the renovation activity begins. A review of the asbestos inventory must be conducted before planning any renovation – minor or major.

Recognized occupational hygiene practices for establishing safe work procedures are outlined in *Section 4 – Working with Asbestos*. Safe work procedures will be commensurate with the level of risk posed by the task or project.

- Where renovation involves direct contact but not removal of the ACMs (e.g. painting or wallpapering over material containing asbestos), special precautions must be taken to not create dust.
- Where an activity may disturb ACMs, greater care is required. These precautions may range from minor removal procedures to full asbestos abatement as outlined in *Section 4 – Working with Asbestos*.

The asbestos control plan manager should review the renovation, alteration or maintenance work planned for areas nearby or adjacent to ACMs before work begins. An internal workplace written request and approval system should ensure proper procedures and precautions are in place to prevent asbestos fibre release and exposure. Sample forms (Form 2 and Form 3) to record the request and approval are included at the back of this guideline.

2.7 FIBRE RELEASE INCIDENTS

As long as ACMs remain in the building, a fibre release incident may occur. Maintenance and custodial staff should remain alert for debris on floors, water or physical damage to the ACMs or other evidence of possible fibre release. Fibre release may occur with normal breakdown of ACMs or during maintenance or renovation activities.

Where fibre release or damage has occurred, the damage should be repaired and the area decontaminated by competent staff appropriately trained in asbestos work or contractors competent in working with asbestos (*Section 4*), as soon as possible.

The minor and major incidents discussed in this section are not planned asbestos removal or abatement projects, but accidental disturbances of materials containing asbestos.

Minor Fibre Release Incidents

Examples of minor incidents include:

- accidental puncture of an insulated pipe
- contact with an insulated structural beam
- breakage of a corner section of tile or wall panel, where a small amount of ACM is dislodged or exposed.

Minor Damage to Pipe Wrap

Major Damage to Fire Insulation

These minor incidents of fibre release can be treated with standard wet cleaning or HEPA vacuuming techniques **by competent workers properly trained to work with asbestos**. In such cases, in order to prevent worker exposure and the spread of asbestos fibres, the following procedures are used in recognized occupational hygiene practice:

- Control all access to the affected area, as may be required, and post warning signage.
- Wear an appropriate, properly fitted respirator selected in accordance with Table 1 and in accordance with the requirements for personal protective equipment provided in *Section 5*.
- The respiratory protection is based on the level of risk of exposure to asbestos fibre. At minimum, a half facepiece respirator with P100 particulate filters should be worn.

- Use a spray container with a very fine spray output to saturate the debris thoroughly with amended water before wet mopping.
- Carefully place debris in an asbestos waste container (as per definition in glossary) properly labelled for disposal or collect debris with a HEPA vacuum cleaner and dispose of the vacuum content as ACM.
- Thoroughly clean the debris area with a damp cloth or mop or HEPA vacuum.
- Repair the damaged ACM with asbestos-free spackling, plaster, cement or insulation, or seal with latex paint or an encapsulant.

Major Fibre Release Incidents

Major incidents of fibre release are very serious. Disturbing a large amount of ACMs may contaminate an entire building with asbestos fibres. Examples of major incidents include:

- water or physical damage to pipe insulation, resulting in missing sections
- insulation falling from structural beams onto the back of ceiling tiles. In these cases, immediate and thorough procedures are required. Well-trained and properly equipped workers must address these situations. Typically, these are contractors trained and equipped to deal with asbestos decontamination.
- accidental or unexpected disturbance of ACMs during a maintenance, repair or renovation activity during which ACMs may have been missed in the inventory, perhaps hidden (e.g. inside walls).

In the event of a major asbestos fibre release, the following immediate actions are essential.

- **Notification to Workplace Safety and Health** (WSH) – the employer must notify WSH immediately by calling 204-957-SAFE or 1-855-957-SAFE (7233) (toll-free in Manitoba) and pressing 1 for Workplace Safety and Health

In accordance with recognized occupational hygiene practice, to prevent the potential spread of fibres and exposure to workers or others:

- Isolate the area as soon as possible after the material containing asbestos is discovered. Where doors can seal the area, lock them from the inside (being careful not to violate fire regulations if the area is an escape corridor).
- Post appropriate warning signs to prevent unauthorized entry.
- Shut off or temporarily modify the air handling system to prevent the distribution of fibres from the affected area to other areas of the building as may be required.
- Seal doors, windows and air registers in the contaminated area with two layers of 6-mil polyethylene sheeting and tape.
- Notify occupants (workplaces occupying space in the building), who may be affected by the release or actions being taken, that an asbestos fibre release has occurred, that corrective measures are being implemented, and any necessary precautionary measures or information they may need to know (e.g. use of building entry and exit, ventilation, building amenities, contact personnel, etc.).

Any further actions should be undertaken in accordance with procedures set forth in *Section 4 – Working with Asbestos*.

Documenting Incidents

Each incident of fibre release, whether minor or major, must be investigated and documented by a competent person. The report should include information regarding the location, a description of the event, air monitoring results, the cause of the incident and a detailed account showing action taken and who took it. The incident report must be communicated to the members of the workplace safety and health committee or representative.

3. TRAINING

Training for maintenance and custodial staff, and people of trades (e.g. construction trades, carpenters, plumbers, electricians, painters, labourers, pipe fitters, HVAC and refrigeration workers) performing routine or intermittent work on or near ACMs at a site is an important part of effective asbestos management.

All maintenance personnel, custodial staff and people of all trades will potentially encounter ACMs in the course of their work activities at a site where ACMs are present, or are suspected to be present. These workers must all obtain ACM awareness training to know the hazards of asbestos, a means of identifying ACMs, and adequate instruction and training in the safe work procedures they may require for maintenance, minor repair or renovation tasks at a site.

All workers regularly working with ACMs require adequate instruction and training to use safe work procedures developed for the level of risk – low, moderate or high (type 1, 2 or 3 respectively) – of the asbestos work they will carry out.

Worker training and safe work procedures must be reviewed and revised as needed every year, or more often, depending on changes in work conditions and project variables. Worker training and safe work procedures shall be reviewed as necessary, in consultation with the workplace safety and health committee or workplace safety and health representative.

3.1 TRAINING FOR MAINTENANCE, REPAIR AND RENOVATION

An employer, owner or person acting on behalf of the owner must ensure that all workers (maintenance, custodial and people of all trades) and supervisors of workers who will work with or near ACMs receive training in keeping with the potential hazard of their work before they do the work.

Levels of training

Work near ACMs

Workers performing maintenance, repair or renovations **near ACMs** must receive, at minimum, training for:

- asbestos awareness
- prohibited activities.

With ACMs

Workers who **work with ACMs** are those who carry out maintenance, repair, renovation, alteration or demolition tasks where asbestos may become disturbed. These workers must receive training for:

- asbestos awareness
- prohibited activities
- safe work procedures for working with asbestos in keeping with the level of risk established for the asbestos work that the worker is required to carry out (type 1, 2 or 3)
- selection and use of the personal protective equipment required for the asbestos work as detailed in *Sections 4 – Working with Asbestos* and in *Section 5 – Personal Protective Equipment.*

Trainer qualifications

Training must be carried out by a competent person with training, experience and demonstrated knowledge specific to working with asbestos. Some of the designations of a competent person may include but are not limited to CRSP, CIH and ROH. Ultimately, the most important factors in evaluating the effectiveness of the worker's training will be:

- a worker's knowledge and competency to safely perform the tasks involved in working with asbestos
- the way in which an employer manages the worksite, the implementation of safe work procedures for the handling and disposal of ACMs (containment, equipment, personal protective equipment, etc.) for the project.

3.1.1 Awareness training

All workers who work with, or near, ACM including maintenance and custodial staff, and people of all trades, must be trained in the hazards of ACMs and the means of identifying it in the workplace. The worker should hold a record of attendance in awareness training.

Objectives of asbestos awareness training are to recognize when ACM may be present (suspected) and know to ask the employer about ACM inventory. Awareness training should also allow the worker to understand when to assume ACM is present if the information is not made available.

Awareness training should include but not be limited to:

a) sources of asbestos, the exposure and risk
b) possible health effects and the additional hazard of cigarette smoking as a risk factor in asbestos-related disease
c) information on the label and what it means
d) photographs and examples
e) learning what to do when a site is suspected to contain ACMs
f) learning to ask if there are ACMs and if the information is not available, to assume they are present at sites where ACMs are suspected to be present
g) know where an inventory can be found and how to read and understand it
h) how to avoid disturbing materials containing asbestos
i) how to recognize and report damage to these materials
j) safe work procedures in case of emergencies involving asbestos, leaving the site and reporting the emergency
k) names and telephone numbers of people responsible for asbestos-related activities in the building.

3.1.2 Prohibited activities

Maintenance and custodial staff should ensure their activities do not damage or disturb ACMs. Where asbestos containing materials are present or suspected to be present, maintenance and custodial staff must be instructed to observe the rules. In accordance with recommended occupational hygiene practice, some of the precautionary rules may include, but are not limited to the following:

- **Do not** drill holes into material containing asbestos.
- **Do not** hang pictures, signs (except asbestos warning signs), clothing, plants or any other articles on structures covered with ACMs.
- **Do not** sand, saw or grind floor tiles, hard board panels or other materials that may contain asbestos.
- **Do not** damage materials containing asbestos while moving furniture or other objects.
- **Do not** install curtains, drapes or dividers in such a way that they damage ACMs.
- **Do not** dust floors, ceilings, mouldings or other surfaces with a dry brush, or sweep with a broom in an environment containing asbestos.
- **Do not** use an ordinary vacuum to clean up debris containing asbestos.
- **Do not** remove ceiling tiles below materials containing asbestos without wearing proper respiratory protection and clearing the area of other people.
- **Do not** remove or shake ventilation system filters in a dry state if it is suspected they may contain asbestos fibres.

3.2 TRAINING FOR WORKERS WORKING WITH ASBESTOS

Supervisors

Requirements for supervisors are as follows. Supervisors:

- should hold a record of attendance certificate for training on asbestos work procedures (typically more than workers, possibly of three days' minimum duration).
- must have demonstrated knowledge of the procedures for working with ACMs, at minimum, for the type of work they are supervising – types 1, 2 and/or 3. The manner in which a site is managed will offer the best indication of the adequacy of the training that has been obtained and sufficiency of the supervision.
- must be able to evaluate worker competency.

Workers

Requirements for workers are as follows:

- Maintenance and custodial staff, and workers of all trades who may work with, or near ACMs, should hold a record of attendance for asbestos awareness training.
- All workers who work with asbestos should hold a record of attendance for training on the procedures for working with asbestos (typically of two days' duration); best practice would yield a certificate of completion that the worker can carry on their person while working at asbestos sites.
- Workers must be able to demonstrate their knowledge in each type of asbestos work procedure they will be assigned to carry out (type 1, 2 and/or 3).
- Workers should be directly supervised on all new procedures for a minimum of three days.

Some components of a training program

Some of the generally accepted and adopted topics for asbestos worker training, in accordance with recognized and widely accepted occupational hygiene practices and principles, typically covered in approximately 14 hours at a minimum of classroom time, may include, but are not limited to the following:

THEORY – Knowledge topics

- Regulatory requirements including the specifically needed assessments, notifications, training, prohibitions and safe work procedures as detailed in MR217/2006
- Asbestos awareness as outlined above
- Risk assessment and control measures specific to asbestos exposure and control measures
  - How accessibility and condition of materials impact risk
  - Understanding the role of inspectors and laboratories
  - Effective controls for work processes with asbestos (dust control measures)
  - General isolation techniques and enclosures (glove bags and negative pressure)
- Essential tools and personal protective equipment information
  - Performance assurance and maintenance records
  - Respiratory protective equipment
  - HEPA vacuums and tool attachments
  - Protective clothing
  - Decontamination
- Associated safety and health risks
  - Workers working alone program
  - Electrical risks due to wet work
  - Working at elevated locations
  - Working in confined spaces
  - Addressing thermal stress
  - Emergency response plans

PRACTICAL – Skill topics specific to individual authorized operations

- To effectively master a skill, workers in training must be provided with a demonstration of safe work procedures followed by closely supervised performance of the skill
- Respiratory protective equipment
- Collecting a bulk sample, glove bag removal, inspection of the negative pressure enclosure.

EVALUATION – Assessment of worker training

- An employer/service provider should implement a system to evaluate the knowledge and hands-on skills of trained workers before they are engaged to perform work that potentially disturbs ACM
- A knowledge exam and skills evaluation should be documented
- Hands-on performance practice for carrying out work activities, collecting samples, installing negative air enclosures and units, donning and doffing of personal protective equipment, entering and exiting of work areas and decontamination areas.

4. WORKING WITH ASBESTOS

Procedures for working with asbestos are required in all workplaces, workplace locations or buildings where asbestos or ACMs are used, handled, abated, demolished, cleaned up and/or disposed of after incidents involving an accidental release of asbestos fibres and in the course of maintenance, renovation and alteration activities.

The objectives of the following procedures are to prevent workers and others from being exposed to asbestos fibres when work is planned.

This section outlines the minimum actions required (steps and procedures) to prevent the release of asbestos fibres and protect workers in the event of ACM disturbances or asbestos work in accordance with recognized occupational hygiene practice.

Inventory

The first step in planning an alteration, renovation, removal or demolition is to determine if ACMs are present, or suspected to be present, at the site prior to any work being carried out. This is accomplished by preparing an asbestos inventory.

Remove ACM prior to demolition or partial demolition

All ACMs that may be disturbed during the course of work in a building must be removed before a demolition or partial demolition (alteration or renovation) is performed in that building or location.

When ACMs are found to be in disrepair, they should be encapsulated or repaired if they are not being removed to prevent the spread of asbestos fibres.

Asbestos-containing material should be considered for removal:

a) when it is breaking away from the surface to which it is applied
b) when the material is likely to be damaged
c) when the ACM is friable and in poor condition
d) when the concentration of airborne asbestos fibre is above the occupational exposure limit
e) prior to renovation, alteration or demolition.

The building owner or employer must notify occupants (workplaces occupying space in the building) and others who may be affected when ACMs are likely to be disturbed, during work carried out on or near ACMs. Otherwise, signage is usually sufficient to restrict areas.

4.1 GENERAL REQUIREMENTS FOR WORKING WITH ASBESTOS

Some of the general requirements that may apply to any planned asbestos work are outlined below.

1) NOTIFICATION TO WORKPLACE SAFETY AND HEALTH

An **employer or owner must notify** the director of Workplace Safety and Health Branch at least **five calendar days** before beginning the work to alter, renovate or demolish a building or structure where ACMs may be released into the atmosphere.

Sampling of ACM as part of an asbestos assessment should not require notification as long as it is conducted by a competent person, in a manner that minimizes disturbance and damage to the ACM.

The potential for the release of ACMs must be assessed for all projects where ACMs are present or suspected to be present. The notification form is accessible on the WSH website: **www.manitoba.ca/labour/safety.**

Where internet access is not available, notification can be made by calling 204-957-SAFE or 1-855-957-SAFE (7233) (toll-free in Manitoba) and pressing 1 for WSH. In this case, the notification should include the following information:

a) name, address and telephone number of the person giving notice

b) name, address and telephone number of the owner, or agent of the owner, of the building or site where the work will be performed

c) address or municipal location of the building or site where the work will be performed

d) name, address and telephone number of the company performing the work

e) a description of the work to be performed; type of materials being removed or affected, size (area or linear feet or metres)

f) start date and expected completion date of the work

g) name and contact information (telephone number) of the supervisor in charge of the work.

Emergency asbestos work

In the case of an emergency where an immediate repair or cleanup is required, for example, when critical services are affected, WSH will make allowances for the five days' notice. However, the notice must be provided as soon as reasonably practicable and before the work is carried out.

2) ASBESTOS EXPOSURE, Air Sampling and Analysis

Air sampling and analysis is used to assess a worker's exposure to airborne concentrations of asbestos. Air sampling and analysis may be performed in any or all of the following locations in accordance with a risk assessment carried out by a competent person.

- background sampling, ambient areas prior to beginning work
- perimeter sampling, areas outside and adjacent to enclosed asbestos work areas
- final clearance inside the enclosed work area upon completion of asbestos work
- in some circumstances, inside the enclosed asbestos work area.

Occupational Exposure Limits

The American Conference of Governmental Industrial Hygienists (ACGIH) and the International Agency for Research on Cancer (IARC) classify asbestos as a human carcinogen, a substance that increases the risk of cancer in humans who are exposed to it.

In Manitoba, designated materials are substances that meet the criteria as carcinogens, respiratory sensitizers, mutagens, and reproductive toxins in accordance with the federal Hazardous Products Regulations. The occupational exposure limit (OEL) of a designated material must be kept as close to zero as is reasonably practicable, but shall not exceed the Threshold Limit Value (TLV©) established by the ACGIH. The current ACGIH TLV for all forms of asbestos is 0.1 fibres per cubic centimetre (f/cc) of air.

Air Sampling and Analysis

The concentration of asbestos fibres in air must be determined in accordance with NIOSH (National Institute for Occupational Safety and Health) Manual of Analytical Methods, latest edition, U.S. Department of Health and Human Services, Public Health Service, Centre for Disease Control, NIOSH, Division of Physical Sciences and Engineering using:

- method 7400 for all fibres, and
- 7402 for characterization of the fibres (TEM – Transmission Electron Microscopy) for airborne asbestos exposure analysis.

NIOSH methods outline the parameters for collecting and analyzing samples. It is expected that a competent person will follow the guidance of the method outlined by NIOSH.

Air Sampling

Asbestos air sampling must be conducted by a competent person with demonstrated knowledge and experience in the practice of collecting air samples for asbestos. The sampling practice includes, but is not limited to, the determination of the volume and sampling rates that are appropriate to the conditions of the site in order to achieve quantifiable loadings for laboratory analysis of the sample, as prescribed in the NIOSH method. The results of the analysis of method 7400 will include all fibres, not only asbestos fibres.

Laboratory analysis

When selecting a laboratory to perform the analysis, first confirm that the laboratory (the actual laboratory that will conduct the analysis – not the head office alone) is accredited for air sample analysis. For example, laboratory accreditation by the AIHA (American Industrial Hygiene Association), NVLAP (National Voluntary Laboratory Accreditation Program), CALA (Canadian Association for Laboratory Accreditation) or any other ILAC MRA (International Laboratory Accreditation Cooperation Mutual Recognition Arrangement) signatory would be acceptable.

In a case where an individual will be performing their own air sample analysis, this individual must be accredited by a certifying body as noted above.

For sampling and analysis of asbestos in the air, the competent person will also have a demonstrated knowledge and experience in laboratory data interpretation and reporting and current Manitoba regulatory requirements respecting occupational exposure limits.

Background sample before work

It may be useful to collect background samples prior to beginning asbestos work when unprotected workers or others occupy areas nearby or adjacent to asbestos work areas. It is expected that airborne concentrations of asbestos fibres outside the area of asbestos work be as close as possible to zero, and not exceed background concentrations, when unprotected workers and others are present.

Perimeter air sample during work

Perimeter air sampling (outside an asbestos work enclosure) should be done during type 2 and type 3 asbestos work when unprotected people are in the area adjacent to or outside the work areas, as follows:

- For high risk (type 3) work, intermittent air sampling for asbestos fibre concentrations outside the perimeter of an enclosed work area, during asbestos work and cleanup. The asbestos fibre concentrations should be as close as possible to zero and not exceed background levels.

  Type 3 daily air monitoring surveillance for both perimeter samples outside the enclosure and personal air samples inside the enclosure are considered to be a measure of best practice.

- For moderate risk (type 2) work, when work is done inside an enclosed containment area (enclosure or glove bag), intermittent sampling just outside the area, should be as close as possible to zero and not exceed background levels.

Final air clearance sample after work

In accordance with recognized occupational hygiene practice, upon completion of high risk asbestos work (type 3), airborne asbestos fibre concentrations inside the asbestos work area (enclosure) must be less than 0.01 fibres per cubic centimetre of air, for all forms of asbestos, before the enclosure is dismantled and workers and others are allowed to reoccupy the area where ACM has been removed. Because these areas are expected to be free of asbestos fibre, a larger volume of air will need to be collected, as discussed above in air sampling.

A final air clearance post-type 2 abatement work is a measure of best practice.

In some circumstances, an assessment of risk may determine that a final air clearance be conducted following a type 2 asbestos work project before dismantling an enclosure.

It is recommended that an aggressive air sampling technique be considered when collecting a final air clearance sample. Aggressive air sampling is discussed in more detail in type 3 procedures below.

3) RISK ASSESSMENT – CATEGORY OF WORK, TYPE 1, 2 OR 3

Work that may result in worker exposure to asbestos is categorized as:

- **Type 1** (low risk) where there is low expectation of asbestos fibre being released or becoming airborne
- **Type 2** (medium risk) where asbestos fibres are expected to be released and must be controlled and the work can be carried out in less than 3 hours
- **Type 3** (high risk) where airborne fibres are expected to be released and must be controlled.

Factors to consider for categorizing asbestos work include, but are not limited to:

- **The amount of ACM disturbed (scope of work)**
  More material = more risk
  More time = more risk

- **Asbestos content in a bulk sample (%)**
  Higher asbestos content = greater risk, number of asbestos fibres = more risk

  The risk increases as the amount of airborne fibres increases. The order of risk from high to low is typically known to be:

  HIGH RISK: contamination > poor condition > fair condition > good condition: LOW RISK

  - Friable materials will easily release the asbestos fibres from the matrix (high risk)

- With non-friable materials, the fibres are bound and not easily released (low risk)
- Materials that are non-friable may become friable over time (as a result of weathering, fire, water damage) or during a work activity

- **Process**
  Assess the likelihood of a process releasing airborne particles and the potential concentration (how much).

  Following are examples of increasing levels of risk resulting from a process:

  a) Removal of manufactured materials containing asbestos with no damage (e.g. intact floor tiles, cementitious siding with no breakage)
  b) Use of hand tools on in situ materials containing asbestos with minimal breakage (e.g. removing stucco with hand tools in large pieces)
  c) Use of a power tool with effective dust control measures (e.g. drilling through ACM flooring with a tool equipped with a HEPA filter)
  d) Use of a power tool with no effective dust control.

4.2 PROCEDURES FOR WORKING WITH ASBESTOS

For all asbestos work in low, moderate or high risk projects (type 1, 2 or 3 respectively), the employer shall:

- ensure that no person may eat, drink, smoke, or chew gum or tobacco at the work site
- make sure that compressed air is not used to clean up or remove dust from work areas, surfaces or clothing
- ensure that an asbestos inventory and control plan have been established
- establish the level of risk for the job and the work procedures to be followed (type 1, 2 or 3)
- notify the director of Workplace Safety and Health Branch at least **five calendar days** before any work that may release asbestos fibres into the atmosphere begins (type 2 and type 3), including the setup operations. The notification form is accessible on the WSH website: **www.manitoba.ca/labour/safety;** where Internet access is not available, notification can be made by calling 204-957-SAFE or 1-855-957-SAFE (7233) (toll-free in Manitoba) and pressing 1 for WSH
- prepare the task-specific safe work procedures for all asbestos work activities
- ensure workers are adequately trained in the hazards of asbestos and the task-specific safe work procedures of the asbestos work they will be doing
- ensure workers follow the safe work procedures prepared for the job
- develop and implement safe work procedures to deal with emergencies such as fire or injury.

Tools

In accordance with recognized occupational hygiene practice, vacuums and negative air units (cabinets) equipped with HEPA filters are used for asbestos work. Industrial standards (e.g. International Organization for Standardization (ISO), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)) can provide guidance on the adequacy and operations of exhaust equipment and performance testing for the equipment.

The employer is responsible to ensure that any HEPA filtered tool, equipment or system intended for asbestos work (power tools, negative air equipment, etc.) is inspected and maintained in accordance with manufacturer's specifications and at intervals sufficient to ensure the integrity of the HEPA system, including all the components (seals, seats, gaskets) required for the optimal filtering of asbestos fibre.

Vacuum cleaning equipment

Only vacuum cleaners equipped with HEPA filters should be used for collecting ACM. The vacuum cleaner should be designed so that it prevents the ACM from escaping back into the workplace.

- Vacuum bags are to be disposable.
- If the vacuum bag bursts:
  - the vacuum cleaner is isolated from the workplace immediately
  - the contaminated vacuum cleaner is cleaned with the use of another vacuum cleaner equipped with a HEPA filter or by wet wiping
  - the burst bag and contents as asbestos waste are handled by an operator wearing protective clothing and respiratory equipment.
- Vacuum bags and collected waste is disposed of as asbestos waste.

Negative air cabinets

As a measure of best practice, negative air cabinets maintained in accordance by the manufacturer should be used for all type 3 asbestos work.

Exhaust Air

All exhaust air should be discharged to the outdoors.

Vacuums equipped with HEPA filters can be used to exhaust air from a type 2 enclosure if they are dedicated for this purpose and equipment performance testing on the unit has been carried out on the unit prior to beginning the project as discussed below.

Air from negative air cabinets in Type 3 enclosures should be exhausted outdoors. Equipment performance testing should be carried out on negative air cabinets before the project begins, in accordance with the manufacturer's specification and as discussed below.

Air exhausted indoors

The employer should include details respecting conditions where it is not possible to exhaust air from a negative air cabinet or vacuum system to the outdoors at the time of notification (i.e. notification to the director of WSH 5 days before the project start). On-site performance testing should also be conducted for the HEPA filter and negative air systems (vacuums or cabinets) using a DOP or equivalent procedure when air cannot be exhausted to the exterior.

Exhaust air equipment performance testing

HEPA filters should be factory tested using a "hot" DOP (Dioctyl Phthalate) test or an equivalent (e.g. PAO (Poly Alfa Olefin) (see *Appendix C* for more information on performance testing procedures).

Generally, most manufacturers recommend yearly performance testing for negative air cabinets. A measure of best practice is to perform testing prior to each use to ensure that the negative air cabinet is functioning properly. At minimum, an employer must follow the manufacturer's specifications for performance testing of their filtering units.

According to recognized occupational hygiene practice, performance testing for HEPA filters and negative air systems (cabinets and vacuums) used for asbestos work should be carried out as follows:

- in accordance with manufacturer's specifications
- quarterly (every three months) for both cabinets and vacuums used to exhaust air from an enclosure
- at the start of a type 2 (moderate risk) asbestos work project when exhaust air from a vacuum cannot be exhausted outdoors
- at the start of all type 3 (high risk) asbestos work projects on the negative air cabinets when air cannot be exhausted outdoors.

When field testing HEPA filtering units, they should:

(a) be tested at their rated air flow for proper results

(b) not be used in equipment that exceeds their labelled air flow rate

(c) be tested to detect leaks in filters, gaskets or related equipment.

Field testing will not be as accurate as factory testing since air flow and temperature cannot be controlled as accurately. Testing should be conducted by a competent person, with suitable training and demonstrated knowledge and experience in conducting performance tests on negative air units and vacuums (*Appendix C*).

Equipment passing the DOP test should be labelled with the test date and the name of the tester on each piece of equipment. Documentation for the analysis should be available at the site.

TYPE 1 ASBESTOS WORK (Low risk)

Type 1 asbestos work includes asbestos abatement activity (handling, renovation, repair, demolition or work) with non-friable ACMs as long as the recognized occupational hygiene practice and control measures are implemented to prevent the release of asbestos fibre into the atmosphere, as outlined below.

Recognized occupational hygiene practices for working with asbestos – type 1

The following work activities and procedures established for type 1 asbestos work (low risk), including the use of personal protective equipment, decontamination and cleanup, tools and equipment, waste disposal, monitoring activities, inspections and records keeping, are set forth by recognized and well-documented occupational hygiene practice to prevent the release of asbestos fibre into the atmosphere and exposure to workers and others.

Type 1 - Work activities – Type 1 asbestos work, activity with non-friable ACMs handled in conjunction with recognized control measures, includes but is not limited to:

1. installing or removing non-friable products (that are in good condition) manufactured with ACMs without cutting, breaking, sanding or vibrating the materials including but not limited to materials such as gaskets, seals, packing, construction mastics, brake shoes and pads, where the condition of the shoe and/or pad is good and no visible break dust is present, clutch plates (manufactured cement products, ceiling tiles, floor tiles, etc.) can become friable with age and wear
2. using non-powered hand tools designed to cut, drill or abrade a non-friable manufactured product containing asbestos, as long as water is used to control fibre release and waste products disposed of as ACM
3. cutting, grinding, drilling or sanding ACM mentioned above with a power tool as long as the power tool is equipped with a HEPA filter. Water is used to control fibre release for the packaging of waste ACM
4. removing or repairing an area of drywall, smaller than 1 square metre, when the drywall joint compound (DJC) contains asbestos, can be carried as Type 1 work in accordance with a risk assessment and if task-specific

work procedures (e.g. use of water, HEPA vacuum, personal protective equipment) are developed by the employer

5. the transportation or handling of ACM in asbestos waste containers
6. working with non-friable flooring and cementitious ACMs; removing asbestos-containing flooring (for example vinyl asbestos floor tile), asbestos cement products, shingles and wallboard, or asbestos cement products, asbestos-containing cementitious siding (millboard, wallboard or Transite) and asbestos cement piping.

Procedures for type 1 asbestos work – Recognized occupational hygiene practice, procedures and control measures for carrying out low risk (type 1) ACM work, including personal protective equipment, tools, equipment, cleanup measures, waste disposal, monitoring activities, inspections and records keeping include, but are not limited to, the following:

- If possible, work should be performed when building occupants (workplaces occupying space in the building) or other workers are not present in the immediate vicinity of the work area.
- Inform building occupants (workplaces occupying space in the building), tradespeople, etc., who may be affected by the work, in advance, of the location, duration and type of work to be performed.
- Install site barriers and warning signs positioned in areas where access needs to be restricted until the work is completed.
- Remove all movable furniture, equipment and fittings from the work area.
- Lock out and isolate all electrical and mechanical equipment within the work area, as may be required.
- If electrical and mechanical equipment has been locked out, supply electrical power for abatement work through a ground fault circuit interrupter (GFCI), as may be required.
- Ensure performance test has been carried out for the HEPA filter and vacuum system being used at the workplace location as discussed above in *Tools*.
- Ensure that any power tools equipped with HEPA filters are inspected and maintained as discussed above in *Tools*.
- Where necessary, 6-mil polyethylene drop sheets can be used to prevent the spread of ACMs (floor tiles or other) to other work areas; the drop sheets should be cleaned as frequently as necessary by HEPA vacuuming, wet sweeping or damp mopping during the work activities.
- Avoid the use of techniques which generate excessive fibre levels.
- When hand tools are used to cut, shape or drill a non-friable manufactured product containing asbestos, the product should be wetted whenever possible to minimize the release of airborne fibres.
- Dry removal of ACM is not permitted; localized wetting of the materials minimizes fibre release. Material should be wet but not saturated to prevent surrounding damage.
- Cleanup techniques should include vacuuming with a vacuum cleaner fitted with a HEPA filter, wet sweeping or damp mopping.
- Dispose of asbestos waste to prevent it from accumulating and drying out before final bagging.
- Seal all rough edges or surfaces of any remaining ACM with an encapsulant once abatement work is completed if required (e.g. cementitious boards).
- Workers remove protective equipment and clothing and clean their hands and faces prior to leaving the work area.

Non-Friable Flooring and Cementitious ACMs

In accordance with recognized hygiene practice, the removal of non-friable flooring and cementitious ACMs as type 1 work is carried out as outlined below. Otherwise, type 2 work procedures will apply.

- **Removing asbestos-containing flooring material:**

  Resilient flooring material and tiles, including the backing material and adhesive/mastic, is assumed to contain asbestos if it was manufactured before 1980 (approximate year when asbestos stopped being used by manufacturers in this type of flooring), unless the material has been analyzed using a method specified in this guideline, and proven not to contain asbestos.

  a) Sanding and cutting of the vinyl asbestos flooring surface, backing material or adhesive with high rpm (revolution per minute) equipment is performed as type 2 or type 3 work.

  b) Mechanical chipping is performed as type 2 work.

  c) Sheet flooring is not ripped up. It is cut into strips of width not more than 15 centimetres.

  d) If possible, tiles are to be removed intact. Wetting is not needed for tiles that are heated and removed intact.

  e) The strips, or tiles, and backing are wetted and then scraped up with the use of a scraper, shovel, trowel or other hand tools.

  f) Residual adhesive and backing material are scraped off under wet conditions.

  g) The removed strips or tiles, backing material and adhesive/mastic are immediately placed in an asbestos waste container, and disposed of as asbestos waste.

  h) All debris is cleaned up using a vacuum cleaner equipped with a HEPA filter, or by wet mopping, wet sweeping or wet wiping, and disposed of as asbestos waste.

  i) Dry sweeping is prohibited.

- **Removing cementitious ACMs including panels (Transite), siding, shingles and wallboard:**

  a) Grinding, cutting, drilling, sanding or scraping the ACM mentioned above with a power tool is prohibited unless the power tool is equipped with a HEPA filter.

  b) The ACM mentioned above should be wetted prior to removal.

  c) Ensure the material is removed with minimal breakage.

  d) All unfinished edges of asbestos cement boards that may remain in place (i.e. not being removed) should be treated with a sealing solution.

  e) Above-mentioned materials are to be handled in either of two ways:

    i. immediately lowered to the ground, in a manner that will not break the material, and then placed in an asbestos waste container and disposed of as asbestos waste.

    ii. placed in an asbestos waste container immediately and lowered to the ground by the end of the shift and disposed of as asbestos waste.

It is important that a competent person identifies that material that was once considered non-friable still maintains its structural integrity as these products may become friable over time and therefore must be handled as a Type 2 abatement project at a minimum.

Personal Protective Equipment – An employer must provide the appropriate personal protective equipment in accordance with a risk assessment carried out for the job. Recognized occupational hygiene practice indicates that workers who may be exposed to asbestos fibres wear at minimum:

- A NIOSH-approved half facepiece air purifying respirator equipped with a P100 or HEPA filter
- disposable coveralls over work clothing to prevent contamination of the worker's clothing

Decontamination and cleanup – During and promptly (as soon as possible) after completing work activities:

- Clean up waste material by vacuuming with a vacuum cleaner equipped with a HEPA filter, wet sweeping or damp mopping; compressed air must not be used to clean up or remove dust from work surfaces or clothing.
- Wet the drop sheets, fold them in on themselves to contain asbestos debris and fibres and dust properly and dispose of them as asbestos waste.

Disposal of asbestos materials

- Waste materials from a type 1 asbestos job, including contaminated disposable clothing, should be placed in asbestos waste containers, as defined in the glossary, for disposal as ACM.
- Asbestos waste containers should 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 a HEPA filter. The cleaned containers must then be removed from the work area.
- The sealed asbestos waste containers must also be clearly labelled to indicate that:
  i. they contain asbestos
  ii. they are a health hazard
- An example of a waste bag label can be seen below

DANGER CONTAINS ASBESTOS FIBRES
INHALATION HEALTH HAZARD
DO NOT DISTURB

- If the waste materials are likely to puncture the asbestos waste container, suitable rigid containers should be used.

Air monitoring

As long as the project is being carried out as type 1 work, as established by a risk assessment, on non-friable ACMs and in conjunction with the recognized control measures established for type 1 asbestos work, asbestos fibres are not expected to be released into the atmosphere. If air monitoring is carried out, concentrations of airborne asbestos fibres should be as close as possible to zero and not exceed the background levels.

Site inspection

Upon completion of the work, the work area must be visually inspected to ensure that all visible asbestos-containing debris has been properly cleaned up. Waste bags must be properly labelled if still on site.

Record keeping

Records must be maintained for inspection activity at the workplace.

TYPE 2 ASBESTOS WORK (Moderate risk)
Type 2 asbestos work includes abatement projects (handling, renovation, repair, demolition or work with ACMs) where friable asbestos fibres are expected to be released as a result of the work activity but the work will be carried out in less than three (3) hours.

Recognized Occupational Hygiene Practices for Working with Asbestos – Type 2
The following work activities and procedures established for type 2 (moderate risk) asbestos work, including the use of asbestos work containment installation (enclosures), tools and equipment, personal protective equipment, decontamination, waste disposal, monitoring activities, inspections and records keeping are adopted from recognized, well-documented, widely accepted (in Canada and internationally), occupational hygiene principles and practices to prevent the release of asbestos fibre into the atmosphere and exposure to workers and others.

Type 2 – work activities – Type 2 asbestos work, projects where it is expected that asbestos fibres may be released as a result of the work activity and can be carried out in less than 3 hours includes but is not limited to:

1. using non-powered hand tools to cut, shape, drill or remove a non-friable manufactured ACM if water is not used to control fibre release
2. removing part of a false-ceiling to gain access to a work area and where friable ACM is, or is likely to be, lying on the surface of the false ceiling
3. removal, encapsulating, enclosing or disturbance a minor amount (less than 1 m2) of friable ACM during the repair, alteration, maintenance, demolition or dismantling of a building, structure, machine, tool or equipment if the work is carried out in less than 3 hours
4. removal of dry wall having joint compound containing asbestos if the work is carried out in less than 3 hours
5. removal of non-friable asbestos material (e.g. stucco finish) where the material must be cut, broken, or otherwise damaged and become friable as a result of the removal process
6. performing glove bag operations (see glove bag removal for detailed information below)
7. any other asbestos abatement work not mentioned in type 1 or type 3 that may result in the release of asbestos fibre as a result of the work activity, and that may cause a worker exposure in excess of the occupational exposure limit (OEL)
8. dry work is carried out as type 3 work.

Procedures for type 2 asbestos work – Recognized occupational hygiene practice, procedures and control measures for carrying out moderate risk (type 2) ACM work including the generally adopted control measures, personal protective equipment, tools, equipment, enclosures, decontamination, cleanup measures, waste disposal, monitoring activities, inspections and records keeping include, but are not limited to, the following:

General control measures and practice

- If possible, work should be performed when building occupants (workers in workplaces occupying space in the building) or other workers are not present in the immediate vicinity of the work area.
- Inform building occupants (workplaces occupying space in the building), tradespeople, etc. who may be affected by the work, in advance, of the location, duration and type of work to be performed.

- Post barriers and warning signs in areas where access to unauthorized persons needs to be restricted until the work is completed. An example of an asbestos sign can be seen below.

DANGER ASBESTOS - Inhalation Health Hazard
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
REQUIRED IN THIS AREA
Site Contact:

- Shut down all air handling and ventilation systems within the contaminated area except for the ventilation required to provide the negative air pressure for the enclosure.
- Where setup operations may release asbestos fibres, all workers must wear appropriate personal protective equipment, including respiratory protective equipment approved for use with asbestos. All high risk preparation such as isolation of the work area, shut down of the heating, ventilation and air conditioning system should be completed first of all.
- Prior to starting any work that is likely to disturb friable asbestos-containing materials, clean the materials by damp wiping or vacuuming with a vacuum cleaner fitted with a HEPA filter.

- Use 6-mil polyethylene sheeting to prevent the spread of ACM to other work areas during work setup activity. The drop sheets should be cleaned as frequently as necessary by HEPA vacuuming, wet sweeping or damp mopping during the setup activities.
- Remove all movable furniture, equipment and fittings from the asbestos work area.
- Carefully wrap and seal immovable (in situ or fixed) items within the work area with 6-mil polyethylene sheeting so they are effectively isolated from the asbestos work area.
- Lock out and isolate all electrical and mechanical equipment within the work area.
- Supply electrical power for abatement work through a ground fault circuit interrupter (GFCI) to protect workers against electric shock from electrical equipment operated in wet conditions.
- Ensure performance test has been carried out for the HEPA filtered negative air cabinet or HEPA filter vacuum system to be used at the workplace location, as may be required. Maintain documentation to show performance testing has been conducted.
- Power, telephone and fire alarm cables may be located beneath the ACM being removed. They should be clearly identified prior to commencing any work and may require re-routing during the work.
- Avoid the use of techniques which generate excessive fibre levels. As mentioned, dry work is prohibited as type 2 work and must be carried out as type 3 work.
- Thoroughly wet ACM before and during the work unless such wetting creates a hazard to workers. Material should be wet but not saturated to prevent surrounding damage.
  - Surface soaking with a spray is useful for small areas. The spray can be from an adjustable pistol-grip garden hose fed from a main water supply. Where no supply is readily available, a portable pressurized vessel such as a pump-up garden sprayer can be used. Constant water pressure is desirable. High pressure water spray should not be used.

- The pressure from streams of water, sealants or encapsulants should be controlled to prevent excessive generation of airborne asbestos fibres. Use of airless or low pressure application systems is recommended.
  - ACMs near workers performing bulk removal activities should be continually misted with water, if practicable.
  - Breaking through finishing compound and cutting reinforcing wire in lagging are operations that can generate considerable quantities of dust. Insulation should be kept wet and tools should be selected to allow insulation to be cut into small sections while keeping dust levels in the asbestos work area to a minimum.
- Seal all rough edges or surfaces of any remaining ACM with an encapsulant once abatement work is completed.
- If asbestos is encapsulated, the sealant must penetrate the material and effectively bind the asbestos fibres together.
- Dispose of asbestos waste to prevent it from accumulating and drying out before final bagging.
- After completing the removal of ACMs, clean exposed surfaces by washing, damp mopping, wet sweeping, HEPA vacuuming and treating with a sealant where required.
  - Apply a sealant (e.g. slow drying glue spray, lockdown agent) to the inside surfaces of an enclosure prior to conducting a final air clearance sampling, if being carried out, and prior to dismantling the enclosure. This ensures that non-visible asbestos fibres are bonded to the surfaces of the enclosure and cannot become airborne.
- Workers should fully decontaminate themselves prior to leaving the work area (or using a washroom).
- If required by a risk assessment, conduct final air clearance monitoring for concentrations of airborne asbestos fibres inside the enclosure prior to dismantling the enclosure.

Enclosures – Work containment areas (enclosures) installed to carry out type 2 asbestos work should include but not be limited to the following elements:

- **Walls –** The spread of asbestos is prevented by using negative pressure in a work area enclosed with 2 layers 6-mil polyethylene sheeting, at least 6-mil thick, held in place with appropriate tape and adhesive. When walls do not enclose the work area, it will be necessary to erect a temporary wooden or metal frame to which the polyethylene sheeting can be attached. Overlap all joints by approximately 30 cm and tape both ends of the seam to ensure the area is completely sealed off. For type 2 work, one layer of 10 mil polyethylene may be acceptable based on a risk assessment conducted by a competent person.
  - For work done indoors where walls enclose the work area, the spread of asbestos is prevented by using negative pressure in the work area and protecting the walls, floors and ceilings with 2 layers of 6-mil polyethylene sheeting. Cover any windows and doors leading into the area with 2 layers of 6-mil polyethylene sheeting barrier. Cut the polyethylene sheeting so it overlaps the framework of the window or door by 10 to 15 cm. Ensure a good seal by applying hand pressure to the surface to ensure it sticks.
- **Floors –** Use a layer of seamless or seam-sealed, fibre-reinforced polyethylene sheeting on the floor of the enclosure, covered by a second layer of at least 6-mil polyethylene sheeting. Use double-sided tape or adhesive to prevent movement between layers. A turn-up of 30 cm should be used where the floor joins the walls. Sheeting covering the walls should overlap the turn-ups on the inside of the enclosure to prevent leaks of asbestos-contaminated water running outside of the enclosure. Extra strength in the enclosure floor can be achieved by running the double layers of 6-mil polyethylene sheeting at 90 degrees to one another.
  - Disable all mechanical ventilation in the contaminated area, except for the ventilation required to provide the negative air pressure.
  - Install a barrier of at least two layers of 6-mil polyethylene to seal all openings in the contaminated area (ventilation, heating duct work or other openings).
  - Install an overlapping 6-mil polyethylene sheeting at the entrance to the work area.
  - Install an airlock chamber in place at the entrance of the enclosure to facilitate decontamination.

- Care should be taken to ensure that asbestos cannot escape at points where pipes and conduit leave the work area.
- Seal off stairways and elevators.
- Special attention should be given to the potential for accumulation of airborne contaminants from combustion equipment inside an enclosure (for example, carbon monoxide).
- Special consideration should be given to the fire facilities in the building and the emergency lighting.
- Emergency exits must be clearly marked, both inside and outside of the enclosure.
- For work done outdoors, an enclosure is used if practicable. The employer should include information pertaining to the use of containment outdoors on the notification form to the director of WSH.
- The enclosure is installed with a negative air pressure differential relative to the surrounding area at all times during the work as outlined in the negative air cabinet section below.

Enclosure inspection

- Perform a visual inspection of the integrity of the enclosure prior to work commencing.
- Verify that negative pressure is maintained as may be required and discussed below in negative air units.
- Visually inspect the work area to ensure that all visible asbestos-containing debris has been properly cleaned up and removed upon completion of the job.
- Final air clearance is conducted if a risk assessment carried out by a competent person indicates it is required, as discussed in air monitoring.

Negative pressure units for enclosures (cabinets and vacuums)

- Install a negative air unit (cabinet) equipped with a HEPA filter or dedicated vacuum cleaner equipped with a HEPA filter to create a negative air pressure differential of approximately 5 Pascals (or -0.02 inches in water gauge) within the enclosure, relative to the surrounding area at all times during the work. The exhaust unit should provide at least four complete air changes per hour.
- The manometer or pressure gauge being used to measure the pressure differential for the enclosure should be properly calibrated in accordance with manufacturer's specifications, and should be of best available technology and in good working order to offer a reliable measurement of the pressure differential.
- A negative air pressure in the enclosed work area relative to the surrounding area (outside the enclosure) is maintained so that air flow is always from the clean outside area into the contaminated asbestos work area.
- Direct the exhaust air from the enclosure to the outdoors through a negative air unit (cabinet) equipped with a HEPA filter or dedicated vacuum fitted with a HEPA filter.
- The HEPA-filtered exhaust unit remains in continuous operation to maintain negative pressure in the enclosure for the duration of the work, while the work is in progress.

- HEPA filters must have a minimum filtration efficiency of 99.97 per cent. A coarse pre-filter should be installed upstream of the HEPA filter to prolong its life.
- Ensure a performance test has been carried out for HEPA filter units (negative air cabinets) and vacuum systems being used at the workplace location, as may be required (see *Tools* section). Best practice in inspecting the filter and seal fittings is to use a static pressure alarm which indicates a failure in the system (see *Appendix C* for more information on performance testing of on-site negative air cabinets and vacuum cleaners (DOP testing) practices).
- The complete negative air system is inspected prior to use to ensure the integrity of the whole system, taking into account all its components (e.g. seats, seals and gaskets).
  - The discharge point for any negative air is to the outdoors, away from other work areas, air-conditioning inlets, breathing air compressors or outdoor passage ways.

- In the rare case where exhaust air cannot be discharged to the outside, or where it must be discharged to areas close to heating, ventilation or air conditioning (HVAC) inlets, breathing air compressors or outdoor passageways, an on-site performance test (DOP or equivalent) should be carried out for the unit.
- Maintain adequate documentation, on site, to show that performance tests have been carried out (certification of DOP test) for the HEPA-filtered equipment.

• When it is not possible to exhaust the air outdoors, it should be reported on the notification to the director of WSH.

Personal Protective Equipment – An employer must provide the appropriate personal protective equipment in accordance with a risk assessment carried out for the job. Only persons wearing the appropriate protective clothing and respiratory protection should enter a type 2 work area since it is recognized that asbestos fibres will be released because of the work activities.

Workers who may be exposed to asbestos fibres, as in the case of type 2 asbestos work, should wear the following personal protective equipment:

• Protective clothing that:
  - is disposable and made of material such as Tyvek™ that resists penetration by asbestos fibres.
  - covers the body and fits snugly at the neck, wrists and ankles.
  - covers the head and feet (laceless rubber boots are recommended)
  - is immediately repaired or replaced if torn.

Street clothes should not be worn under disposable protective clothing.

• Respiratory protection selected as follows:
  a) All workers inside the contaminated area should wear, at minimum, a NIOSH-approved full-face piece powered air purifying respirator (PAPR) with HEPA or P 100 cartridges (filters) while working on wetted asbestos-containing materials.
  b) A NIOSH-approved half facepiece respirator equipped with a P100 or HEPA filter may be worn if a competent person conducts a risk assessment for the job being carried out.
  c) If personal air sampling is performed inside the contaminated work area to determine the actual exposure to airborne asbestos fibres, an appropriate respirator is selected from Table 1 in Section 5.

Decontamination and cleanup

• Promptly (as soon as possible) upon completing the work:
  - Clean up the ACM debris, waste and dust by vacuuming with a vacuum cleaner fitted with a HEPA filter, by wet sweeping or by damp mopping.
  - Wet the drop sheets and fold them in on themselves to contain dust, properly bag and dispose of the sheets as asbestos waste.

• Before leaving the work area:
  i. Clean non-disposal protective equipment and clothing (e.g. non-disposal items such as rubber boots) before removing them from the work area. Use a vacuum cleaner fitted with a HEPA filter or wipe the equipment and clothing with a damp cloth.
  ii. Leave all disposable protective clothing used during abatement in the work area and dispose of it as asbestos waste.
  iii. Wash all exposed skin surfaces prior to removing respirators. All persons in the work area must properly decontaminate themselves prior to leaving the work area. This is to be done under all circumstances, including prior to drinking, eating, using a bathroom, etc.

Waste disposal

- Place asbestos waste, kept wet, into an asbestos waste container and seal.
- Clean the external surfaces of sealed containers of asbestos waste by wiping with a damp cloth that is also to be disposed of as asbestos waste, or by using a vacuum cleaner fitted with a HEPA filter.
- Remove containers from the work area.
- Asbestos waste should be stored in a manner to ensure that it will not be damaged or pose a risk of exposure to worker or others.

Air monitoring

If air sampling conducted for worker exposure to airborne concentrations of asbestos fibres inside an enclosure indicates that levels inside the work area exceed the protection factor (PF) of the respiratory protective equipment (see Table 1 in Section 5) being used, the work must be stopped until appropriate respirators are supplied and adequate control measures are implemented.

In the case of unprotected workers or others situated outside the type 2 work area, who may be affected by the escape of asbestos fibres from the work area, a risk assessment carried out by a competent person could establish if intermittent perimeter sampling for airborne concentrations of asbestos fibres is required outside the enclosure or work area. Airborne asbestos fibre concentrations outside an enclosure or work area where type 2 asbestos work is being carried out should be as close as possible to zero and not exceed the background levels of the area prior to the start of the job.

In accordance with a risk assessment carried out by a competent person, final air clearance sampling may be carried out for some type 2 asbestos work projects, inside the enclosure prior to dismantling it (e.g. schools, hospitals, public spaces). The result of a clearance sample inside the enclosure must be less than 0.01 fibres per cubic centimetre (f/cc) before dismantling the enclosure. A final air clearance would be considered a measure of best practice.

Glove bag

A glove bag allows the removal of asbestos-containing materials from mechanical components such as piping, valves, fittings and small dimension duct work without constructing an elaborate enclosure. Glovebag removal of ACM is considered a type 2, moderate risk project. Glove bags come in a variety of types and styles. Some are multi-use, meaning they can be moved along a pipe as removal progresses. Other glove bags are taped in place and used only in that one location before being discarded. Only single-use glove bags are permitted.

Glove bag procedures

Before working with a particular type of glove bag, workers should read and understand the manufacturer's instructions for use.

- At minimum, workers wear a half facepiece respirator with P100 or HEPA filters and protective clothing.
- Place a 6-mil polyethylene drop sheet beneath the area in which the glove bag is to be installed.
- Properly identify the work area by placement of tape barricade and signage for authorized personnel only.
- Review the need to isolate and/or otherwise shutdown any HVAC ducts.
- Stable elevated platforms and scaffolding must be provided where needed.
- Glovebag should be made of a minimum of 6-mil polyethylene and must be seamless at the bottom.
- A glovebag properly designed for each task should be used.
- Glovebag is to be disposed of when full and not reused, or cleaned for reuse.

- Check with the glovebag manufacturer for the recommended range of temperatures in which the bag can be used. Standard glovebags should not be used on piping at temperatures exceeding 65 C.
- Before beginning work, wet all insulation with amended water.
- All damaged areas of pipe should be wrapped with 6-mil polyethylene sheeting prior to removal or prior to installing glove bag.
- Where the insulation is not fully wrapped with 6-mil polyethylene sheeting, the insulation should be banded with tape at the places where the glove bag is to be attached, to provide a clean surface for affixing the tape that seals the glove bag, and to prevent damage to the insulation when the sealing tape is removed.
- Care must be taken when metal bands, wires or metal jacketing are encountered to avoid lacerations to the hands or to the glove bag.
- Whenever possible, sharp edges must be folded in and the items placed in the bottom of the bag.
- A smoke test should be performed inside the glove bag periodically to assure that the glove bag has been installed correctly.
- Place the tools in the bag 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 of the pipe.
- Place hands into the gloves and using the tools, cut and remove any jacketing. Wet exposed insulation to reduce fibre release.
- Remove the insulation, wetting it and arranging it in the bottom of the bag.
- Pre-formed insulation blocks should be cut at the joints to minimize fibre generation.
- Using a wire brush, abrasive pad or scraper, clean asbestos residue off of the pipe or fittings.
- Wet and seal the exposed ends of the insulation with a sealant material.
- Sealant should also be applied to the inside upper section of the bag prior to removal of the bag.
- Place tools in the glove and pull the glove out 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 glove bag or into a pail of water for cleaning. For cleaning, open the pouch under water and clean the tools thoroughly.
- Extract (remove) the air out of the glove bag using the vacuum cleaner equipped with a HEPA filter. 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 container and seal. Disposable clothing and drop sheets must also be disposed of as asbestos waste.
- Insulation material that may have fallen from the pipe must be cleaned up, as soon as possible, by using a vacuum cleaner equipped with a HEPA filter, or by wet mopping or wet sweeping prior to attaching the glove bag.
- The surfaces from which asbestos has been removed should be visually inspected after removal of the glove bag to ensure that there is no remaining asbestos residue.
- All work equipment, including reusable work clothing, should be cleaned by damp wiping or with a vacuum cleaner fitted with a HEPA filter.
- The work area should be decontaminated by using a vacuum cleaner equipped with a HEPA filter, or by wet wiping, wet sweeping or wet mopping, after the completion of the removal.
- Workers should wash their hands and face before leaving the work area.
- Where outdoor work is performed, the same glove bag procedures apply and barricades should be placed around the work area.

Air Monitoring for Glovebag Work
Intermittent area sampling (in the area of work) should be carried out during the glove bag work activities if unprotected workers, or others, are present adjacent to the work area. In these cases, area sampling (in the work area) for airborne concentrations of asbestos should be performed at least once per shift to ensure that the work is being performed without the release of fibres. Airborne concentrations of asbestos fibre should be as close as possible to zero and not exceed the background concentration obtained before the work began.

Monitoring could be carried out for long-term projects where glove bag activities occur over a period of time or for ongoing or intermittent maintenance activities where the same workers and procedures are used each time. In either of these cases, monitoring should be carried out occasionally to demonstrate that fibres are controlled when the work is done, but not necessarily each time a glove bag operation is performed.

Any air monitoring performed to ensure that fibre releases are not being observed would be considered a measure of best practice.

Record keeping
The employer must maintain documentation of all monitoring results and inspection activity at the workplace.

TYPE 3 – ASBESTOS WORK (High Risk)
Type 3 asbestos work includes abatement projects (handling, renovation, repair, demolition or work with ACMs) where asbestos fibre is expected to be released because of the work activity.

Recognized Occupational Hygiene Practices for Working with Asbestos – Type 3
The following work activities and procedures established for Type 3 (high risk) asbestos work including the use of asbestos work containment installation (enclosures), tools and equipment, personal protective equipment, decontamination, waste disposal, monitoring activities, inspections and records keeping are adopted from recognized, well-documented, widely accepted (in Canada and internationally), occupational hygiene principles and practices to prevent the release of asbestos fibre into the atmosphere and exposure to workers and others.

Type 3 - Work activities – Type 3 asbestos work is a project where it is expected that asbestos fibres may be released as a result of the work activity. They include but are not limited to:

- removing, encapsulating, enclosing or disturbing friable ACM during the repair, alteration, maintenance, demolition, or dismantling of a building, structure, machine, tool or equipment, or part of it and where the job takes longer than 3 hours to complete. Work done in less than 3 hours can be conducted in accordance with type 2 asbestos practice.
- spray application of a sealant or encapsulant onto a friable ACM that is greater than one square metre (1 m2)
- cleaning or removal of air-handling equipment, including rigid ducting, in a building that has, or previously had sprayed-on asbestos fireproofing, thermal or acoustic insulation in the building, unless it can be shown that the air handling equipment has been effectively cleaned and cleared of the presence of asbestos
- repairing, altering or dismantling a boiler, furnace, kiln or similar device, or part thereof, where ACM has been used or applied
- repair, alteration or demolition of equipment made in part of refractory ACM
- grinding, cutting, drilling, sanding or scraping any ACMs involved in type 1 work with a power tool not equipped with a HEPA filter
- removal of drywall with asbestos-containing drywall joint compound requiring more than three hours of work to complete

- demolishing, dismantling, altering or repairing any building or structure, or part of it, in which insulating ACM was used or in which asbestos products were manufactured
- dry removal of friable ACM when wet removal is not feasible as determined by an assessment risk and to be indicated on the notification to the director of WSH.

Type 3 Asbestos Work Procedures – Recognized occupational hygiene principles to manage high risk (type 3) ACM work, the typical activity known to be high risk and the generally adopted control measures (enclosures, personal protective equipment, tools, equipment, decontamination, cleanup measures, waste disposal, monitoring activities, inspections and records keeping) to prevent the release of asbestos fibres and worker exposure include, but are not limited to, the following:

General control measures and practices

- If possible, work should be performed when building occupants (workers in workplaces occupying space in the building) or other workers are not present in the immediate vicinity of the work area.
- Inform building occupants (workplaces occupying space in the building), tradespeople, etc. who may be affected by the work, in advance, of the location, duration and type of work to be performed.
- Place barriers and warning signs in areas where access to unauthorized persons needs to be restricted until the work is completed. An example of an asbestos sign can be seen below.

DANGER ASBESTOS

Inhalation Health Hazard

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING

REQUIRED IN THIS AREA

Site Contact:

- Shut down all air handling and ventilation systems within the contaminated area except for the ventilation required to provide the negative air pressure for the enclosure.
- Prior to starting any work that is likely to disturb friable asbestos-containing materials, clean the materials by damp wiping or vacuuming with a vacuum cleaner fitted with a HEPA filter.
- Where setup operations may release asbestos fibres, all workers must wear appropriate personal protective equipment including respiratory protective equipment approved for use with asbestos. All high-risk preparation such as isolation of the work area, shut down of the heating, ventilation and air conditioning system, installation of HEPA-filtered negative air units and the worker decontamination facility should be completed using type 2 procedures.
- Use 6-mil polyethylene sheeting to prevent the spread of ACM to other work areas during work setup activity. The drop sheets should be cleaned as frequently as necessary by HEPA vacuuming, wet sweeping or damp mopping during the setup activities.
- Remove all movable furniture, equipment and fittings from the asbestos work area.
- Carefully wrap and seal immovable (*in situ* or fixed) items within the work area in 6-mil polyethylene sheeting so they are effectively isolated from the asbestos work area.
- Lock out and isolate all electrical and mechanical equipment within the work area.
- Supply electrical power for abatement work through a ground fault circuit interrupter (GFCI) to protect workers against electric shock from electrical equipment operated in wet conditions.

- Ensure performance test has been carried out for the negative air cabinets(s) and HEPA filter and the vacuum system(s) equipped with HEPA filters to be used at the workplace location. Maintain documentation to show performance testing has been conducted.
- Power, telephone and fire alarm cables may be located beneath ACM being removed. They should be clearly identified prior to commencing any work and may require re-routing during the work.
- Avoid the use of techniques which generate excessive fibre levels.
- ACM is thoroughly wetted before and during the work unless such wetting creates a hazard to workers. Material should be wet but not saturated to prevent surrounding damage.
- Surface soaking with a spray is useful. The spray can be from an adjustable pistol-grip garden hose fed from a main water supply. Where no supply is readily available, a portable pressurized vessel such as a pump-up garden sprayer can be used. Constant water pressure is desirable. High pressure water spray should not be used.
- The pressure from streams of water, sealants or encapsulants should be controlled to prevent excessive generation of airborne asbestos fibres. Use of airless or low pressure application systems is recommended.
- ACMs near workers performing bulk removal activities should be continually misted with water, if practicable.
- Breaking through finishing compound and cutting reinforcing wire in lagging are operations that can generate considerable quantities of dust. Insulation should be kept wet and tools should be selected to allow insulation to be cut into small sections while keeping dust levels in the asbestos work area to a minimum.
- Dry removal produces very high levels of asbestos fibre. It should only be used in instances where wet methods may be hazardous to workers or cause damage, for example:
  - live electrical apparatus that cannot be locked out and may be made dangerous if in contact with water
  - where hot metal is to be stripped and the use of water may be damaging
- Dry removal should be identified on the notice to the director of WSH
- If asbestos is encapsulated, the sealant must penetrate the material and effectively bind the asbestos fibres together.
- Dispose of asbestos waste to prevent it from accumulating and drying out before final bagging.
- After completing the removal of ACMs, clean exposed surfaces by washing, damp mopping, wet sweeping, HEPA vacuuming and treating with a sealant as may be required.
- Seal all rough edges or surfaces of any remaining ACM with an encapsulant once abatement work is completed.
- Apply a sealant (e.g. slow drying glue spray, lockdown agent) to the inside surfaces of an enclosure prior to conducting a final air clearance sampling. This ensures that non-visible asbestos fibres are bonded to the surfaces of the enclosure and cannot become airborne.
- Workers should fully decontaminate themselves prior to leaving the work area or using a washroom as described in the decontamination unit section.
- Conduct final air clearance monitoring for concentrations of airborne asbestos fibres inside the enclosure prior to dismantling the enclosure.

Enclosures – Work containment areas (enclosures) installed to carry out type 3 asbestos work should include, but not be limited to, the following elements:

- **Walls –** When walls do not enclose the work area, use 2 layers 6-mil polyethylene sheeting, at least 6-mil thick, held in place with appropriate tape and adhesive. It may be necessary to erect a temporary wooden or metal frame to which the polyethylene sheeting can be attached. Overlap all joints by approximately 30 cm and tape both ends of the seam to ensure the area is completely sealed off.
  - For work done indoors where walls enclose the work area, the spread of asbestos is prevented by using negative pressure in the work area and protecting the walls, floors and ceilings with 2 layers of

6-mil polyethylene sheeting. Cover any windows and doors leading into the area with 2 layers of 6-mil polyethylene sheeting barrier. Cut the polyethylene sheeting so it overlaps the framework of the window or door by 10 to 15 cm. Ensure a good seal by applying hand pressure to the surface to ensure it sticks.

- **Floors –** Use a layer of seamless or seam-sealed, fibre-reinforced polyethylene sheeting on the floor of the enclosure, covered by a second layer of at least 6-mil polyethylene sheeting. Use double-sided tape or adhesive to prevent movement between layers. A turn-up of 30 cm should be used where the floor joins the walls. Sheeting covering the walls should overlap the turn-ups on the inside of the enclosure to prevent leaks of asbestos-contaminated water running outside of the enclosure. Extra strength in the enclosure floor can be achieved by running the double layers of 6-mil polyethylene sheeting at 90 degrees to one another.
- Disable all mechanical ventilation in the contaminated area, except for the ventilation required to provide the negative air pressure.
- Install a barrier of at least two layers of 6-mil polyethylene to seal all openings in the contaminated area (ventilation, heating, duct work or other openings).
- Care should be taken to ensure that asbestos cannot escape at points where pipes and conduit leave the work area. Seal off stairways and elevators. Special care should be taken if elevators are intended to be used. Elevator movement can impact the negative air pressure. Where asbestos is removed from an entire floor of a multi-storey building, all passenger elevators should be prevented from stopping at that floor. Asbestos abatement workers may gain access to the floor via the fire staircase or from an elevator dedicated for this purpose.
- Special attention should be given to the potential for accumulation of airborne contaminants from combustion equipment inside an enclosure (for example, carbon monoxide).
- Special consideration should be given to the impact on fire protection facilities and emergency lighting.
- Emergency exits must be clearly marked, both inside and outside of the enclosure.
- If possible, the enclosure (work area) and material transfer rooms should be fitted with a clear acrylic panel or some other form of window so that the work within may be monitored from outside.
- Workers inside the enclosure should have some form of communication with the workers outside the enclosure.
- For work done outdoors, an enclosure should be installed unless it is not practicable or possible. The employer should include information pertaining to the use of containment outdoors on the notification form to the director of WSH.
- A decontamination facility is attached to the asbestos work area (as outlined in the decontamination area section below) to allow workers to remove contaminated clothing and properly shower before leaving the area. The decontamination facility consists of a series of connected rooms, a shower room, a clean room and equipment room, separated by airlocks. Use of this facility prevents the spread of asbestos beyond the contaminated area. Ideally a second series of decontamination rooms is installed for the waste transfer as outlined in the waste decontamination section below.
- Enclosures, including the decontamination facilities, are not to be dismantled until an acceptable final air clearance sampling has been achieved (less than 0.01f/cc).
- The enclosure is installed with a negative air pressure differential relative to the surrounding area at all times during the work as outlined in the negative air cabinet section below.

Negative pressure for enclosures (cabinets)

- Install a negative air unit (cabinet) equipped with a HEPA filter to create a negative air pressure differential of approximately five Pascal (or -0.02 inches in water gauge) within the enclosure, relative to the surrounding area at all times during the work. The exhaust unit should provide at least four complete air changes per hour.
- The manometer or pressure gauge being used to measure the pressure differential for the enclosure must be properly calibrated in accordance with manufacturer's specification, be of best available technology and in good working order to offer a reliable measurement of the pressure differential.

- A negative air pressure in the enclosed work area relative to the surrounding area (outside the enclosure) is maintained so that air flow is always from clean outside area into the contaminated asbestos work area.
- Discharge exhaust air from the enclosure to the outdoors through a negative air unit (cabinet) equipped with a HEPA filter.
- The HEPA-filtered exhaust unit remains in continuous operation to maintain negative pressure in the enclosure for the duration of the work, while the work is in progress, at night and on weekends, until the work is completed and final air clearance test(s) confirm fibre levels are low enough to permit dismantling of the enclosure.
- The discharge point for any negative air is to the outdoors, away from other work areas, air-conditioning inlets, breathing air compressors or outdoor passageways.
- In the rare case where exhaust air cannot be discharged to the outside, or where it must be discharged to areas close to heating, ventilation or air conditioning (HVAC) inlets, breathing air compressors or outdoor passageways, on-site performance testing should be carried out for the equipment.
- The HEPA-filtered negative air units should be positioned to allow access to the filters from within the asbestos work area, while the units themselves are kept outside the asbestos work area. This makes decontamination of the units easier. Where it is not possible to change the filter while within the asbestos work area, a temporary enclosure should be constructed around the unit during filter replacement.
- HEPA filters must have a minimum filtration efficiency of 99.97 per cent. A coarse pre-filter should be installed upstream of the HEPA filter to prolong its life.
- Ensure a performance test has been carried out for HEPA filter units (negative air cabinets) and vacuum systems being used at the workplace location, as may be required (see *Tools* section).
- The complete negative air system is inspected prior to use to ensure the integrity of the whole system, taking into account all its components (e.g. seats, seals and gaskets). Best practice in inspecting the filter and seal fittings is to use a static pressure alarm which indicates a failure in the system (see *Appendix C* for more information on performance testing of on-site negative air cabinets and vacuum cleaners (DOP testing) practices).
- Maintain adequate documentation on site to show that performance tests have been carried out (certification of DOP test) for the HEPA-filtered cabinets and vacuum cleaners.
- When more than one negative air cabinet is required to maintain adequate negative pressure, the units should be strategically placed inside the enclosure to keep the pressure uniform throughout the enclosure.
- In rare cases where it is not possible to exhaust the air from a negative air cabinet outdoors, it should be reported on the notification to the director of WSH.

Worker Decontamination Unit

- For type 3 work, the decontamination unit is connected to the enclosed asbestos work area. The facility is divided into three distinct rooms:
  - equipment room (dirty room)
  - shower
  - clean room
- The decontamination facility's three rooms are separated from one another by means of a suitable airlock. This airlock defines the boundary between each segment of the decontamination facility. The airlock allows personnel to access the work area and restricts the flow of air between areas. Partitions between rooms in the decontamination facility are self-closing so that each room functions as an airlock. These partitions are normally constructed of fully overlapping sheets of 6-mil polyethylene sheeting suspended to form a curtain and weighted at the bottom. One airlock installation should be 2 sets of overlapping sheets (total of 4 sheets).

- The equipment room should have provision for:
  - storage of contaminated re-usable protective equipment (e.g., footwear)
  - an asbestos waste container for disposable protective equipment
  - airflow to be directed towards the asbestos work area.
- The shower room should have provision for:
  - a shower area with an adequate supply of soap, shampoo and hot and cold water
  - airflow directed towards the equipment room and enclosure area
  - clean or disposable towels
  - an asbestos waste container for disposable towels or a bin for wet towels.
- The clean room should have provision for:
  - storage of individual respirators in containers or lockers
  - a mirror to assist in donning respiratory protective equipment
  - storage area or hooks for clean clothing
  - airflow directed towards the shower room and equipment room
  - supply of clean disposable and re-usable equipment (e.g., footwear and respirators)
  - an ACM waste container for the respirator cartridges
  - a charging station for the PAPR battery packs.

Entering and leaving Type 3 work areas

Workers arriving at the work area

a) Enter the clean room of the worker decontamination unit; remove all street clothing, store it in the space provided and put on clean, appropriate respiratory protection and protective clothing (disposable and covers head) and footwear.

b) Pass through the shower room to the equipment (dirty) room.

c) Leave the equipment room to enter the asbestos work area (enclosure).

Workers leaving the work area

a) Before leaving the work area and before entering the equipment room, workers remove asbestos material on their protective equipment with a vacuum cleaner fitted with a HEPA filter.

b) In the equipment room, the worker removes all protective clothing and equipment except the worker's respirator. Any waste material disposable protective equipment is placed in an asbestos waste container.

c) The worker enters the shower room and showers thoroughly without removing the respiratory protection.

i. 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.

d) The worker enters the clean room.

e) The respirator is then thoroughly wiped down, disinfected and stored until required.

f) Unless the cartridges are being discarded as ACM waste, place adhesive tape (duct tape) on the respirator filters, if they will be re-used, prior to storage in the clean room to prevent any asbestos fibres from being dislodges from the filters.

g) The worker dresses in street clothes and leaves through the clean area door.

Remote worker decontamination units

- When it is not possible to connect a decontamination unit to an enclosure, the employer should include information pertaining to using a remote decontamination unit on the notification to the director of WSH.
- Where it is not practical to attach the worker decontamination unit to the asbestos work area (enclosure) procedures to minimize asbestos contamination must be implemented. Usually a two-room worker decontamination unit is located both at the work area and remote locations (equipment room and a clean area (an isolated changing area) at the work area, a shower room and a clean room at the remote site). The following procedure used to enter and exit the area:
  - workers discard their disposable coveralls, overshoes or other outer garments in an equipment room and move to the clean area (an isolated changing area) attached to the removal area (enclosure) to change into clean disposable outer clothing for the journey to a remote decontamination facility while still wearing their respiratory protection.
  - If the journey to the remote decontamination unit is outdoors, the change into clean disposable clothing may not be required.

Entering and leaving remote decontamination units

a) when starting, work workers:

i. enter the clean room (isolated changing area) of the remote worker decontamination unit, remove all street clothing, store it in the space provided and put on appropriate disposable protective clothing and respiratory protection

ii. from the clean room, proceed to the work area through the equipment room attached to the work area.

b) at the end of work, workers:

i. remove visible contamination in the work area

ii. enter the equipment room attached to the work area; remove all asbestos fibre from respiratory protection using a HEPA-filter equipped vacuum cleaner and remove the coveralls

iii. place disposable coveralls in an asbestos waste container for disposal with the asbestos waste

iv. pass into the clean room (isolated changing area), don clean coverall and proceed immediately to the remote worker decontamination unit

v. enter the shower area of the remote worker decontamination unit, remove protective clothing and shower thoroughly

vi. proceed into the clean room, remove the respiratory protection and store it appropriately using adhesive tape to cover the filters if they will be re-used; respiratory protection must be cleaned following manufacturers' instructions.

vi. dry off, dress in street clothes and leave through the clean area.

Waste decontamination unit

- All bags of waste asbestos and contaminated protective clothing are removed from the work area through the waste decontamination unit connected to the negative pressure work area (enclosure).
- The waste decontamination unit consists of a series of interconnecting rooms including:
  - Equipment room (container cleaning room) – is a contaminated space.
  - Holding room is a clean space; no worker need enter here.
  - Transfer room is a clean space.

- The waste decontamination unit is constructed so that overlapping 6-mil polyethylene sheeting is fitted to each side of the entrance or exit to each room.
- Bags of asbestos waste and contaminated protective clothing are removed from the work area using the following procedure:

  a) Remove any contamination visible on the outsides of bags in the work area.

  b) Transfer the bags into the container cleaning room.

  c) Clean the outsides of bags with a damp cloth or sponge, place each bag into a second 6-mil polyethylene bag, seal the outer bag and transfer the double-bagged waste to the holding room.

  d) Worker(s) performing the activities described in (b) and (c) must wear the same protective clothing and respiratory protection as those workers in the contaminated work area.

  e) Workers performing the activities described in (b) and (c) exit by the worker decontamination unit.

  f) The double-bagged waste is then moved from the holding room to the container clean room, without entering the holding room, and then outside the waste decontamination unit by a worker who enters from the waste container clean room.

  g) Workers performing the activity described in (f) do not require respiratory protection or protective clothing.

- Contaminated equipment, tools and other items (e.g., hand tools, power tools, vacuum cleaners) used in the work area is cleaned with a damp cloth or vacuumed with a vacuum equipped with a HEPA filter and removed from the work area through the waste decontamination unit by the same method as described for asbestos waste.
- Where decontamination for tools and equipment is not possible, the item should be wrapped in 2 layers of 6-mil polyethylene sheeting and sealed for appropriate decontamination off-site or only opened when inside the enclosure of another asbestos project. The wrapped equipment or tool should be labelled as ACMs.

Personal Protective Equipment

Employers must provide personal protective equipment to workers appropriate to the hazards present at the work site. Workers exposed to asbestos fibres in a type 3 situation should wear protective clothing that:

- Is disposable and made of material such as Tyvek™ that resists penetration by asbestos fibres
- Covers the body and fits snugly at the neck, wrists and ankles
- Covers the head and feet (laceless rubber boots are recommended)
- Coveralls are immediately repaired or replaced if torn

Street clothes should not be worn under disposable coveralls.

- Unless personal sampling is conducted in the work area to determine the actual exposure to airborne asbestos fibres and an appropriate respirator is selected from Table 1, all persons inside the contaminated area must wear, at minimum, one of:

  a) full facepiece powered air purifying respirator (PAPR) with HEPA or P 100 cartridges while working on wetted asbestos-containing materials

  b) a full facepiece supplied air respirator or self-contained breathing apparatus complete with a reserve escape bottle, operating in continuous flow mode while working on dry asbestos-containing materials.

Half facepiece air purifying respirators equipped with a HEPA or P100 particulate filter are only appropriate for the setup and dismantling phases of the high-risk asbestos work projects.

Site Inspection

Enclosures and decontamination units

- Visually inspect enclosure and decontamination units for gaps, breaks and any defects:
  - before the start at the beginning of each work shift
  - at the end of the shift if there is not a shift immediately following the shift that is ending
  - at least once each day when there are no shifts.
- Any defect revealed during the inspection is remedied immediately. Where necessary, additional air monitoring might be required to assess the impact of defect(s) noted.
- Visually inspect the work area to ensure that all visible asbestos-containing debris is cleaned up at least daily.
- This inspection includes a visual check and may include smoke testing to ensure that air flows from clean areas into contaminated areas. Keep a record of these inspections.
- A competent person should verify that negative pressure is maintained (as discussed in negative air units section) during the project to ensure asbestos will not escape. The negative pressure enclosure should be tested and recorded daily using any of the following techniques:

  a) operating a smoke generator and watching for visible smoke outside the enclosure

  b) using a manometer to ensure a minimum pressure differential of -0.02 inches of water gauge (w.g) relative to the air outside of the enclosure is maintained at all times

  c) daily perimeter air sampling.
- Periodically record measurements of air pressure differentials between clean and contaminated areas during the abatement project.
- Inspect all equipment used for asbestos work before the work begins, following repair and at least once every seven days where continually used. Maintain a record containing details of the equipment inspection and any repairs.

Completion of work

- Complete a walk-through inspection after the removal is complete and before sealant spray is applied to ensure that all visible asbestos in the area has been removed and the cleanup is satisfactory.
- A final visual inspection and decontamination, including wash down and cleaning of the enclosure area with a vacuum cleaner fitted with a HEPA filter that removes all visible signs of asbestos contamination from the enclosure and equipment. This decontamination must be completed before a final air clearance can be performed.
- Before the negative pressure enclosure, worker decontamination unit, and waste decontamination unit may be dismantled or altered:

  a) the contaminated area is decontaminated by a combination of wet cleaning and vacuuming with a vacuum cleaner equipped with a HEPA filter

  b) there must be no visible trace of asbestos, debris or dust

  c) a lock-down agent should be used on the inside of the enclosure walls, ceiling and floors (on the 6-mil polyethylene sheeting) and on in situ building materials that have been stripped of ACMs wherever possible to prevent any remaining fibres from becoming airborne

  d) a final air clearance sample is collected and the results confirmed to be acceptable for dismantling the enclosure (i.e. less than 0.01 fcc).
- It is considered best practice and recommended that an aggressive technique, discussed below, be used when collecting the final air clearance sample.
- All polyethylene sheets used to form the negative pressure enclosure, the worker decontamination unit(s), the waste decontamination unit and the polyethylene sheets covering all openings inside the contaminated area should be folded to contain any remaining debris, placed in an asbestos waste container and disposed of as asbestos waste.

- To ensure the site is adequate for re-occupancy by unprotected workers, complete a final walk-through inspection after the enclosure has been removed.

Disposal of Asbestos Materials

- Waste material from within the enclosed asbestos work area should be placed in asbestos waste containers (doubled 6-mil polyethylene bags at least six mil thick are acceptable), sealed and clearly labelled to indicate that:
  i. they contain asbestos
  ii. the health hazard.
- If the waste materials are likely to puncture the 6-mil polyethylene bags, suitable rigid containers should be used.
- Clean the external surfaces of sealed containers of asbestos waste by wiping with a damp cloth that 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 work area for the transfer room.
- A continuous cleanup and disposal program should be in place to prevent unnecessary accumulation and drying out of the asbestos-containing waste materials at the work site. The waste material should be cleaned up frequently during the work and at the end of each work shift.
- Keep the asbestos waste wet.

Air monitoring

- Air monitoring for airborne concentrations of asbestos may include any, or all, of the following activities depending on the recommendations from a risk assessment carried out by a competent person:
  i. Background sampling of the area collected prior to any work commencing (prior to site preparation and enclosure installation), to establish baseline airborne fibre levels
  ii. Perimeter area sampling should be carried out on a daily basis outside the enclosure close to the points of passage for personnel and/or waste. Fibre counts must be as close as possible to zero, and not exceed the background sampling results. Sampling may also occur in other areas such as the floors above or below, or in adjacent rooms, depending on the setup of the work site and occupancy of these areas
  iii. Personal samples (at the workers' breathing zone during the work activity, inside the enclosure) can be obtained to ensure the results are within acceptable limits for the respiratory protection selected. Personal sample collection frequency will depend on work conditions and an assessment of risk.
    a. Personal samples during work activities may be recommended if dry removal is required.
    b. When personal samples are collected, filters must be analyzed and results provided to workers as soon as possible.
    c. Personal samples obtained inside an enclosure should be representative of the variable work areas and tasks being carried out inside the work area.
- A final air clearance sample for airborne asbestos fibre concentration is obtained inside the enclosure (work area) prior to dismantling it for all type 3 asbestos work projects where unprotected workers or others are present at the work location.
  i. More than one sample may be required for final air clearance of larger projects (areas) depending on the site conditions, to determine suitability for re-occupancy.
  ii. For final air clearance sampling, consider using aggressive air sampling techniques (discussed below).
- All air sampling must be completed by a person who is competent in the practice of collecting asbestos air samples with the appropriate volumes of air.
- The following criteria should be applied when reviewing airborne fibre test results:
  i. If fibre levels inside the enclosure exceed the protection factor of the respiratory protective equipment being used, work must stop until appropriate respirators are supplied and airborne fibre levels can be controlled.

ii. If fibre levels measured outside the enclosure or in the clean room exceed 0.1 fibres per cubic centimetre, work must stop until the reasons for the high levels are identified and corrected.

iii. Final air clearance test results must be less than 0.01 fibres per cubic centimetre using aggressive sampling techniques. If the final air test fails, the enclosure cannot be dismantled. The work area should be evaluated and re-tested.

Aggressive Air Sampling

The following procedure for collecting final clearance tests under aggressive air sampling, recommended for type 3 asbestos work projects prior to removal of an enclosure, developed by the U.S. EPA and published in the agency's Manual Guidance for Controlling Asbestos Containing Materials in Buildings are provided as an example technique:

- Before starting air sampling pumps, direct the exhaust from forced air equipment such as a 1 horsepower leaf blower, against all walls, ceilings, floors, ledges and other surfaces in the enclosure. This should take at least five minutes per 93 m^2 (1000 ft^2) of floor area.
- Place a 51 cm (20 in) fan in the centre of the room (use one fan per 283 m^3 or 10,000 ft^3 of room space). Put the fan on low speed and point it towards the ceiling.
- Start the sampling pump(s) and sample for the period of time required to collect the volume of sample that provides optimum fibre load on the filter (100 to 1300 f/mm^2) with a stopping rule of 10,000 L (10 m^3).
- Turn off the pump(s) and fan(s) when sampling is completed. If testing reveals that contamination levels are exceeded, the area is decontaminated once again using the techniques described for cleanup and the sampling equipment is either be properly decontaminated, wrapped for use on subsequent projects (if this is possible), or discarded.

Record keeping

The employer must maintain documentation of all monitoring results and inspection activity at their site.

WORK WITH ASBESTOS-CONTAINING VERMICULITE AND ASPHALT

The following section outlines the sampling, handling and abatement procedures for vermiculite and asphalt, established in accordance with recognized occupational hygiene principles. The only way to know whether the material contains asbestos is to have it tested.

Vermiculite

Collecting a Sample of Vermiculite Insulation

- All sampling, including vermiculite sampling, should be carried out by someone competent in the practice of collecting asbestos samples.
- The objective of the sampling is to determine if the material contains asbestos fibres rather than to determine how much asbestos is present. The main factors to consider when sampling vermiculite include:
  - The concentration of asbestos in the product is highly variable, so more than one sample is required.
  - Because asbestos fibres can be present at low concentrations, typically a larger sample size is required.
  - Asbestos fibres tend to fall off from the product and settle at the bottom of the insulation layer. Samples obtained must represent the entire thickness of the insulation layer.

Sampling procedure should follow the basic steps outlined in *Appendix D*; however, check with your laboratory as each one may have different requirements.

Handling and Removal of Vermiculite Insulation
If vermiculite insulation is known or suspected to be contaminated with asbestos, it must be treated as an ACM, even if the actual concentration of asbestos in the product may be less than 0.1%. For demolition projects, the materials must be removed from a structure before the building is demolished due to its potential to release asbestos fibres when disturbed.

Two of the most common removal scenarios are when loose vermiculite is present in concrete block walls or in attics as insulation. Vermiculite abatement is typically conducted as type 3 work since the work usually requires more than 3 hours (e.g., attics). Type 2 procedures may be sufficient for a small repair or renovation which may take less than 3 hours.

Vermiculite in Concrete Block Walls
In concrete block walls, the vermiculite was often poured into the vertical cavities. Material may be present in the vertical cavities and there may be small amounts in the joint cavities. Vermiculite in the joint cavities cannot be removed without compromising the structural integrity of the building. This remaining vermiculite must be taken into account at demolition sites to ensure that the adequate practices for preventing the spread of asbestos fibre and for worker protection are adopted.

Usually the material is removed by creating an opening at the base of the wall and allowing the material to drain by gravity. Wall construction and site conditions will cause the procedures to vary.

Wetting the insulation in the wall is usually not effective, as the insulation will then stick to the inside of the wall. As a result, there is potential for an elevated concentration of asbestos fibre to be released and the work is carried out using type 3 procedures.

As the material from inside the wall drains, if possible, it should be wetted at the exit point prior to placing it into asbestos waste containers or vacuumed with a vacuum cleaner equipped with a HEPA.

If the insulation is removed by gravity, the following work procedures should be used:

(1) When holes are made in a wall to remove the vermiculite, an engineer may need to be consulted to ensure that the removal does not compromise the building integrity.

(2) Type 2 or 3 procedures should be used when removing vermiculite from concrete block walls.

(3) A waste bag is taped to the wall to catch the draining material.

(4) A hole is made in the concrete block wall while negative pressure is maintained in the enclosure

(5) As insulation drains into the bag, the waste in the bag should be wetted down

(6) Some residual material will remain in cavities in the concrete blocks. If the wall is to be demolished following removal of the insulation, wet demolition techniques, worker personal protective equipment and generally accepted hygiene practices based on the level of risk established by a risk assessment should be implemented.

Vermiculite in Attics - Loose Fill Insulation

Vermiculite used in attics as insulating material is generally loose and exposed (i.e. not encapsulated or covered). There is a high risk of fibre release if the material is disturbed.

In general, removal of material should include:

a. Type 3 procedures are generally required unless the work can be done in less than 3 hours.

b. Typically the insulation material is removed by hand with scoops and shovels with the use of a HEPA filtered vacuum system. This should be done with as little disturbance of the insulation as possible.

c. If a HEPA filtered vacuum system is not used, then a negative air unit equipped with HEPA filters should be installed to remove air from the work area in accordance with the type 3 procedures previously discussed (-0.02 inches of water)

d. Workers should be provided with the appropriate protective equipment. Full facepiece PAPRs are to be used at minimum unless air sampling.

e. Water may be used to control the release of asbestos fibres. However, it can cause the asbestos fibres to adhere to the rough surfaces of the attic space. Water is applied as a fine mist only on the surface to prevent particles from becoming airborne.

f. Sometimes it is not possible to install a decontamination unit immediately adjacent to the attic space. In those cases, remote decontamination procedures will be necessary.

Once the material is removed, the area should be thoroughly HEPA vacuumed and visually inspected for residual material, especially rough surfaces, sealant applied and final air clearance sampling carried out.

Note that if the vermiculite material is contained in an enclosed space where there is little potential for contact or being distributed, it can be safely left in place. If it is left in place, the employer must develop a suitable management plan.

5. PERSONAL PROTECTIVE EQUIPMENT

Respiratory protection

- A respirator must not be shared unless it is cleaned and disinfected before a different worker uses it.
- All respirators must be provided and maintained by the employer without cost to the worker.
- Only those types of respirators tested and certified by the National Institute for Occupational Safety and Health (NIOSH) in accordance with the current edition Canadian Standards Association Standard CSA Z94.4 – 11 (or most current), Selection, Use and Care of Respirators, or other device approved by the director of the Workplace Safety and Health Branch (WSH) may be used.
- All air purifying respirators must be equipped with a HEPA or P 100 filter.
- A respirator must be selected with an appropriate protection factor so that the user's exposure does not exceed 0.1 fibres per cubic centimetre of air (f/cc).
- The protection factors (adopted in CSA Standard Z94.4 – 11) presented in Table 1 must be used when selecting a respirator.
- The maximum use concentration for each type of respirator is listed in Table 1.
- The employer must provide supervision to ensure the respirator is used properly.
- Workers required to wear a respirator must be adequately trained in the use, care, maintenance and limitations of that respirator.
- In accordance with the CSA standard, instruction must be given on:
  - reasons for using the respirator
  - when to use the respirator
  - how the respirator works
  - how to perform a seal check for daily use
  - how to perform regular servicing
  - the name of the respiratory protection program coordinator.
- In accordance with the CSA Z94.4 – 11, the workplace respiratory program must include:

  a) keeping a record of training for each worker

  b) ensuring respirators are appropriately cleaned and serviced on a regular basis

  c) providing suitable containers (metal box or polyethylene bag) to store individual respirators when not in use

  d) ensuring respirators are maintained according to procedures described in Canadian Standards Association Standard CSA Z94.4 – 11 and the manufacturer's specifications.

Respirator fit testing

Minimum requirements for respirator fit tests, in accordance with CSA Z94.4–11, include the following:

- An ongoing record must be kept for each worker who is required to wear a respirator, listing any medical screening outcomes or restrictions, the type of respirator issued, the date of fit testing, model number and size, and method of **fit testing** (i.e., qualitative or quantitative).
- Respirator fit testing is to be conducted every two years and include the medical pre-screening step.
- Respirator fit testing must be carried out by a competent professional experienced in the practice of fit testing.
- Use of respiratory protection should be recorded on the monitoring records of exposure for that job.

Personal Monitoring

- Personal monitoring must be carried out by someone competent in the practice of collecting personal samples for worker exposure to asbestos fibres
- To establish the requirements for conducting worker personal monitoring (conducting a risk assessment), adopting sampling methodologies and reporting asbestos concentrations, the employer shall refer to Part 36 of *Workplace Safety and Health Regulation* (MR 217/2006).
- If personal monitoring is required, it is carried out while the worker is working.
- Personal monitoring is done in a way that the average and, in any case, the maximum level of exposure of each worker can be determined when the concentration of airborne asbestos fibres may vary from one work operation or phase to another.
- Personal monitoring should be done at various times throughout the work shift, as may be required, and should include short-term sampling during periods of peak emission.

Record-keeping

Monitoring records must be kept for 30 years.

Protective clothing

- When the use of a respirator is required, protective clothing should also be provided and worn.
- Protective clothing, including appropriate head covering, should completely cover all parts of the body.
- Protective clothing (except for washable rubber boots, unless disposable boot covers are used) should be disposable.

For additional details on personal protective equipment, refer to Part 6 of the *Workplace Safety and Health Regulation*.

TABLE 1

This table is based on *CSA Z94.4-11 Selection, Use and Care of Respirators* for the more common respiratory protection types with the appropriate quantitative fit test performed. Assigned Protection Factor (APF) values are a maximum of 10 with a qualitative fit test.

Type of Respirator		**Assigned Protection Factor**	**Maximum Use Concentration fibres per cc**
Air Purifying disposable filtering facepiece or dust mask		Not recommended for protection from airborne asbestos fibres	
	half facepiece	10	1
	full facepiece	50	5
Powered Air Purifying			
	half facepiece	50	5
	full facepiece	1000	100
	helmut/hood	25*	2.5
	loose-fitting facepiece/visor	25	2.5
Air Supplying airline (pressure demand or continuous flow)			
	half facepiece	50	5
	full facepiece	1000	100
	self contained breathing air SCBA (pressure demand)	10000	1000

*With a SWPF study, the APF is 1000
Manufacturer may provide a simulated workplace protection factor study

6. WORKER HEALTH SURVEILLANCE

6.1 MEDICAL SURVEILLANCE

Medical surveillance applies to workplaces where workers may have at least 100 hours of accumulated exposure to fibrogenic dust during a year of work.

SCREENING PROGRAM COMPONENTS

1. Pre-placement and baseline medical screening

(a) A medical and occupational history, with emphasis on the respiratory system

(b) A physical examination, with emphasis on the respiratory system

(c) Pulmonary function test (PFT) – outlined in Table A below

(d) A baseline chest x-ray

(e) A respiratory health questionnaire (shown below)

2. Periodic medical screening

(a) A biennial (every two years) occupational medical history, with emphasis on any exposures during the previous year

(b) A biennial pulmonary function test (PFT) in Table A

(c) A biennial respiratory health questionnaire

(d) A physical medical examination (with emphasis on the respiratory tract) should be pursued if the occupational medical history indicates a possible health problem that may be adversely affected by the work or the work environment (such as more than 100 hours of exposure per year)

(e) A chest x-ray as outlined in the schedules in Table B below

3. Reporting and actions

A. List of workers in the surveillance program

- List of those who participate in surveillance each year
- This list is to be shared with the workplace safety and health committee

B. Recording and reporting of individual results

- Each worker is told the results of all his/her screening tests and provided with further instruction and advice as indicated. This may be carried out by the employer's designated Occupational Health Physician/Occupational Health Nurse or the worker's personal physician.
- The name and address of the worker's personal physician and date of screening should be recorded on the worker's chart.
- If the worker has gone or been sent to a private physician/clinic, the worker should provide the physician with an employer's form for signature indicating whether the worker is fit for usual work; able to work with specified restrictions; or is unfit for work. The worker is then to return this signed form to the employer.
- A record of all individual workers' medical test results must be kept in a confidential file by the employer and accessible only by designated occupational health personnel. This file must be made available for 30 years.

- Confidential medical information, such as individual test results, can only be shared with the express written permission of the worker, except as stated above.

C. Results

The employer is responsible for setting up an "occupational health service" that will ensure the following instructions are carried out. This may be done by establishing a complete occupational health service that includes its own physician and nurse who then carry out all aspects of the Fibrogenic Dust Exposure Worker's Medical Screening Guideline.

Alternatively, especially for employers with fewer workers, the screening program may be contracted out or a system devised for workers to attend their own physicians. If, however, a worker does not have a personal physician, the company will have to contract with a physician to interpret and advise on the results. The employer must have a process in place for ensuring the worker is properly assessed for medically indicated work restrictions. This may be provided by the designated occupational health physician or, if necessary, by the worker's own physician. All abnormal results are to be forwarded to the worker's physician, if the worker agrees.

The appropriate medical investigation, treatment and follow up are the responsibility of the worker's primary care physician. This follow up includes an explanation of test results and their implications, especially as they relate to working. Note: A lung CT scan may be ordered for any worker whose chest x-ray report indicates the possibility of a silica- or asbestos-related abnormality – this is based on a case-by-case evaluation by the physician.

All abnormalities reported as work-related and that require medical investigation and or further treatment are to be reported to the Chief Occupational Medical Officer. The Chief Occupational Medical Officer may be in contact with the worker's physician to discuss the work-relatedness and prognosis for cure. A workplace safety and health investigation and improved preventive steps may be necessary to ensure worker protection from exposure.

Work-related disease must also be reported to the Workers Compensation Board on a case-by-case basis.

D. Annual Report

The employer must produce an annual report that includes a summary of the screening program test results and a summary of the actions taken by the employer to reduce worker exposure to fibrogenic dust. The report must also include the number of workers who undergo screening, the work location and type of work performed by each worker.

This Annual Fibrogenic Dust Surveillance Report must be forwarded to the Chief Occupational Medical Officer at the Workplace Safety and Health Division, and be shared with the joint workplace safety and health committee.

Table A – PULMONARY FUNCTION TESTING

FEV1
FVC
FEV1 / FVC ratio

TABLE B – CHEST X-RAY SCREENING FREQUENCY FOR SILICA OR ASBESTOS EXPOSURE

Duration of exposure*	Chest x-ray frequency
0 to15 years	Every 4 years
Over 15 years	Every 2 years

* "Duration of exposure" includes the cumulative time from all previous employment

Chest x-rays must be interpreted and reported on by a licensed Radiologist. **All abnormal Pulmonary Function Tests (PFT)** must be interpreted and reported by a licensed physician experienced in reporting such tests.

HEALTH QUESTIONAIRE FIBROGENIC DUST – HEALTH QUESTIONNAIRE

(This questionnaire focuses on respiratory health. However, other health issues may be of equal or more importance to the individual worker – this should be elaborated on and noted as necessary.)

INTERVIEW DATE (M/D/Y)	WORKER ID NUMBER	LAST NAME	FIRST NAME
ADDRESS		CITY	POSTAL CODE
GENDER (MALE/FEMALE)	BIRTH DATE (M/D/Y)	MHSC # (MEDICAL)	OCCUPATIONAL CODE
COMPANY NAME & COMPANY BUSINES		WCB FIRM NUMBER	
FAMILY PHYSICIAN	PHYSICIAN CLINIC	CLINIC ADDRESS	

Past Occupational History Answer Comments

Have you ever had a serious lung problem, like TB?	No	Yes
Have you had exposure to asbestos/silica in your previous job?	No	Yes
Have you been exposed to gas or chemical fumes since last surveillance or on previous job?	No	Yes

When was your last chest x-ray? _____

Present Occupational History

Position/Job title _____

How long have you been working at this job? _____

Do you work underground or on surface?

Do you work in a quarry/gravel pit/pit	No	Yes
Do you work in a quarry/gravel pit/pit	No	Yes
Do you work in casting/smelter?	No	Yes
Do you work in pottery/grinding?	No	Yes
Do you work in an asbestos/silica dusty environment?	No	Yes
Do you need to wear a respirator at work?	No	Yes

Medical History Comments

Does your health interfere or impair your performance at work? No Yes

Have you ever been diagnosed with T.B., interstitial fibrosis, asbestosis, silicosis, lung cancer? No Yes

Have you ever been diagnosed with asthma, bronchitis or emphysema? No Yes

Have you had any chest injuries or surgeries? No Yes

Have you ever or are you now experiencing

1. Shortness of breath (SOB) or wheezing when:

   a. walking at a brisk pace on ground level or up slight hills No Yes

   b. walking with other people of your age on a ground level No Yes

   c. at rest No Yes

2. Coughing frequently and most days? No Yes

   If yes, for how long? _____

   Do your symptoms change during the working day? No Yes

   Do you use a puffer (bronchodilator or inhaled steroids) No Yes

   If yes, how often do you use it? _____

   What causes more frequent puffer use? _____

   Have you had a cold, bronchitis or pneumonia within last 3 weeks? No Yes

Tobacco Smoking

Have you ever smoked? No Yes

Do you smoke now? No Yes

When was the last time you smoked? _____

How old were you when started smoking? _____

On average, how many cigarettes, cigars or pipes do you or did you smoke per day? _____

7. ADDITIONAL PRACTICES

The following information outlines additional generally accepted guidance and hygiene practice to protect workers from exposure to airborne asbestos fibres in asbestos waste disposal and other trades.

7.1 DISPOSAL OF ASBESTOS WASTE

Friable

- Loose material collected by any means is wetted and placed in an asbestos waste container.
- Asbestos waste is not allowed to dry out on floors or other surfaces of the work area.
- Asbestos waste is placed in suitable containers immediately on removal.
- Full containers are sealed immediately to prevent the escape of airborne asbestos fibres.
- The external surface of all asbestos waste containers is cleaned with a vacuum cleaner equipped with a HEPA filter or by wet wiping.
- The cleaned containers are removed to a secure area set aside for such waste.
- The containers and the waste storage area are clearly identified as containing asbestos.

Non-friable asbestos materials

- Non-friable asbestos waste, including ceiling tiles, gaskets, seals, packing, construction mastics, panels, siding, shingles, wallboard, brake shoes and clutch plates, asbestos cement products and joint sealant are stored in a manner to ensure that asbestos fibres will not become airborne while awaiting disposal.
- Non-friable asbestos waste is placed in an asbestos waste container.
- Non-friable asbestos waste is wetted in order to minimize the creation of airborne asbestos fibres.

Labelling and isolation of waste

- All containers of asbestos waste must be labelled in accordance with Part 35 of the Workplace Safety and Health Regulation.
- The label on containers of asbestos waste should include:
  - a product identifier
  - hazard information
  - information for the safe handling of the hazardous product.
- Asbestos waste awaiting disposal must be stored so that waste containers will not be damaged. Asbestos waste must not be mixed with other wastes having no special disposal requirements.

Transport of waste

- Written instructions on the actions to be taken in the event of an accidental spill must be issued to drivers of vehicles carrying asbestos waste.
- Workers must be trained in the procedures for cleaning up a spill of ACMs (i.e. asbestos work).
- Workers performing the cleanup of a spill must wear appropriate protective clothing and respiratory protection equipment according to the level of risk, established by a competent person, for the asbestos work to be carried out.
- Cleanup procedures must be carried out immediately in the event of accidental spill during transport to the disposal site.
- All vehicles used for the transport of asbestos waste should be cleaned after unloading.

Procedure at the disposal site

- Approval for the disposal of asbestos waste at a disposal site should be obtained from the municipal authority, and/or the Manitoba Department of Sustainable Development before a disposal site is used.
  - The contractor should follow the procedures set forth by the disposal site. These may include, but not be limited to, some of the following:
    - the disposal site having vehicular access to the working face or to a hole or trench dug specifically to receive the asbestos waste
    - depositing the waste at the foot of the working face of the landfill site or at the bottom of an excavation dug to receive it.
  - Ensure that bags or containers are not broken when the waste is being disposed of. All friable waste should be covered in accordance with the landfill specific practices and procedures, generally as follows:

    a) covered to a depth specified by the landfill (at least 20-25 centimetres) as soon as possible

    b) covered to a minimum depth specified (at least 1 metre) by the end of a working day.
  - When non-friable waste is deposited on a dry site, it should not be subject to crushing by vehicles moving over it to release airborne fibres to the atmosphere to potentially expose the landfill workers.
  - Employers must provide suitable protective clothing, respiratory equipment and training for workers who are involved in collecting, transporting or disposing of asbestos waste.

7.2 OTHER TRADES WORKING WITH ACMS

All trades and workers involved in the manufacturing of products that contain ACMs should, at minimum, receive awareness training. In addition, the following practices should be applied for these workers.

Use of friction material in workshops

- Where practicable, friction materials should be supplied prefabricated, machined or drilled to requirements.
- Where practicable, hand tools or slow-running tools that produce coarse dust or chips should be used rather than high-speed machines or those that cut by grinding or scraping the material.
- Fixed workstations or machines should have an effective local exhaust ventilation system installed.
- Portable tools should be fitted with built-in local exhaust units; low-volume, high-velocity systems are the most appropriate for this purpose.
- All local exhaust ventilation systems should be fitted with HEPA filters.
- Dust extraction equipment should be installed at workstations where linings, blocks and clutch facings are riveted.
- All exhaust ventilation equipment should be inspected and tested by a competent person at regular intervals.
- If a worker is, or may be, exposed to airborne asbestos fibres, an exposure assessment must be conducted to ensure adequate control measures are implemented to keep the exposure as close as possible to zero, in accordance with Part 36 or MR 217/2006.
- A record of every inspection and monitoring activity should be kept for 30 years.

APPENDIX A – SOME KNOWN TYPICAL ACM BY YEAR OF INSTALLATION

Building Materials Which May Contain Asbestos

(Source: US Environmental Protection Agency)

Product	% of Asbestos	Dates of Use	Binder	Friable/ Non-Friable
Walls and Ceilings				
Sprayed coating	1-95	1935-1978	Portland cement, sodium silicate, organic binders	Friable
Trowled coating	1-95	1936-1978	Portland cement, sodium silicate	Friable
Asbestos-cement sheet	20-50	1930-present	Portland cement	Non-Friable
Spackle	3-5	1930-1978	Starch, casein, synthetic resins	Friable
Joint compounds	3-5	1945-1977	Asphalt	Friable
Textured paints	4-5	?-1978		Friable
Millboard, rollboard	80-85	1925-?	Starch, lime, clay	Friable
Vinyl wallpaper	6-8	?		Non-Friable
Insulation board	30	?	Silicates	Friable
Floors				
Vinyl-asbestos tile	21	1950-1980	Poly(vinyl) chloride	Non-Friable
Asphalt-asbestos tile	26-33	1920-1980	Asphalt	Non-Friable
Resilient sheet flooring	30	1950-1980?	Dry oils	Non-Friable
Mastic adhesives	5-25	1945-1980?	Asphalt	Friable
Roofing and Siding				
Roofing felts	10-15	1910-present	Asphalt	Non-Friable
Roof felt shingles	1	1971-1974	Asphalt	Friable
Roofing shingles	20-32	?-present	Portland cement	Non-Friable
Roofing tiles	20-30	1930-present	Portland cement	Non-Friable
Siding shingles	12-14	?-present	Portland cement	Non-Friable
Clapboards	12-15	1944-1945	Portland cement	Non-Friable
Pipes and Boilers				
Cement pipe and fittings	20-?	1935-present	Portland cement	Non-Friable
Block insulation	6-15	1890-1978	Magnesium carbonate, calcium silicate	Friable
Preformed pipe wrap	50	1926-1975	Magnesium carbonate, calcium silicate	Friable
Corrugated asbestos paper	90 35-70	1935-1980 1910-1980	Sodium silicate, starch	Friable
Paper tape	80	1901-1980?	Polymers, starches, silicates	Friable

APPENDIX B – SOME KNOWN TYPICAL ACM AND PROCESSES

Some of the known, typically used asbestos containing materials in building components, sprayed-on and insulation applications and other products, sprayed asbestos and insulation applications:

Building Exteriors

- asbestos cement siding panels – flat, corrugated, shingles or accent panels
- asbestos cement soffits – flat or perforated panels
- asbestos cement roof panels – corrugated
- roofing felts and mastics
- building overhangs – thermal spray
- stucco
- brick and block mortar
- loose fill insulation in exterior wall cavities (vermiculite)

Flooring

- vinyl asbestos tiles (VAT)
- sheet vinyl flooring (asbestos paper backing)
- floor leveling compound

Ceilings

- t-bar ceiling tile
- asbestos cement ceiling tile
- acoustic and stippled finishes
- plaster or drywall jointing materials

Walls

- plaster or drywall jointing materials
- stippled finishes
- thermal spray
- asbestos cement panels

Mechanical or Service Areas

- insulation in boiler rooms — boilers, vessels, pipes, ducts, incinerators, floors, ceilings, walls
- fan rooms — insulation on pipes, ducts, chillers, floors, ceilings, walls
- machine rooms — insulation on pipes, ducts, floors, ceilings, walls
- crawl spaces — insulation on pipes, ducts
- wall cavities, insulation above ceiling spaces — pipe and duct chases, pipes, ducts

Structural

- fire proofing spray on beams, decks, joists, columns and other structural members

Pipes (insulation on either exposed or concealed pipes)

- steam and hot water heating supply and return lines
- domestic water supply and drain lines
- chilled water lines
- rain water and sanitary lines — asbestos cement or bell and spigot cast iron, insulated or bare pipe
- gaskets in flanged pipe joints

Miscellaneous

- incandescent light fixture backing
- wire insulation
- fume hoods – internal linings and exhaust ducts
- lab counters
- elevator brake shoes
- heating cabinet panels (asbestos cement)
- fire dampers and fire stop flaps
- diffuser back plaster
- emergency generators – thermal insulation and exhaust manifolds
- fire stopping
- theatre curtains
- welding blankets and screens
- incinerators – internal insulation
- cooling towers – panels and fill
- duct tape
- duct expansion/vibration isolation joints

Building products containing asbestos in an unbound or loosely bound form include:

- insulating cements
- sprayed insulation — fire resistant, acoustic, thermal, condensation control
- insulation block — magnesia or calcium silicate
- textiles — not saturated, for lagging, curtains or clothing
- vermiculite insulation (may contain tremolite asbestos as a contaminant) – produced from the Libby, Montana mine by W.R. Grace and Company and known by the brand name Zonolite.

The list of products containing asbestos which are used in applications other than construction includes:

- bound-fibre products
- brake linings, brake blocks, clutch facings
- gaskets, packings
- plastics
- textiles and catalyst supports
- non-bound fibre products such as millboards and papers
- some electrical insulation and filters or filter aids

Sprayed ACM applications

Asbestos was introduced into North America for acoustical and decorative use in hotels and restaurants. In 1950, the U.S. based Underwriters' Laboratory gave approval for the use of asbestos as a fibrous spray for fireproofing. It was widely used for the fireproofing of structural steel, components of high-rise office and public buildings, and in auditoriums, hallways and classrooms of school buildings. The use of asbestos containing spray products was widespread until approximately 1972, although the use of several acoustic products containing asbestos continued after this date.

As a general rule, this asbestos-containing sprayed-on insulation contained chrysotile, amosite or amosite/chrysotile combinations. The use of crocidolite in sprayed applications was small, largely due to cost, geographical location and availability. The concentration of asbestos can vary greatly within one installation due to the method of application.

The formulation of sprayed-on insulation depends to some extent on the method of application. There were two main methods of application — the wet method and the dry method. The extent of the problems associated with the insulation at a particular site is determined by the method of its application and the skill of the person applying the product.

Wet application method

With the wet method, asbestos (generally five to 30 per cent by weight of the total formulation), mineral wool and/or fiberglass were mixed with Portland cement or gypsum as cementitious binders in a slurry. This material tended to be denser and therefore less likely to crumble than similar materials applied dry. With the slurry-cementitious product, maximum application thickness was usually 20 to 25 mm (¾ to one in), with most applications being six to 13 mm thick (¼ to ½ in). The surface was often troweled following spray application producing a dense, hard surface. Most acoustic or texture sprays were applied by the wet method.

Dry application method

The dry method used a dry blend of asbestos fibres (anywhere from five to 90 per cent of the total weight) and mineral wool or fiberglass, some Portland cement or gypsum, water soluble resins, starches and possibly other additives. These materials were blended in a hopper on site and then forced through a hose to the application surface. As the dry blended asbestos-containing material left the nozzle, it passed through a ring of water jets which converged several centimetres from the end of the nozzle. This wetted the dry blended material and activated the water-soluble binders, producing a wet fibrous mix that easily adhered to the application surface. It was usually applied in a layer 13 to 63 mm thick (½ to 2 ½ inches).

Sprayed insulation products and condition

The trade names of some sprayed on insulation products which contained asbestos include:

Wet-applied (cementitious)	Dry-applied (fibrous)
• Kilnoise Plaster	• Asbestos-spray
• Cafco — Soundshield	• Limpet
• Monokote — MK III	• Spraycraft
• Audicote	• Cafco — Type D
• Sabenite	• Cafco — Type I
	• Cafco — Heat Shield
	• Cafco — Blaze Shield
	• Spraydon Type J

These materials were used in applications ranging from fully exposed in factories, partially hidden for architectural effect, or fully enclosed behind suspended ceilings. The materials may be found on beams, beams and columns, or beams and decks. The material may be in good condition or may be flaking badly. It may have a hard or solid surface but be very soft beneath the outer layer. The materials may have become damaged by maintenance or renovation activities or water. The applications may range in thickness from almost no measurable thickness to 75 mm (three in). The materials may be extremely well coated with a layer of dirt behind a suspended ceiling or be completely open in a room and susceptible to damage by direct contact.

Pipe or boiler insulation

Asbestos-containing materials have been used extensively in thermal mechanical insulation because of their excellent insulating properties. Trade names of pre-formed products used in pipe insulation that may contain asbestos include:

- John Manville (JM) and Newalls 85 per cent magnesia block or pipe covering and cements
- JM Suprex blocks (diatomaceous silica)
- JM Thermobestos block (calcium silicate)
- JM Marinite (diatomaceous silica and binders)
- JM Asbestocell
- JM and Atlas Spongfelt pipe covering
- JM Thermo-wrap, Thermo-tape
- JM Asbestos-sponge
- JM Fibrofil (diatomaceous earth)
- Atlasite pipe covering and sheet block (almost pure amosite, some inorganic binders)
- JM Newtherm
- Newalls Newtempheit pipe covering and blocks and cement (diatomaceous silica and long-strand asbestos)
- Atlas Aircell pipe and tank covering sheets and blocks
- Atlas Finecell pipe and tank covering sheets and blocks
- Rope lagging from JM, Atlas and others
- Owens Corning Kaylo

Asbestos material was frequently formed in place to complete irregular sections around valves, elbows and fittings or to provide additional strength over fiberglass insulation on pipes or ducts. This material is frequently called asbestos cement, asbestos insulating cement or blue mud. It may be used with other asbestos containing insulations or is frequently found combined with fiberglass pipe insulation on straight runs of piping. Trade or product names of typical materials include:

- JM 302 and 352 insulating cements
- Atlas 650, 660, 250, 28, 18
- Cold water paste from a variety of manufacturers

APPENDIX C - NEGATIVE AIR EQUIPMENT PERFORMANCE TESTING

Equipment used to test HEPA filters consists of a DOP hot smoke generator capable of generating particles down to 0.3 microns in diameter. A photometer is used on the downstream side of the filter to detect leaking particles. The photometer should be able to detect particles down to 0.3 microns in diameter. Agents other than DOP may be used if they can produce equivalent results. Poly-alpha olefin type material, approved as a substitute for DOP, is one such agent.

(1) The equipment is visually inspected for sources of leakage such as cracked frames, holes or damage. The filter must be properly installed and meet or exceed the air flow rating of the equipment in which it is installed.

(2) The DOP smoke generator must reach the proper temperature to ensure that small range particles are generated.

(3) For draw-through style negative air units (air is drawn through the filter and then blower):

a) place the photometer probe in the duct, directly in the exhaust of the blower

b) control the DOP smoke generated with a hose

c) pass the smoke slowly over the entire filter and gaskets. While doing so, watch the photometer for signs of leakage in excess of 0.03 per cent. If a leak is detected, repairs can be made or the filter changed and the equipment retested. It is recommended that no more than two per cent of the filter and gasket surface be affected by the repair.

(4) For blow-through negative air units (air is passed through the blower and then through the filter):

a) DOP smoke is generated at the air intake where it is misted into the blower unit and dispersed over the filters

b) the photometer probe is passed over the entire area of the gasket and back and forth over the filter. If leaks in excess of 0.03 per cent are detected, the filter must be repaired or replaced and then re-tested.

(5) For vacuum cleaners fitted with a HEPA filter, introduce DOP smoke at the vacuum cleaner's suction inlet and monitor the exhaust with the photometer probe to detect leaks in excess of 0.03 per cent. If the unit fails, it may be repaired but no direct repairs to the filter should be done — a new filter must be installed. If exhaust air is used to cool the motor fan, some particulate may be produced from the carbon brushes of the motor and affect the test. Test the vacuum exhaust, not the fan cooling exhaust. (Vacuum cleaners fitted with HEPA filters should be tested each time the filter is replaced and at least once per year if they are only used occasionally).

APPENDIX D - VERMICULITE SAMPLING PROCEDURES

This procedure may need to be modified, depending on where and how the material is installed.

Equipment

1. Four litre plastic bag (such as a large heavy duty zip lock freezer bag)
2. Metal scoop with a flat edge
3. Appropriate protective equipment (gloves, coveralls, half facepiece respirator with high efficiency particulate filters such as P100s)

Procedure

(1) Insert the scoop into the insulation until it reaches the bottom substrate, move it along the bottom and raise it through the remaining material. Deposit the material collected into the plastic bag.

(2) Collect multiple scoops at random spots to make up the sample.

(3) Seal the bag and wipe the outside with a damp cloth and place bag into a second bag.

(4) Label the sample.

Sample Analysis

It is not unusual for vermiculite to contain asbestos in concentrations below one 0.1% per cent. However, the concentration can be variable and hazardous concentrations of airborne asbestos fibres can be generated even when the concentration is below 0.1% if the material is disturbed. There are a few options for sample analysis; some methods are quantitative (provide a precise concentration) and, some are qualitative (provide an estimate of concentration). In either case, the key is to determine whether the product is contaminated with asbestos. In the absence of sampling and analysis data or other information that shows that the vermiculite is not contaminated with asbestos, **it is assumed that the product is contaminated.**

For quantitative analysis, the US Environmental Protection Agency (EPA) has developed a specific analytical method for vermiculite in their publication “Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation”. It is noted that some laboratories may not be able to provide this type of analysis. This method uses transmission electron microscopy (TEM) and can achieve detection limits from 0.1 to 0.0001 per cent.

For more information:
http://www.epa.gov/asbestos/pubs/vairesearchmethodfinal.pdf
Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation

www.epa.gov/asbestos/pubs/vermiculite.pdf
Sampling and Analysis of Consumer Garden Products that Contain Vermiculite

The more common method for analyzing vermiculite samples is the USEPA Method EPA/600/R-93/116 “Method for the Determination of Asbestos in Bulk Building Materials”. There is also a NIOSH method (NIOSH Method 9002, Asbestos (bulk) by PLM). These are qualitative methods (inspection of the sample under a stereoscope which can be combined with point counting). A detection limit of 0.1 to 0.25 per cent can be achieved, depending on the point count method used. While not quantitative, these methods may be sufficient for vermiculite samples, if a competent analyst completes the analysis. If the analyst visually detects asbestos fibres, either during stereoscope examination or during the PLM examination, the sample is positive for asbestos and it is not necessary to determine the precise asbestos concentration to confirm that there is a risk of asbestos exposure so precautions

are required. If the analyst does not visually detect asbestos fibres during the analysis, then the sample should be sent for TEM analysis.

For more information:
www.nist.gov/sites/default/files/documents/nvlap/EPA-600-R-93-116.pdf
www.cdc.gov/niosh/docs/2003-154/ NIOSH Manual of Analytical Methods

GLOSSARY OF TERMS

Abatement: procedures to encapsulate, enclose or remove asbestos-containing material.

ACGIH: American Conference of Governmental Industrial Hygienists.

ACM (Asbestos-Containing Material):

a) a friable material containing 0.1 per cent or greater asbestos;

b) a non-friable material containing 1.0 per cent or greater asbestos

c) vermiculite insulation that contains asbestos

Actinolite: a mineral that is considered to be asbestos when it occurs in fibrous form.

Aggressive Sampling: air sampling that takes place while air is physically circulated to produce a worst case situation. This type of sampling takes place after final clean-up.

AIHA: American Industrial Hygiene Association.

Air-line Respirator: a supplied air respirator through which breathable air is delivered to the worker via an airline. Air is supplied from a compressor or compressed air cylinder.

Airlock: a device allowing movement of persons from one room to another while permitting minimal air movement between those rooms. Curtained doorways are typically constructed by placing two overlapping sheets of 6-mil polyethylene sheeting over an existing or temporarily framed doorway, securing each sheet along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite side of the doorway. The door flaps are constructed to allow make-up air to flow into the enclosure area. Two curtained doorways spaced a distance apart form an airlock.

Air Monitoring: the process of measuring a sample of airborne fibre levels in a specified area over a period of time. This involves drawing a known volume of air through a filtered cassette with an effective (0.25 um) pore size, counting the fibres that collect on the filter and expressing the result as fibres per cubic centimetre (f/cc).

Air Purifying Respirator: a respirator that filters air inhaled by the respirator wearer. Air is exhaled through a valve in the bottom of the respirator.

Amended Water: water that is used during asbestos removal to reduce airborne fibre generation. This water has a non-ionic surfactant added to it at the manufacturers' recommended concentration which allows for more thorough wetting of asbestos fibres by reducing the water's surface tension.

Amosite: a type of asbestos that becomes airborne easily and is not easily wetted. The removal of insulation or other materials that contain amosite presents an increased risk of exposure to asbestos relative to the removal of chrysotile-containing material.

Analysis: methods and procedures used to determine whether material is asbestos-containing material and for establishing its asbestos content and the type of asbestos it contains.

Anthophyllite: a type of mineral that is considered to be a form of asbestos when it occurs in fibrous form.

Asbestiform: a term used to describe certain silicate minerals that crystallize in fibres. There are two recognized types of asbestiform minerals (serpentine and amphibole) distinguished by how the fibres are formed

Asbestos: a generic name given to a number of commercially significant naturally occurring hydrated mineral silicates. These silicates are incombustible, separate into sub-light microscopic fibres and have a unique crystalline structure. Asbestos may be found as the fibrous form of crocidolite, amosite, chrysotile, anthophyllite, actinolite, tremolite or a mixture containing any of these minerals

Asbestos Waste: discarded materials from which there is a reasonable chance that asbestos might be released and become airborne, and includes disposable protective clothing that has been used in a restricted area.

Asbestos Waste Container: impermeable container labelled as asbestos-containing material, comprised of the following:

a) a sealed 6-mil (0.15 mm) polyethylene bag or single use glove bag, inside a second 6-mil (0.15 mm) sealed polyethylene bag (preferably yellow for the exterior);

b) a sealed 6-mil (0.15 mm) polyethylene bag or single use glove bag, positioned inside or outside a rigid sealed container of sufficient strength to prevent perforation of the container during filling, transportation and disposal.

c) A sealed packaging comprised of at least 2 layers of 6-mil polyethylene sheeting wrapping the waste material

Asbestosis: a fatal lung disease caused by the inhalation of high concentrations of asbestos fibres, leading to a build-up of scar tissue in the lungs around the fibres. It is a chronic lung disease with symptoms that include coughing, weight loss and difficulty in breathing.

Aspect Ratio: the ratio of the length of a fibre compared to its width.

ASTM: American Society for Testing and Materials

Background Air Sampling: a method used to determine currently existing airborne fiber concentrations in an area where abatement work is to be conducted, and prior to commencing the work.

Bulk Samples: representative samples of building materials collected by a competent person. The minimum number of samples to be collected from an area of homogeneous material is set out in the American Society for Testing and Materials Standard Practice for Comprehensive Building Asbestos Surveys (E 2356).

Chrysotile: a serpentine type of asbestos mineral most commonly used in building construction.

Clean Room: an uncontaminated area of a decontamination facility in which workers change into their disposable clothing and back into their street clothes. It is adjacent to the shower room and opens to the outside of the decontamination facility.

Competent Person: a person who, through education, training and experience, understands the nature, monitoring and control of health hazards associated with exposure to asbestos. For example, Registered Occupational Hygienists (as registered by the Canadian Registration Board of Occupational Hygiene) and Certified Industrial Hygienists (as certified by the American Board of Industrial Hygiene) are deemed to be technically qualified people. Other people without such certifications may be technically qualified based on other education, training and experience.

Contaminated Item: any object that has been exposed to airborne asbestos fibres without being sealed off, isolated or cleaned.

Crocidolite: a type of asbestos mineral “blue asbestos”.

Decontamination Facility: an area constructed to prevent the spread of asbestos fibres beyond the work area. It is a series of rooms consisting of a clean room, a shower room, an equipment or waste transfer room. There can be 2 sets of decontamination facilities, one for personnel leaving the work area and one for waste being removed from the work area.

Decontamination Unit: a series of interconnected airlocks used for employee or waste decontamination.

Designated Material: a chemical or biological substance that meets criteria as a carcinogen, mutagen, respiratory sensitizer, reproductive toxin under the Hazardous Products Regulations (federal legislation).

DOP Testing: testing of equipment fitted with HEPA filters such as vacuum cleaners and negative pressure units after filter installation has been completed. An aerosol of Dioctyl Phthalate (DOP) is introduced on the upstream side of the HEPA unit and if aerosol particles are detected on the downstream side, the unit is shut down and inspected and/or repaired. The particles generated are 0.3 micrometres in diameter or larger. The test is used to determine whether there are imperfections in the filter or in the seal between the filter and the cabinet frame. Where signs of leakage in excess of 0.03 per cent are detected with a photometer, the filter must be repaired or changed and equipment retested.

Emery 3004: a compound (a poly-alpha olefin) that may be substituted for DOP in HEPA filter testing.

Employer: defined by the Act as:

a) every person who, by himself or his agent or representative employs or engages one or more workers, and

b) the Crown and every agency of the government.

Encapsulation: the process of coating asbestos-containing materials to control the release of asbestos fibres into the ambient air. A sealant is applied that hardens the material (penetrant sealant) and/or provides a protective cover (bridging sealant).

Enclosure: procedures taken or a structure built to completely seal asbestos-containing materials behind airtight, impermeable, temporary barriers.

Equipment (dirty) Room: a room connected to an enclosed asbestos work area (enclosure) where workers place waste or remove personal equipment, except for their respirators, before entering the shower room.

When there are 2 sets of decontamination units (one for workers and one for waste), the equipment room is where the waste ACM is placed for cleaning before being put into a second bag and the holding room.

Fibre: a particle that is at least 5 microns long and has a length-to-width ration equal to or greater than 3:1

Filter Cassette: an apparatus used to collect air samples for airborne fibre counting, consisting of a 25 mm diameter filter and a 0.45 to 1.2 micrometer cellulose ester membrane that traps the fibres.

Friable Material: material that can be crumbled by hand. The more friable the material, the greater the potential hazard due to fibre release.

Glove Bag: a onetime use, manufactured impervious bag-like enclosure constructed of at least 6-mil transparent polyethylene sheeting, seamless at the bottom, with inward projecting long sleeve glove(s), which may also contain an inward-projecting water-wand sleeve, an internal tool pouch, and an attached, labeled receptacle or portion for asbestos waste. The glove bag is constructed and installed to surround the object or area to be decontaminated and contain all asbestos fibers released during the abatement process.

HEPA Filter: a High Efficiency Particulate Arresting (HEPA) Filter. HEPA filters are used in both respirators and air handling equipment. The filters have a minimum particulate removal efficiency of 99.97 per cent for thermally generated mono-dispersed DOP aerosol particles with a diameter of 0.3 micrometers and a maximum pressure drop of 1.0 inch water gauge when clean and operating at their rated airflow capacity.

Homogeneous: evenly mixed and similar in appearance and texture throughout.

IARC: International Agency for Research on Cancer

Negative Air Pressure System: reduced air pressure within the work area compared to air pressure in adjacent areas, produced through the use of negative air units. Reduced pressure in the work area prevents leakage of contaminated air out of the work area. Airborne fibres will tend to be pulled into the HEPA filter equipped filtration system instead of escaping the work area (enclosure).

Negative Pressure Enclosure: a restricted enclosed area within a workplace where reduced pressure is created by removing air from the enclosure and passing it through a HEPA filter to the outside of the building.

NIOSH: the National Institute for Occupational Safety and Health. It is the United States-based approval agency for respiratory protective equipment and methods of analyzing air samples.

Non-Friable Material: a material that when dry cannot be crumbled, crushed or powdered by hand pressure (i.e. vinyl asbestos floor tiles or gaskets).

PF (protection factor): protection factor as provided by a respirator.

Phase Contrast Microscopy (PCM): a method used to determine the airborne fibre concentration in sampled air using a “Walton-Beckett” graticule for calibration. A ~ 1/4 segment of the sampling filter is mounted on a microscope slide and then analyzed using a phase contrast microscope at 400X to 500X magnification. Fibres meeting the 3:1 aspect ratio that are greater than five micrometres in length are counted as one fibre. Fibres crossing the perimeter of the Walton-Beckett graticule are counted as ½ fibre

Plural Mesothelioma: a disease mainly associated with asbestos. It is an inoperable and fatal form of cancer of the lining of the lungs.

Powered Air Purifying Respirator (PAPR): a full-face elastomeric respirator into which filtered air is pumped at approximately 100 – 150 litres per minute (four - six cubic feet per minute). PAPR consists of a full facepiece, a battery pack, an air pump, high efficiency filter and hoses.

Qualitative Fit Test: a method of testing a respirator’s facepiece-to-face seal by injecting an agent such as isoamyl acetate, saccharin or Bitrex™ inside a test chamber (enclosure head), or irritant smoke around the facepiece and subjectively determining whether the wearer detects the agent.

Quantitative Fit Test: a method of testing a respirator’s facepiece-to-face seal using instrumentation that quantifies the actual protection factor or in-leakage provided by the respirator.

Removal: procedures necessary to strip asbestos-containing materials from designated areas and to then dispose of these materials at an acceptable site.

Respirator: personal protective equipment that protects a worker against the inhalation of airborne contaminants providing it is the correct type of respirator and is fitted, used, and maintained in accordance with the CSA Z94.4-11 or most current revision.

Shower Room: part of a decontamination facility, this room is situated between the clean room and the equipment room and contains a walk-through shower.

Transmission Electron Microscopy (TEM): an analytical procedure used to determine asbestos fibre concentrations and positively identify types of asbestos and other fibres. Compared to phase contrast microscopy, it has more resolving power although TEM sample handling procedures may increase the relative number of fibres detected (and concentration) when complex fibre structures are disrupted.

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