Government of Alberta

Alberta Asbestos Abatement Manual

Printed copies of the Alberta Asbestos Abatement Manual are available from:

Alberta Queen's Printer
Suite 700, Park Plaza Building
10611 - 98 Avenue NW
Edmonton, AB T5K 2P7
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www.qp.alberta.ca

ISBN 978-1-4601-4335-3
ASB001

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Scope of this Manual

This manual describes the principles to be followed when selecting the most appropriate techniques for the safe abatement of asbestos-containing materials. The manual also presents basic information on asbestos and asbestos products, health hazards, requirements for worker protection, safe work procedures, inspection criteria, applicable legislation and competency profiles for those persons involved in abatement activities.

Work practices and precautions vary considerably with the type of material being removed, the amount of asbestos it contains, its condition and its location. The objective of this manual is to present best practices in asbestos abatement that are to be followed in Alberta.

Occupational Health and Safety (OHS) officers from Alberta Labour and Immigration use this manual as a guide when reviewing abatement work practices and employer codes of practice. Work practices are assessed against those presented in the manual to determine if they meet the intent of the province's occupational health and safety legislation. Alternate practices are acceptable if they provide workers with a level of safety equal to or greater than those practices presented in this manual and comply with the *OHS Act*, Regulation and Code.

Glossary of terms

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

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 plastic 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 must be constructed to allow make-up air to flow into the containment area by passing through two curtained doorways spaced a distance apart to form an airlock.

Air Monitoring – the process of measuring 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 pore size, counting the fibres that collect on the filter and expressing the result as fibres per cubic centimetre (f/cc) per NIOSH method 7400.

Air-purifying Respirator – a respirator that filters air inhaled by the respirator wearer.

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

Asbestos – a generic name given to a number of naturally occurring hydrated mineral silicates. These silicates are incombustible, separate into fibres and have a unique crystalline structure.

Asbestos-containing Material – a product or building material containing asbestos in any quantity or percentage.

Asbestosis – a lung disease caused by the inhalation of high concentrations of asbestos fibres, leading to a build-up of scar tissue in the lungs. It is a chronic lung disease with symptoms that include coughing, weight loss and difficulty in breathing. In some cases, asbestosis can lead to death from respiratory failure.

Asbestos Waste – discarded materials from which there is a reasonable chance that asbestos might be released and become airborne, and includes disposable protective clothing used during asbestos abatement.

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

Atmosphere Immediately Dangerous to Life or Health – an atmosphere that poses an immediate threat to life, immediate or irreversible adverse effects on health, or acute eye exposure that would prevent escape.

Bulk Sample – a representative sample taken of any material that is suspected of containing asbestos.

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

Contaminated Item – any object that has been affected by the presence of asbestos on workers or at the work site in a quantity sufficient to pose a risk to health.

Competent – adequately qualified, suitably trained and with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision.

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 dirty room, shower room, equipment transfer area and clean room. Decontamination facilities may be constructed for personnel leaving the work area or wastes that must be removed from the work area.

Dirty Room – a room adjacent to the containment area where workers dispose of waste or remove personal equipment before entering the shower room.

DOP/PAO 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) or Poly Alpha Olefin (PAO) 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.

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 —a structure built to completely seal asbestos-containing materials behind airtight, impermeable, permanent barriers.

Equipment and Waste Transfer Section – allows for the removal of asbestos waste material and contaminated equipment. This section should include a dirty room, a holding room and a transfer room. The section can be part of the decontamination facility.

Exposed Worker – a worker who may reasonably be expected to work in a restricted area during at least 30 work days in a 12-month period.

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 micrometre cellulose ester membrane that traps the fibres.

Fogging – a procedure used to minimize airborne fibre concentrations in the containment area by using a low pressure atomizing spray.

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

Glovebag – a manufactured clear polyethylene plastic bag with attached long-sleeve gloves. It is designed to permit the removal of insulation on pipes and pipe fittings.

Heat Cramps – a heat stress condition that causes painful involuntary spasms of heavily used muscles, most commonly of the abdomen and extremities. This form of heat illness is probably the result of an imbalance in the body's fluid level and electrolyte concentrations. Heat cramps can be prevented by drinking copious amounts of water and increasing daily dietary salt intake.

Heat Exhaustion – a heat stress condition resulting from dehydration and inadequate fluid intake that compromises blood circulation and is usually accompanied by fatigue, nausea, headache, giddiness, clammy skin and pale appearance.

Heat Stress – any of the disorders associated with exposure to excessive heat.

Heat Stroke – caused by the loss of the body's ability to cool itself through sweating. It is the most serious of the heat stress disorders and requires immediate medical attention. Some of the symptoms are hot dry skin, dizziness, nausea, severe headache, confusion, delirium, loss of consciousness, convulsion and coma.

Heterogeneous – diverse in content, possibly dissimilar in appearance and texture.

HEPA Filter – a High-Efficiency Particulate Air 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 air flow capacity.

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

Negative Air Pressure System – reduced air pressure within the work area compared to the ambient air pressure, 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 trapped by the HEPA filter equipped filtration system instead.

Negative and Positive Pressure Fit Check – a method of testing a respirator's facepiece-to-face seal by covering the inhalation or exhalation valves and either breathing in or out to determine the presence and location of leaks.

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.

PF – protection factor provided by a respirator.

Phase Contrast Microscopy (PCM) – a method used to determine the airborne fibre concentration in sampled air. A segment of the sampling filter is mounted and then analyzed using a phase contrast microscope at 400X to 500X magnification. This method cannot distinguish asbestos fibres from other fibres as all fibres meeting the method criteria are counted.

Polarized Light Microscopy (PLM) – a method used to determine the asbestos concentration in bulk samples. This method uses specific optic properties of the mineral to identify asbestos.

Pleural 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 mask into which filtered air is pumped at approximately 100-150 litres per minute (four to six cubic feet per minute). The PAPR consists of a full-face mask, a battery pack, an air pump, a 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 fit factor 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 disposal 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 worn properly.

Restricted Area – an area of a work site where there is a reasonable chance the concentration of airborne asbestos exceeds or may exceed the eight-hour occupational exposure limit (0.1 fibres per cubic centimetre).

SCBA (Self Contained Breathing Apparatus) – respirator that provides breathing air from a compressed air cylinder, usually worn on the back.

Shower Room – part of a decontamination facility, this room is situated between the clean room and the dirty room, is separated by airlocks and contains a walk-through shower.

Surfactant – substance added to water to reduce the water's surface tension. The surfactant allows for more thorough wetting of asbestos-containing materials.

Transmission Electron Microscopy (TEM) – an analytical procedure used to determine asbestos fibre concentrations. Compared to phase contrast microscopy, it has more resolving power and can be used to positively identify asbestos fibres.

Chapter 1 Asbestos and Asbestos-Containing Materials

1.1 Introduction

Asbestos is the common name given to a group of naturally occurring mineral silicates that can be separated into flexible fibres. The name asbestos comes from the Greek word meaning “unquenchable or indestructible.” There are two main mineralogical classifications of asbestos – serpentines and amphiboles – based on the rock types which form the asbestos. Each classification is further sub-divided as follows:

- Serpentine Asbestos
  - Chrysotile
- Amphibole Asbestos
  - Amosite
  - Crocidolite
  - Fibrous Tremolite
  - Fibrous Anthophyllite
  - Fibrous Actinolite

The serpentine family consists of only chrysotile or “white” asbestos. It is a hydrated magnesium silicate having long, wavy fibres that are white or off-white.

Within the amphibole family, only amosite and crocidolite have had significant commercial use. Amosite is often called “brown” asbestos and has much straighter and shorter fibres than chrysotile. Crocidolite is referred to as “blue” asbestos and has long, straight fibres, much like amosite.

Asbestos is found in veins in the host rock and is produced in a commercially useful form by open pit mining and successive stages of crushing and aspiration of the ore. The fibres are then sealed in plastic bags for use in the manufacture of products containing asbestos. The chrysotile form accounts for approximately 90 per cent of current world consumption.

1.2 Uses of asbestos

Many products that at one time contained asbestos are either no longer in use or have been replaced; however, some asbestos-containing products, such as friction materials and cementitious drainage pipe, continue to be imported into the province of Alberta.

The main properties that make asbestos useful are its incombustibility, strength and flexibility when separated into fibres. It is also effective as a reinforcing or binding agent when combined with cement or plastic. The construction industry was historically the main user of asbestos products.

Some examples of the locations and types of products that contain asbestos include:

Building exteriors	- asbestos-cement siding panels – flat, corrugated, shingles or accent panels (such as Transite panels) - asbestos-cement soffits – flat or perforated panels - asbestos-cement roof panels – corrugated - roofing felts and mastics - building overhangs – thermal spray - stucco - cement parging - brick and block mortar
Flooring	- vinyl asbestos tiles (VAT) - sheet vinyl flooring (asbestos paper backing) - mastic - floor leveling compound - skate tile
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
Insulation	- insulation in boiler rooms – boilers, vessels, pipes, ducts, incinerators, floors, ceilings, walls - fan rooms – insulation on pipes, ducts, acoustical linings, 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 - sprayed insulation – fire resistant, acoustic, thermal, condensation control - insulation block – magnesia or calcium silicate - 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” - 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
Structural	- fireproofing spray on beams, decks, joists, columns and other structural members
Miscellaneous	- incandescent light fixture backing - wire insulation - fume hoods – internal linings and exhaust ducts - laboratory counters - elevator brake shoes - heating cabinet panels (asbestos-cement) - fire dampers and fire stop flaps - diffuser backplaster - emergency generators – thermal insulation and exhaust manifolds - firestopping - theatre curtains

- welding blankets and screens
- incinerators – internal insulation
- cooling towers – panels and fill
- duct tape
- duct expansion/vibration isolation joints
- caulking
- textiles – not saturated – for lagging, curtains or clothing
- brake linings, brake blocks, clutch facings
- gaskets, packings
- plastics
- textiles and catalyst supports
- non-bound fibre products such as millboards and papers

1.3 Friable sprayed products used in buildings

One product that is usually friable and a major cause of concern in buildings is asbestos-containing sprayed-on acoustic or thermal insulation. A good measure of a product's potential hazard is its friability:

- A very friable material easily crumbles with hand pressure when dry.
- A less friable material cannot be crushed with hand pressure. The more friable the material, the more likely it is to release fibres into the air.

Asbestos was introduced into North America for acoustical and decorative use in hotels and restaurants. In 1950, the United States 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 a single application due to the method of preparation and use.

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 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 inch), with most applications being six to 13 mm thick (¼ to ½ inch). 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 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).

Products and condition

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

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

These materials were used in applications ranging from being 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 skin. 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 inches). The materials may be coated with a layer of dirt behind a suspended ceiling or be completely open in a room and susceptible to damage by direct contact.

1.4 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:

- Johns 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 that can be formed in place was frequently used 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 and is also 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 18, 28, 250, 650, 660
- Cold water paste from a variety of manufacturers

This wide range of asbestos-containing products and the variety of their appearances means it is impossible to confirm by eye, or from building plans, if a product contains asbestos. Because multiple layers of insulation may be present, the only way to be sure of the presence of these materials is to have representative bulk samples of the product properly collected and analyzed in a laboratory.

1.5 Assessing health and exposure risk

Asbestos must be inhaled to cause disease. Intact and undisturbed asbestos presents no direct health hazard but does present a potential exposure hazard if fibres are released and inhaled. As a result, there is some risk associated with all asbestos installations.

The health risk is considered minimal for asbestos materials in good condition, in an inaccessible location and protected from damage. Where damage can be controlled or prevented, managing the exposure risk is often the most cost-effective control measure. Where damage or disturbance cannot be controlled or where there is deterioration, management of the exposure risk is very difficult.

The use of air monitoring of occupied areas is not considered an acceptable method to determine whether or not asbestos-containing materials must be removed, enclosed, encapsulated or left in place, refer to Section 1.6 ***Asbestos Risk Decision Tree***. Air monitoring alone is insufficient to determine the potential health and exposure risk since asbestos fibres cannot usually be detected above background levels unless the material is disturbed. Additional criteria are needed to determine the risk of exposure or the need for removal.

Examples of materials that cannot be effectively managed include:

- materials in air handling systems where air movement can break down or erode the material
- materials that are damaged by water or vibration
- materials that are easily accessible to the general public and may be damaged by accident or through vandalism

- friable materials in proximity to maintenance activities

1.6 Exposure assessment algorithm

There are eight major factors that assist in evaluating the condition of an asbestos installation. Assessment and determination of health risk should be conducted by competent personnel, trained in the evaluation of potential asbestos exposure risk.

1. Condition of Material

   The condition of the asbestos-containing materials may indicate how easily fibres can be released into the area. An assessment of the condition considers the quality of the installation, adhesion of the material to the underlying substrate, deterioration, vandalism and/or damage.

2. Water Damage

   Water can dislodge, delaminate and disturb friable asbestos-containing materials that are otherwise in good condition. Water can carry fibres as a slurry to other areas where evaporation leaves a collection of fibres that can be released into the air.

3. Exposed Surface Area

   The exposed surface area of friable material affects potential fibre release and the possibility for contact and damage. Visible friable material is considered to be exposed.

   Maintenance personnel frequently access the space above suspended ceilings to service or maintain electrical or communications equipment, or adjust the ventilation system. In most cases, this space is considered an exposed surface. Areas with louvres, grids or other open ceiling systems should be considered exposed.

4. Accessibility/Location

   Accessibility is one of the most important indicators of exposure potential. If the asbestos-containing material can be reached, it is accessible and subject to accidental or intentional contact and damage. Friable material is considered accessible if it is close to heating, ventilation, lighting and plumbing systems requiring maintenance or repair.

   In schools, student activity should be considered in evaluating accessibility. Damage is the most obvious factor. For example, students involved in sport activities may accidentally damage material on the walls and ceiling of a gymnasium. Material that is easily accessible is also subject to damage by vandalism.

5. Activity and Movement

This factor combines the effects of general causes that may result in contact with, or damage to, friable material. These causes include air movement, maintenance activities, vibration (from machinery or other sources) and activity levels of students or building workers. This factor is also an indication of the potential for future exposure.

6. Air Distribution System

   According to the OHS Code, asbestos materials may not be located in supply or return air plenums in a form or in a location where asbestos fibres could enter the air supply or return air systems. Action is required by building owners if asbestos-containing materials are found in these areas.

7. Friability

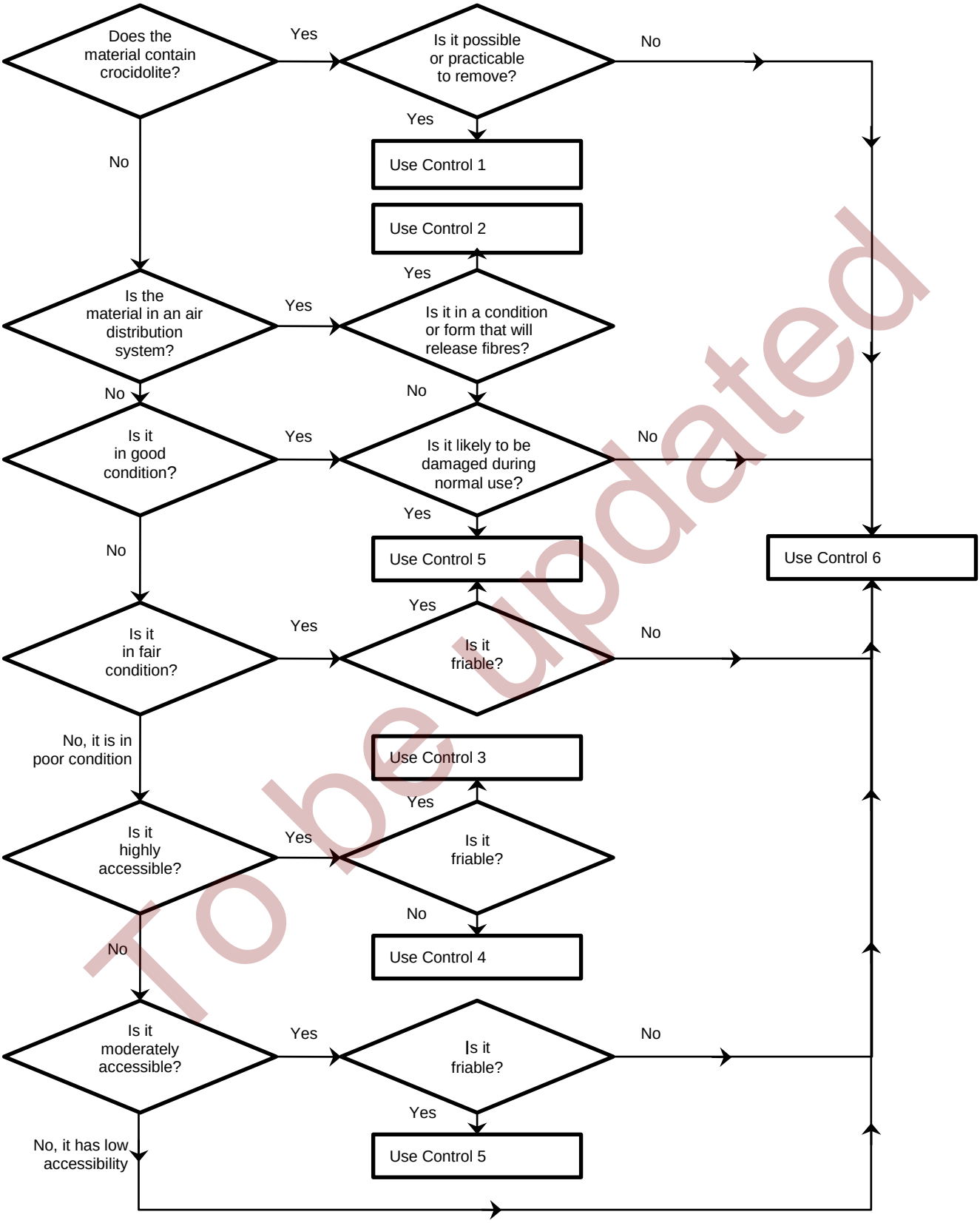
   The easier the material can be crumbled, the more friable the material and the greater the potential for asbestos fibre release and contamination. Sprayed asbestos material is generally more friable than most troweled materials or mechanically installed insulation.

8. Asbestos Content

   To calculate total asbestos content, the percentage content for each type of asbestos present in a given sample should be summed. While all asbestos-containing materials present an exposure potential, those with a high percentage of asbestos content can release more fibres.

   In order to determine the appropriate control strategy based on these eight factors, an easy-to-follow algorithm has been developed. The Risk Decision Tree is a simple graphic that helps the user determine which control strategy is needed in a particular situation by answering a series of questions.

The Risk Decision Tree and Legend (Reprinted with the permission of PHH Ltd.)



Asbestos Risk Decision Tree Legend

Condition

Good Condition	No significant signs of damage, deterioration or delamination.
Fair Condition	Mild to moderate damage, deterioration or delamination.
Poor Condition	Severely damaged, deteriorated or delaminated.

Accessibility

High Accessibility	Can be touched or contacted through activities (routine or by accident) by all building users.
Moderate Accessibility	Accessible in low activity areas or beyond the reach of most occupants (with the exception of maintenance staff).
Low Accessibility	Enclosed or concealed; requires the removal of a building component, including suspended in ceilings and access panels into solid ceiling systems. Includes rarely entered areas such as crawl spaces and attic spaces.

Control Strategy

Control 1	Immediate removal of material is required.
Control 2	Immediately prevent the asbestos fibres from entering the air distribution system through changes to the system, removal, clean up and/or repair, and if material is not removed, implement an asbestos management plan (Control 6).
Control 3	Immediately restrict access to the area and prevent air movement. Remove or clean up and/or repair. If material is not removed, implement an asbestos management plan (Control 6).
Control 4	Immediately restrict access to the area. Remove or clean up and/or repair. If materials is not removed, implement an asbestos management plan (Control 6).
Control 5	Schedule removal or clean up and/or repair in a reasonable time frame and if not ultimately removed, implement an asbestos management plan (Control 6).

Control 6	Implement an asbestos management plan. The plan should be in writing and include the following: • inventory of asbestos-containing materials in the building • inspection frequency and procedures • training requirements for maintenance staff and others who may come into contact with the materials or work in proximity to the materials • procedures to follow in the event of damage or other emergency situations • procedures to follow should the condition of the materials change or work routines alter • notification procedures for occupants and others in the building • labeling of asbestos-containing materials • details for ultimate removal of asbestos • record of controls implemented • schedule for future management activities

Chapter 2 Health Effects Associated With Exposure to Asbestos

2.1 Physical characteristics of asbestos

Asbestos fibres, unlike man-made fibres such as fiberglass, can be split into thinner and thinner fibres parallel to their length. At their finest, the fibres can hardly be seen by the best optical microscope. The average diameter of an airborne asbestos fibre ranges from 0.11 to 0.24 micrometres, depending on the type of asbestos. By comparison, a human hair is approximately 75 micrometres in diameter (more than 300 times thicker) and a glass fibre ranges between three to 15 micrometres in diameter. Seen under a microscope, chrysotile asbestos has a very curly nature, similar to a wavy string or thread. Amosite and crocidolite forms of asbestos are very straight and rod-like, reflecting their solid structure.

Chrysotile (Serpentine) Amosite (Amphibole) Crocidolite (Amphibole)

These fine fibres tend to settle very slowly in air. The aerodynamics of settling are determined by the mass, form (particularly the diameter) and orientation of the fibre. If any air turbulence is present, the fibre may not settle out or can easily re-enter the air stream after it has settled.

2.2 Entering the lungs

Asbestos-related lung diseases are caused by asbestos fibres that are inhaled and settle in the lungs. Once embedded in lung tissue, the fibres may remain within the body for extended periods. How far asbestos fibres penetrate into lung tissue depends on their length, diameter and shape. Inside the upper respiratory tract, fibres are deposited either by simple gravity or through impact at points where the air stream changes direction. The size of the deposits depend on both fibre diameter and fibre length.

2.3 Health effects from occupational exposure

The hazardous effects of asbestos were recognized as early as the first century A.D., when Pliny the Elder – a Roman naturalist, and Strabo – a Greek geographer, wrote of a sickness of the lungs of slaves involved in weaving asbestos cloth. Asbestosis was first identified in 1930, but the cancer-producing potential of asbestos was not established until 1949. That year, a report described higher than normal percentages of lung cancer among individuals dying from asbestosis. It was not until 1960, with the publication of a series of cases in South Africa, that the association between malignant pleural mesothelioma (a cancer of the lining of the lungs) and asbestos exposure was generally recognized.

2.3.1 Asbestosis

Asbestosis is a condition associated with exposure to high concentrations of airborne asbestos. It is an irreversible, sometimes fatal disease. The lungs build up scar tissue because the body recognizes asbestos fibres as foreign and this triggers an immune response. This causes lung tissues to stiffen and leads to symptoms of coughing, breathing difficulty, weight loss and eventually death. The disease is similar to silicosis and “black lung”, diseases associated with work in mines.

Once established, asbestosis is an untreatable condition. While elimination of further exposure to asbestos will not stop or reverse the disease, it will help to slow down the rate at which the disease progresses. Early symptoms of the disease – shortness of breath, often accompanied by a dry cough – usually develop 10 to 20 years after initial exposure.

2.3.2 Lung cancer

Inhalation of asbestos fibers has been linked to an increased risk of lung cancer in many studies of asbestos-exposed workers. This increased risk is seen with all forms of asbestos (there is no “safe” type of asbestos in terms of lung cancer risk). In general, the greater the frequency and duration of exposure to asbestos, the higher the risk of lung cancer. Most cases of lung cancer in asbestos workers occur approximately 15 years after their first exposure to asbestos.

Workers that smoke and are exposed to asbestos have a greater risk of developing lung cancer than either exposure on its own.

2.3.3 Pleural and peritoneal mesothelioma

Malignant mesothelioma is a rare type of cancer affecting seven to eight persons per million population. 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 which lines the abdomen.

Malignant mesothelioma is almost 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 illness ranges from 15 to 55 years, with a mean of 40 years for both long- and short-term exposures.

2.3.4 Other cancers related to asbestos exposure

Other cancers related to asbestos exposure include cancers 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.

2.3.5 Other health effects related to asbestos exposure

Asbestos can cause fluid to accumulate in the chest around the lungs (pleural effusions), or thickening of the lining of the lungs (pleural plaques). In many cases, the development of pleural plaques is not seen for 20 to 30 years after exposure. Pleural effusions can be seen within 10 years after asbestos exposure.

Chapter 3 Legislation

3.1 History of requirements on asbestos use in legislation

Overall, asbestos import, sale and use, as well as the manufacture, import, sale and use of products containing asbestos has been banned in Canada with some exceptions.

3.1.1 Federal legislation

Historically, the sale and use of some asbestos products in Canada was regulated by the federal *Hazardous Products Act* (HPA). The HPA listed a number of asbestos products that were "prohibited products" (could not be sold or imported for sale in Canada):

- Textile fibre asbestos designed to be worn by a person other than those for protection against fire or heat hazards and are constructed in a way that ensures that asbestos fibres will not become separated from the product when used as intended (date issued July 17, 1973).
- Products containing asbestos for use by children in learning or play in which asbestos may become separated from the product (date issued June 1, 1976).
- Products for use in modelling or sculpture (date issued June 1, 1976).
- Drywall joint cements, compounds or spackling or patching compounds used in construction, repairs or renovations (date issued April 24, 1980).
- Asbestos products used to simulate ashes or embers (date issued April 24, 1980).
- Goods containing asbestos that are packaged as consumer products (date issued May 5, 1988).
- Spray-applied asbestos products (date issued August 24, 1989).
- Products containing crocidolite (date issued October 5, 1992).

In 2007, the requirements that applied to asbestos products were revised and moved into the Asbestos Products Regulations under the C*anadian Consumer Product Safety Act.* The Asbestos Products Regulations were amended again in 2011. These regulations were repealed once the more stringent Asbestos and Asbestos Products Regulations came into force in December 2018 (see below).

"Asbestos product" was defined as a product that contains any type of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite, cummingtonite, fibrous erionite and tremolite.

The Asbestos Products Regulations prohibited asbestos in products:

- for use in modelling or sculpture,
- used to simulate ashes or embers, or
- composed entirely of asbestos.

The following products, which may not contain crocidolite, could be used:

1. A textile product worn on the person: may be used if it provides protection from fire or heat hazards and the person who uses the product in a reasonably foreseeable manner cannot come into contact with airborne asbestos fibres from the product.
2. A product that is used by a child in learning or play: may be used if asbestos cannot become separated from the product.
3. Drywall joint cement or compound, or spackling or patching compound that is used in construction, repair or renovation: may be used if asbestos cannot become separated from the product during its post-manufacture preparation, application or removal.
4. Spray-applied products: may be used if the asbestos is encapsulated by a binder during spraying and the materials that result from spraying are not friable after drying.

With respect to crocidolite, the following products could be imported, sold or advertised as long as the product was not composed entirely of crocidolite, the person who uses the product in a reasonably foreseeable manner could not come into contact with airborne asbestos during use, and a warning label was applied to the product or its container that included specified information:

1. Asbestos-cement pipe
2. Torque converters
3. Diaphragms for chloralkali production
4. Acid and temperature resistant seals, gasket, gland packings and flexible couplings
5. A product that contains one or more of the above items

A product composed entirely of crocidolite could be imported for the purposes of manufacturing items 3 or 4 as long as the manufacturer followed certain conditions.

The HPA was amended in February of 2015 to align with the Globally Harmonized System for Classifying and Labelling Chemicals (GHS). This resulted in new requirements for hazardous product labelling,

classification and information sheets. Under the HPA, asbestos-containing products cannot be imported or sold in Canada unless they comply with labelling and safety data sheet requirements in the HPA.

On October 18, 2018, the Prohibition of Asbestos and Asbestos Products Regulations (under the *Canadian Environmental Protection Act*) were published in the Canada Gazette, Part II. These regulations came into force on December 30, 2018. The Prohibition of Asbestos and Asbestos Products Regulations prohibit the import, sale and use of asbestos, as well as the manufacture, import, sale and use of products containing asbestos, with some exceptions. The Prohibition of Asbestos and Asbestos Products Regulations do not apply to:

- mining residues,
- pest control products as defined in subsection 2(1) the *Pest Control Products Act*,
- asbestos integrated into a structure or infrastructure prior to the in-force date of the Regulations, or
- asbestos products in use prior to the in-force date of the Regulations.

In addition, physical possession or control of some products may be transferred to allow for their disposal and asbestos may be reused in the restoration of asbestos mining site or in road infrastructure, including mounds and noise barriers if the asbestos was integrated into road infrastructure prior to the in-force date. Asbestos may also continue to be used in laboratories for scientific research and display products in a museum. In cases where a person wishes to continue to use an asbestos product (for example, there is no non-asbestos substitute available), they will be required to apply for a permit from Environment Canada.

As the Prohibition of Asbestos and Asbestos Products Regulations are more stringent than regulatory controls under the Asbestos Products Regulations made under the *Canada Consumer Product Safety Act*, the Asbestos Products Regulations have been repealed.

3.1.2 Alberta Building Code

The Alberta Building Code is the provincial legislation that has specific prohibitions on the types of asbestos products that can be used in buildings. The Alberta Building Code also had provisions regarding when asbestos-containing building products had to be removed or otherwise managed in buildings being demolished or renovated. These provisions were transferred to the Occupational Health and Safety (OHS) Code. While summaries of Building Code requirements are provided in this section, the most current version of the Alberta Building Code should be referred to directly.

The dates when the Alberta Building Code provisions came into effect are as follows:

1977 Alberta Heating, Ventilating and Air Conditioning Regulations

- Supply and return air may not pass over surfaces containing asbestos except for the surfaces of fire stops.
- This provision was incorporated into the 1978 Alberta Heating, Ventilation and Air Conditioning Code.

1981 Alberta Building Code

- No product that has a potential for releasing asbestos fibres in a building may be installed, apart from asbestos-cement board and asbestos-cement pipe (as long as the latter two were not used in a supply or return air system).

1985 Alberta Building Code

- Asbestos may not be used in air distribution systems or equipment in a form or location where asbestos fibres could enter the air supply or return systems.

1987 STANDATA 85-DR-009

- Alberta became a signatory to an International Labour Organization convention banning the spray application of asbestos products and products containing crocidolite. On June 16, 1988, Canada ratified the convention.

1991 Alberta Building Code (Note, these are the provisions moved to the 2003 edition of the OHS Code, see Section 3.1.3)

- A condition where there is a potential for asbestos fibres to be released in a building may be declared by the Director to be an unsafe condition.
- The use of materials containing crocidolite is prohibited.
- Spray application of asbestos products is prohibited.
- In potential for releasing asbestos fibres in the area of alteration or renovation in buildings being altered or renovated, any materials having asbestos must be encapsulated, enclosed or removed.
- In buildings to be demolished, materials having the potential for releasing asbestos fibres must first be removed.

2006 Alberta Building Code

- Prohibition on installing asbestos-containing products that have the potential for releasing asbestos fibres in buildings.
- Allowance for installation of asbestos-containing piping and cement board in a building, except in a supply or return air system.
- References standards for cement drain pipe, siding and shingles.

2014 Alberta Building Code

- Prohibition on installing asbestos-containing products that have the potential for releasing asbestos fibres in buildings.
- Allowance for installation of asbestos-containing piping and cement board in a building, except in a supply or return air system (asbestos may not be used in a form or location where asbestos fibres could enter the air supply or return systems).
- References standards for asbestos-cement drain pipe and asbestos siding.
- Requirement to notify the responsible permitting municipality that the abatement plans and specifications for demolition projects have been submitted in accordance with OHS legislation and the work has been completed.

3.1.3 History of OHS legislation for asbestos in Alberta

1966 Regulations Respecting the Protection of Persons with Fibrosis of the Lungs (AR 186/66).

- Passed under the *Public Health Act*.
- Amended AR 572/57 by inserting Division 25.
- Health assessment requirements for anyone who may be exposed to a substance that causes fibrosis.

1971 Fibrosis of the Lungs (AR 375/71).

- Passed under the *Public Health Act*.
- Health assessment requirements for anyone who may be exposed to a substance that causes fibrosis.

- Amended by AR 9/82 (some requirements related to silica added).
- Repealed by AR 243/83.

1976 *Occupational Health and Safety Act* (Chapter 40, RSA 1976).

General Accident Prevention Regulation (AR 267/76)

- Passed under the *Occupational Health and Safety Act*.
- Requirements for ventilation systems to ensure worker exposure kept below the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs).

1980 *Occupational Health and Safety Act* (Chapter 0-2, RSA 1980) (No changes related to asbestos).

1982 Asbestos Regulation (AR 7/82)

- Passed under the *Occupational Health and Safety Act.*
- Contained the health assessment requirements that had been in the Fibrosis Regulations.

Chemical Hazards Regulation (AR 8/82)

- Passed under the *Occupational Health and Safety Act*.
- Consolidated requirements for asbestos, silica, coal dust as well as general provisions for chemical hazards and Workplace Hazardous Materials Information System (WHMIS) requirements.
- Occupational exposure limit (OEL) for asbestos fibres (2 f/cc for chrysotile, 0.2 f/cc for other forms of asbestos).

1988 Chemical Hazards Regulation (AR 393/88)

- Revised OEL for asbestos fibres (0.5 f/cc for chrysotile, 0.2 f/cc for other forms of asbestos).
- Amended by AR 17/89 to add Schedule 2 (asbestos included in Schedule).

1992 Chemical Hazards Regulation amended by AR 303/92

- Asbestos added to Part 3 of the Regulation.
- Asbestos Regulation repealed.

1997 Chemical Hazards Regulation amended by AR 169/97

- Amendments to section 41 (health assessments).
- Section 42 (worker registry) repealed.

2000 *Occupational Health and Safety Act* (Chapter 0-2, RSA 2000)

2003 Occupational Health and Safety Regulation

- Definitions for asbestos and restricted area and requirements for notifiable diseases.

2004 Occupational Health and Safety Code

- Alberta Building Code requirements moved to the OHS Code (see 3.1.2).
- Revised OEL for asbestos, 0.1 f/cc for all forms.

3.2 *Occupational Health and Safety (OHS) Act*

The *OHS Act* is the Alberta law intended to protect the health, safety and welfare of workers on the job. Alberta Labour and Immigration is the government department responsible for administering the *OHS Act*. Work site parties regulated by the *OHS Act* are employers, supervisors, workers, suppliers, service providers, owners, contractors, prime contractors, self-employed persons and temporary staffing agencies. Key definitions for work site parties and their responsibilities are summarized below. Definitions can be found in section 1 of the *OHS Act*, and work site party obligations in Part 1. Note that other parties may also have responsibilities under the *OHS Act*.

ALL work site parties are responsible to cooperate with a person exercising a duty imposed by the OHS legislation and must comply with the legislation in addition to the roles and responsibilities summarized below. The summaries below are not intended to be a comprehensive list of requirements under the *OHS Act*, for more detailed information, the *OHS Act* should be referred to directly. Work site parties may also have specific responsibilities under the OHS Regulation and OHS Code in addition to their general duties under the *OHS Act*.

Employers

"Employer" means

> (i) a person who employs or engages one or more workers, including a person who employs or engages workers from a temporary staffing agency,
>
> (ii) a person designated by an employer as the employer's representative, or
>
> (iii) a director or officer of a corporation or a person employed by the employer who oversees the occupational health and safety of the workers employed by the corporation or employer.

Employers must ensure, as far as is reasonably practicable for the employer to do so:

- the health, safety and welfare of their workers, other workers present at the work site and other persons at the work site or in the vicinity of the work site who may be affected by the hazards at the work site,
- workers working for them are aware of their responsibilities and duties under the *OHS Act*, Regulation and Code, and of any health and safety issues arising from the work,
- none of the employer's workers are subjected to or participate in harassment or violence at the work site,
- workers are supervised by a competent person who is familiar with the OHS legislation that applies to the work performed at the work site,
- they consult and cooperate with the joint work site health and safety committee or the health and safety representative, as applicable, to exchange information on health and safety matters and to resolve health and safety concerns, and
- ensure health and safety concerns raised by workers, supervisors, self-employed persons and the joint work site health and safety committee or health and safety representative are resolved in a timely manner, in cooperation with the health and safety committee or health and safety representative.

Employers must also ensure workers receive adequate training necessary to protect their health and safety before they begin performing a work activity, when they perform a new work activity or use new equipment or processes, and when they are moved to another area or work site.

Supervisors

“Supervisor” means a person who has charge of a work site or authority over a worker.

Supervisors must, as far as it is reasonably practicable for the supervisor to do so:

- ensure they are competent to supervise workers,
- take all precautions necessary to protect the health and safety of every worker under the supervisor’s supervision,
- ensure that workers under their supervision comply with the OHS legislation,
- ensure that every worker under their supervision uses all hazard controls, and properly uses or wears personal protective equipment designated or provided by the employer, or required to be used or worn under the OHS legislation, and
- ensure that none of the workers under the supervisor’s supervision are subjected to or participate in harassment or violence at the work site.

Supervisors also must:

- advise every worker under their supervision of health and safety hazards in the area where the worker is performing work, and
- report concerns about an unsafe or harmful work site acts or conditions to the employer.

Workers

“Worker” means a person engaged in an occupation, including a person who performs or supplies services for no monetary compensation for an organization or employer and, for greater certainty, includes a self-employed person, but does not include:

(i) a student in learning activities conducted by or within an educational institution for which no compensation is paid to the student, or

(ii) except for the purpose of Section 5(a) and (b), the following persons engaged in a farming and ranching operation specified in the OHS Regulation or Code:

(A) a person to whom no wages, as defined in the Employment Standards Code, are paid for the performance of farming or ranching work;

(B) a person referred to in clause (hh)(i)(B)(I) to (IV) to whom wages, as defined in the Employment Standards Code, are paid for the performance of farming or ranching work.

Workers are responsible to:

- take reasonable care to protect their safety and the safety of other workers and other persons at or in the vicinity of the work site while they are working,
- cooperate with their supervisor or employer or other persons to protect the health and safety of themselves and others at the work site,
- use all devices and personal protective equipment designated and provided by the employer or required to be used in accordance with the OHS legislation,
- refrain from causing or participating in harassment or violence, and
- report concerns about an unsafe or harmful work site acts or conditions to the employer or supervisor.

Suppliers

"Supplier" means a person who sells, rents, leases, erects, installs or provides any equipment or who sells or otherwise provides any harmful substance or explosive to be used by a worker in respect of any occupation, project or work site.

Suppliers must, as far as is reasonably practicable for the supplier to do so:

- ensure that the equipment they supply are in safe operating condition,
- ensure harmful substances and explosives are safe to use when used in accordance with the manufacturer specifications,
- maintain equipment in safe condition in accordance with the manufacturer specifications, if any, and the requirements in the *OHS Act*, Regulation and Code, if they have responsibility under an agreement to maintain the equipment,
- when they become aware (or ought reasonably to be aware) of any equipment, harmful substance or explosive they supply, or is about to be supplied, does not comply with a standard under the *OHS Act*, Regulation and Code, provide notice to all employers to this effect, and
- ensure that any equipment, harmful substance or explosive they supply complies with the OHS legislation.

Service Provider

"Service provider" means a person who provides training, consulting, testing, program development or other services in respect of any occupation, project or work site.

Service providers must, as far as is reasonably practicable for the service provider to do so:

- ensure the service provided to a person to meet an obligation in the *OHS Act*, Regulation and Code will enable the person to comply,
- ensure that all services provided in respect of a work site comply with the *OHS Act*, Regulation and Code,
- ensure that services are completed by workers who are competent to provide those services, and
- ensure no person at or near a work site is endangered as a result of the service provider's activity.

Owner

"Owner" means the person who is registered under the *Land Titles Act* as the owner of the land on which work is being carried out or may be carried out, or the person who enters into an agreement with the owner to be responsible for meeting the owner's obligations under the *OHS Act*, Regulation and Code, but does not include a person who occupies land or premises used as a private residence unless a business, trade or profession is carried out on in that premises.

Owners must ensure, as far as is reasonably practicable for them to do so, the land, infrastructure and any building or premises on the land that is under the owner's control is provided and maintained in a manner that does not endanger the health and safety of workers or any other person.

Contractors

"Contractor" means a person, partnership or group of persons who, through a contract, an agreement or ownership, directs the activities of one or more employers or self-employed persons involved in work at a work site.

Contractors must, as far as is reasonably practicable for the contractor to do so:

- ensure every work site where an employer, employer's worker or self-employed person works pursuant to a contract with the contractor, and every work process or procedure performed at a work site by an employer, employer's worker or self-employed person pursuant to a contract with the contractor that is under the control of the contractor does not create a risk to the health and safety of any person, and

- advise the prime contractor, if there is one, of the name of every employer or self-employed person with whom the contractor directs the work activities.

Prime contractor

"Prime contractor" means the prime contractor for a work site referred to in section 10 of the *OHS Act*.

Prime contractors are required where there are two or more employers and/or self-employed persons at a construction or oil and gas work site as well as at work sites or classes of work sites as designated by a statutory director. If no prime contractor is designated, the person in control of the work site is deemed to be the prime contractor. The person in control of the work site must designate the prime contractor and the name of the prime contractor must be posted in a conspicuous place.

Prime contractors must, as far as is reasonably practicable for the prime contractor to do so:

- establish a system or process that will ensure compliance with the OHS legislation,
- coordinate, organize and oversee the performance of all work at the work site to ensure no person is exposed to hazards arising out of, or in connection with, activities at the work site, and
- conduct their activities to ensure no person is exposed to hazards arising out of, or in connection with, activities at the work site.

Prime contractors must also:

- consult and cooperate with the joint work site health and safety committee or health and safety representative, as applicable, to attempt to resolve any health and safety issues, and
- coordinate the health and safety programs of employers and self-employed persons on the work site, if two or more employers or self-employed persons or one or more employers and one or more self-employed persons on the work site have a health and safety program,

Self-employed persons

"Self-employed person" means a person who is engaged in an occupation but is not in the service of an employer for that occupation.

Self-employed persons must:

- conduct their work to ensure they or any other person are not exposed to hazards from activities at the work site,

- advise the prime contractor, if there is one, that the self-employed person is working on the project,
- comply with requirements for employers or workers, with any necessary modifications, and
- report, to the extent that it is reasonably practicable to do so, concerns about unsafe or harmful work site acts or conditions to affected employers or self-employed persons at the work site.

Temporary staffing agency

"Temporary staffing agency" means a person who retains workers and deploys or facilitates the placement of those workers with other employers.

A temporary staffing agency must:

- ensure, as far as is reasonably practicable to do so, workers assigned to another employer are suitable to perform the assigned tasks,
- ensure workers are or will be equipped with any necessary personal protective equipment prior to the start of work, and
- ensure the client employer is capable of ensuring the health and safety of the workers.

Other key requirements in the *OHS Act*:

- Work site parties must ensure health and safety information is provided and available to those who require it.
- Equipment and harmful substances must be provided with written manufacturer specifications and instructions for safe use.
- Documentation required by the OHS Regulation or OHS Code, such as a code of practice for asbestos, must be in writing.
- Workers may refuse to do work if they believe, on reasonable grounds, there is a dangerous condition at the work site or the work constitutes a danger to the health and safety of the worker or another person. If a worker refuses, the employer must inspect; during the refusal the worker must continue to be paid the same wages and benefits or be reassigned to alternative work.

The joint work site health and safety committee (HSC) or health and safety (HS) representative (*OHS Act* Part 3)

Where there is an HSC or HS representative, they must be involved in health and safety issues, including those related to the presence or removal of asbestos at the work site. Examples include:

- Handling worker complaints or concerns related to asbestos exposure in the workplace.
- Identifying asbestos-containing materials in the workplace and activities that may disturb them.
- Developing an asbestos management plan.
- Checking the effectiveness of management plans and work procedures.
- Reviewing asbestos air monitoring results related to worker exposure.
- Developing asbestos awareness training and worker training related to asbestos hazards at the workplace.
- Workplace inspections to assess the condition of asbestos materials.
- Participating in investigations related to serious injuries or incidents on an abatement work site.
- Making recommendations to the employer as to how health and safety can be improved on abatement projects.
- A forum for workers to bring health and safety concerns for discussion and preparation of recommendations to the employer on how to address concerns.

3.3 Occupational Health and Safety (OHS) Regulation

The OHS Regulation contains the definition for asbestos and a hazardous work site. The definition of "asbestos" includes all forms of asbestos. A "work site" is an area of the work site where there is a reasonable chance that the airborne concentration of asbestos may exceed the occupational exposure limit (OEL) specified in the OHS Code. The summaries below are not intended to be a comprehensive list of requirements under the OHS Regulation, for more detailed information, the OHS Regulation should be referred to directly.

There are specific requirements in the OHS Regulation that apply to asbestos:

- For the purposes of the *OHS Act*, an occupation of a person who works with asbestos is designated a "hazardous occupation" and a work site where there is a reasonable chance the airborne concentration of asbestos exceeds or may exceed the OEL is considered a "hazardous work site". This designation allows the Director of Medical Services, under section 50 of the *OHS Act*, to require registration of workers and require the employer to provide medical examinations for the workers.

- Asbestosis, mesothelioma and asbestos induced cancers are notifiable diseases. Where a worker is diagnosed with one of these diseases, their physician must notify the Director of Medical Services.

The employer must also ensure all work sites meet the following general provisions:

- Equipment used at a work site is properly maintained and used for the function it was intended. The employer must ensure that workers use or wear equipment required by the legislation.
- Workers are competent; i.e. adequately qualified, suitably trained and with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision, or under the direct supervision of a competent worker.
- Workers are familiar with work procedures and are competent in the application, use, maintenance and limitations of equipment or protective equipment.
- Workers are provided with adequate training in the safe operation of equipment they use.
- If a worker may be exposed to a harmful substance at a work site, the employer must develop procedures to minimize worker exposure to that substance, provide training on the procedures, and ensure workers follow the procedures.

Workers must:

- Not perform work that may endanger others if they are not competent, unless they are under the direct supervision of a competent worker.
- Report to the employer all equipment that is in a condition that may compromise the health and safety of workers using or transporting it, is not functioning properly, is not strong enough for its purpose or has an obvious defect.
- Participate in and apply training provided by the employer, follow procedures developed by the employer and use or wear required equipment.

3.4 Occupational Health and Safety (OHS) Code

Note: The summaries below are not intended to be a comprehensive list of requirements under the OHS Code. For more detailed information, the OHS Code should be referred to directly.

Part 1 of the OHS Code has a number of asbestos-specific terminology including:

- "Asbestos waste" – material that is discarded because there is a reasonable chance that asbestos might be released from it and become airborne, including protective clothing that is contaminated with asbestos.

- "Exposed worker" – a worker who may reasonably be expected to work in a restricted area at least 30 work days in a 12-month period.

- "Fibre" – a particulate material with:

    (a) a diameter equal to or less than 3 micrometres,

    (b) a length equal to or greater than 5 micrometres, and

    (c) a length-to-diameter ratio equal to or greater than 3 to 1

- "Restricted area" means an area of the work site where there is a reasonable chance that the airborne concentration of asbestos exceeds or may exceed the OEL.

3.4.1 OHS Code Part 2 – Hazard Assessment and Control

For all work sites, an employer must assess the work site for existing or potential hazards before work begins. Affected workers and the joint work site health and safety committee or health and safety representative, as applicable, must be included in the hazard assessment process. The hazard assessment is the starting point for identifying specific work site hazards as well as the scope of an asbestos management plan. Employers must prepare a report that provides the results of the assessment and specifies the methods that will be used to control or eliminate the hazards. This report must be in writing and available to workers.

Once identified, hazards must be eliminated whenever it is reasonably practicable to do so. If elimination is not reasonably practicable, hazards must be controlled:

- first by using engineering controls,

- then administrative controls,

- then by using personal protective equipment, and

- finally, by using a combination of the above controls.

3.4.2 OHS Code Part 4 – Chemical Hazards

Part 4 of the OHS Code sets limits for exposure to chemicals, including asbestos. The portions of the OHS Code dealing specifically with asbestos identify the general duties of employers, requirements for health

assessments, training and project notification. There are additional parts of the OHS Code that will also apply to abatement projects, depending on the work procedures and specific work site hazards.

General duties

Part 4 of the OHS Code requires employers dealing with asbestos to take appropriate steps to:

- minimize the release of asbestos into the air, keeping work exposure as low as reasonably achievable/practicable, and never exceeding the OEL,
- keep the work site clear of unnecessary accumulations of asbestos waste and materials containing asbestos,
- ensure decontamination of workers and materials does not result in release of airborne fibres,
- ensure containers used to dispose of asbestos are sealed and impervious to asbestos,
- ensure that asbestos waste is labeled as **"Carcinogenic – Do not inhale dust",** and
- provide a means to prevent workers' street clothes from being contaminated with asbestos fibres or other workplace contaminants.

Restricted areas

If an area of the work site meets the definition for a "restricted area", the employer has additional duties:

- ensure only authorized persons enter a restricted area,
- post signs around restricted areas warning of the hazards and keep the signs posted until the area is no longer a restricted area,
- provide workers with, and ensure they wear, appropriate protective clothing and respirators while they are in a restricted area,
- make sure workers decontaminate themselves before leaving a restricted area, and
- ensure that protective clothing used in a restricted area is properly decontaminated or laundered if it is not to be discarded as asbestos waste – it must be kept in properly labelled, sealed containers until it is laundered.

Note that where a worker must enter a restricted area, the employer is responsible to provide the necessary personal protective equipment suitable for the level of exposure to workers at the employer's cost.

Maximum allowable asbestos exposure levels

The OEL for all forms of asbestos is 0.1 f/cc based on eight hours of exposure. If workers are working shifts that are more than eight hours, the exposure limit must be adjusted using the equation in section 18(1) of the OHS Code or by a method that uses recognized scientific principles and is approved by the Director of Occupational Hygiene. In the latter case, an approval must be applied for and received per section 56 of the *OHS Act*.

Monitoring for airborne concentrations of asbestos fibres

The requirements for worker exposure monitoring on asbestos abatement projects are set out in the OHS Code, sections 16, 20, 21 and 22.

- Section 16, an employer must comply with the OEL for asbestos (0.1 f/cc) and keep exposure as low as reasonably achievable.
- Section 20 specifies the air monitoring methods to be used when collecting samples for the purposes of complying with the OEL.
- If a worker may be exposed to a harmful substance at a work site, section 21 of the OHS Code obligates an employer to identify the health hazards associated with exposure and assess the worker's exposure. So if a worker is potentially exposed to asbestos at the work site when an asbestos-containing material is disturbed (whether or not the employer knows that the OEL is being complied with), the employer must conduct monitoring to determine what the worker is exposed to, unless they have other information to confirm that exposure will not exceed the OEL.
- If a worker is potentially exposed in excess of the OEL, section 22 of the OHS Code requires the employer to take additional specific actions, in addition to conducting air monitoring.

While the OHS Code does not specify how often monitoring must be done, generally some monitoring is needed for every asbestos abatement project, particularly for high-risk projects (projects that are in "restricted areas"). More guidance on asbestos monitoring is provided in Chapter 7.

Worker training

The OHS Code requires that all workers who work with asbestos receive training necessary for them to perform their work safely. Since an employer is obligated under section 3(2) of the *OHS Act* to ensure that workers are trained in all matters necessary to protect their health and safety before they start work, perform a new activity or use new equipment, or are moved to another area or work site, where the employer must ensure the training is done, they must also pay the cost of the training and compensate the worker for time spent in training.

The employer must ensure that all workers who might enter a "restricted area" successfully complete an asbestos abatement course of at least two days duration. The course must be approved by Alberta Labour

and Immigration. A list of the training agencies approved to provide the asbestos worker training course and issue Asbestos Worker Cards is available on the OHS website www.alberta.ca/asbestos-worker-training.aspx.

The course provides basic awareness of asbestos hazards and OHS legislation. Practical sessions focus on worker protection, set-up of the work area and safe work practices. Each course concludes with an examination that requires an 80 per cent as a passing grade. Workers who successfully pass the course receive an Asbestos Worker Card. Successful completion of the approved course will not ensure that a worker is competent, as defined by the *OHS Act*, since competence is a mixture of training and experience.

Workers must have their original valid Asbestos Worker Card available at the work site when they are working. OHS officers may ask a worker to produce their original card and appropriate identification.

The Asbestos Worker Card remains the property of Alberta Labour and Immigration and can be revoked.

Workers involved in low- and moderate-risk abatement projects (work sites that are not “restricted areas”) are not required to complete a two-day asbestos abatement course and need not possess an Asbestos Worker Card. However, in accordance with section 15 of the OHS Regulation, appropriate training must be provided to meet the level of worker involvement in the project. The training should, at a minimum, contain the following elements:

- Health hazards associated with exposure to asbestos.
- Responsibility of work site parties under the *OHS Act.*
- Asbestos requirements in Part 4 of the OHS Code.
- Work site specific safe work procedures related to the work.
- Instructions on how to properly wear, use and maintain personal protective equipment required for the work.
- Procedures to be followed in an emergency.
- Information and procedures related to other hazards that may be encountered during the work.

This training may be provided by a training agency or in-house by persons who are knowledgeable in the procedures and hazards associated with asbestos abatement. The employer must ensure the worker has their valid certificate of completion of the course in their possession, and proof of training should be available at the work site for inspection by an OHS officer.

Worker health assessment

Each worker must undergo a health assessment within 30 calendar days of becoming an exposed worker[1], and every two years thereafter. An exposed worker is a worker who may reasonably be expected to work in a restricted area at least 30 work days in a 12-month period. This threshold does not take into account whether or not the worker was wearing a respirator while in the restricted area. Further guidance is provided in Table 1.

At the time the worker becomes an exposed worker, their employer must ensure the health assessment is completed. The assessment must be conducted by a qualified physician and consists of a chest x-ray including radiologist's report, a pulmonary function test, worker's history that includes the elements listed in section 40 of the OHS Code and a written interpretation and explanation of the results of the assessment with particular reference to the worker's exposure to airborne substances.

The cost of medical testing and the time taken to undergo the tests must be borne by the employer. The worker may refuse all or some of the tests by submitting a written refusal to the employer. The employer may not coerce, threaten or force the worker to refuse all or part of the health assessment. Test records are medical information and must be kept confidential unless the worker has given written permission for access by another person or the records are in a form that do not identify the worker.

[1] An "exposed worker" is defined as a worker who may reasonably be expected to work in a restricted area at least 30 work days in a 12-month period. A "restricted area" means an area of a work site where there is a reasonable chance that that the airborne concentration of asbestos exceeds or may exceed the OEL.

Table 1: Health assessment parameters

Worker exposed to asbestos below the OEL	Worker with confirmed asbestos exposure above the OEL, but not meeting the exposed worker definition	Asbestos exposed worker according to the legal definition of an exposed worker
Consult family doctor (inform doctor of potential exposure)	Consult family doctor (inform doctor of potential exposure)	Health assessment performed as required by law
Chest x-ray and PFT[2] not recommended unless advised by family doctor	Chest x-ray and PFT[2] not recommended unless advised by family doctor	Health assessment includes: • chest x-ray • PFT[2] with FEV[3], FVC[4] • written interpretation and explanation of health assessment results history (see below)
History of exposure should be recorded (see below)	History of exposure should be recorded (see below)	
History should cover: • worker's name • employer's name • occupational exposure to asbestos, industrial dusts and carcinogens • any significant exposure to asbestos, dusts or carcinogens during recreational or hobby activities • any symptoms related to impaired respiratory function or that may be an indication of asbestosis or malignancy • any past or present medical diagnoses of respiratory disease • history of smoking • dates of chest x-ray and PFT[2]		

[2] PFT — Pulmonary Function Test

[3] FEV — Forced Expiratory Volume in the first second

[4] FVC — Forced Vital Capacity

Code of practice

Asbestos is identified in Table 1, Schedule 1 of the OHS Code. If there is more than 10 kg of pure asbestos, or asbestos-containing material that has more than 0.1 per cent asbestos by weight and the amount exceeds 10 kg, the employer must establish a code of practice governing the storage, handling, use and disposal of the asbestos. If there is a possibility that the fibres may be released in an uncontrolled manner, the employer must also establish a code of practice governing procedures to be followed to prevent uncontrolled release and procedures to be followed in the event of a release.

While the OHS legislation does not specify the required elements of a code of practice, it should include the following:

- A statement of purpose and of the responsibilities of individuals.
- Methods of hazard identification, assessment and control.
- Safe work practices, as applicable.
- Worker education and training.
- Storage, use, handling and disposal procedures.
- Descriptions of personal and work site hygiene practices and decontamination practices.
- Measures to be used to prevent the uncontrolled release of the substance and the procedures to be followed if there is an uncontrolled release.
- Processes of health monitoring, including health assessment, documentation and record keeping.
- Procedures for maintenance of the code of practice, including specifying the parties responsible for ongoing reviews and updating.

An asbestos management plan, as described in Chapter 4 is an important component of the code of practice to identify hazards and determine methods of control.

The employer, contractor or prime contractor must consult and cooperate with the joint work site health and safety committee and all health and safety representatives for the work site, as applicable, to develop the code of practice. The committee (and representative) has a corresponding duty to develop measures to protect the health and safety of persons at the work site and check the effectiveness of such measures.

Notification of project start-up

Notification must be given to Alberta Labour and Immigration at least 72 hours before beginning activities that may release asbestos fibres. This includes the set-up operations that may release fibres, for example, the removal of barriers or partitions such as false ceilings behind or on which asbestos-containing materials may have accumulated. The 72-hour period starts once the work site party receives acknowledgement of receipt of the notice of project.

This notification must include the location of the work site, the start and completion dates, and a description of the work to be performed. The notification can be submitted online at www.alberta.ca/submit-asbestos-project-notification.aspx. Once the notification is submitted, receipt of the notification will be acknowledged via email.

Notification is required for all high-, moderate- and low-risk projects, except as noted below. There can be some flexibility in timing where it can be demonstrated that there is a need to carry out the work immediately. An example of this type of situation would be the immediate removal of asbestos cladding on a ruptured water pipe. Immediate action is justified to prevent damage to the building. However, delays in construction schedules resulting from the discovery of asbestos are not considered sufficient reason to reduce the notification period.

For ongoing routine maintenance work involving low- or moderate-risk activities, projects may be granted "extended project notification status" as long as all workers are adequately trained and follow safe work procedures. Extended notifications may be granted for up to a year, depending on the employer's ability to plan in advance. Extended notifications will only be considered for low- or moderate-risk work. If an employer, contractor or prime contractor wishes to apply for an extended notification, they should contact Alberta Labour and Immigration at www.alberta.ca/submit-asbestos-project-notification.aspx.

Types of projects that do not require notification include:

- Inspection of asbestos-containing materials as part of a management plan or asbestos assessment project.
- Sampling of asbestos-containing materials or potential asbestos-containing materials as part of an asbestos assessment project – sampling must be performed by competent personnel in a manner that minimizes disturbance and damage to the asbestos-containing materials.
- Removal and replacement of one small (less than 30-centimetre diameter) manufactured asbestos product such as a gasket or valve packing.
- Short-term work in areas containing non-friable asbestos-containing materials that does not involve disturbing the asbestos-containing materials.
- Transportation of asbestos-containing materials in sealed containers, unless the transportation relates to disposal of materials as part of an asbestos abatement project.

In the above cases, employers must take precautions to ensure that asbestos fibres are not released. These types of projects must only be carried out by competent workers and in accordance with the requirements of the Part 4 of the OHS Code. Work procedures must be developed and followed to prevent potential asbestos exposure.

Asbestos in buildings

The following uses of asbestos are prohibited in new or existing buildings:

- the use of materials containing crocidolite (blue) asbestos,
- the use of asbestos-containing materials in a supply or return air plenum in a location or form that will allow asbestos fibres to enter the system,
- installation of a product that has the potential for releasing asbestos fibres in a building – asbestos-cement pipe and asbestos-cement board are exceptions as long as they are not installed in a supply or return air plenum, and
- installation of asbestos by spray application.

In existing buildings, it is considered an unsafe condition if there is a potential for the release of asbestos fibres. In such cases, the material must be removed, enclosed or encapsulated.

In buildings or parts of buildings that are being demolished, materials having the potential for releasing asbestos fibres must be removed prior to demolition. Materials containing low levels (less than one per cent asbestos by weight) or those with asbestos bound in the product (e.g. asbestos-cement products, vinyl flooring) still have the potential to release asbestos fibres when they are disturbed and must be removed prior to demolition.

If an area within a building is being altered or renovated, the employer must ensure materials that have the potential for releasing asbestos fibres in that area are removed, enclosed or encapsulated. These requirements are based on the potential for asbestos fibres to be released when the material is disturbed, not on the amount of asbestos in the material.

Materials such as drywall joint compounds and stipple may not have been uniformly mixed when they were applied and could contain variable asbestos concentrations. When dealing with large quantities of such materials, employers should take non-homogeneous mixtures into consideration and ensure that bulk sampling is done appropriately (see Chapter 7).

It is the responsibility of the employer to conduct a hazard assessment and evaluate the likelihood of asbestos fibre release based on the material in question and the work procedures. This assessment must be documented and may need to be supported with air monitoring and bulk sampling data.

In cases where asbestos cannot be removed from a building prior to demolition, for example, the building is structurally compromised, an acceptance must be applied for and received prior to demolition in accordance with section 55 of the *OHS Act* and received prior to demolition.

For more information

Asbestos-containing Materials in Buildings to be Demolished (ASB003) ohs-pubstore.labour.alberta.ca/asb003

3.4.3 OHS Code Part 5 – Confined Spaces

Some areas where asbestos must be removed may be confined spaces, presenting additional hazards to workers. A “confined space” is defined in the OHS Code as *a restricted space which may become hazardous to a worker entering it because of:*

- an atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity, or toxicity,
- a condition or changing set of circumstances within the space that presents a potential for injury or illness, or
- the potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space.

A “restricted space” is defined in the OHS Code as an enclosed or partially enclosed space – not designed or intended for continuous human occupancy – that has a restricted, limited or impeded means of entry or exit because of its construction.

Employers must:

- develop procedures to eliminate hazards associated with confined spaces, to the extent that this is reasonably practicable, to address ventilation, presence of harmful substances in the air, oxygen deficiency, isolation from other piping and supply lines, protective equipment, rescue procedures and communication.
- develop a written code of practice that includes identification of the confined space, worker qualifications and training, isolation, ventilation, tests to be done prior to entry, protective equipment, rescue procedures and equipment, and identification of other hazards that may be present.
- consult and cooperate with the joint work site health and safety committee and all health and safety representatives for the work site, as applicable, to develop the code of practice; the

committee and representatives have a corresponding duty to develop measures to protect the health and safety of persons at the work site and check the effectiveness of such measures.

For more information

Guideline for Developing a Code of Practice for Confined Space Entry (CS001) ohs-pubstore.labour.alberta.ca/cs001

3.4.4 OHS Code Part 18 – Personal Protective Equipment

Respiratory Protective Equipment

The OHS Code lists factors an employer must consider when determining the need for respiratory protection. Respiratory protective equipment must be provided at the employer's expense and worn by the worker where a risk of over-exposure exists, or where a worker will be working in a restricted area. Respirators must be selected in accordance with Canadian Standards Association (CSA) Standard Z94.4.02, *Selection, Use and Care of Respirators* and the employer must consider:

- the nature and exposure circumstances of the airborne contaminant(s)
- the concentration, or likely concentration, of the airborne contaminants
- the duration, or likely duration, of worker exposure
- toxicity of the contaminants
- oxygen concentrations
- warning properties of the contaminants
- the need for emergency escape from the work area

The OHS Code allows air-purifying respirators to be used if the environment in the work area is not immediately dangerous to life or health and the oxygen content is 19.5 per cent or more and will continue to be, provided the equipment is designed to protect against the specific airborne contaminants present. If not, a supplied air system with an auxiliary source of respirable air sufficient to allow escape from the work area or a positive pressure self-contained breathing apparatus (SCBA) fitted with an alarm warning must be worn. Where air-purifying respirators are used, the airborne contaminant level must not exceed the product of the protection factor assigned to the respirator multiplied by the OEL for asbestos.

The OHS Code also addresses approval of equipment. All respirators and their constituent components must be approved by the National Institute for Occupational Safety and Health (NIOSH) in the United States. A different equipment testing organization's approval is only permitted if approved by a Director of Occupational Hygiene.

The quality of air used for supplied-air respiratory protection systems must comply with the CSA Standard Z180.1 for compressed breathing air. As well, no contaminant may be present in a concentration exceeding 10 per cent of its OEL.

Each worker must have a properly fitted respirator and workers must be clean shaven where the respirator meets the skin of the face (if respirator efficacy depends on a tight facial seal). Respirators must be selected and fit-tested in accordance with the CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*. Respirators must be:

- stored in a readily accessible location,
- stored in manner that prevents the respirator from being contaminated,
- maintained in a clean and sanitary condition,
- inspected before and after each use to ensure it is in satisfactory working condition, and
- serviced and used in accordance with the manufacturer's specifications.

The OHS Code also requires that a code of practice for the selection, maintenance and use of respiratory protection be established. The employer, contractor or prime contractor must consult and cooperate with the joint work site health and safety committee and all health and safety representatives for the work site, as applicable, to develop the code of practice. The committee and representatives have a corresponding duty to develop measures to protect the health and safety of persons at the work site and check the effectiveness of such measures.

For more information

Respiratory Protective Equipment – An Employer's Guide (PPE001) ohs-pubstore.labour.alberta.ca/ppe001

Guidelines for the Development of a Code of Practice for Respiratory Protective Equipment (PPE004) ohs-pubstore.labour.alberta.ca/ppe004

Personal protective equipment and clothing

To prevent worker contamination and protect against other hazards at the work site, protective equipment and clothing are normally required during asbestos abatement work. The employer must ensure:

- the equipment itself does not endanger the worker,
- workers wear and use the required personal protective equipment,

- equipment is correct for the hazard and protects workers, and
- the equipment is in a condition to perform the function for which it was designed.

Employers must also ensure workers are trained in the correct use, care, limitations and assigned maintenance of the personal protective equipment. Supervisors must ensure that workers wear the appropriate personal protective equipment. Workers must, in turn, properly wear the equipment in accordance with training and instruction, inspect the equipment before using it and not use equipment that is unable to perform the function for which it was designed.

Where there is a foreseeable danger of injury to a worker's head, the employer must ensure workers wear protective headwear. This equipment must meet the referenced CSA or American National Standards Institute (ANSI) Standard and be appropriate to the hazards.

If a worker's eyes may be injured or irritated at work, the employer must ensure that the worker wears suitable eye protection that meets the referenced standards in Part 18 of the OHS Code. This equipment must be appropriate to the work being done, the hazard involved and be approved to the appropriate CSA standard.

Foot protection or limb and body protection may also be required where there is a danger of injury to the foot, hands, legs or trunk. Again, it must meet standards referenced in the OHS Code.

Where there is a danger of falling from a height, appropriate fall protection equipment or methods must be used. The OHS Code, Part 9 describes the circumstances under which the equipment or methods must be used and the standards for the protective equipment.

3.4.5 OHS Code Part 23 – Scaffolds and Temporary Work Platforms

The OHS Code presents requirements for this type of equipment and how it should be erected. The equipment must be installed by workers who are competent to do so. The employer must ensure that the equipment is appropriate for the job and loads to be supported and meets referenced standards, as applicable. Refer to Part 23 of the OHS Code for further details.

3.4.6 OHS Code Part 27 – Violence and Harassment

The *OHS Act* defines violence and harassment and places responsibilities on employers and supervisors to address such hazards in the workplace and on workers to refrain from these behaviours.

"Harassment" means any single incident or repeated incidents of objectionable or unwelcome conduct, comment, bullying or action by a person that the person knows or ought reasonably to know will or would cause offence or humiliation to a worker, or adversely affects the worker's health and safety, and includes:

(i) conduct, comment, bullying or action because of race, religious beliefs, colour, physical disability, mental disability, age, ancestry, place of origin, marital status, source of income, family status, gender, gender identity, gender expression and sexual orientation, and

(ii) a sexual solicitation or advance,

but excludes any reasonable conduct of an employer or supervisor in respect of the management of workers or a work site.

"Violence", whether at a work site or work-related, means the threatened, attempted or actual conduct of a person that causes or is likely to cause physical or psychological injury or harm, and includes domestic or sexual violence.

Employers must develop and implement violence and harassment prevention plans, in cooperation with the joint health and safety committee or health and safety representative, if one is required. If the employer does not have a committee or representative, they must consult with affected workers when developing the plan. These plans include a violence/harassment prevention policy and work procedures. Work procedures must include the elements prescribed in the OHS Code.

If an incident of violence or harassment occurs, an employer or prime contractor must:

- investigate the circumstances surrounding the incident,
- prepare a report outlining the circumstances and the corrective action taken, if any, undertaken to prevent a recurrence,
- have a copy of the report available to provide to an OHS officer if they request it, and
- retain the report for at least two years after the incident.

For more information

Harassment and Violence in the Workplace (LI045) ohs-pubstore.labour.alberta.ca/li045

Workplace Harassment and Violence Prevention Plan Samples and Template ohs-pubstore.labour.alberta.ca/li045tmp

3.4.7 OHS Code Part 29 – Workplace Hazardous Materials Information System (WHMIS)

Part 29 of the OHS Code applies to all work sites where hazardous products are used, handled, stored or made. The employer must ensure:

- safety data sheets for the products are received when the products are purchased and available to workers at the work site,
- products have WHMIS labels applied to the containers, and
- workers receive WHMIS training that complies with section 397 of the OHS Code.

Refer to Part 29 of the OHS Code for further details.

For more information

WHMIS – Information for Workers (CH007) ohs-pubstore.labour.alberta.ca/ch007

WHMIS – Information for Employers (CH008) ohs-pubstore.labour.alberta.ca/ch008

National portal for WHMIS information www.WHMIS.org

3.5 Alberta Building Code

Alberta Municipal Affairs sets standards to provide a safe environment for building occupants. Part of the mandate of Alberta Municipal Affairs includes regulations for the use of building materials containing asbestos and permitting for building construction or demolition. The need for a building permit should be discussed directly with Alberta Municipal Affairs or an agency accredited by Alberta Municipal Affairs to issue building or demolition permits.

An owner who is proposing to alter or demolish a building must notify the permitting body having jurisdiction that asbestos abatement plans and specifications have been submitted to Alberta Labour and Immigration and when the work is completed. Safety Code officers from Alberta Municipal Affairs will need to confirm that any asbestos-containing materials have been addressed by the owner of the building prior to issuing a renovation or demolition permit and may contact Alberta Labour and Immigration for confirmation that OHS legislation requirements have been complied with.

While a summary of Building Code requirements is provided in this section, refer to the Alberta Building Code for the specific requirements.

Items that should be considered for abatement projects in the context of the Alberta Building Code:

Additions/Renovations

- Where asbestos-containing building components are removed, equivalent replacements such as fire barriers may be required.
- Impact on exits during the abatement project, e.g. a second floor exit may be blocked off while abatement occurs on the floor below.

	• Operation of existing fire suppression systems. • Impact on electrical systems and emergency lighting or alarm systems while the abatement project is in progress. • Impact on building ventilation systems. Asbestos-containing materials are not allowed in ventilation systems in a form or condition where asbestos fibres could enter the supply or return air systems.
Demolition	• A fire safety plan must be developed for the site. • Proof that asbestos-containing materials have been removed must be provided. • Preventing the spread of contamination to other buildings must be considered.

In all cases, the OHS legislation must be followed.

Fire safety and protection of the public during construction, alteration, or demolition of buildings must be addressed during asbestos abatement projects. Exiting, fire alarm systems, sprinkler systems, hose and standpipe systems, and ventilation systems must remain operational for portions of the building that are to be occupied during an asbestos abatement project. Alternative measures may be required if this is not possible.

3.6 Waste packaging, transport and disposal

The OHS Code requires that asbestos waste is stored, transported and disposed of in sealed containers that are impervious to asbestos and asbestos waste. The focus of the OHS legislation is the protection of workers who handle and transport the waste, while environmental legislation regulates the disposal requirements. More information on work procedures for asbestos waste disposal are provided in Chapter 5.

Alberta Environment Dangerous Goods Emergencies has published a transportation guidance document on transporting asbestos waste. This document is meant to serve as a guide to certain parts of the Transportation of Dangerous Goods (TDG) Regulations.

In addition to TDG Regulations for transportation, employers and workers transporting asbestos waste must comply with Alberta OHS legislation. Additional employer obligations include:

- Establishing safe work procedures to minimize worker exposure during loading, unloading and in the case of a spill. This includes the use of administrative controls such as ensuring windows are up and air supply to the cab is shut off during loading, the selection and use of appropriate

personal protective equipment, and methods/facilities for decontaminating workers and equipment if required.

- Ensuring workers have and use the required personal protective equipment.
- Ensuring workers are trained in the safe work procedures and informed of the health hazards associated with asbestos exposure.
- Possessing the necessary equipment to deal with a spill such as a shovel, a broom, wetting agent, protective clothing, a supply of six mil thick polyethylene bags and tape.

TDG legislation also requires that:

- Bags are marked with a dangerous goods label, shipping name, and UN number.
- The shipment vehicle is placarded.
- The vehicle operator has a valid Certificate of Training issued by the operator's employer (a TDG training course is usually taken).
- Asbestos is transported as directly as possible to the disposal site.
- Asbestos is not transported with any other cargo in the same vehicle.
- Asbestos is not mixed with other types of waste.
- Asbestos is not transported in a compaction type of waste haulage vehicle.

For more information

Guidelines for the Disposal of Asbestos Waste open.alberta.ca/publications/guidelines-for-the-disposal-of-asbestos-waste

Transportation of Asbestos as a Waste
www.transportation.alberta.ca/Content/docType272/Production/asbestos.pdf

Chapter 4 Management of Asbestos at the Work Site

The first step to managing asbestos is to conduct a building survey to confirm the location of asbestos-containing materials, the types of asbestos present and the condition of the materials. In situations where a building was constructed prior to 1980, the building survey is an important step prior to the start of any renovation or demolition work. However, asbestos has been found in buildings constructed after 1980 into the early 1990s.

If asbestos-containing materials are identified and exposure is occurring or is likely to occur, corrective action must be taken. In deciding which actions provide the most efficient long-term solution, consideration should be given to the condition of the asbestos-containing materials, the location of these materials, their function and the cost of the proposed method for controlling asbestos exposure.

There are four basic approaches to controlling exposure:

1. **Removal** – asbestos-containing materials are completely removed and properly disposed of.

2. **Encapsulation** – asbestos-containing materials are coated with a bonding agent called a sealant.

3. **Enclosure** – asbestos-containing materials are separated from the building environment by barriers.

4. **Management Plan** – the area is inspected periodically for changes in exposure potential and maintenance staff are correctly notified and trained to deal with the asbestos-containing materials. A management plan can be used to deal with asbestos-containing materials that do not pose a risk or for materials remaining after remedial actions have reduced the potential for exposure.

Removal, encapsulation and enclosure are corrective methods and can be used separately or in combination. Complete removal eliminates the source of exposure and therefore offers a permanent solution. Enclosure and encapsulation are containment methods that do not remove the potential source of asbestos exposure. If asbestos-containing materials remain in place (even if enclosure or encapsulation have been implemented), a management plan is required for the building. Since asbestos-containing materials remain within a building following enclosure or encapsulation, these approaches should be considered as temporary control measures. The expected length of time before a building is to be demolished or undergo major structural changes will be a factor in deciding which method to use. If a building is later renovated or demolished, encapsulated and enclosed asbestos-containing materials must be removed and disposed of by acceptable methods.

The following sections present detailed explanations of each of the approaches to controlling exposure.

4.1 Removal

During removal, all asbestos-containing materials are taken off the underlying surface and collected and placed in containers for burial at an approved waste disposal site. This process is the most expensive control method in the short term and may require interruption of building activities. Removal is a necessary prerequisite for demolition of a building containing asbestos-containing materials or when planned renovations will disturb the asbestos.

Fireproofing material that has been removed must be replaced to maintain compliance with fire and building codes (except in the case of a building that is to be demolished). If the asbestos-containing materials fulfilled either an insulating or an acoustical function, the replacement material should have similar characteristics.

Where asbestos had been used to protect structural members from fire conditions, it is important that precautions are taken to maintain an adequate level of fire safety in the building during the removal process and subsequent application of fire protection materials. A registered architect and/or professional engineer must be retained to assist in the development of plans and specifications for the overall project. The architect and/or engineer should require site review during the project.

Advantages of removal	• Eliminates the source of the asbestos. • Eliminates the need for an ongoing surveillance program.
Disadvantages of removal	• Usually the most costly and complicated method of controlling exposure. • Usually the most time consuming method. • Replacement with substitute material may be necessary. • Highest potential for worker exposure during removal.
Comments	• Removal is mandatory prior to demolition or renovations. • Removal is more cost effective if combined with renovation or demolition activities.

4.2 Encapsulation

During encapsulation, asbestos-containing materials are coated with a bonding agent called a sealant. Sealants penetrate and harden the material (penetrants) and/or cover the surface of the material with a protective coating (bridging sealants).

Sealants are applied over the surface of the material using airless spray equipment at a low pressure setting. Airless equipment reduces the force of the stream of sealant spray and its impact on the friable asbestos material surface, thus reducing the potential for fibre release during application. Where a sealant is applied, the person doing so must ensure that it penetrates through the material to the underlying support, such as piping. Otherwise, the potential for delamination of the asbestos-containing material due to the additional weight of sealant is increased. In some cases, a test application may be recommended to ensure sufficient penetration of the sealant into the material.

Bridging sealants must form a tough skin that can withstand moderate impact, is flexible and flame retardant, resists deterioration over time and is non-toxic.

Encapsulation should be limited to areas where the asbestos-containing material will not be subject to further damage by contact. Encapsulation should also be limited to material that is capable of supporting the additional weight of the sealant. In addition, the fire rating of the material must be considered before applying a sealant. Encapsulated material needs to be routinely inspected for deterioration or damage. Although the method may be less costly than removal in the short term, the long term cost will be greater due to increased management of the material and removal will eventually be required.

Advantages of encapsulation	• Can be a more rapid and economical method of controlling exposure. • Reduces the potential of fibre release.
Disadvantages of encapsulation	• The asbestos source remains. • If material is damaged or deteriorating, the additional weight of the sealant may cause delamination. • A management system is required. Precautions are necessary to prevent damage during maintenance or removal. • Continuing inspection is required to check for damage to encapsulated surfaces. • Maintenance of damaged or deteriorating encapsulated surfaces is required. • Encapsulated material may be more difficult to remove later.

Comments	• Encapsulation is a temporary only measure – the encapsulated asbestos will eventually require removal. • Encapsulation may require high-risk work procedures, depending on the friability of the material being treated. • Encapsulation is difficult to do where access to the asbestos material is difficult.

4.3 Enclosure

Enclosure requires that a physical barrier be placed between asbestos-containing materials and the building environment. A drywall covering is normally an acceptable enclosure. A suspended ceiling is too easily entered and does not provide a reliable barrier. If a suspended ceiling must be saved, the tiles should be labelled to indicate that asbestos is present behind the tiles and will be disturbed if a tile is removed.

Since the asbestos has not been removed, fibres will continue to be released and will accumulate behind the barrier. If the enclosure is damaged or entered for maintenance, this accumulation may be released into the building environment. Although the enclosure method may be less costly than removal in the short term, the long term cost will be greater due to increased management of the material and removal will eventually be required.

Advantages of enclosure	• May be a rapid, economical, uncomplicated method of controlling exposure.
Disadvantages of enclosure	• The asbestos source remains. • Fibre fallout may continue behind the enclosure. • May be costly if the enclosure disturbs the function of other systems e.g. enclosure may require lighting changes. • A management system is required. Precautions are necessary for entry into the enclosure when performing maintenance or renovation activities. • Continuing inspection is required to check for damage to the enclosure system.
Comments	• Enclosure is a very cost-effective method of repairing damage to mechanical systems.

- Enclosure is a temporary measure only – asbestos-containing materials will eventually require removal.
- Depending on the location and condition of the asbestos, enclosure may be performed using moderate or high-risk work procedures.

4.4 Management plan

When asbestos-containing materials remain in place, the OHS Code requires a code of practice. The code of practice must describe the storage, handling, use and disposal of asbestos. A management plan is a part of the code of practice. The plan should be in writing and address the following:

- inventory of asbestos-containing materials in the building
- inspection frequency and procedures
- training requirements for maintenance staff and others who may come into contact with the materials or work in proximity to the materials
- procedures to follow in the event of damage or other emergency situations
- procedures to follow should the condition of the materials change or work routines alter
- notification procedures for occupants and others in the building
- labelling of asbestos-containing materials
- details for ultimate removal of asbestos
- record of controls implemented
- schedule for future management activities

The cost of a management plan can vary greatly, but may result in a cost savings if work can be deferred to a later renovation or demolition.

Encapsulation, enclosure and management plans allow asbestos-containing materials to remain within the building. It is important to recognize that the risk of hazardous asbestos exposure may increase as a result of changing conditions in the building. For example, materials can be damaged by floods, fires, maintenance, repairs or renovation activities, causing further fibre release. Consequently, a management plan should be implemented to ensure that asbestos is not released as a result of these activities. All persons involved in such activities must be informed that asbestos-containing materials are present and be trained in work procedures to prevent damaging them.

Advantages of a management plan	• Initial cost lowest and minimum disruption to building operation.
Disadvantages of a management plan	• The asbestos source remains. • The potential for exposure may increase over time. • Precautions are necessary to prevent damage during maintenance or renovation activities. • Continuing inspection and re-evaluation are necessary.
Comments	• A management plan may be difficult and costly to implement and enforce. • This is a temporary measure as removal of the material will eventually be required.

Chapter 5 Asbestos Abatement Procedures

5.1 Introduction

Asbestos abatement procedures vary depending on the type, amount and location of the asbestos. In general, the procedures can be divided into three categories – low risk, moderate risk and high risk – according to their potential for generating airborne asbestos fibres.

All procedures follow the same four principles:

1. isolate the work area,
2. protect workers,
3. minimize the release of asbestos fibres, and
4. ensure adequate clean-up and decontamination.

This chapter presents procedures for low-, moderate- and high-risk abatement activities. The information provided should be used as a guide since actual risk levels may vary and, depending on work conditions, the project risk level can change. Site or work conditions may require modification of procedures, therefore a hazard assessment must be performed by a competent person familiar with the work site, asbestos abatement methods and the potential hazards that may be present or may be created during the work. In these cases, alternative work procedures must provide “equal or greater” protection to workers and minimize the release of asbestos into the air. Despite the examples provided in this section, in any work area that may become a “restricted area”, high-risk abatement measures must be incorporated.

5.2 Low-risk abatement activities

5.2.1 Description of projects

Work activities classified as “low risk” have a minimal risk of releasing asbestos fibres into the air. The precautions to adequately protect workers are relatively simple to follow.

Low-risk activities include:

- Installing, disturbing or removing good condition non-friable products without cutting, breaking, sanding or vibrating the materials. This includes handling products such as gaskets (30 cm

diameter and greater), vinyl asbestos floor tile, asbestos-cement products, non-friable millboard (Transite) and asbestos-cement piping.

- Work done in proximity to friable asbestos that does not require contacting the asbestos.
- 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 are controlled.
- The transportation or handling of asbestos-containing materials in sealed containers (waste packaging, transfer).

5.2.2 Equipment

Required equipment should include the following:

- vacuum cleaner fitted with a HEPA filter
- polyethylene drop sheets having a minimum six mil thickness
- six mil thick labelled asbestos disposal bags
- spray bottle or hand pump garden sprayer to wet asbestos
- barriers and warning signs
- hand powered tools for abatement work
- mops and/or rags and water for clean-up
- worker decontamination supplies
- fire extinguisher
- appropriate first aid kit

5.2.3 Personal protective equipment

Workers who may be exposed to asbestos fibres should wear all of the following:

(1) Disposable coveralls over work clothing to prevent contamination of the work clothing.

(2) a NIOSH-approved half-mask air-purifying respirator equipped with a P100 (oil Proof), R100 (Resistant to oil) or N100 (Not resistant to oil) particulate filter. **Disposable single-use respirators must not be used**.

(3) Other personal protective equipment, such as safety boots, hard hats, gloves and safety glasses, appropriate to the other hazards present at the work site must be used. If other airborne contaminants are also present, respiratory protective equipment appropriate to those hazards is necessary.

5.2.4 Pre-job planning

(1) Conduct a work site-specific hazard assessment.

(2) Establish the work procedures to be followed and assemble the equipment required to perform the job.

(3) Submit a completed Asbestos Project Notification Form to Alberta Labour and Immigration at least 72 hours before workers may be exposed to airborne fibres, including set-up operations that may release fibres (see Section 3.4.2 **Notification of project start-up**).

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

(5) Ensure all HEPA-filtered equipment has been tested on site before the job commences (see Section 5.6.1).

(6) Develop procedures to deal with emergencies such as fire or injury. These must be in place prior to work starting.

5.2.5 Work site preparation

(1) Review the work site-specific hazard assessment with the workers.

(2) Appropriate barriers and warning signs should be positioned in areas where access needs to be restricted until the work is completed.

5.2.6 Work procedures

(1) Localized wetting of the material should be done to minimize fibre release. Dry removal of asbestos-containing materials is not permitted. If the material cannot be wetted, the work must be classified as moderate risk and moderate-risk abatement procedures followed.

(2) Remove visible dust on work surfaces with a damp cloth or a vacuum cleaner fitted with a HEPA filter.

(3) Where necessary, use plastic drop sheets or similar materials to prevent the spread of asbestos dust to other work areas.

(4) 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.

Use of hand tools to remove wall boarding containing asbestos

Cutting asbestos-containing wall board by hand

Cutting asbestos-containing pipe by hand

(5) No person may eat, drink, smoke or chew gum or tobacco at the work site except in a designated clean area. Workers must remove protective equipment and clothing and clean their hands and faces prior to any of these activities.

5.2.7 Decontamination

(1) Immediately upon completing the work:

(a) clean up dust and waste by wet sweeping, damp mopping, or vacuuming with a vacuum cleaner fitted with a HEPA filter, and

(b) ensure drop sheets are wetted, folded in on themselves to contain dust, properly bagged and disposed of as asbestos waste.

(2) Before leaving the work area:

(a) Clean protective equipment and clothing using a vacuum cleaner fitted with a HEPA filter, or wipe with a damp cloth.

(b) Place protective clothing, if it will not be laundered and re-used, in a sealable container and dispose of it as asbestos waste. Clothing and protective equipment that is to be reused must be laundered and cleaned using proper procedures.

(c) 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 or using a washroom.

(3) Do not use compressed air to clean up or remove dust or materials from work surfaces or clothing. Techniques that generate excessive fibre levels should be avoided. Cleaning must be done with a vacuum cleaner fitted with a HEPA filter or by wet sweeping or damp mopping.

5.2.8 Disposal

(1) Place asbestos waste into a sealable container labelled as containing asbestos waste. This includes used protective equipment that will not be laundered.

(2) 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.

(3) Remove containers from the work area (see Section 5.5 for more information).

5.2.9 Air monitoring

Air monitoring is useful in determining typical exposure levels during the performance of low-risk abatement activities.

- Air monitoring results should be below 0.01 f/cc during all phases of the work. Once air monitoring has confirmed this, in accordance with the hazard assessment for the work, further air monitoring may not be required.
- In the case of low-risk projects, a baseline measurement (measurement of air quality normally present in the workplace before asbestos is disturbed for the abatement work) should be taken in addition to monitoring during the work, as required.

5.2.10 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. Keeping records of inspections is recommended.

5.3 Moderate-risk abatement activities

5.3.1 Description of projects

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

- Using non-powered hand tools to cut, shape, drill or remove a non-friable manufactured product containing asbestos if water is not used to control fibre release.

- Using a mechanical or electrically powered tool fitted with a HEPA filter dust collector to cut, shape or grind non-friable manufactured products containing asbestos.

- Removing all or part of a false ceiling to gain access to a work area and where friable asbestos-containing materials are, or are likely to be, lying on the surface of the false ceiling.
- Removing, encapsulating, enclosing or disturbing minor areas (less than 0.09 m^2 or 1 sq. ft.) of friable asbestos-containing material during the repair, alteration, maintenance, demolition or dismantling of a building, structure, machine, tool or equipment, or parts of it.
- Performing glovebag operations (see Section 5.5.9 for detailed information).
- Dry buffing and stripping vinyl asbestos tile.
- Renovation or hand demolition involving drywall joint compound, block mortar, stucco or brick mortar products containing asbestos.
- Removal of 9.3 m^2 (100 sq. ft.) or less of contiguous ceiling tile containing asbestos or sheet vinyl flooring/vinyl floor tiles having an asbestos backing.
- Dry removal of non-friable asbestos material where the material may be cut, broken or otherwise damaged during removal.

5.3.2 Equipment

Required equipment should include the following (there may be some adjustments if a containment is used):

- vacuum cleaner fitted with a HEPA filter
- polyethylene sheeting having a minimum six mil thickness
- six mil thick labelled asbestos disposal bags
- spray bottles or hand pump garden sprayers to wet asbestos
- barriers and warning signs
- appropriate tools
- mops, rags, brushes, water and other supplies for clean-up
- worker decontamination supplies
- fire extinguisher
- appropriate first aid kit

5.3.3 Personal protective equipment

(1) Workers exposed to asbestos fibres should wear protective clothing that:

(a) is made of material such as Tyvek™ that resists penetration by asbestos fibres,

(b) covers the body and fits snugly at the neck, wrists, and ankles,

(c) covers the head and feet (laceless rubber boots are recommended), and

(d) can be immediately repaired or replaced if torn.

The wearing of disposable coveralls is recommended. Street clothes should not be worn under disposable coveralls if work is conducted inside a containment.

(2) A NIOSH-approved respirator equipped with a P100 (oil Proof), R100 (Resistant to oil) or N100 (Not resistant to oil) particulate filter must be worn. The respirator selected must have a sufficient protection factor to provide adequate protection for the fibre levels encountered during the project. **Disposable, single use respirators must not be used**.

(3) Other personal protective equipment such as safety boots, hard hats, gloves and safety glasses appropriate to the other hazards present at the work site must be used. If other airborne contaminants are also present, respiratory protective equipment appropriate to those hazards is necessary.

5.3.4 Pre-job planning

(1) Conduct a work site-specific hazard assessment.

(2) Establish the work procedures to be followed and assemble the equipment required to perform the job.

(3) Submit a completed Asbestos Project Notification Form to Alberta Labour and Immigration at least 72 hours before workers may be exposed to airborne fibres, including set-up operations that may release fibres (see Section 3.4.2 **Notification of project start-up**).

(4) Ensure all HEPA-filtered equipment has been tested on site before the job commences (see Section 5.6.1).

(5) Ensure workers are adequately trained in the hazards and proper methods of working with asbestos.

(6) Ensure that building occupants, tradespeople and other workers in the building are notified in advance, of the location, duration and type of work to be performed, as appropriate.

(7) Develop procedures to deal with emergencies, such as a fire or injury, which must be in place prior to work starting. Where a containment is used for moderate-risk work, a worker should be stationed outside the containment to respond to emergencies and contact rescue personnel if needed.

5.3.5 Work site preparation

(1) Review the work site-specific hazard assessment with workers.

(2) Barriers and warning signs should be posted in areas where access to unauthorized persons needs to be restricted until the work is completed. The signs should read as follows and include the name of a contact person on site.

Caution Asbestos Dust Hazard	Avoid Breathing Dust Wear Protective Equipment
Breathing Asbestos Dust May Cause Cancer	Entry is Prohibited Except to Authorized Persons
Eating, Drinking and Smoking are Prohibited in this Area	

(3) Clearly mark the boundary of the work area by placing barricades, fencing or similar structures around it. Place a drop sheet under the work area.

(4) Prior to starting any work that is likely to disturb friable asbestos-containing materials, the materials must be cleaned by damp wiping or vacuuming with a vacuum cleaner fitted with a HEPA filter.

(5) All air handling and ventilation systems that could cause asbestos fibres to be distributed, disturbed or become airborne during the work should be shut down before work begins. They should be isolated to prevent accidental starting.

(6) Lock out and isolate all electrical and mechanical equipment within the work area.

(7) Electrical power for abatement work should be supplied through a ground fault circuit interrupter (GFCI).

(8) If required, a containment should be constructed using six mil thick polyethylene sheeting. For a moderate-risk project, the containment should be less than 9.3 m^2 (100 sq. ft.) in size. A HEPA-filtered exhaust unit should be connected to the containment to provide negative pressure for the duration of the project. If a larger containment is needed, the project may require re-classification as high risk. (See Section 5.4.5 regarding site preparation of larger containments.)

(9) A worker decontamination room should be attached to the containment.

5.3.6 Work procedures

(1) Wet material thoroughly before and during the work, unless such wetting creates a hazard to workers. Material should be wet but not saturated, as this may cause delamination or disintegration of the material.

(2) Use polyethylene drop sheets and barriers to prevent the spread of asbestos-containing dust to other work areas.

(3) Do not allow asbestos waste to accumulate or dry out before final bagging.

(4) Once abatement work is complete, seal all rough edges or surfaces containing asbestos-containing material at the edges of the work area with an encapsulant.

(5) If a containment is constructed, apply a slow-drying sealant such as glue spray to its surfaces prior to dismantling it. This application ensures that non-visible asbestos fibres are bonded to the surfaces of the containment and cannot become airborne.

(6) If a containment is used, complete an aggressive final air test after a minimum drying period of four hours. (See Chapter 7 for air monitoring procedures.)

5.3.7 Decontamination

(1) Immediately upon completing the work:

(a) clean up dust and waste by wet sweeping, damp mopping or vacuuming with a vacuum cleaner fitted with a HEPA filter, and

(b) ensure drop sheets are wetted, folded in on themselves to contain dust, properly bagged and disposed of as asbestos waste.

(2) Before leaving the work area:

(a) Clean protective equipment and clothing before removing it from the work area using a vacuum cleaner fitted with a HEPA filter or wipe with a damp cloth.

(b) Place protective clothing, if it will not be laundered and re-used, in a sealable container and dispose of it as asbestos waste. Clothing and protective equipment that is to be reused must be laundered and cleaned using proper procedures.

(c) 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 or using a washroom.

(3) Do not use compressed air to clean up or remove dust or materials from work surfaces or clothing. Techniques that generate excessive fibre levels should be avoided. Cleaning must be done with a vacuum cleaner fitted with a HEPA filter, or by wet sweeping or damp mopping.

5.3.8 Disposal

(1) Place asbestos waste into a sealable container labelled as containing asbestos waste. This includes used protective equipment that will not be laundered.

(2) 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.

(3) Remove containers from the work area (see Section 5.5 for more information).

5.3.9 Air monitoring

Best practices for air monitoring require that samples are taken prior to work starting (baseline or background samples), during abatement activities and upon completion of the job if required. Air monitoring must be performed by competent personnel following the methods specified in the OHS legislation.

Sampling should include the following:

- **Before work starts in the work areas** – background samples to establish baseline airborne fibre levels.
- **On a daily basis** – outside the enclosure, if one is used, or adjacent to work activities if there is no enclosure.
- **On a daily basis** – personal sampling of workers conducting removal. Ensure results are within acceptable limits for the respiratory protection selected. Personal samples should be collected at least daily, but may need to be collected more frequently depending on work conditions. Samples should be analyzed and results provided to workers within 24 hours.
- **Before the enclosure, if one is used, is dismantled.**

The following criteria should be applied when reviewing results:

- If fibre levels inside the work area exceed the OEL, work must stop and work procedures re-evaluated. If high levels continue, work must stop until the reasons for the high levels are identified and corrected, or the work re-classified to high risk.

- If fibre levels outside the work area approach 50 per cent of the OEL, work must immediately stop until the reasons for the high levels are identified and corrected. The work area may need to be reclassified as high risk.

- Final air monitoring test results must be less than 0.01 fibres per cubic centimetre (f/cc). Aggressive sampling techniques should be used for final air sampling if a containment is used (see Chapter 7).

5.3.10 Site inspection

A competent worker should perform a visual inspection of the integrity of the containment, if one is used, prior to work commencing. If the project continues for more than one work shift, the containment should be checked for damage at the time of the shift change and any damage detected should be repaired immediately.

Upon completion of the work, the work area should be visually inspected by a competent worker to ensure that all visible asbestos-containing debris has been properly cleaned up and removed. Records of inspections completed should be kept.

5.4 High-risk abatement activities

5.4.1 Description of projects

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


Typical high risk abatement project

- Removing, encapsulating or enclosing areas 0.09 m^2 (1 sq. ft.) in size or greater of friable asbestos-containing materials during the repair, alteration, maintenance, demolition or dismantling of a building, structure, machine, tool or equipment, or part of it.
- Cleaning, maintaining or removing air-handling equipment in buildings where sprayed fireproof asbestos-containing material has been applied to airways or ventilation ducts.
- Repairing, altering or dismantling a boiler, furnace, kiln or similar device, or part thereof, where asbestos-containing materials have been used or applied.
- Demolishing, dismantling, altering or repairing any building or structure, or part of it, in which insulating material containing asbestos was used or in which asbestos products were manufactured.
- Removal of more than 9.3 m^2 (100 sq. ft.) of contiguous ceiling tile containing asbestos or sheet vinyl flooring having an asbestos backing.
- Dry removal of friable asbestos-containing material.
- Abatement activities involving any type of project where there is a reasonable chance of the concentration of airborne asbestos exceeding the eight-hour OEL (a “restricted area”).

5.4.2 Equipment

Required equipment should include:

- portable HEPA-filtered exhaust units with extra fuses
- replacement HEPA filters
- flexible or rigid duct
- vacuum cleaners fitted with HEPA filters
- airless sprayer for water dispersion

- electrical extension cords
- portable ground fault circuit interrupter (GFCI)
- garden hose
- hand pump garden sprayer to wet isolated areas
- wetting agent (50 per cent polyoxyethylene ether and 50 per cent polyoxyethylene, or equivalent)
- scrapers, nylon brushes, dust pans, shovels, to remove asbestos
- scaffolds with railings, if required
- duct tape or an alternative tape with similar or better adhesive qualities
- polyethylene sheeting having a minimum six mil thickness
- six mil thick labelled asbestos disposal bags
- barriers and warning signs
- mops and/or rags, water and other supplies for clean-up
- encapsulant for sealing edges
- manometer, pumps and smoke generator
- fire extinguisher
- appropriate first aid kit
- decontamination equipment (including shower, soap, shampoo, hot water tank)
- glue/sealant for use after completion of abatement before final air clearance

5.4.3 Personal protective equipment

Protective equipment required for high risk activities

(1) Workers exposed to asbestos fibres should wear protective clothing that

(a) is made of material such as Tyvek™ that resists penetration by asbestos fibres,

(b) covers the body and fits snugly at the neck, wrists and ankles,

(c) covers the head and feet (laceless rubber boots are recommended), and

(d) can be immediately repaired or replaced if torn.

The use of disposable coveralls is recommended. Street clothes must not be worn under disposable coveralls. Work clothing may be worn under disposable coveralls and will be considered as contaminated.

(2) If contaminated work clothing is to be laundered, it must be vacuum cleaned, wetted down, placed in plastic bags, sealed and labelled prior to being sent to laundry facilities. Machines and facilities equipped with HEPA filters must be used to clean asbestos-contaminated clothing. On-site facilities are preferred. Workers who launder the clothes must be informed of the hazards of asbestos and the precautions required when handling contaminated clothing. Contaminated clothing or towels must not be taken home by workers for laundering.

(3) During high-risk abatement activities, acceptable respiratory protection is, at minimum, a tight-fitting powered air-purifying respirator (PAPR), equipped with a P100 (Oil proof), R100 (Resistant to oil) or N100 (Not resistant to oil) particulate filters. Positive pressure supplied air respirators may be required if wet removal is not possible. In some cases, dual cartridge half- and full-face respirators with high-efficiency filters are acceptable. The appropriate level of respiratory protection can only be determined by conducting air-monitoring tests and calculating the protection factor needed. Where a level of protection lower than PAPR is chosen for a high-risk operation, the suitability of such equipment must be assessed for the duration of the project. If fibre concentrations increase, workers will need to switch to respiratory protective equipment with a higher protection factor. **Disposable single-use respirators must not be used.**

(4) Half-mask air-purifying respirators equipped with a P100 (Oil proof), R100 (Resistant to oil) or N100 (Not resistant to oil) particulate filter can be used for the set-up and dismantling phases of the removal project.

(5) Protective clothing and respiratory protective equipment must be provided for authorized visitors. Authorized visitors will also be required to meet training and other requirements, such as respirator fit testing, before entering the containment.

(6) Other personal protective equipment such as safety boots, hard hats, gloves and safety glasses appropriate to the other hazards present at the work site must be used. If other airborne contaminants are also present, respiratory protective equipment appropriate to those hazards is necessary.

5.4.4 Pre-job planning

(1) Conduct a work site specific hazard assessment.

(2) Establish the work procedures to be followed and assemble the equipment required to perform the job.

(3) Submit a completed Asbestos Project Notification Form to Alberta Labour and Immigration 72 hours before workers may be exposed to airborne fibres, including set-up operations that may release fibres (see Section 3.4.2 **Notification of project start-up**).

(4) Obtain the necessary building permit(s) by contacting the municipality or accredited agency that issues building permits.

(5) Have the following documentation available:

(a) worker asbestos training certificates

(b) required permits

(c) written lock-out procedures

(d) proof of worker training

(e) names of supervisory personnel

(f) shop drawings of work area layout/decontamination facility

(g) construction schedule

(h) certification of HEPA-filtered equipment

(i) code of practice for respiratory protection

(6) Ensure all HEPA-filtered equipment has been tested on site before the job commences (see Section 5.6.1).

(7) Ensure workers are adequately trained in the hazards and proper methods of working with asbestos.

(8) Workers must have successfully completed a course of instruction approved by the Director of Occupational Hygiene and be in possession of their original valid asbestos worker certificate if they are entering a “restricted area”.

(9) Ensure that building occupants, tradespeople and other workers are notified, in advance, of the location, duration and type of work to be performed.

(10) Develop procedures to deal with emergencies such as a fire or injury, which must be in place prior to work starting. One worker, who is appropriately trained, must be stationed outside the containment to respond to emergencies and contact rescue personnel if required. Workers inside the containment should have some form of communication with the worker outside the containment. Emergency exits should be clearly marked, both inside and outside of the containment.

5.4.5 Work site preparation

(1) Review the work site specific hazard assessment with the workers.

(2) Isolate the asbestos work area by placing signs around it warning persons not to enter the area unless authorized to do so. The signs should include the name of a contact person on site and read as follows:

Caution Asbestos Dust Hazard	Avoid Breathing Dust Wear Protective Equipment
Breathing Asbestos Dust May Cause Cancer	Entry is Prohibited Except to Authorized Persons
Eating, Drinking and Smoking are Prohibited in this Area	

(3) Clearly mark the boundary of the work area by placing barricades, fencing or similar structures around it.

(4) The setup process may result in worker exposure to asbestos such as when installing upper seals in a ceiling space containing spray-on fireproofing or building a containment in an asbestos-contaminated environment. The use of appropriate personal protective equipment and airborne fibre generation control must be used during the setup phase where this hazard is present.

(5) The entire work area should be enclosed to prevent the escape of asbestos fibres. Use polyethylene sheeting at least six mil thick, or a similar impervious material, held in place with heavy duty tape and adhesive. It may be necessary to erect a temporary wooden or metal frame to which the plastic barrier can be attached. All joints must overlap by approximately 30 cm and be double-taped to ensure the area is completely sealed off.

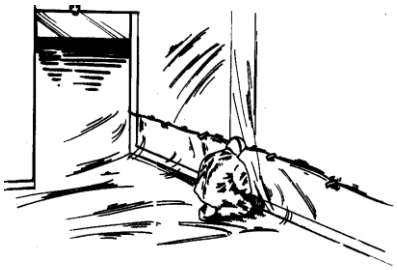
(6) A HEPA-filtered exhaust unit must be installed to create a negative air pressure of approximately 5 Pascal (gauge) or 0.02 inches of water column within the enclosure relative to the surrounding area. The exhaust unit must provide at least four complete air changes per hour. In this arrangement, the major and usually only route of air into the removal area is through the decontamination unit. The OHS Code requires an employer to minimize the release of asbestos into the air. Maintaining negative pressure for asbestos containments is one way to help ensure the release of asbestos fibres is minimized. The pressure difference of 5 pascals or 0.02 inches of water column is the common specification for asbestos containments in both Canada and the United States. Relying on visual indicators of pressure difference, such as flap movement, does not provide a reliable understanding of the negative pressure in the containment. Sudden pressure changes, containment breaches and work activities can all have immediate and unpredictable effects on the negative pressure of an asbestos containment, which may not be obvious from visual cues. A manometer or equivalent should be available and used to monitor negative pressure.

(7) A negative air pressure in the enclosed space relative to the surrounding area must be maintained so that air flow is always from clean outside areas into the contaminated area. Exhaust air from the enclosure should be discharged to the outdoors through a HEPA filter. 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 or breathing air compressors, the discharge must be routinely monitored for airborne asbestos. The OHS Code requires the concentration of asbestos in air from a recirculating air system does not exceed 10 per cent of its OEL. The air flow pattern in the work area must ensure that the clean room and shower room of the decontamination facility are safe for workers who are not wearing respirators.

(8) The HEPA-filtered exhaust unit must remain in continuous operation to maintain negative pressure in the enclosure while the removal is in progress and during clearance procedures after the removal. Negative pressure must be maintained until site decontamination work is complete and air-monitoring tests confirm fibre levels are low enough to permit dismantling of the enclosure.

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

(10) 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. Where practical, the discharge point for any exhaust unit should be to the outside air, away from other work areas, air conditioning inlets or breathing air compressors.



Containment Area

(11) If a complete enclosure cannot be constructed, cover windows and doors leading into the area with a plastic sheeting barrier. Cut the plastic sheeting so it overlaps the framework of the window

or door by 10 to 15 cm. Ensure a good seal by wiping the area around the window or door with a moist cloth so that the tape sticks.

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

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

(14) Use a layer of seamless or seam-sealed, fibre-reinforced polyethylene sheeting on the floor of the containment, covered by a second layer of at least six mil thick 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 containment to prevent leaks of asbestos-contaminated water running outside of the containment. Extra strength in the containment floor can be achieved by running the double layers of plastic at 90 degrees to one another.

(15) Power sources with ground fault circuit interrupters must be used to protect workers against electric shock from electrical equipment operated in the presence of water inside the enclosure. All existing electrical circuits or lighting must be physically locked out to prevent unintentional start-up of electrical equipment.

(16) Remove all movable furniture, equipment and fittings from the asbestos removal area. Immovable items should be carefully wrapped and sealed in suitable plastic sheeting so they are effectively isolated from the removal area. In areas of heavy traffic or high wear, additional physical barricading may be necessary.

(17) Where set-up operations may release asbestos fibres, all personnel in the removal area must wear appropriate personal protective equipment, including respiratory protective equipment suitable for asbestos. All other high risk preparation, such as isolation of the work area, shut down of the heating, ventilation and air conditioning system, installation of HEPA-filtered exhaust units and the worker decontamination facility must be completed first.

(18) The need for appropriate respiratory protective equipment is particularly important when removing barriers or partitions such as false ceilings. Where asbestos-containing materials have fallen onto a false ceiling, the ceiling should only be removed by following at least the procedures required during moderate-risk abatement activities. Any utility or service line which hangs down into the ceiling space should be sealed up if it cannot be sealed from outside the removal area.

(19) Care should be taken to ensure that asbestos dust cannot escape at points where pipes and conduits leave the removal area. Additional attention to sealing and compliance testing is required at these points, particularly if service riser shafts pass through the removal area.

(20) When planning and building an asbestos removal containment, special consideration must be given to the impact on the fire rating of the building and to the provision of firefighting facilities and emergency lighting.

(21) Power, telephone and fire alarm cables may lie beneath asbestos insulation. To prevent the cables from being damaged or creating a hazard to workers, the cables must be clearly identified prior to commencing any cutting. Cables should be re-routed or disabled during the removal period.

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

(23) A decontamination facility must be attached to the work area to allow workers to remove contaminated clothing and properly shower before leaving the area. The decontamination facility consists of a series of connected rooms separated by airlocks (see Section 5.4.7). The use of this facility helps prevent the spread of asbestos beyond the contaminated area. An additional decontamination facility should be attached to the containment for waste transfer. Waste removal from the transfer area should be conducted at separate times from abatement work to avoid a pressure drop within the containment.

5.4.6 Work procedures

(1) Unless wetting the asbestos-containing materials creates a more imminent hazard, asbestos-containing materials must be handled and removed only when wet. Surfactants and wetting agents can be used with water to assist in thoroughly wetting asbestos-containing materials. Surface soaking with a spray jet is useful for small areas and where total saturation is not practicable. 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.**

(2) **Dry sweeping must NOT be used to clean up waste materials. Compressed air must NOT be used for any cleaning purpose.**

(3) Exhaust air from the containment must pass through a HEPA filter and be discharged outdoors.

(4) Vacuum cleaners used to clean up asbestos materials must be fitted with HEPA filters.

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

(6) All surfaces exposed to asbestos fibres must be cleaned by HEPA vacuum cleaning or damp wiping.

(7) If asbestos is encapsulated, the sealant must penetrate the material and effectively bind the asbestos fibres together.

(8) After completing the removal of asbestos-containing materials, exposed surfaces must be washed or HEPA vacuum cleaned and treated with a sealant.

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

(10) Workers must not eat, chew gum or tobacco, drink or smoke in the asbestos removal area. Workers must leave the work area and fully decontaminate themselves prior to performing these activities or using a washroom.

(11) 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 removal area to a minimum.

(12) Power tools used in asbestos removal activities should be selected carefully, since not all types are appropriate for use in dusty and wet conditions. In general, power tools driven by compressed air or hand tools are preferable.

5.4.7 Decontamination

(1) For high-risk removal jobs, the only satisfactory method of providing an appropriate decontamination facility is with a mobile or specially constructed on-site unit. The decontamination facility is located immediately adjacent to, and joined to, the enclosed asbestos removal area. The facility is divided into three distinct rooms: dirty room, shower room and clean room.

(2) The decontamination facility's three rooms are separated from one another by an airlock or buffer zone. This airlock defines the boundary between each segment of the decontamination facility. The airlock allows personnel to access the removal area and restricts the flow of air between areas. Partitions between rooms in the decontamination facility must be self-closing so that each room functions as an airlock. These partitions are normally constructed of overlapping sheets of heavy weight plastic suspended to form a curtain.

(3) Generally, no more than 10 persons should use one decontamination facility so that adequate access to shower and cleaning facilities is provided and line ups are avoided.

(4) The dirty room should have provision for:

(a) hosing down contaminated clothing and footwear or cleaning it with a vacuum cleaner fitted with a HEPA filter,

(b) storage of contaminated clothing and footwear,

(c) disposal containers for waste materials, and

(d) air flow towards the removal area.

(5) The shower room should have provision for:

(a) a shower area with an adequate supply of soap, shampoo and hot and cold water, and

(b) air flow towards the dirty decontamination area.

(6) 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 of clean clothing and towels,
- separate storage of clean and dirty towels, and
- air flow towards the shower and dirty area.

(7) All water from the decontamination facility should pass through a 10 micrometre water filter before it passes into the sewer mains.

(8) The worker enters the clean room and removes all street clothes and personal belongings, leaves these in the clean room and changes into clean work clothes. A respirator is put on and checked for fit and proper operation. The worker then passes through the shower room into the dirty room. Alternatively, work clothing which is worn throughout the job may be stored and put on in the dirty room. Respirators, however, must always be donned in the clean room.

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

(10) In the dirty room, the worker removes all protective clothing and equipment except the worker's respirator. Any waste material must be placed in plastic bags or bins for disposal.

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

(12) After showering, the worker enters the clean room, dries off and dresses in street clothes. The respirator is then thoroughly cleaned, disinfected and stored until required. Respirator cartridges should be discarded after each work shift (if appropriate, reused during a work shift if workers leave the containment for breaks, as long as the cartridge can be kept dry).

(13) Hand tools and supplies should be kept in an equipment transfer room associated with the dirty room. This room is also used when transferring asbestos waste containers or equipment that has been decontaminated.

(14) In circumstances where the decontamination unit cannot be located adjacent to and joined to the removal area, procedures to minimize asbestos contamination must be implemented. Usually this requires workers to discard their coveralls, overshoes or other outer garments in an isolated changing area attached to the removal area enclosure and thereafter change into fresh outer clothing for the journey to the decontamination facility. Following initial cleaning, the worker enters the dirty room, removing coveralls, boots and any other clothing. While still wearing a respirator, the worker proceeds to the shower room and follows the personal decontamination procedures described in point (11). Following this shower, the worker passes through the second airlock or buffer zone into the clean change area. Here the worker changes into work or street clothing stored in the locker provided.

(15) A final decontamination, including wash down and cleaning of the enclosure area with a vacuum cleaner fitted with a HEPA filter, removes all visible signs of asbestos contamination from the enclosure and equipment. This decontamination must be completed before dismantling the enclosure barriers.

(16) Glue bonding or spraying with an appropriate sealant should be done throughout the containment to seal down dust and fibre undetected during the final inspection following abatement activities. Following confirmation of effective decontamination of the space by final air tests, the containment can be dismantled. All dismantling work should be completed following at least low-risk work procedures.

(17) All tools and electrical equipment, such as vacuum cleaners and power tools, must be left in the removal area until completion of the removal job. Before the equipment is removed, it should be vacuumed thoroughly and all accessible surfaces wiped with a damp cloth. Where decontamination is not possible, the item should be plastic wrapped and sealed and only opened when inside the containment area of another asbestos project.

(18) On completion of asbestos removal jobs, all tools and equipment not needed for the final clean up should be thoroughly washed and removed from the work site.

5.4.8 Disposal

(1) Waste material from within the enclosed asbestos work area must be placed in impervious containers (such as doubled polyethylene bags at least six mil thick), sealed and clearly labelled to indicate that:

(a) they contain asbestos,

(b) asbestos is carcinogenic, and

(c) asbestos fibres should not be inhaled.

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

(2) 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 contaminant area/transfer room.

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

(4) A continuous clean-up and disposal program must be in place to prevent unnecessary accumulation of asbestos-containing waste materials at the work site. At the end of each work shift, all asbestos waste material must be properly contained. Prior arrangement must be made with appropriate authorities to deliver asbestos-containing waste to assigned dump sites. Transport drivers must be informed of the precautions that must be taken. Transport vehicles may be required to carry signs or placards specifying the nature of the cargo (see Section 3 and the *Transportation of Dangerous Goods Act*).

(5) Disposal sites must conform to provincial and municipal requirements (refer to Section 3 on legislation and contact the Waste Management Branch of Alberta Environment and Parks for more information).

5.4.9 Air monitoring

Air sampling to determine airborne asbestos fibre concentration is required before and during the abatement work, and prior to removal of the enclosure. All air sampling must be completed by competent personnel following methods specified in the OHS legislation. Where possible, results should be made available to workers on the same day or a maximum of 24 hours after sampling. More information on sampling procedures is provided in Chapter 7.

Sampling should include the following:

- **Before work starts in the work areas** – background samples to establish baseline airborne fibre levels.

- **On a daily basis outside the enclosure** – sample when there are unprotected workers in the immediate vicinity of the enclosure. In some cases, sampling may be required in other areas such as the floors above or below, or in adjacent rooms, depending on the set-up of the work site and occupancy of these areas.

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

- **On a daily basis in the clean room** – sample during bulk removal operations. Sampling must cover at least half of the work shift and at least one shift of decontamination. Samples must be analyzed and results provided to workers within 24 hours.

- **Before the enclosure is dismantled** – the air inside the enclosure must be sampled. At a minimum, one sample should be collected for every 450 m^2 of enclosure area to determine suitability for re-occupancy. The final air test should be completed using aggressive sampling techniques.

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

- If fibre levels inside the containment exceed the protection factor (see Section 6.1.3) of the type of respiratory protective equipment being used, work must stop until appropriate respirators are supplied and airborne fibre levels can be controlled.

- If fibre levels measured outside the containment or in the clean room exceed 50 per cent of the OEL, work practices and the containment structure should be reviewed. If elevated levels continue, work must stop until the reasons for the high levels are identified and corrected. If fibre levels outside the containment approach the OEL, work must immediately stop until the reasons for the high levels are identified and corrected. Fibre levels outside the work area must never exceed the OEL. If it is anticipated that the outside area has become contaminated, decontamination procedures should be implemented.

- Final air-monitoring test results should be less than 0.01 fibres per cubic centimetre (f/cc) using aggressive sampling techniques. If the final air test fails, the containment cannot be dismantled. The work area should be glue-sprayed again and re-tested.

5.4.10 Site inspection

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

(1) Check the integrity of the removal area enclosure *before* asbestos removal begins and *before* the exhaust units begin operating. If using a smoke test, see Section 5.7.

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

(3) Inspect all equipment used for the removal of asbestos material before the removal job 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.

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

(5) Continuously measure and record, at regular intervals, air pressure differentials between clean and contaminated areas during the abatement project. Pressure differentials should be maintained at a minimum of five pascals (0.02 water column).

(6) 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 clean-up is satisfactory.

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

(8) Records should be maintained for all inspections completed.

5.5 Special cases

Removal of the numerous forms of asbestos-containing products, from various types of facilities, under a wide variety of circumstances, creates the potential for non-standard approaches. In such cases, it is important to remember that the OHS Code requires employers to:

- Minimize the release of asbestos into the air as far as is reasonably practicable.
- Keep the work site clear of unnecessary accumulations of asbestos and waste materials.
- Ensure that the methods used to decontaminate the work area, workers, equipment and protective clothing prevent, as much as is reasonably practicable, the generation of airborne asbestos fibres.

The four basic principles of handling asbestos should always be followed:

1. Isolate the work area.
2. Protect workers.
3. Minimize the release of fibres.
4. Ensure adequate clean-up and decontamination.

Using these principles in conjunction with a hazard assessment performed by a competent person, the detailed information describing low-, moderate- and high-risk procedures can be modified to make asbestos abatement faster and more economical without sacrificing workers' health and safety.

5.5.1 Vinyl floor tiles

Vinyl floor tiles must be removed prior to the demolition of a building. Asbestos fibres in floor tiles are bound within a vinyl matrix. Floor tiles usually contain relatively little asbestos (approximately 10 per cent by weight) and present low risk of release into the environment during removal as long as proper procedures are followed. Before removal starts, floor tiles should be sampled and checked for backing materials which may also contain asbestos. The backing materials usually are friable and contain considerably more asbestos. Sampling for adhesives and floor-leveling compound should also be completed. If these materials are present, moderate or high-risk removal procedures may be required, depending on the amount and concentration of asbestos in the materials.

Only hand tools, such as ice scrapers, should be used during floor tile removal. Low-risk work procedures are adequate if no power tools or abrasive methods such as sanding are used during the removal. Pre-wetting or flooding of the tiles in advance of removal will greatly aid in their release from the floor. Mastic used to glue tiles to the floor and leveling compound under the tiles may also contain asbestos fibres. This mastic should be removed using work procedures similar to those used for the removal of floor tiles.

5.5.2 Dry removal

Dry removal should only be done where wetting the asbestos would create unacceptable safety hazards. Examples include working adjacent to electrical power sources that cannot be suitably protected from moisture or working around very sensitive equipment where the risk of water damage is unacceptable.

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

The dry removal area should be continually cleaned to prevent the accumulation of waste. Once debris is removed, the area should be cleaned with a vacuum cleaner fitted with a HEPA filter or by wet wiping if it is safe to do so. Barriers should be inspected regularly to ensure there are no breaks or holes.

Waste must be immediately placed in disposal containers. Where possible, use a high velocity local exhaust system at the point of removal to capture fibres released at the source. Where very small quantities of waste are involved, direct vacuuming with a vacuum cleaner fitted with a HEPA filter will greatly reduce fibre levels.

Since dry removal results in much higher airborne fibre levels within the containment, frequent and more intensive monitoring and more stringent procedures are required to minimize fibre release.

5.5.3 Outdoor removal

Weather conditions will influence whether or not work can be performed, with heat, cold or high winds making work unsafe. Mobile decontamination facilities, special work platforms and other specialized equipment may be required for outdoor removal.

Air samples taken each shift should include the air downwind of the removal area, around workers in the removal area, as well as personal sampling of workers performing the removal. Personal samples should be taken at least once per day.

Exposure to the cold can be an important consideration for workers if work must be done outdoors in the winter or indoors if a building's heating system must be shut down.

5.5.4 Removal under hot conditions

Hot removal should be avoided unless circumstances do not allow for the shutdown of equipment and cooling off of the work area and equipment. In such cases, the standard high-risk procedures are blended with special equipment and techniques to allow removal of asbestos from pipes, vessels or systems at high ambient temperatures.

Standard glovebags can be effectively used up to 65^{o}C. Where boilers, vessels and other large systems are involved, hoardings must be erected to contain asbestos fibres. Fire resistant polyethylene is recommended where very high temperatures are encountered. The circulation of cooled air into the enclosure and very high rates of air exhausted through HEPA units will assist in controlling ambient temperatures. Only encapsulants with a temperature rating equivalent to the surface temperatures encountered should be used.

Workers should wear gloves, aprons and other heat resistant clothing to protect themselves from burns. Cloth coveralls rather than disposable ones will be more comfortable and afford greater protection. Vests with the ability to circulate a coolant may be considered.

An enclosure must be capable of withstanding and compensating for expected heat loads. Appropriate fire extinguishers and first aid supplies for burns and heat stress must be available in the work area. Localized exhaust at the point of removal activities can help cool the area and minimize the spread of airborne fibres via heat convection. Thorough wetting of asbestos-containing materials may be difficult when working next to extremely hot surfaces. Dry removal techniques may be required. The work area should be inspected to ensure that combustible materials cannot come into contact with hot surfaces.

The employer must have an emergency plan in the event of a fire or heat-related injury. Appropriate firefighting equipment and personnel must be able to respond quickly. Workers should be trained and drilled in emergency escape routines in the event of fire. Workers must also be trained to spot and treat heat stress illnesses and minor burns.

Heat stress and burn hazards are potential problems. Therefore,

- a buddy system for workers should be used to monitor signs of heat stress;
- heat stress monitoring should be done,
- a plentiful source of cool drinking water located outside the work area should be available for break periods,
- strict work/rest schedules must be carefully followed to prevent heat stress – frequent rest breaks will be needed depending on the working conditions, and
- cool lunchrooms or break areas should be provided.

5.5.5 Crawl spaces and attics

Work in crawl spaces may present unique problems such as the presence of dirt floors and confined space or restricted space entry hazards. Wheeled dollies may be needed to allow greater mobility, as well as extra lighting, kneepads and hard hats.

Where practicable, glovebag removal is recommended. Moderate- or high-risk removal practices are required, depending on the conditions and materials involved. Examples of such situations include where the quantity of asbestos prevents a cost-effective job, where the asbestos is mixed into the dirt floor of a crawl space or where there are space constraints.

The employer must have plans in place to deal with workers who may get stuck in tight spots and getting workers out in the event of an injury. The use of a buddy system and two-way radios may be appropriate.

Areas considered confined spaces or restricted spaces require stringent site-specific procedures in addition to work procedures for asbestos abatement and a written code of practice for confined space entry.

Where high-risk procedures are followed and the dirt floor is contaminated, polyethylene sheeting on the floor is not required. Openings in the floor or walls should be sealed airtight and the rest of the preparation practices for high-risk removal followed.

Where dirt floor crawl spaces are encountered, asbestos mixed in with the dirt must be removed. Contaminated dirt must not be spread around either within or outside of the work area. All dirt removed must be disposed of as asbestos waste. If it is not practical to remove contaminated dirt, it may be possible to apply a sealant to the surface to trap asbestos fibres.

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

If the contaminated dirt is left in place, a management plan is required.

5.5.6 Encapsulation

Encapsulation involves the application of a sealant to the surface of asbestos-containing materials to prevent or minimize the release of asbestos fibres. This process is not recommended on highly friable surfaces because of the risk of fibre release during sealant application. Two categories of encapsulants; bridging or penetrating, may be used. Bridging encapsulants bond to the surface of asbestos-containing materials to provide a protective seal while penetrating encapsulants are absorbed into the material and bond fibres together.

Manufacturers' directions should be followed to determine the appropriate equipment required when applying an encapsulant. No active standard for encapsulants exists, but as a best practice, encapsulants should comply with Canadian General Standards Board (CGSB) Standard CAN/CGSB-1.205-2003, *Sealer for application to asbestos fibre releasing materials,* or an equivalent standard.

High- or moderate-risk removal methods should be used, depending on the size of the job, the friability of the asbestos and the potential for fibre release. Encapsulated asbestos-containing materials must be inspected to ensure:

- the entire asbestos surface has been adequately encapsulated,
- the thickness of the encapsulating film meets the manufacturer's requirements if a bridging encapsulant has been used (make test holes as required), and

- penetration of a penetrating encapsulant meets the manufacturer's requirements if a penetrating encapsulant has been used (make test holes as required).

5.5.7 Enclosure

Enclosure involves covering asbestos-containing materials with a physical barrier such as plywood or gypsum board. For mechanical insulation, the physical barrier may consist of painted and labelled canvas wrap or labelled metal jacketing. The intent of enclosure is to prevent physical contact with asbestos-containing materials, thereby preventing fibre release. When enclosing friable materials the same precautions used for high-risk removal in terms of work area set-up, personal protection, decontamination, etc., should be followed. Moderate-risk procedures may be appropriate where the potential for fibre release is much lower, as may be the case when enclosing non-friable products.

The appropriateness of enclosure, the materials and their means of application must be considered. The disadvantages of enclosure include its complexity and the fact that asbestos is still left in place.

Personal protective equipment selection must be based on expected levels of airborne fibre concentrations generated during the project. Equipment selection and use criteria appropriate for moderate and high-risk abatements should be used.

During installation of the enclosure material and required support system, the release of asbestos fibres can be minimized by lightly misting the asbestos-containing materials and using care when contacting them. All barriers and materials used during the installation that cannot be cleaned must be disposed of as asbestos waste.

Upon completion, the enclosure must be inspected to ensure:

- the entire surface of the asbestos-containing material is adequately enclosed,
- the enclosure forms an airtight barrier, and
- the enclosure is securely fastened to nearby support structures or directly to the asbestos-containing material.

5.5.8 Glovebag removal

A glovebag allows the removal of asbestos-containing materials from mechanical components such as piping, valves, fittings and small dimension duct work without constructing an elaborate containment. This becomes cost effective where small quantities of material are removed from within a large area, eliminating the need to completely enclose the area. Glovebag removal of asbestos-containing materials is considered a moderate-risk project unless the work area meets the definition of a "restricted area".

Glovebags come in a variety of types and styles. Some are multi-use, meaning they can be moved along a pipe as removal progresses. Other glovebags are taped in place and used only in that one location before being discarded.

Other equipment required for glovebag removal include:

- vacuum cleaner fitted with a HEPA filter
- polyethylene drop sheets having a minimum six mil thickness
- six mil thick labelled asbestos disposal bags
- spray bottle or hand pump garden sprayer to wet asbestos
- water and wetting agent
- duct tape or tape having similar or better strength
- utility knife with retractable blade
- wire cutters
- flexible wire saw

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

Glovebags should not be adhered to pipe insulation that is not covered with a wrap such as Caposite. Without a wrap, fibres can be released during installation of the glovebag and when it is moved along the pipe.

5.5.8.1 Work procedures

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

(1) Place a polyethylene drop sheet beneath the area in which the glovebag is to be installed.

(2) Prior to applying the bag, seal any loose insulation by wrapping it with polyethylene.

(3) Prior to starting the removal, clean up any loose asbestos debris on or around the pipe with a vacuum cleaner fitted with a HEPA filter.

(4) Assemble all the required tools and equipment.

(5) 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.

(6) Place hands into the gloves and using the tools, cut and remove any jacketing. Wet exposed insulation to reduce fibre release.

(7) Remove the material, wetting it and arranging it in the bottom of the bag.

(8) Using a wire brush, abrasive pad or scraper, clean asbestos residue off of the pipe or fittings.

(9) Wet and seal the exposed ends of the insulation. The sealant should also be applied to the inside upper section of the bag prior to removal of the bag.

(10) 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 glovebag or into a pail of water for cleaning. For cleaning, open the pouch under water and clean the tools thoroughly.

(11) Suck the air out of the glovebag using the vacuum cleaner. Twist the lower section of the bag containing the waste and seal it with tape. Slowly remove the tape connecting the bag to the pipe. Place the bag into an asbestos waste disposal bag and seal. Disposable clothing and drop sheets must also be disposed of as asbestos waste.

(12) All work equipment, including work clothing, should be cleaned by damp wiping or with a vacuum cleaner fitted with a HEPA filter.

(13) Workers should wash their hands and face before leaving the work area.

(14) The surfaces from which asbestos has been removed should be visually inspected after removal of the glovebag to ensure that there is no remaining asbestos residue.

Glovebags may be used once and then disposed of unless they are designed for multiple uses. They must not be cleaned and reused. Standard glovebags must not be used on piping at temperatures exceeding 65°C. Check with the glovebag manufacturer for the recommended range of temperatures in which the bag can be used.

5.5.8.2 Air monitoring

Personal or breathing zone air samples should be taken at least once per shift during glovebag removals to ensure release of asbestos is controlled (measured levels should not be above baseline or background

sample results). However, there may be circumstances where air monitoring is not required or practical, including:

- If the employer has documentation that fibres will not be released during the work. This would apply to a long-term project where glovebag activities are occurring over a period of time or to ongoing maintenance activities where the same workers and procedures are used each time. In these cases, monitoring would be required at the beginning and then occasionally to demonstrate that fibres are controlled when the work is done, but not necessarily each time a glovebag operation is performed.

- If the work is of very short duration. When NIOSH Method 7400 is used to evaluate exposure, the air flow rates during sampling may range from 0.5 to 16 litres per minute. The limits of quantification in the method are based on passing 400 to 1000 litres of air through the filter during the sampling period. Assuming the maximum flow rate is used, the sample period must be at least 25 minutes to meet the minimum volume requirements in the NIOSH method. A longer sampling period is required if a lower collection flow rate is used. This applies to an individual glovebag operation; it is not acceptable for the employer to split the work into shorter periods to avoid conducting air sampling. This would not apply in cases where the workers are conducting a number of glovebag operations consecutively (for the same or different materials) over the work shift. Where air monitoring cannot be done due to the short duration of the work, the employer must have written work procedures in place and ensure the work is supervised by a competent supervisor or worker so there is minimal potential for worker exposure to asbestos.

5.5.9 Pre-demolition asbestos removal

Prior to demolition of a building, all asbestos-containing materials that can release fibres during the demolition must be removed. The type and quantity of materials present will dictate the procedures used for abatement, although some special considerations need to be made for demolition projects. Because the building is being demolished, all asbestos-containing materials must be removed, including those hidden in shafts, chases, between walls, above false ceilings and in other hidden locations. Cutting holes into these spaces may be required. Care must be taken to ensure that all these spaces are examined. All pipes should be traced from their source to their termination and all asbestos-containing materials removed. The work procedures must take into account the structural integrity of the building before the start of work and the impact of the abatement activities on the structural integrity of the building.

A method for removing asbestos covered pipes during demolition projects is “wrap and cut”. The method involves wrapping a portion of the insulated pipe with polyethylene and then the pipe itself is cut through on either side. The wrapped pipe and insulation are then disposed of as asbestos waste. Normally this “wrap and cut” operation can be conducted as a low-risk removal. Glovebag removal of asbestos-containing materials at the points where the pipe is to be cut must be done first.

Where high-risk procedures are used, applying polyethylene sheeting to floor and wall surfaces is usually unnecessary. Openings in the floor or walls should be sealed airtight and the rest of the preparation practices for high-risk removal should be followed. Drop sheets are useful in collecting bulk debris during early stages of removal.

Air monitoring can be less intensive for pre-demolition if the building is not occupied. Personal or breathing zone, clean room and final air test samples will suffice.

In some cases, asbestos-containing materials may be left in place during demolition. However, an acceptance from section 34 of the OHS Code is required prior to demolition. Criteria evaluated when granting the acceptance include:

- assessing whether the material is problematic to remove and removal would create more of a hazard to workers
- determining if alternative work procedures will provide equivalent or better protection to workers
- determining the asbestos content of the material
- assessing the friability of the asbestos-containing material
- determining if demolition will be done by machine
- determining if water will be used for dust control

Note that “problematic to remove” is not the same as difficult to remove, or expensive to remove. Cost considerations to remove asbestos prior to demolition are not factors evaluated when an acceptance request is reviewed. An example of “problematic to remove” could be a building with compromised structural integrity from fire or flood which is unsafe to enter.

For more information

Asbestos Containing Materials in Buildings to be Demolished (ASB003) ohs-pubstore.labour.alberta.ca/asb003.

5.5.10 Mechanical abatement

The OHS Code requires asbestos to be removed from a structure prior to demolition. Mechanical abatement techniques apply in cases where the structure is destroyed so asbestos cannot be abated. For example, the building has been consumed by fire, or has independently collapsed due to structural damage.

Mechanical abatement is completed **independent of** any demolition activities. The use of this abatement procedure must not be considered a way to avoid complying with the requirements to remove asbestos

prior to demolition under section 28 or 34 of the OHS Code or applying for an acceptance to leave asbestos in place during a demolition. For structures that are still standing, an acceptance is required.

Set-up

(1) Conduct a hazard assessment and review with workers on site.

(2) A work perimeter of 30 metres, or up to the property boundary, should be established including visible separation (such as fencing) and signage.

(3) The signage must state “Danger, asbestos, authorized personnel only, eating, drinking and smoking are prohibited.”

(4) When no work is occurring, the work site must be secured to prevent unauthorized personnel from entering.

(5) The waste receptacles and equipment used for the project should be inside the perimeter.

(6) All workers, including equipment operators, transport drivers, and labourers must have suitable training related to asbestos hazards and the work procedures to be used on the project.

Work procedures

(1) Workers, including equipment operators, transport drivers and labourers, must be protected with personal protective equipment suitable for low-risk asbestos abatement projects. Additional protective equipment may be required depending on the hazards present at the work site.

(2) The structure must be pre-wetted and continuously wetted during the removal of the debris with enough volume to ensure the material is saturated and minimize airborne dust generation. During winter, if it is too cold to use water, alternative procedures must be in place for dust control.

(3) Work must be suspended if wind speeds above 20km/hr are measured (measured by an anemometer). The material must be wetted and covered if possible.

(4) Procedures must be developed to address a possible collapse of the whole or part of the structure during the work if portions remain standing.

(5) All debris should be scooped up by the heavy equipment and placed directly into the disposal bins. For dump trucks, the driver of the truck should remain inside the cab, with the windows closed while the bin is filled. Disposal bins must be covered during transport to the disposal site. Disposal bins

should be positioned for easy pick-up by the truck so the driver does not have to enter the work perimeter during pick-up.

(6) Materials removed from the structure may not be recycled.

(7) The landfill must be informed in writing that the waste contains asbestos.

(8) Should the work take more than one day to complete, the debris and waste should be wetted and covered overnight, if this is possible.

(9) Any visible contamination on the ground must be removed. Once the clean-up is complete, but before the perimeter is removed, the work area should be inspected by a competent person to check for debris or contamination left behind.

Decontamination

(1) Workers, including the equipment operators, must decontaminate prior to leaving the work perimeter.

(2) All personal protective equipment, equipment and tools must be decontaminated prior to leaving the work perimeter. Decontamination of heavy equipment should include interior and exterior cleaning and removal of air filters.

(3) The disposal bins should be lined with polyethylene sheeting or there should be procedures in place to decontaminate them at the end of the project.

(4) A decontamination area for workers and small equipment should be set up near the entrance to the work perimeter, which includes a source of clean water, wipes, soap and towels. Workers must remove personal protective equipment (which remains inside the work perimeter) and clean their hands and face before leaving. If respirators are taken with the worker, the filters should be removed and disposed of.

(5) Large equipment may be cleaned by hoses or a pressure washer before leaving the work perimeter. Special attention should be paid to tires and buckets on heavy equipment.

(6) No eating, chewing gum or tobacco, drinking or smoking is permitted in the work perimeter. Workers should have a clean area where they can do these activities once they have decontaminated.

Air Monitoring

(1) An occupational air sample should be collected on a worker inside the work perimeter each day of work.

(2) Air monitoring should be conducted in appropriate locations at the work perimeter including downwind.

(3) If sample results are at 50 per cent of the OEL within the work perimeter or at 10 per cent of the OEL at the work perimeter, work should be suspended and work procedures evaluated.

(4) Air sample results must be available prior to the commencement of work the following day so they can be reviewed by workers, supervisors and employers and adjustments made to work procedures, if required.

5.5.11 Handling or removal of vermiculite containing asbestos

Some forms of vermiculite insulation, (for example Zonolite, which was produced from the W.R. Grace and Company mine in Libby, Montana from the 1920s to 1990), may be contaminated with asbestos. Not all Zonolite that was produced came from the same mine, and even within the product from the Libby mine there was considerable variation in the concentration of asbestos fibres. The only way to know whether the material contains asbestos is to have it tested. While the concentration of asbestos fibres is often less than one per cent in the product, hazardous concentrations of airborne fibres can result when the material is disturbed. Information on how to sample vermiculite insulation is provided in Chapter 7.

If vermiculite insulation is known or suspected to be contaminated with asbestos, it must be treated as an asbestos-containing material, even if the concentration of asbestos in the product is less than one per cent. For demolition projects, the materials must be removed from a structure before the building is demolished due to their 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 in concrete block walls

In concrete block walls the vermiculite was often poured into the vertical cavities. The material may be present in the vertical cavities and there may be small amounts in the joint cavities. The vermiculite in the joint cavities cannot be removed without compromising the structural integrity of the building. If the material cannot be safely removed, the employer will need to apply for and receive an acceptance prior to the demolition to proceed with the material left in place.

Work procedures depend on the construction of the wall and conditions at the work site. Usually the material is removed by creating an opening at the base of the wall and allowing the material to drain by gravity. Where holes will be 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. 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, fibres will be released as the material drains from the wall. Historical test results from occupational measurements on workers involved in removing vermiculite from concrete block walls using high-risk procedures and water to mist the area near the wall opening, show that exposure levels can reach 0.3 f/cc. If the work is done with no water and no negative air units, fibre levels can reach 0.9 f/cc. Work areas in which the OEL for asbestos (0.1 f/cc) is exceeded are defined as “restricted areas” in the OHS Code. For

this reason, abatement projects involving the removal of vermiculite from concrete block walls are considered high-risk projects.

If the insulation is removed by gravity, employers must comply with requirements in Part 4 of the OHS Code that apply to asbestos. The following work procedures should be used:

(1) Set up containment around the work area that meets the criteria outlined in Section 5.4. This may range from a large containment encompassing a whole wall to a small containment built around the opening in the wall from which the material is drained. The containment should be designed so that negative pressure can be maintained inside it and so that there is sufficient air flow (at least four air exchanges per hour).

(2) Tape a waste bag to the wall to catch the draining material.

(3) Make a hole in the concrete block wall while maintaining negative pressure in the containment.

(4) As insulation drains into the bag, wet down the waste in the bag.

(5) Ensure waste bags are cleaned and double bagged, and the waste material is handled as an “asbestos waste”.

(6) Worker decontamination facilities should include a shower and clean change room. Depending on the design of the work site, these may or may not be attached to the containment.

(7) Some residual material may remain in cavities in the concrete blocks. If the wall is to be demolished following removal of the insulation, the employer may need to apply for an acceptance to leave this material in place.

(8) Air monitoring should be done before work commences, during the opening of the wall and during the removal. Air monitoring should also be done outside the containment area.

(9) Final visual inspection, glue spray and air testing should be done prior to teardown of the containment.

(10) Workers on the project should be provided with appropriate protective equipment for a high-risk abatement project.

Loose fill insulation in attics

Vermiculite used in attics as insulating material is generally loose and exposed. There is a high risk of fibre release if the material is disturbed. Fibre levels ranging from 0.15 to more than 1 f/cc have been measured in the breathing zone of workers involved in the removal of this material. If a HEPA equipped vacuum truck is used, the project may be done using moderate-risk removal procedures. However, monitoring must be

done during the removal to ensure that fibre levels do not exceed the OEL. Otherwise, high-risk removal procedures are required.

(1) Removal of material should include:

   (a) Isolation of the work area to control fibre release.

   (b) Use of a HEPA filtered vacuum truck to suck out loose insulation. This should be done with as little direct contact with the insulation as possible.

   (c) If a HEPA filtered vacuum truck is not used, then a negative air unit equipped with HEPA filters should be installed to remove air from the work area and maintain a high level of air movement (six to 12 air changes per hour). This will help reduce airborne fibre levels in the work area and reduce the chance of leakage to occupied areas of the structure.

   (d) Water may be used to control dust, however it may also cause the vermiculite and asbestos fibres to adhere to the rough surfaces of the attic space.

(2) Workers must be provided with appropriate protective equipment suitable for moderate-risk abatement procedures (usually full facepiece powered or non-powered air-purifying respirator with P100 filters) and decontamination facilities (depending on the extent of work, showers may be required).

(3) Waste must be disposed of in leak-tight containers.

(4) Air sampling should be conducted during the work to ensure that workers are protected. Air monitoring should be done in the area where the material is being disturbed, as well as in a location outside this area.

(5) Once the removal is complete, the area, particularly rough surfaces, should be thoroughly HEPA vacuumed and visually inspected for residual material. Once this is complete, all surfaces should be glue sprayed and clearance air sampling using aggressive methods should be done to ensure that the cleanup is complete (see Chapter 7).

Note that if the material is contained in an enclosed space where there is little potential for contact or being distributed, it can be left in place until future renovations or demolition is done. If it is left in place, the employer must develop an asbestos management plan.

5.5.12 Asbestos in asphalt

From about the early 1960s to the mid-1980s, asbestos was added to some asphalt mixes used in road paving and curbing to improve durability. The products generally contained one to two per cent chrysotile asbestos by weight. While these products were not used in every jurisdiction, their use was fairly widespread in Canada. This product does not present a hazard where the paving material remains intact and is not abraded or ground up. There may be a potential hazard where the asphalt is resurfaced or

processed and stored for recycling. Since there are limited records available as to where these products were used in Alberta, it is assumed that asphalt paving on roads contains asbestos unless there are test results to show otherwise.

There are a number of operations in which asphalt may be disturbed and asbestos fibres released:

- planing (grinding up asphalt using planers and transferring the material into trucks),
- hauling (transferring milled asphalt or new asphalt to trucks),
- stockpiling (storage of bulk aggregate and recycled asphalt in a yard, stockpiles are be maintained using a variety of equipment at the yard),
- loading and handling,
- saw cutting and jackhammering (small sections of road are cut and broken out),
- recycling (material is broken down, separated and mixed at a recycling plant to form new asphalt), and
- paving (new asphalt is applied over old asphalt or previously milled surfaces).

When conducting asphalt removal, cutting, milling, grinding or grooving, the employer should:

(1) Avoid removal methods (e.g. dry grinding) that may create airborne dust.

(2) Apply water to control dust.

(3) Monitor air quality. Asbestos should not be present in occupational or area samples above background levels while conducting these activities.

(4) Keep stockpiles of recycled asphalt covered or enclosed as much as possible.

For operations that involve handling the asphalt during which the material can be kept wet or hot, asbestos related precautions are not required, as long as monitoring data shows that asbestos levels in air samples are not above background levels. For operations that are done with no water (e.g. dry cutting), low-risk asbestos procedures are needed.

5.5.13 Emergency response

Emergency responders (fire department personnel, paramedics, on-site emergency response teams) may be required to deal with situations such as fires, spills and medical emergencies during an asbestos abatement project. Though dealing with the emergency will take precedence over standard asbestos abatement work procedures, care must still be taken to protect all workers who may be involved.

5.5.13.1 Emergency plan

The employers involved in the abatement activities must prepare an emergency response plan, in consultation with the joint work site health and safety committee (HSC) or health and safety (HS) representative, if there is one, and ensure that workers are trained on the procedures to follow.

The emergency response plan must address:

- Identification of potential emergencies that could occur at the work site.
- Procedures for dealing with emergencies, including:
  - instructions for who to contact in the event of an emergency,
  - procedures for decontamination or segregation of workers who may be contaminated, and
  - procedures for repair and clean-up of the abatement work area once the emergency has been dealt with.
- Emergency response training requirements.
- Identification and location of emergency equipment, facilities and communication equipment such as work site fire alarms and fire extinguishers.
- Additional first aid requirements or services, if required.
- Procedures for rescue and evacuation, including:
  - exit routes out of the enclosure and immediate work area,
  - evacuation procedures and routes out of the building, and
  - muster point for workers wearing contaminated clothing (this should be separate from the muster point used for other personnel evacuated from the building).
- Any designated rescue and evacuation workers at the work site, if applicable.

The employer must ensure that they know who is present at the work site at any given time so that all personnel can be accounted for if an evacuation is necessary.

When emergency responders arrive at the worksite, the employer must provide information on where the safe entry and exit points are located and whether all workers are accounted for. The employer must also ensure that emergency responders are informed that the area is contaminated with asbestos.

5.5.13.2 Emergency procedures: fire, explosion and spills

Fire can create an immediate danger to life and health. A fire hazard may become so severe that workers may need to break through the polyethylene barriers on the abatement containment. In a fire emergency, workers may not have time to decontaminate before leaving the work area. If this is the case, workers should keep all protective clothing and respirators on while they evacuate to the muster area.

In the course of responding to the fire or spill, fire department personnel and emergency responders may disturb materials that contain asbestos. Standard duty gear and SCBAs will provide acceptable protection from the asbestos hazard. However, this equipment must be properly decontaminated by fire department personnel before responders enter their vehicles and leave the work site. Cleaning with water and a mild detergent solution is acceptable for this purpose. Gear that cannot be wetted can be vacuumed with a HEPA filtered vacuum and then wiped with a damp cloth or disposable wipe.

Decontamination should be done in a separate outside area, designated for this purpose. Workers should wash their face and hands once they have removed their protective equipment. Water used should be collected and may be disposed of in a sanitary sewer. If it is not possible to decontaminate gear before leaving the work site, the equipment (including respirators and footwear) must be placed in plastic bags which then must be sealed and labeled as asbestos contaminated. This equipment must be sent to the appropriate location for decontamination before it is used again. Workers must not take equipment or clothing home for cleaning or laundering.

In responding to circumstances that involve a fire or spill, there may be additional chemical or physical hazards at the work site for which responders require protection, over and above the asbestos hazard. Depending on the hazards involved, standard duty gear may not be sufficient or appropriate. Prior to entry into the work site, responders must ensure that they check with on-site personnel to identify other hazards that may be present and that they have the appropriate protective clothing and equipment for these hazards.

5.5.13.3 Emergency procedures: medical emergencies

A serious injury or medical emergency is an immediate concern. The employer must ensure workers are trained on how to respond to a medical emergency and designated first aiders must be present at the work site. If it is safe to do so, first aiders must remove the injured worker from the abatement area to the clean room unless the worker has sustained a head, neck or back injury. Moving the worker minimizes exposure of emergency response personnel and their equipment to asbestos. The first aiders must decide whether it is appropriate (or possible) to decontaminate the injured worker or remove other protective clothing and equipment.

In cases where it is not safe to move the worker from the abatement area, external emergency personnel may be contacted to do so, such as the fire department. Standard duty gear and SCBAs will provide acceptable protection to fire department personnel from the asbestos hazard. Paramedics who respond to a medical emergency must at least wear disposable coveralls and properly fitted half-face respirators

equipped with R- or P-100 filters. Emergency responders may be required to remove the worker's contaminated protective clothing. If so, this clothing should be placed in a plastic bag which is sealed and labeled as asbestos contaminated. If not, contaminated clothing should be covered with a blanket or towel while the worker is transported to hospital for treatment. Emergency response personnel must inform hospital staff that the worker is wearing contaminated clothing or equipment. The worker should be placed in a negative air room until they can be decontaminated, if possible. Paramedics should continue to wear their protective clothing while transporting the worker in this case.

Emergency response personnel should ensure that their protective clothing and respirators are removed before leaving the work site unless the injured worker cannot be decontaminated. Disposable equipment and clothing should be placed in a plastic bag which is sealed and disposed of as asbestos waste. Re-useable equipment should be cleaned with water and mild detergent solution or vacuumed with a HEPA filtered vacuum and wet wiped. If it is not possible to decontaminate protective equipment and clothing before leaving the work site, the equipment (including respirators and footwear) must be placed in plastic bags which then must be sealed and labeled as asbestos contaminated. This equipment must be sent to the appropriate location for decontamination before it is used again. Workers must not take equipment or clothing home for cleaning or laundering.

If the worker is transported while wearing contaminated equipment or clothing, the ambulance may also require decontamination. The employer must ensure that workers involved have suitable training and equipment. This may be limited by covering the worker with a blanket or towel (the blanket or towel must be treated as asbestos contaminated). Cleaning with a HEPA filtered vacuum and wet wiping should be done to ensure that surfaces in the vehicle are decontaminated.

5.5.14 Removal of asbestos insulation on elevated insulated pipelines

There are situations, primarily on industrial work sites, where insulation has to be removed from pipelines that are hot because the processes are still operational. In these circumstances, conventional glovebag techniques may not work since the bags would melt when they come into contact with the exposed lines. One option is referred to as the "trough" or "open air" method. This method may also be used when the application of traditional glovebag is not practical, however other options for abatement should be considered first.

Unlike traditional glovebag removal methods loose debris is contained in a catch-basin or trough suspended under the area being abated while intact sections of insulation are removed and placed in bags or other suitable containers. Since there is no enclosure, this process is considered a high-risk abatement.

Before undertaking this form of abatement, the following items must be considered:

- type of material being removed,
- condition of material,

- use of appropriate fibre control methods (e.g. use of amended water may not be applicable or effective),
- environmental conditions (e.g. wind speed, temperature), and
- access to work area (e.g. scaffold, man-lift).

Specific procedures for this type of abatement must be developed based on the criteria above and any other work site-specific conditions or hazards.

One of the key factors is the control of asbestos fibre release. Both workers directly involved in the abatement and those in adjacent areas must be protected from airborne asbestos fibres. Use of amended water is the main method of control used, however there is a risk of contaminated water being spilled or released, which can result in asbestos contamination below the work area. Water used during the abatement will have to be collected and disposed of appropriately. In addition, water may not be effective for fibre control on very hot lines (water will evaporate too quickly) or very cold lines (water will freeze).

Due to the higher risk of fibre generation, this method requires constant air monitoring using personal samples to assess the adequacy of the control measures and ensure that adequate respiratory protection is used by workers. If the fibre concentrations in the personal samples reach or exceed 50 per cent of the OEL, the work should stop and work procedures should be reassessed.

Work procedures should address:

- high wind events (e.g. greater than 20 kilometres/hour),
- encountering sections of damaged or degraded insulation,
- elevated fibre concentrations on personal and area (perimeter) samples,
- situations where water cannot be used or is ineffective,
- worker and tool decontamination (a remote location will need to be used),
- working at heights and rescue of an injured worker from an elevated work platform,
- fire evacuation procedures, and
- spill procedures.

5.5.15 Disposal of asbestos waste

Asbestos waste is defined by the OHS Code as, “material that is discarded because there is a reasonable chance that asbestos might be released and become airborne, including protective clothing that is

contaminated with asbestos".

Employers must ensure that asbestos waste is stored, transported and disposed of in impervious, sealed containers. Handlers must take precautions to ensure the waste will not spill as a result of handling or shipping of the materials.

5.5.15.1 Preparing waste for disposal

Bagging and packaging of waste

The waste should be disposed of in double bags of at least 6 millimetres in thickness or other appropriate sealed containers impervious to asbestos and the asbestos waste.

If these objectives cannot be achieved and the packaged materials may pose a hazard to handlers, transporters or landfill workers, the packaging method must be re-evaluated. Alberta Environment and Parks "Guidelines for the Disposal of Asbestos Waste" requires friable asbestos-containing waste intended for transportation be double bagged in 6 mil polyethylene bags; or packaged in accordance with a method approved in writing by the Director of Standards and Approvals of Alberta Environment and Parks.

Whole building demolition debris that cannot be readily packaged should be placed in a sealable bin lined with 6 mil polyethylene and sealed to prevent asbestos fibers and particulates from escaping. For example, the plastic could be overlapped and tucked down the sides of the bin. If this is done, the landfill operator must be informed so they can ensure work practices at the landfill address the hazards associated with the dumping of this type of material. Special landfill cell preparation and additional wetting may be required.

The filled bags must be tightly sealed at the neck. Loosely twisting and taping of the neck or tying the neck may allow for the release of asbestos. The neck should be tightly twisted and taped. The twisted neck is then folded over on to itself and taped again (goose necked).

Preparing waste for transport

Asbestos waste must be securely packed for transport and disposal so it does not pose a hazard to transport workers, landfill workers or the public. Bags should not be over filled and the bags should be placed gently into disposal bins so they do not rupture. Bins should be lined or lubricated so that bags do not freeze to the steel bin during the winter. Frozen bags may rip while dumping and attempting to dislodge them from the inside of the bin. Alternatively, single bags can be placed inside larger totes which can be lifted out of the bin by the landfill operator and placed into the prepared disposal cell.

Labelling packaging

All bags must be clearly labelled to indicate that the contents are asbestos, that they are carcinogenic, and that they must not be inhaled. Where materials are packaged in a bin, the labelling can be placed on the outside of the bin (in addition to any applicable labelling required for transportation).

5.5.15.2 Transporting asbestos waste

Alberta Environmental and Dangerous Goods Emergencies published a transportation guidance document "A Guide to the Transportation of Dangerous Goods Regulations". This document is intended to provide guidance on complying with certain parts of the Alberta Transportation of Dangerous Goods (TDG) Regulations.

In addition to TDG Regulations for transportation, workers transporting asbestos waste must comply with OHS legislation. Employers must:

- establish procedures to minimize worker exposure during loading, unloading and to address emergency situations such as spills. This includes the use of administrative controls such as ensuring vehicle windows are closed and air supply to the cab is shut off during loading, the selection and use of appropriate personal protective equipment and ensuring decontamination of workers and the vehicle, as required,

- in addition to training required under TDG legislation, ensure workers are trained in the specific safe work procedures for the project and the health hazards associated with asbestos exposure, and

- ensure the necessary equipment to deal with a spill, such as a shovel, a broom, wetting agent, protective clothing, a supply of six mil thick polyethylene bags, and tape, are immediately available to the worker transporting the waste.

5.5.16 Landfilling asbestos waste

Landfill operators can be put at risk by poor packaging, transportation and disclosure practices for wastes. In a landfill setting, asbestos may be found in the waste stream including demolition or renovation debris. This material may show up as packaged asbestos waste or mixed in bulk demolition waste materials. Asbestos waste may be deposited only at a sanitary landfill approved by the Local Board of Health or an industrial landfill approved and designated as class I or II.

The disposal of hazardous wastes is regulated by Alberta Environment and Parks; however, health and safety on the work site is covered under the OHS legislation.

Alberta Environment and Parks defines asbestos waste as "a waste containing more than one per cent asbestos by weight." This definition applies to the waste classification for disposal purposes. OHS legislation does not define asbestos waste this way; the OHS definition is based on the potential for asbestos fibres to be released, not the concentration of asbestos in the waste. Under the OHS legislation,

appropriate measures must be implemented at landfills to ensure risk to workers and the public is controlled.

Activities that may generate airborne asbestos include:

- unloading, and dumping of waste, including bagged waste where bags may tear,
- manipulation of the waste in the cell, and
- disturbing waste post-disposal, such as by driving over top of exposed bags and excavating activities.

Identifying asbestos waste

Landfills should have site screening procedures in place to ensure the materials coming in are accurately identified. Without identification of the hazard, appropriate controls cannot be developed and implemented. Possible screening procedures include:

- random sampling and testing of construction waste,
- requesting documentation that confirms asbestos in the building was removed prior to demolition,
- requiring bulk sampling reports for the waste prior to accepting it at the landfill, and
- inspection of waste packaging.

Once the landfill takes possession of the material, the landfill (employer) is responsible for ensuring the OHS legislation is met for worker training, waste handling, worker exposure and decontamination. Transfer station operators, as the first point of contact at the landfill, must be informed about these obligations and the hazard asbestos poses on their sites. Screening waste before disposal will provide landfill operators the necessary knowledge about the hazards on their work site and provides the landfill the ability to control what is being disposed of at the site.

Receiving the waste

There are a number of controls that can be implemented to minimize the asbestos hazard to workers. The most important control is for the landfill operator to know what type of waste is being received. Additional controls include:

- mandating specific packaging that facilitates safe receipt and burial processes; such as requiring bagged waste to be further packaged in large totes that can be easily placed rather than dumping bags into waiting cells,
- setting a schedule for days and times for the receipt of asbestos waste so workers can be prepared with the required equipment to handle materials safely and for the necessary ground preparation,
- requiring the landfill be notified in advance of asbestos waste delivery,
- inspection of loads to ensure the material is properly packaged; torn bags or inappropriate packaging could be criteria for rejecting the load,
- developing procedures to safely handle loose demolition waste that cannot be packaged in bags, and
- completion of specific ground and cover preparation in advance of receiving waste to ensure materials can be buried quickly and effectively and documenting the location of the material.

Managing the waste on site

Where containers of asbestos waste are being unloaded, the unloading must be performed so that no loose asbestos waste or punctured, broken or leaking containers are landfilled. Asbestos waste in a container that is punctured, broken or leaking must be double bagged in six mil thick polyethylene bags immediately upon discovery.

Asbestos waste may be deposited only at locations in a landfill site that have been adapted for the purpose of receiving asbestos waste or are otherwise suitable for that purpose. Asbestos waste may be deposited at a landfill site only while supervised by the site operator. Where asbestos is deposited, at least 25 cm of cover material other than garbage must be placed immediately over the waste to prevent direct contact with compaction equipment or other equipment operating at the site. The final cover should be at least 125 cm thick and may include garbage.

The surfaces of vehicles and reusable containers that have been in contact with friable asbestos waste must be thoroughly cleaned prior to leaving the disposal site. Only the minimum amount of water necessary to wet the asbestos fibres should be used during cleaning. Any waste produced during vehicle or container cleaning should also be covered immediately.

Every person directly or indirectly involved in the transportation, handling or management of asbestos waste must take all precautions necessary to prevent asbestos fibres from becoming airborne.

Protecting workers

When asbestos-containing materials are received at a landfill, the employer must ensure:

- a hazard assessment is completed and the necessary controls identified to protect workers,
- workers are trained on the hazards of asbestos and work site controls and procedures,
- the asbestos OEL is complied with, which may require exposure monitoring for workers,
- workers have and wear the appropriate personal protective equipment,
- decontamination facilities are provided for equipment and workers,
- a code of practice is developed for the work site and readily available to the workers and other persons at the work site,
- requirements for restricted areas are complied with, as appropriate, and
- workers are provided with health assessments if they are exposed to the materials.

5.6 HEPA filtration test procedures

5.6.1 Testing HEPA filters

The employer must assess the effectiveness of HEPA filters by DOP (dioctyl phthalate) testing, PAO (Poly-alpha olefin) testing or similar means. HEPA filters should be tested:

- when a filter is replaced in a HEPA vacuum cleaner or ventilation unit or on site prior to a HEPA vacuum being used outside of a containment area.
- on site prior to the start of work before a negative air ventilation system begins to filter contaminated air,
- at least every 30 days, or more frequently when in operation to ensure the integrity of the HEPA unit; and
- at least annually, when not in operation.

HEPA filters are rated for a minimum particulate removal efficiency of 99.97 per cent for particles down to 0.3 microns in diameter. All HEPA filters should be factory tested using a “hot” DOP challenge or its equivalent. While there is no requirement for the tester to be certified, they still must be competent (have suitable training and experience) to do the testing.

When field testing HEPA filters:

- filters must be tested at their rated air flow for proper results,

- filters should not be used in equipment that exceeds their labelled air flow rate, and
- testing is designed to detect leaks in filters, gaskets or related equipment. It will not be as accurate as factory testing since air flow and temperature cannot be controlled as accurately.

Documentation for HEPA filter testing should be available at the work site.

Test procedures

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 must 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. PAO 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 the 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, and

(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; and

(b) 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 retested.

(5) For vacuum cleaners fitted with a HEPA filter, introduce DOP smoke at the vacuum cleaners' 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 should 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.

(6) Equipment passing the DOP test should be labelled with the test date and the name of the tester. A log should be kept for each piece of equipment.

(7) The person performing the test should check and note the physical condition of the equipment (e.g. electrical connections, wheels) at the time of the test.

(8) DOP test equipment should be maintained and factory calibrated at least annually. The person performing DOP testing should be trained to understand the test procedure and equipment being tested.

5.7 Smoke testing of enclosures

For high-risk abatement projects, a smoke test may be conducted to check the integrity of the enclosure prior to the removal beginning and before exhaust units are operated. This test is done in conjunction with a thorough visual inspection of the enclosure.

Smoke testing may be done using a smoke bomb or smoke generator. Other procedures may be used if they can produce equivalent or better results. For simple containments where there is little possibility of leakage to adjacent areas, a smoke pencil may be adequate to test air flow patterns.

Workers required to be inside the enclosure during the smoke test must wear appropriate protective equipment, including respirators and protective eyewear.

Test procedure

(1) The fire department and building occupants, as applicable, should be notified prior to the smoke test.

(2) Conduct a thorough visual inspection of the containment to ensure it is free of obvious holes or openings. If any are found, they should be repaired before the test.

(3) Ensure that DOP tested negative air units are functional and equipped with exhaust ducting that is vented outside the building.

(4) Ensure all door flaps are in place and are able to both seal the containment under static conditions and allow inward flow of make-up air when negative air units are running.

(5) Turn off all negative air units.

(6) The smoke used must be able to stay dispersed in the air for 30 minutes.

(7) (a) If smoke bombs are used:

(i) follow the manufacturer's recommendations on the quantity or size of smoke bombs required to produce an adequate coverage of smoke,

(ii) use a metal pail or equivalent non-flammable container, placing it on the floor or the containment. Place an insulating material such as a sheet of fiberglass, fire blanket, etc. between the container and the containment floor to prevent melting the polyethylene drop sheet,

(iii) ignite the smoke bomb(s) and place it in the non-flammable container. The worker igniting the smoke bomb(s) must wear appropriate eye and respiratory protective equipment,

(iv) exit the containment as soon as the smoke bomb(s) ignites, and

(v) allow approximately 10 minutes for the smoke to evenly disperse throughout the containment. Even disbursement can be confirmed visually.

(b) If smoke generators are used:

(i) the operator of the smoke generator should wear appropriate eye and respiratory protective equipment,

(ii) the operator should be aware of the heat produced by the generator and exercise caution,

(iii) in a logical pattern, starting at the top or area furthest away from the decontamination area, expel smoke to fill the containment, and

(iv) visibly confirm that the smoke is evenly dispersed and exit the containment.

(8) Conduct visual inspections:

(a) All external surfaces of the containment and structures to which the containment is attached should be inspected for leaking smoke.

(b) Once leaks have been identified, activate the negative air units. Take note of the time required for the smoke to clear.

(c) Verify that all areas within the containment are clear of smoke to ensure that “dead air spots” are not present.

(d) When the smoke has cleared, necessary hoarding repairs can be made.

(e) Repeat the smoke test to verify that repairs are adequate.

(9) The integrity of the containment is confirmed if smoke is not detected outside the containment.

(10) Activate the negative air units. Time how long it takes for the smoke to clear. Verify that all areas within the containment are clear of smoke to ensure that “dead air spots” are not present. Based on clearing time, calculate the actual number of air exchanges per hour. Calculations involving negative air flow (m^3) and the containment volume only establish the theoretical number of air exchanges per hour. The industry standard is at least four actual exchanges per hour.

(11) Document the smoke test results and clearing times.

Chapter 6 Personal Protective Equipment

Every person working at an asbestos abatement project must wear appropriate personal protective equipment. Workers must use:

- respiratory protective equipment during all abatement activities as well as construction work and most maintenance work around friable asbestos where fibre release may occur,
- protective clothing to reduce the potential for contaminating street clothing, work clothing, skin and hair, and
- other protective equipment such as eye protection, hard hats, hearing protection and steel toe footwear depending on work site conditions and hazards.

The employer must ensure that personal protective equipment provided to workers will not itself cause medical problems e.g. latex allergies, respirators and breathing difficulties. The supervisor on the work site is responsible to ensure personal protective equipment workers are required to wear is used.

6.1 Respiratory protection

For protection against airborne asbestos, three main types of respiratory protective equipment are available: air-purifying, supplied air and self-contained breathing apparatus (SCBA). The purpose of a respirator is to provide clean air to the person wearing it. This section provides basic information on respirator use.

Respiratory protective equipment works properly only when selected, used, maintained and cared for in the correct manner. Only approved respirators may be used. Approved respirators are those that have undergone testing and have been granted NIOSH approval. The “TC” number is a NIOSH classification given to all approved respirators. Respirator cartridges and filters must also bear their own TC approval number.

For more information:

Respiratory Protective Equipment – An Employer’s Guide (PPE001) ohs-pubstore.labour.alberta.ca/ppe001

Guideline for the Development of a Code of Practice for Respiratory Protective Equipment (PPE004) ohs-pubstore.labour.alberta.ca/ppe004

6.1.1 Types of respirators

Types of respirators

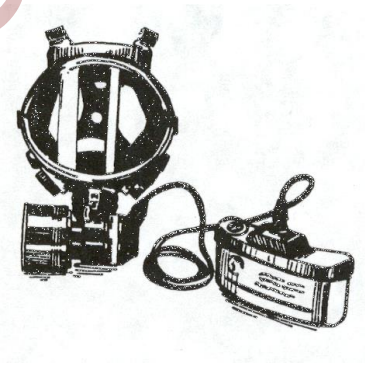
Air-purifying respirator

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

An air-purifying respirator does not protect the wearer from an atmosphere deficient in oxygen. The air must already have enough oxygen content to meet the minimum standard for breathable air (19.5 per cent). An air-purifying respirator is also not intended for use in an atmosphere that is immediately dangerous to life or health (IDLH).

Filters used for asbestos fibres must be high efficiency (99.97 per cent) as classified by NIOSH. NIOSH approves three types of high-efficiency particulate respirators – N, R and P. N-class respirator filters may only be used where the work area is free of oil. R-class filters are oil resistant and can only be used for a total of eight hours. P-class filters are oil proof and can be used for more than one work shift. High-efficiency respirators will be denoted with a “100”, e.g. P-100.

Air-purifying half-mask respirator equipped with P100 cartridges



Powered air-purifying respirator equipped with P100 filters

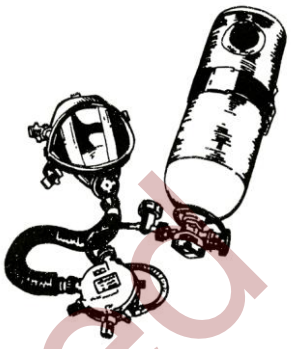
Supplied air respirator

These respirators provide breathable air from an external air source through an air hose connecting the air source to the respirator facepiece. They can provide protection against higher levels of airborne contaminants than can air-purifying respirators. Air supplied to the respirator must meet the air quality requirements of CSA Standard Z180.1-00 *Compressed Breathing Air and Systems*.

Supplied air respirator

Self-contained breathing apparatus (SCBA)

The air supplied in this system is contained in a cylinder that the wearer usually carries on the back. The wearer's air is completely independent of the ambient atmosphere. SCBAs are used in areas where very high levels of protection are required. SCBAs may not be practical for the majority of asbestos abatement projects.



Self-contained breathing apparatus (SCBA)

6.1.2 Code of practice for respiratory protection

Whenever respiratory protective equipment is used, a code of practice describing the selection, use and maintenance of that equipment must be developed. Employers responsible for developing a code of practice should refer to the OHS Bulletin *Guideline for the Development of a Code of Practice for Respiratory Protective Equipment*.

6.1.3 Protection factor

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

$$PF = \frac{\text{concentration of fibres outside respirator facepiece}}{\text{concentration of fibres inside respirator facepiece}}$$

The higher the protection factor, the greater the degree of protection provided by the respirator. The actual protection factor achieved by a respirator is greatly dependent on the fit of the mask to the wearer's face. This can vary with the worker's activities, facial movements and shaving habits. Assigned protection factors have been developed for different respirators based on extensive research. These protection factors can be used to select a respirator that will maintain the asbestos fibre concentration inside the facepiece at an acceptable level. Table 2 summarizes protection factors assigned to a number of selected respirators.

Table 2 Assigned respiratory protection factors for selected respirators

Type of Respirator	Assigned Protection Factor and Comments[5]
Single use (disposable) respirator	NOT ACCEPTABLE FOR ASBESTOS RELATED WORK
Reusable half facepiece air-purifying respirator equipped with high-efficiency filter	APF = 10, can be used for work where airborne concentrations are less than 10 times the OEL
Full facepiece air-purifying respirator equipped with high-efficiency filter	APF = 10 if qualitative fit testing has been done, can be used for work where airborne concentrations are less than 10 times the OEL APF = 100 if quantitative fit testing has been done, can be used for work where airborne concentrations are less than 100 times the OEL
Half facepiece powered air-purifying respirator (PAPR) equipped with high-efficiency filter	AFF = 50, can be used for work where airborne concentrations are less than 50 times the OEL
Full facepiece powered air-purifying respirator (PAPR) equipped with high-efficiency filter	APF = 1000, can be used for work where airborne concentrations are less than 1,000 times the OEL
Positive pressure supplied air full-face respirator (without auxiliary bottle)	APF = 1000, can be used for work where airborne concentrations are less than 1,000 times the OEL
Pressure-demand or positive pressure self-contained breathing apparatus (SCBA)	APF = 10,000, can be used for work where airborne concentrations are less than 10,000 times the OEL

6.1.4 Factors affecting respirator fit

A major limitation of the protection provided by a respirator is the effectiveness of the seal between the facepiece and the wearer's skin. Persons who are or may be required to wear a respirator must ensure they have an effective facial seal each time they put on their respirator. This is done by performing a user seal check following the manufacturer's instructions. Two types of seal checks are commonly used:

[5] The values listed in this table are based on CSA Standard Z94.4-02, Selection, Use and Care of Respirators, Table 2.

- *Negative Pressure Check* – Wearing the respirator, the wearer places the palm of each hand over the cartridge assemblies or inhalation points and inhales. The facepiece should collapse slightly as one breathes in and no inward rush of air should be felt against the wearer's face.

- *Positive Pressure* Check – Wearing the respirator, the wearer places the palm of their hand over the exhalation valve and presses lightly while exhaling gently into the facepiece. The fit is satisfactory if no air escapes around the edges of the respirator.

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

Facial hair Facial hair, even a single day's growth of stubble, can seriously reduce the effectiveness of the facial seal. Whiskers lying between the sealing edge of the respirator facepiece and the skin will break the seal and cause leakage. For this reason, the person wearing a respirator must be clean-shaven, at least where the respirator contacts the face.

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

Headstrap tension Some respirator wearers tighten headstraps as much as possible in the belief that doing so provides a better seal and fit. The exact opposite is often the result, with the shape of the facepiece becoming distorted in such a way as to break the seal. Headstraps should be snug, yet comfortable, and fit testing will demonstrate just how tight or loose the straps must be.

Facial shapes The sizes and shapes of human heads vary widely. High cheekbones, narrow faces, double chins and broad noses ensure that one size and one design of respirator cannot possibly fit everyone.

Other factors Facial scars, eyeglasses, wrinkles and dentures can also affect the seal obtained with certain respirators. Prescription glasses cannot be worn with a full-facepiece respirator as the arms of the eyeglasses will break the seal. Alternatives such as eyeglass inserts should be considered for those who require prescription glasses.

6.1.5 Methods of fit testing

Respiratory fit testing must be completed at least every two years, but annual testing is recommended. There are two accepted methods for fit testing respirators – qualitative and quantitative tests. Positive and negative pressure fit checks also need to be done each time the respirator is donned; these are not the same as fit testing. The type of fit test method will affect the assigned protection factor for the respirator if air-purifying equipment is used.

Qualitative fit test

Qualitative fit testing consists of relatively quick and simple tests to confirm that the worker has an effective seal. This testing consists of positive and negative pressure checks followed by an odourous chemical or irritant smoke test. Qualitative fit testing should be done when the respirator is first issued and then repeated on a regular basis.

Chemical or irritant smoke tests involve the release of an odourous chemical inside a test chamber (enclosure head) or irritant smoke around the edges of the respirator while it is being worn. The wearer performs actions that simulate movements typically made during work activities such as talking, bending, reaching or nodding. If the wearer detects the chemical or irritant smoke, the respirator must be re-adjusted or exchanged and the test repeated until no odour, tastes or smoke is detected.

Commonly used test agents include banana oil (isoamyl acetate), irritant smoke (stannic chloride or titanium tetrachloride), artificial sweetener (saccharin) and bittering compound (Bitrex™). The respirator must be equipped with organic vapour cartridges when administering the banana oil test agent;high-efficiency particulate filters must be used for the irritant smoke agent; particulate filters must be used for the saccharin and Bitrex™ agents.

Depending on the test agent, the wearer will either detect the smell of banana, will sense irritation of the nose and throat due to the irritant smoke, taste the sweetness of the saccharin or the bitterness of the Bitrex™ if there is leakage. The person administering the test relies on the wearer's ability to smell, notice, or taste the test agent. A properly administered qualitative fit test takes a minimum of 15 to 20 minutes to perform, assuming a perfect fit during the first attempt. Additional information describing fit testing can be found in CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*.

Quantitative fit test

Quantitative fit tests are more sophisticated and involve measurement of actual respirator leakage by monitoring inside and outside the facepiece. Unlike qualitative fit testing, it does not depend on a person's sense of smell or taste to tell whether or not the facepiece leaks. Portable computerized equipment accurately measures leakage of contaminant into the respirator during various test exercises.

According to CSA Standard, Z94.4-02, when a respirator undergoes quantitative fit testing, the resulting protection factor must be at least 10 times the nominal protection factor assigned to the respirator. If this condition is not met, the fit of the respirator is inadequate and the respirator should be readjusted or a different respirator selected and tested.

Regardless of the protection factor determined by quantitative fit testing, it is the assigned protection factor that determines the selection of the respirator for use (see Table 2).

Record keeping

A permanent record of individuals who are fit tested and issued with respiratory protective equipment should be maintained. These records form part of the overall respiratory protection program and are useful for future reference. Fit-test records must be kept for respiratory protective equipment used by workers.

6.1.6 Inspection, cleaning, use, storage and maintenance

Inspection

Regular cleaning and inspection of respirators is extremely important and must be done according to the manufacturer's instructions. Respirators must be cleaned and inspected *daily* by routine users, and *before and after* each use by occasional users.

Prior to cleaning a respirator, each part of the respirator should be inspected. Defective parts must be replaced before the respirator is used. The facepiece must be checked for cuts, tears, holes, melting, stiffening or deterioration. If the unit is damaged, it must be replaced. Headstraps must be checked for breaks, frays, tears or loss of elasticity. Cartridge sockets can be inspected by removing the cartridges. Special attention should be given to the rubber gaskets located at the bottom of the cartridge sockets as cracks or flaws may contribute to an ineffective seal.

The cover on the exhalation valve should be removed and the rubber valve carefully examined to ensure it seals properly and has not become brittle. The edge of the valve should be examined for holes, cracks and dirt which may interfere with a proper seal. The exhalation valve is a critical component of the respirator and must be replaced if there is any doubt about its ability to function properly. The valve cover is also important and must not be damaged or fit too loosely.

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

Cleaning

Following inspection, the respirator should be cleaned according to the manufacturer's instructions. Strong detergents, hot water or household cleaners or solvents must not be used because they may deteriorate the rubber parts. A stiff bristle brush (not wire) can be used to remove dirt if necessary. The respirator should then be rinsed thoroughly in clean, warm water. This is important because detergents or cleaners that dry on the facepiece may later cause skin irritation. The respirator can be hand-dried with a clean, lint-free cloth, or air-dried and then reassembled. The respirator should be tested to ensure all parts work properly prior to being used.

Use

There are different makes, models and sizes of respirators. Workers should use the same make, model and size of respirator they have been fit tested for. If the worker will be using a variety of different respirator makes and models, employers should ensure that appropriate fit testing is conducted for each respirator make and model.

Storage

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

Maintenance

All respirator manufacturers suggest regular maintenance and parts replacement. Respirators should be maintained and inspected according to the instructions provided with each respirator. Only approved replacement parts should be used. Mixing and matching of parts from one respirator brand or model to another must never be allowed. Makeshift parts for respirators must never be installed.

6.2 Protective clothing

Protective clothing for asbestos abatement work consists of disposable, impermeable coveralls, foot coverings, gloves and head coverings. Protective clothing reduces contamination of the worker's body and hair and makes decontamination when leaving the work area much easier.

Protective clothing with an attached hood and foot coverings provides the most complete protection. Alternatively, laceless rubber boots can be worn as long as they are properly decontaminated prior to removal from the work site. Disposable types of protective clothing are made of products such as Tyvek™. Permeable outer clothing is not recommended for asbestos abatement work as fibres can penetrate the clothing, contaminating clothing worn beneath it and contaminating the skin. The employer should check with the manufacturer of the clothing to ensure it is impermeable to asbestos fibres before use.

Protective clothing *does not include* street clothes such as shoes, t-shirts, socks, blue jeans, sweat bands, etc. If these items are used inside the work area, they must be treated as contaminated and remain within the containment and be disposed of as asbestos waste at the end of the job or laundered at a proper facility. Protective clothing that is intended to be reused must be collected, handled and washed in a manner that prevents the spread of asbestos fibres and ensures that the clothing is free of asbestos. Workers must never take contaminated clothing or towels home for laundering. Reusable clothing and towels must be collected at the work site and sent to a laundry that specializes in cleaning clothing contaminated with asbestos.

Protective clothing may also be required to protect workers from physical hazards. If the asbestos-containing materials that are being removed contain wire mesh, lath or other sharp objects, heavy gloves should be worn to protect workers' hands. Appropriate footwear must also be worn to provide protection from sharp or heavy objects and wet or slippery conditions. Other safety equipment such as head, eye and hearing protection should be worn if hazardous conditions requiring their use are encountered.

Chapter 7 Asbestos Sampling and Analysis

7.1 Sampling of asbestos materials

7.1.1 Bulk sampling to determine asbestos content

As part of a hazardous materials assessment, sampling of materials suspected to contain asbestos are collected. Verification whether a material contains asbestos cannot be done conclusively by visual inspection alone; samples must be analyzed for asbestos content. Samples must be collected by a competent person and packaged/handled carefully to prevent asbestos contamination or exposure. Bulk sampling is considered a low-risk activity and the appropriate procedures need to be followed (see Chapter 5).

(1) Sample materials when the immediate area is not in use and there are no unprotected workers nearby. Only the persons doing the sampling should be in the immediate area.

(2) Spray the material with a light mist of water.

(3) Take the sample in a manner that avoids disturbing it any more than necessary. If there is a cover over the suspected asbestos that must be damaged for access, it must be repaired immediately after the sample is collected.

(4) Take a representative sample from within the material by penetrating the entire depth of the material, since materials may have been applied in more than one layer or covered with paint or another protective coating.

(5) Ensure that materials having different appearances, colours or textures are sampled separately.

(6) Place the samples in sealable, impervious containers and label them as laboratory samples. The containers should have WHMIS labels that contain the following information (sample quantity less than 10 kg):

- product identifier,
- a statement that the material may contain asbestos,
- the statement “Hazardous laboratory sample. For hazard information or in an emergency call …”, and
- an emergency telephone number.

(7) If pieces of the material break during sampling, clean the contaminated area with a vacuum cleaner equipped with a HEPA-filtered exhaust or by wet wiping. Where necessary, polyethylene drop cloths should be placed under the sample area to catch and contain loose waste generated during sampling.

(8) The workers doing the sampling must wear an appropriate respirator (at least a half-mask air-purifying respirator equipped with high-efficiency particulate filters) and also wear disposable gloves. Gloves must be changed each time a sample is collected. The gloves will be disposed of as asbestos waste.

(9) Ensure that sampling tools and other equipment used during sampling are decontaminated by cleaning with soap and water, followed by water rinse or wet wiping. If sampling tools and equipment cannot be cleaned, place in a bag for disposal or cleaning off site. NOTE: If multiple samples are collected, the sample tools must be cleaned between samples.

(10) Put waste materials into labelled bag appropriate for asbestos waste.

For each homogenous material (evenly mixed and similar in appearance and texture throughout), it is recommended that the minimum number of bulk samples collected be done as noted in Table 3. If analysis establishes that a bulk material sample does contain asbestos, then the entire area of homogeneous material from which the bulk material sample was taken is considered to be asbestos-containing material.

Table 3 Bulk material samples

Type of material	Size of area of homogeneous material	Minimum number of bulk material samples to be collected
Any homogenous material, including but not limited to fireproofing, drywall joint compound, ceiling tile stucco, acoustical and stipple finishes and visually similar floor tiles.	Less than 90 m^2 (<1,000 sq. ft.)	3
	90 or more m^2, but less than 450 m^2 (1,000-5,000 sq. ft.)	5
	450 or more m^2 (>5,000 sq. ft.)	7

Note: These recommendations represent the minimum number of samples for each type of **homogeneous** material that should be sampled. For large quantities of suspect materials, more samples may be required. Materials such as drywall joint compound and plasters should be considered heterogeneous materials unless it can be established that the materials in the structure were installed at the same time, using the same products.

Samples should be collected at random locations and need to be representative of the materials sampled. At least one quality assurance/quality control sample should be collected for every 20 samples or per building.

Composite sampling is a sampling technique commonly used for environmental sampling of soils. Multiple soil samples from a defined area can be mixed and analyzed as a screening tool to help identify where additional sampling may be required. **Composite sampling of asbestos-containing materials is not a recognized best practice.** Unlike the chemical analyses of soil, bulk asbestos analysis involves the microscopic visual examination of a small portion of the collected sample. If materials are low in asbestos content or are heterogeneous, such as wall plaster or drywall joint compound, composite sampling of materials, where non-containing and containing materials are combined, would dilute the analyte and interfere with the analysis.

For bulk sample analysis, there are a number of options. NIOSH has two methods, NIOSH Method 9002, *Asbestos (bulk) by PLM* or Method 9000, *Asbestos Chrysotile by XRD* (if the material is chrysotile). Method 9002 involves viewing the sample under a polarized-light microscope. Identification is based on appearance and colour. The percentage of asbestos in the sample is expressed as an estimate of the area per cent of all material present (diagrams are provided to assist with this). Method 9000 involves preparing the sample and doing an x-ray diffraction scan using an x-ray powder diffractometer with a copper target x-ray tube and scintillation detector. Chrysotile is identified by specific diffraction peaks and the size of the peaks determines the content. NIOSH methods can be found at www.cdc.gov/niosh/nmam/default.html

Alternatively, US EPA has test method EPA/600/R-93/116, *Method for the Determination of Asbestos in Bulk Building Materials*. The method uses polarized light microscopy (PLM), x-ray diffraction (XRD) and analytical transmission electron microscopy for qualitative identification of materials. Quantitative analysis is done by comparing gravimetrically prepared standards of known composition with unknown samples using a combination of visual comparison, point counting, gravimeter and quantitative XRD. The method is available on line at cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=ORD&dirEntryID=33479.

If more precise results are needed or the content of asbestos may be low, the bulk samples may also be analyzed by transmission electron microscopy.

7.1.2 Wipe sampling

While there are currently no criteria for asbestos levels on surfaces, there are two methods for sampling dust on surfaces that have been developed by ASTM International (ASTM):

- D6480-05, *Standard Test Method for Wipe Sampling of Surfaces, Indirect Preparation and Analysis for Asbestos Structure Number Concentration by Transmission Electron Microscopy*
- D5756-03, *Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Mass Surface Loading*

The standards can be purchased by contacting ASTM at www.astm.org

If asbestos fibres are detected on surfaces, a competent person must perform a risk assessment to determine if the surface is contaminated as defined by the OHS Code. Additional air monitoring may be

required to determine if there is a potential worker exposure issue. Where wipe sampling is chosen as a method to evaluate the effectiveness of asbestos abatement, samples will need to be collected before and after asbestos-containing materials are distributed and compared. If asbestos fibres are found on surfaces outside the abatement area the extent of contamination and extent of clean up required will need to be assessed. Work practices will need to be reviewed.

7.1.3 Collecting a sample of vermiculite insulation

Procedures for sampling vermiculite insulation are somewhat different than procedures for other asbestos-containing materials. The objective is to determine whether or not the product is the type that is asbestos contaminated (contains asbestos fibres) rather than determine how much asbestos is present. There are three important factors that must be considered when sampling this material:

1. The concentration of asbestos in the product is highly variable, so more than one sample is required.

2. Because asbestos fibres can be present at low concentrations, typically a larger sample size is required.

3. Asbestos fibres tend to fall off from the product and settle at the bottom of the insulation layer. Samples must be taken that represent the entire thickness of the insulation layer.

The sampling procedure should follow the basic steps outlined below. This procedure may need to be modified, depending on where and how the material is installed.

Equipment

- four-litre plastic bag (such as a large heavy duty ziplock freezer bag)
- metal scoop with a flat edge
- personal protective equipment (disposable gloves, coveralls, half-mask respirator with high-efficiency particulate filters such as P-100s)

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 (or place bag into another bag).

(4) Label the sample.

(5) At least three four-litre samples should be taken at each sampling site. The scoop should be cleaned between samples and new gloves donned.

Sample analysis

It is not unusual for vermiculite to contain asbestos in concentrations below one per cent. However, the concentration can be variable and hazardous concentrations of airborne asbestos fibres can be generated even when the concentration is below one per cent if the material is disturbed. There are a few options for sample analysis; some methods are quantitative (provide a precise concentration), 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:

Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation
cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=81468.

Sampling and Analysis of Consumer Garden Products that Contain Vermiculite
hero.epa.gov/hero/index.cfm/reference/details/reference_id/783704.

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

7.2 Air sample collection

Air monitoring is important in evaluating how well workers are being protected, the selection of respiratory protective equipment, the effectiveness of decontamination and the integrity of the containment during abatement activities. Collection of reliable data requires a thorough knowledge of air sampling, analytical

techniques and when a particular technique should be used. Air monitoring must only be performed by competent personnel.

Air sampling is conducted to estimate airborne asbestos fibre concentrations before, during and after abatement activities. Samples are generally collected on a filter inside a cassette assembly. The cassette is attached to a sampling pump via tubing. The type of filter used depends on the analysis method. During sampling, the front cover of the cassette is removed and air drawn by the pump passes through the cassette, trapping airborne fibres in the filter media.

When conducting analyses that involve counting fibres, NIOSH Method 7400 must be applied and only to particles that meet the size criteria for fibres in the method.

The following are key points regarding air sampling:

- Calibrate pumps before and after sampling with representative sample collection equipment such as filters connected to the sampling port. This must be done to verify the pump air flow during sampling. Pump air flow in the post-calibration check should be within 10 per cent of the flowrate measured in the pre-sampling calibration check.

- Submit at least two field blanks (or 10 per cent of the total samples, whichever is greater) for each set of samples. The NIOSH 7400 Method requires two to 10 field blanks to be submitted per sample set.

- Sampling flow rates can range from 0.5 to 16 litres per minute depending on anticipated fibre concentrations. The sampling flow rate should be adjusted to produce a fibre density of 100 to 1300 fibres per square millimetre (f/mm^2) on the filter.

- Untreated polystyrene foam packing material must not be used when shipping sampling cassettes as electrostatic forces may remove fibres from sample filters.

- Fibre concentration must be reported with an accuracy of two decimal places e.g. < 0.01 f/cc.

- The working range for the method is 0.04 to 0.5 f/cc for a 1,000 litre air sample.

- The limit of detection is based on the volume of sample collected and fibre density (see Appendix D of the NIOSH Method 7400).

Three types of sampling can be used to determine airborne fibre concentrations:

1. Personal/breathing zone/occupational sampling

   Occupational samples are intended to directly measure a worker's exposure. These are the most reliable way to evaluate a worker's exposure compared to the OEL.

Personal, breathing zone or occupational samples are collected using a portable battery-powered pump worn by the worker during work activities. The sampling cassette is positioned facing downward in the worker's "breathing zone" (as close to the mouth as possible) and the pump is attached to a belt worn around the worker's waist. Most commonly, phase contrast microscopy is used to analyze the samples.

Personal sampling should be done during a repair, renovation or abatement project to determine the worker's exposure to asbestos fibres. Representative samples should be taken to confirm proper selection of respiratory protective equipment and the effectiveness of removal or control techniques in reducing worker exposure to airborne asbestos fibres as well as assessing compliance with the OEL for asbestos.

2. Area sampling

Area samples do not directly measure work exposure, they measure airborne concentrations in the general work area. They may not be reliable indicators of an individual worker's exposure unless the worker remains close to the sample location for the duration of the sample time. In asbestos abatement projects, area sampling is done to evaluate controls.

Area samples are usually taken at flow rates ranging from 0.5 to 16 litres per minute using electric-powered pumps. The sample cassette is attached to the pump via tubing and is positioned facing downward at a height of approximately 1.5 metres above the ground.

Area sampling should be used in the following situations during abatement projects:

- *Before abatement activities begin* – air monitoring conducted prior to abatement work commencing is called "background sampling" or "prevalent level sampling". Background samples provide valuable information for documentation purposes. Generally, one background sample should be taken for each 450 m^2 of space with 3,000 to 10,000 litres of air volume collected per sample.

- *Area air samples inside the work area when no containment is built* – samples are collected throughout the duration of the asbestos abatement project to determine how well asbestos fibres are being contained in the work area. These samples are important to ensure work procedures are adequate to control fibre release.

- *Area air samples outside the work area but inside the building* – samples are collected throughout the duration of the asbestos abatement project to determine how well asbestos fibres are being contained in the work area. These samples are very important when abatement activities are performed in an occupied building. Samples should be collected from:

  - the clean room,

  - the clean side of the containment barrier,

- in multi-storey buildings, one floor above and one floor below (if these areas are occupied) and the floor on which abatement activities are occurring, and

- at any other locations representative of those that could be contaminated due to fibre migration should there be a loss of containment.

- *Area sampling outside the building* – area sampling can be conducted outside the building during abatement activities to determine if any asbestos fibres are leaking from the work area. Suggested sampling locations include windows, doors, the exhaust from negative air units, waste load-out areas and areas downwind of abatement activities.

- *Area air sampling after final clean-up of the containment* – after a thorough final visual inspection has been completed and the clean-up is considered acceptable, the abatement contractor encapsulates all surfaces inside the containment with a glue spray. The spray is allowed to settle and dry for a minimum of 4 hours (ideally 8 to 12 hours) and then final air tests can be conducted. Negative air units should remain running until the final air test is completed and analyzed as acceptable unless dust from construction or other activities would be drawn into the containment. Care must be taken to collect a sufficient volume of air to achieve quantifiable loadings on the filter. One sample should be taken for each 450 m^2 of space with 3,000 to 10,000 litres of air volume collected per sample.

3. Aggressive air sampling

   Aggressive air sampling is done at the completion of a high- or moderate-risk project prior to removal of the enclosure. It involves mechanically disturbing the air to simulate air movement. Aggressive sampling gives a more reliable indication of the degree of cleanliness of the containment. The following is an example of a procedure that can be used:

   (1) 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 sq. ft.) of floor area.

   (2) Place a 51 cm (20 in) fan in the centre of the room (use one fan per 283 m^3 or 10,000 cubic feet of room space). Put the fan on low speed and point it towards the ceiling.

   (3) Start the sampling pump(s) and sample for the period of time required to collect the volume of sample.

   (4) Turn off the pump(s) and fan(s) when sampling is completed.

   If testing reveals final clearance levels exceed (0.01 f/cc), the sampling equipment must either be properly decontaminated, wrapped for use on subsequent projects (if this is possible) or discarded.

7.3 Analytical methods

7.3.1 NIOSH 7400 phase contrast microscopy (PCM) method

PCM is the most common and frequently used analytical method for analyzing air samples for asbestos. It is also the least expensive method and has a well-established protocol. However, the NIOSH method for PCM analysis does not distinguish between asbestos and other types of fibres. All fibres are counted and assumed to be asbestos.

A cellulose ester filter, having a 0.8 micrometre effective pore size, is analyzed to determine the concentration of fibres present on the filter. A section of the filter is mounted and “cleared” on a microscope slide using a special mounting solution or acetone vapour. Using a phase contrast microscope with 400X to 500X magnification, fibres on the prepared slide meeting the method criteria are counted. Fibres less than 0.3 micrometers in diameter are below the resolution of the microscope. Fibres are counted according to the counting rules specified for analytical method 7400 in the NIOSH Manual of Analytical Methods.

Results of analysis

(1) Results are expressed in fibres per cubic centimetre (f/cc) taking into account the number of fibres and fields counted, the filter and graticule area, and the volume of air collected. The following formula is used:

$$f/\text{cc} = \frac{\text{average count x sampling area}}{\text{field area x flow rate x sample time x conversion}}$$

(2) The working range is 100 to 1,300 fibres/mm^2. The main problem with the PCM method is variability among analysts counting the fibres. Variability is reduced by collecting samples within the working range. Counts below 100 fibres/mm^2 are probably over-counted (positive bias) and counts above 1,300 fibres/mm^2 are probably under-counted (negative bias).

(3) The Limit of Detection (LOD) is 7 fibres/mm^2 or 5.5 fibres counted in 100 fields. This value was obtained from the Proficiency Analytical Testing (PAT) program from blank values. This means that any filter that is counted with fewer than 5.5 fibres in 100 fields is not statistically reliable because the number is below the blank value. Sample results below the Limit of Detection should be reported as such.

(4) The Limit of Quantitation (LOQ) is 100 fibres/mm^2, which is the lower end of the working range. The LOQ is an amount of analyte at which a certain acceptable level of precision has been reached. If a sample result falls below this value, it should be reported that there is diminished statistical reliability.

(5) The LOD of the method is 0.003 f/cc. Fibre concentrations below this should be reported as < 0.01 f/cc. This is based on the collection of at least 1,000 litres of air. If less air is passed through the filter,

the detection limit will increase (see Appendix D of the Method). Increasing the volume of air collected does allow the user to report LODs lower than 0.01 f/cc.

7.3.2 Polarized light microscopy (PLM) and point counting

PLM is the primary method used to analyze bulk asbestos samples. This is a qualitative analysis conducted using two microscopes. It is relatively low cost but only provides an estimate of concentration. Other fibres with optical properties similar to asbestos may give positive interferences and fibres finer than the resolving power of the microscope will not be detected. Coatings on fibres may also interfere with the analysis.

The analyst first uses a stereo-binocular microscope to identify the characteristics of the material. The individual components identified are then mounted on a slide and viewed using PLM for identification and estimation of asbestos content. The identification and estimation are based on training with bulk sample standards of known percentages of fibrous components. The range for PLM is 1 to 100 per cent asbestos. If the asbestos content is less than 1 per cent, it can only be reported as “<1%”.

Point counting is a technique used in conjunction with the PLM method to provide a more reliable quantification of the asbestos content in a bulk sample, particularly in cases where the content may be below 1 per cent. Point counting is more time consuming and often will cost extra if included with PLM. In this method, the analyst makes a number of slides with a small amount of homogenized sample material. Through a method-defined system of slide movements on the PLM, each time an asbestos fibre is identified it is recorded. The analyst must look at 400 observations or “points” over the slides. The number of asbestos fibre bundles recorded is divided by the total number of points observed to calculate the percentage of asbestos. For example, if five fibre bundles were identified in 400 observation points, the asbestos content would be 1.25 per cent. The 400 point count method has a detection limit of 0.25 per cent. The number of observation points can be increased to improve sensitivity, some jurisdictions require 1,000 points to be counted.

7.3.3 NIOSH 7402 transmission electron microscopy (TEM) method

This analytical method can distinguish asbestos from other fibres, can detect very thin fibres and can be used for both air and bulk sampling methods. TEM analysis is valuable when other fibres are present that may interfere with the PCM or PLM methods. The disadvantages of TEM include increased cost compared to PCM, a more complicated sample preparation procedure and a longer time required for analysis.

The TEM method provides a means of determining the fraction of asbestos fibres collected on the sample (fraction count) as well as estimating the total fibre concentration of fibres (distribution count). The cassette used for TEM has a 0.45 to 1.2 micrometre pore size and samples are collected in a similar fashion to PCM. At a flow rate of 0.5 to 16 litres per minute, 700 to 2,800 litres of air should be drawn through the filter in dusty atmospheres and 3,000 to 10,000 litres of air in clean atmospheres. The filter is initially viewed under high magnification (10,000X) and then the fibres are counted under low magnification (500 – 1,000X).

While TEM may be used on asbestos projects, results should be reported using NIOSH method 7400 PCM size criteria for regulatory purposes.

Results of analysis

(1) Results are expressed as an asbestos fibre count. The type of asbestos present is also reported.

(2) The working range is 0.04 to 0.5 f/cc for a 1,000 litre air sample.

(3) The LOD is less than 0.01 f/cc for atmospheres free of interference, but depends on sample volume and the quantity of interfering dust.

7.4 Laboratories conducting asbestos analyses

All laboratories analyzing asbestos samples for the purposes of meeting an obligation with the Alberta OHS legislation have certain responsibilities under the *OHS Act*.

Laboratories considered service providers under the OHS legislation must ensure:

- Workers providing the services are competent.
- Their work complies with requirements in the OHS legislation (for example, following prescribed methods for analysis of samples).
- If their service is intended for a person to meet an obligation under the OHS legislation, it enables that person to comply.
- Their work does not endanger anyone at or near a work site.

7.4.1 Proficiency testing by inter-laboratory comparison

All laboratories engaged in asbestos counting should participate in a proficiency testing program and routinely exchange field samples with other laboratories to compare the performance of counters. This is one way a laboratory may demonstrate that the analysts are competent as defined in the *OHS Act*. Proficiency testing programs available to laboratories include:

American Industrial Hygiene Association (AIHA)
Asbestos Analysts Registry
3141 Fairview Park Dr, Suite 777
Falls Church, VA 22042
USA

www.aiha.org//registries/aar/Pages/asbestos-analysts-registry.aspxw

American Industrial Hygiene Association (AIHA)
Proficiency Analytical Testing Program (PAT)
3141 Fairview Park Dr, Suite 777
Falls Church, VA 22042
USA

www.aihapat.org

Canadian Association for Laboratory Accreditation Inc. (CALA)
102-2934 Baseline Road
Ottawa, Ontario K2H 1B2

www.cala.ca

7.4.2 Guidelines for checking a laboratory's quality control (QC) program

Training and experience

All persons producing measurements must be trained and understand their roles. Only laboratories with demonstrated proficiency in asbestos analysis should be selected. When selecting a laboratory, its QC program should be reviewed as well as the lowest levels of fibres it routinely reports.

Quality control checks

Field and laboratory blanks should be used to check for fibre contamination, coded sample labels to avoid analyst bias, duplicate analysis to confirm precision and a second laboratory to spot check the accuracy of results.

Chain of custody

Responsibility for security of the samples should be assigned to specific persons at each stage of the analysis. Each step in the passage of samples from the field to the laboratory must be documented.

Documentation

The laboratory should be able to provide documentation with the analysis on the quality assurance/quality control checks used. Laboratory results must be checked and documented.

Chapter 8 Other Health and Safety Considerations

Asbestos abatement work is potentially hazardous. Employers and workers must not ignore other hazards such as falls, cuts and bruises, electrocution, exposure to chemicals and heat stress. This chapter summarizes some of the other common OHS hazards at asbestos abatement project work sites.

8.1 Identifying the hazards

During pre-job inspection, work site preparation and removal activities, many potential hazards can be identified and eliminated. The most common occupational health and safety hazards inherent to asbestos abatement work are:

- poor housekeeping
- electrical hazards
- working at heights – ladders and scaffolds
- slips, trips and falls
- heat stress
- carbon monoxide exposure
- limb and body hazards
- exposure to hazardous chemicals

Additional hazards may be present at the work site beyond those addressed in this chapter. The employer, or prime contractor if there is one, must conduct a hazard assessment before work starts to identify all potential hazards. Control must be put in place to protect workers for all hazards identified in the hazard assessment.

8.2 Summary of hazards

8.2.1 Poor housekeeping

Containments can be cramped with obstructions and limited space for workers and equipment. Asbestos abatement procedures create waste materials that accumulate on floors in the work area. Poor housekeeping and waste management can create hazards to workers by obstructing exits, creating slip and trip hazards and interfering with work. Work procedures should be in place to ensure waste is regularly removed from the work area and equipment and supplies are kept organized. Housekeeping should be checked as part of the routine inspections of the work site and addressed quickly when issues are identified.

8.2.2 Electrical hazards

One of the most common hazards on abatement projects is contact with electricity since work procedures involve the use of water. Electrical hazards resulting from improper grounding, incorrect wiring and lack of proper shielding are especially dangerous.

Wiring faults may include open ground paths, reverse polarity and incorrectly connected hot, neutral or ground wires. These faults can be identified with plug-in type circuit testers and may need to be corrected prior to the project starting.

Asbestos abatement often occurs in partially renovated or demolished buildings where damaged equipment or electrical fixtures may be present. Where possible, circuits that will not be used during the removal should be identified, tagged and locked out. All wiring should be treated as energized unless tested and proven to be de-energized.

Transformers or control boxes that must remain energized during the abatement project often cannot be sealed due to heat build-up. Dry removal may be necessary in this situation to maintain air circulation and control the electrical hazard.

All electrical equipment used during the abatement project must be regularly inspected for damage, proper grounding and integrity of insulation. Non-metallic tools should be used for scraping; wooden or fiberglass ladders should be used to reduce or eliminate the possibility of a path to ground if a worker contacts an energized circuit or equipment.

Due to the presence of water, power to removal areas must be supplied through ground fault circuit interrupters (GFCIs). GFCIs protect all circuits and provide the safest power source since any ground fault will trip the circuit.

8.2.3 Working at heights – ladders and scaffolds

Asbestos abatement work frequently requires the use of ladders and scaffolds to reach asbestos-containing materials. Improper use or inadequate maintenance of this equipment can cause worker injury.

Ladders should be inspected regularly for damage and repaired or replaced. Workers must be instructed on how to use ladders correctly. Ladders must not be used as a work platform or walk board. Stepladders should be used only when completely open. If extension ladders are used, the base location should be one metre away from the point below the upper contact point for every four metres of elevation.

Many asbestos abatement projects require the use of scaffolds. Correct set-up, regular inspection and basic maintenance are essential. If a scaffold is rented, the contractor should inspect all components before accepting them.

To reduce the risk of a mobile scaffold tipping over, the height must not exceed three times the smallest dimension of its base. The wheels of the scaffold must operate properly. Guardrails should always be installed on scaffolds to prevent worker falls. Toe boards should be installed to prevent tools and other objects from dropping on workers below.

8.2.4 Slips, trips and falls

Areas sealed with polyethylene sheeting and kept damp to reduce airborne fibres may become very slippery. Rubber boots with non-skid soles are recommended. Asbestos-containing materials or other debris should be bagged immediately to reduce slipping and tripping hazards. Hand tools, cords and hoses should be organized and moved away from where workers could trip over them. Walkway should be kept clean of tripping hazards.

Where there is a danger of falling from a height, appropriate fall protection equipment or methods must be used. Floor openings in the work area must be protected by a securely installed temporary cover (including a warning sign) or by a guardrail and toe boards.

Running and horseplay in work areas should never be allowed.

8.2.5 Heat stress

Heat-related disorders are common to asbestos abatement work. Hard physical labour, potentially non-breathable protective clothing and the need to use a respirator combine to reduce the body’s ability to cool itself. Heat exhaustion can be life threatening and may develop into heat stroke, which is a serious medical emergency if it is left untreated.

Heat-related disorders can be prevented by:

- acclimatizing workers to the heat
- ensuring that workers drink plenty of water

- having workers strictly follow a work/rest schedule
- cooling and ventilating the work area to the extent possible

For more information:

Working Safely in the Heat and Cold - Best Practice (GS006) ohs-pubstore.labour.alberta.ca/gs006

8.2.6 Carbon monoxide

A variety of potential sources of carbon monoxide may exist at an asbestos abatement project site. Respiratory protective equipment supplied with air from a compressor powered by an internal combustion engine may be a source of carbon monoxide. Engine exhaust, which contains carbon monoxide, may be drawn into the fresh air intake of the breathing air compressor. Diesel or gasoline powered generators or heaters may also be used inside buildings on abatement projects where utilities have been disconnected. Since it is not irritating and has no odour, a worker may remain unaware of their exposure to carbon monoxide.

Workers monitoring the breathing air system should be familiar with the symptoms of carbon monoxide poisoning. If an airline respirator supplied from a compressor is used, the filter on the compressor should be equipped with a carbon monoxide monitor or alarm. Employers must ensure fuel powered equipment used indoors has its exhaust vented to the outside to prevent accumulation of carbon monoxide in the work area.

For more information

Carbon Monoxide at the Work Site (CH031) ohs-pubstore.labour.alberta.ca/ch031

8.2.7 Limb and body hazards

A work site hazard assessment should be conducted to identify limb and body hazards. Workers must wear properly fitting hand, arm, leg or body protective equipment appropriate to the work being done and the hazards involved.

Hardhats, eye protection and safety boots, as appropriate, must be worn at all times when there is potential for workers to be exposed to falling objects, debris entering the eyes or materials falling on feet.

8.2.8 Hazardous chemicals

Chemicals such as glues, encapsulants, paints and other solvents used at an asbestos abatement site may be hazardous. The employer is responsible to assess potential exposure and ensure OELs are not

exceeded. Information to identify hazardous components on these products will be available on their safety data sheets, if one is required, or on the product label. The employer must ensure workers receive site-specific training based on the products to be used. The training should included the hazards of the products, safe work procedures and procedures to follow in an emergency.

Chapter 9 Roles and Competency Profiles for Workers, Project Managers, Supervisors and Consultants at Asbestos Abatement Projects

This chapter provides guidance on the skills that workers, project managers, supervisors and consultants should have with respect to an asbestos abatement project. Each section discusses the general tasks that each role is responsible to complete. As projects may vary in their set up, some sections may not be applicable or may need to be adjusted. There may also be additional tasks that need to be completed.

From the perspective of the *OHS Act*, workers and project managers both have the responsibilities of workers, and consultants are considered service providers.

9.1 Worker competency profile at asbestos abatement project work sites

Standards of performance

(1) Job execution

(a) Review work procedures with supervisor

i. Verify all work procedures with immediate supervisor.

ii. Visually inspect the job with the supervisor.

iii. Discuss concerns/problems of job with the supervisor, joint work site health and safety committee or health and safety representative, as applicable.

iv. Recommend changes in work procedures when necessary.

v. Implement work procedures as agreed to with supervisor.

(b) Identify material supply needs

i. Report shortages of materials and supplies to the supervisor.

ii. Determine the need for special supplies and request them through the supervisor.

(c) Maintain site and services

i. Repair damage to the enclosure and report the damage to the supervisor or employer.

ii. Report to the supervisor any interruption to, or lack of, water, power or lighting.

(d) Isolate work area

i. Rope off all work areas.

ii. Post signs outside the contaminated area.

iii. Maintain airtight isolated work areas.

iv. Post signage to mark the entrance and exit points.

v. Assemble the airlock as directed.

vi. Seal air-handling system as directed.

(e) Install negative pressure air system

i. Install the negative pressure air system.

ii. Seal the negative pressure air system as directed.

iii. Visually inspect the work site to confirm that negative pressure is established in the enclosed area.

(f) Set up decontamination facility

i. Construct the decontamination facility as directed.

ii. Report any sanitation supply shortages to the supervisor.

iii. Ensure waste water is collected or treated appropriately.

(g) Minimize airborne asbestos fibres

Follow established work procedures to control the release of asbestos fibres:

i. Wet, remove and bag asbestos-containing materials where practicable.

ii. Encapsulate areas as directed.

iii. Prevent unnecessary accumulations of waste by containing waste material as soon as possible.

iv. Use safe practices when handling material for disposal.

(h) Maintain good housekeeping

i. Follow established work procedures as directed.

ii. Use a vacuum cleaner fitted with a HEPA filter to clean up waste material.

iii. Place waste material in containers; seal and remove to disposal area.

iv. Decontaminate all tools, scaffolding and equipment prior to removal from the work site.

(i) Prepare material for disposal

i. Use established work procedures to minimize airborne fibre release during removal of isolation enclosures.

ii. Take care to prevent puncturing waste material bags.

iii. Clean the exterior of bags prior to their removal to the transfer area.

iv. Double-bag waste material and seal.

v. Mark waste material with required label.

vi. Store waste material in designated storage area.

(j) Maintain decontamination facility

i. Maintain a housekeeping schedule.

ii. Clean and sanitize floors and walls.

iii. Repair airlocks as directed.

iv. Maintain services for decontamination facility.

(k) Operate asbestos removal equipment

i. Be able to demonstrate procedures for safe operation of removal equipment used at the work site.

ii. Notify supervisor and obtain approval for any equipment modification.

(l) Maintain asbestos removal equipment

i. Perform maintenance and minor repairs to equipment as directed by the supervisor.

ii. Check filter on negative pressure air system as required or directed.

iii. Report to the supervisor the need for any repairs to equipment.

(2) Health and safety

(a) Review health and safety procedures with supervisor

i. Check with supervisor on any site-specific health and safety procedures.

ii. Be able to explain why procedures must be followed with the supervisor.

iii. Review emergency procedures to be followed.

(b) Demonstrate knowledge of asbestos health hazards

i. Describe the specific health hazards from asbestos exposure.

ii. Describe the increased risk of illness resulting from smoking combined with asbestos exposure.

(c) Demonstrate knowledge of requirements, responsibilities and rights under OHS legislation

i. Be able to describe worker's responsibilities under the *OHS Act*.

ii. Describe situations where a worker has the right to refuse work that is unsafe.

iii. Recognize the limitations of respiratory protective equipment used at the work site.

iv. Know the requirements in the OHS Code with respect to asbestos.

v. Cooperate in health assessment monitoring by the employer.

vi. Perform work according to the code of practice or established work site procedures.

vii. Cooperate with others who are exercising a duty under the OHS legislation (e.g. supervisor, service providers, OHS officers).

(d) Report violations of health and safety requirements

i. Report any violations of safe work procedures to the supervisor or employer.

ii. If violations continue, report them to Alberta Labour and Immigration, Occupational Health and Safety.

(e) Report and act on potential work site health and safety hazards

i. Report to supervisor or employer unsafe conditions or unsafe equipment.

ii. Rope off area and restrict access and/or tag equipment until hazard is corrected or eliminated.

iii. Do not use unsafe equipment.

(f) Report potential electrical hazards

i. Report any electrical hazards to the supervisor.

ii. Rope off and restrict access to the area until the hazard is eliminated.

iii. Use a ground fault circuit interrupter system for power distribution.

(g) Use and maintain personal protective equipment properly

i. Demonstrate proper donning, fit checks, use and maintenance of respirators, including filter replacement.

ii. Use disposable clothing provided according to work site procedures.

iii. Decontaminate footwear, respirator and any other reusable protective equipment used at the work site in accordance with the work site procedures.

(h) Use decontamination facility

i. Follow established work procedures for leaving contaminated area.

ii. Remove all contaminated clothing and place in containers provided.

iii. Maintain a schedule of cleaning the contaminated side of the decontamination facility to minimize fibre levels.

iv. After showering (with respirator on), remove filters (if applicable) and dispose of them in containers provided.

v. Place all towels in the recycling containers provided.

vi. Clean and disinfect respirators.

vii. Maintain a housekeeping schedule for the decontamination facility.

viii. Treat all equipment, tools and clothing used inside the contaminated area as contaminated material and remove only through a decontamination facility.

(i) Report worker health problems

i. Watch for and assist any co-worker showing signs of physical or heat-related distress.

ii. Report any relevant worker health concerns to the supervisor or employer.

9.2 Project manager competency profile at asbestos abatement project work sites

Standards of performance

(1) Job execution

(a) Validate site conditions

i. Identify and locate essential services and work areas prior to job set-up.

ii. Review site access and equipment set-up with employer and supervisor prior to job set-up.

iii. Review work site-specific concerns such as unusual work routines or site conditions.

iv. Ensure a work site-specific hazard assessment has been done.

(b) Ensure isolation of work area

i. Review isolation procedures with employer and supervisor prior to project start-up.

ii. Ensure isolation procedures are implemented as described in the work plan prior to start of removal.

iii. Ensure isolation of work areas is maintained during removal.

iv. Ensure sealing of heating, ventilation and air conditioning systems is done according to work plan, and review prior to starting any removal.

v. Inspect containment on a regular basis for signs of damage.

(c) Ensure installation of negative pressure air system

i. Ensure installation and testing of negative pressure air system is done according to work plan or as directed.

ii. Visually inspect the work area to confirm that negative pressure is established in the containment.

(d) Check the set-up of decontamination facility

i. Ensure the decontamination facility is constructed and equipped according to work plan or as instructed by employer or supervisor.

ii. Ensure the decontamination facility is complete prior to start of the removal phase.

(e) Minimize fibres in the air

i. Ensure work procedures to minimize airborne fibre concentrations are followed during the removal process.

ii. Visually check work procedures and correct as necessary.

iii. Review asbestos monitoring results and adjust work procedures, as required.

(f) Monitor air testing

i. Monitor air testing equipment during sample period to ensure continuous operation.

ii. Ensure workers do not remove or tamper with air monitoring equipment during sampling.

iii. Ensure service providers retained to complete air testing know and comply with work site procedures.

(g) Identify material supply needs

i. Manage materials required for the job.

ii. Maintain an inventory of materials and equipment.

iii. Report material needs to employer to ensure a constant supply.

(h) Ensure proper operation of equipment

i. Verify worker knowledge of the correct and safe operation of all equipment.

ii. Demonstrate proper and safe use of equipment to workers as required.

iii. Visually check during work that equipment is used correctly and safely.

(i) Ensure maintenance of equipment

i. Inspect equipment for condition and evidence of proper maintenance in accordance with manufacturer specifications.

ii. Train workers in maintenance of equipment.

iii. Identify and ensure any equipment failure is corrected.

iv. Maintain an inventory of equipment parts and materials.

v. Ensure proper decontamination or containment of equipment upon job completion.

vi. Ensure HEPA filtered systems have been tested for efficiency and are in working condition

(j) Implement abatement procedures

i. Ensure abatement procedures are implemented in accordance with work site procedures.

ii. Monitor worker adherence to abatement procedures.

iii. Correct any observed deviations from abatement procedures or report them to the supervisor for corrections.

iv. Ensure correct waste handling, transportation and disposal procedures are followed.

(2) Oversight

(a) Review work procedures with workers

Provide worker orientation to work procedures, emphasizing health and safety, decontamination, material handling, supplies, equipment and area security.

(b) Review health and safety procedures with workers

i. Discuss critical health and safety topics with workers.

ii. Highlight and explain problem areas and question workers for understanding.

iii. Clarify any changes to health and safety procedures.

iv. Identify and show workers evacuation routes and emergency procedures.

(c) Monitor work

i. Observe work and, in conjunction with supervisor, ensure the performance of workers is corrected in:

- work procedures,
- using and maintaining all required personal protective and safety equipment in accordance with work procedures, and
- handling and preparing materials for transportation and disposal.

ii. Ensure non-compliance with work procedures is reported to the supervisor.

(d) Monitor use of materials

i. Ensure that sufficient materials are available at the work site.

ii. Correct misuse of materials.

iii. Maintain and reorder supplies as needed.

iv. Verify that ordered supplies are received.

v. Ensure materials are properly stored in areas designated for material storage purposes.

(e) Ensure use of decontamination facility

i. Train workers in proper use of decontamination facility according to work procedures.

ii. Verify through spot checks that workers are using decontamination facility correctly.

iii. Ensure improper use of decontamination facility is corrected.

(f) Ensure adequacy of first aid

i. Identify the on-site first aid person and first aid station to all workers.

ii. Verify daily that adequate first aid supplies are on site.

iii. Ensure that the first aid person possesses a valid training certificate.

iv. Ensure a first aid person is present at the work site during all work shifts.

(g) Recognize and act on worker health problems

i. Rotate staff as necessary to avoid physical- or heat-related distress.

ii. Observe workers on an ongoing basis for symptoms of heat stress.

iii. Immediately report to supervisor any workers with symptoms of distress.

(h) Ensure maintenance of site and services

i. Check site services regularly.

ii. Rectify any interruption to services.

(3) Health and safety

(a) Explain health hazards of asbestos

i. Explain health hazards of asbestos exposure to workers.

ii. Explain the increased risk of illness resulting from smoking combined with asbestos exposure.

(b) Know work site health and safety hazards and safe work procedures

i. Ensure a site-specific hazard assessment has been done and controls are in place to protect workers.

ii. Know and understand how to use controls in place to protect workers.

iii. Explain work site hazards and controls in place to protect workers.

iv. Know the work site procedures for the project.

v. Provide a health and safety procedures orientation to workers prior to starting the job.

(c) Demonstrate knowledge of requirements, responsibilities and rights under OHS legislation

i. Demonstrate a working knowledge of requirements applicable to asbestos abatement procedures for the project being undertaken.

ii. Identify requirements and procedures described in the *OHS Act*, Regulation and Code.

iii. Explain rules when a violation is observed.

iv. Outline and discuss responsibilities and requirements of work site parties as described in the *OHS Act*, Regulation and Code.

v. Cooperate with others who are exercising a duty under the OHS legislation (e.g. supervisor, service providers, OHS officers).

(d) Identify and act on health and safety hazards

i. Monitor work site for health and safety hazards on an ongoing basis.

ii. Visually inspect site for violations of health and safety procedures.

iii. Ensure hazard warning signs are posted.

iv. Check fire alarm sensors, smoke detectors and other sensors/alarm system components are working properly.

(e) Monitor and ensure compliance with health and safety procedures

i. Take corrective action as directed by supervisor or employer to ensure compliance with health and safety practices.

ii. Ensure that health and safety regulatory requirements are followed.

iii. Report to supervisor or employer any ongoing violations and describe corrective actions that must be taken.

(f) Ensure control of electrical hazards

i. Ensure, where possible, that all electrical circuits are locked out prior to starting work on the job.

ii. Check to ensure that circuits are locked out at the beginning of each shift.

iii. Ensure that the ground fault circuit interrupter system is checked by a qualified person prior to job start-up and when repairs are required.

(g) Ensure proper use and maintenance of personal protective equipment

i. Observe worker use and maintenance of personal protective equipment and correct errors.

ii. Check personal protective equipment daily.

iii. Ensure workers are clean shaven and fit tested for respirators to be used during the work.

iv. Ensure workers inside a restricted area are in possession of their valid, original asbestos worker training certificates.

(h) Ensure maintenance of decontamination facility

i. Monitor the integrity of the decontamination facility, including airlocks.

ii. Maintain and correct any failure in the decontamination facility or airlocks immediately.

(i) Monitor the preparation of waste materials for disposal

i. Observe and correct work practices involving the handling of waste and hazardous materials prior to their removal from the work site.

ii. Monitor and correct practices involving the improper handling of contaminated clothing.

iii. Check all equipment for proper decontamination prior to removal from the work site.

(j) Ensure good housekeeping

i. Establish and maintain a clean-up schedule that is monitored at least once per shift.

ii. Monitor housekeeping and ensure the decontamination facility is cleaned on a daily basis.

9.3 Supervisor competency profile at asbestos abatement project work sites

Standards of performance

(1) Supervision/management

(a) Complete written documentation

i. Develop written work site-specific safe work procedures.

ii. Maintain daily work logs.

iii. Complete progress reports.

iv. Obtain required forms and permits.

v. Develop a written work plan.

vi. Develop contingency plans, as required.

vii. Develop an emergency response plan.

viii. Maintain training records for site personnel.

ix. Ensure a notice of project is filed with Alberta Labour and Immigration at least 72 hours in advance of the start of work (see Section 3.4.2 **Notification of project start-up**).

(b) Verbally communicate with others

i. Explain work plan to project manager and other workers.

ii. Solicit input from workers and adjust work procedures as appropriate.

iii. Question workers of their understanding of work plans.

iv. Describe or clarify standards required.

v. Resolve differences of opinion.

vi. Direct others on completion of work assignments.

vii. Negotiate special job needs with client/contractor (e.g. job and access safety needs).

viii. Instruct affected people on work site, as required.

ix. Communicate with government agencies.

(c) Identify potential and existing issues

i. Review work site conditions and hazards with owner.

ii. Examine blueprints and specifications, if available.

iii. Visually inspect work site to note actual site conditions. Determine hazards or problem areas such as electrical, mechanical (e.g. operating equipment, computers, or other dust/moisture-sensitive equipment).

iv. Review layout and design of containment barriers with respect to security.

v. Observe effectiveness of entry restrictions to unauthorized personnel.

vi. Inspect work site to verify compliance with OHS legislation and owner requirements.

vii. Conduct hazard assessment of work area; ensure affected workers and the joint work site health and safety committee or health and safety representative, if there is one, are involved.

(d) Resolve issues and monitor solution effectiveness

i. Solve work site health and safety problems with work site health and safety personnel and/or the joint work site health and safety committee or health and safety representative, if there is one.

ii. Arrange for removal/protection of sensitive equipment with the owner.

iii. Monitor equipment removal operations.

iv. Conduct scheduled checks of area and equipment.

(e) Evaluate performance of workers and service providers

i. Evaluate adherence to safe work procedures through observation and communication.

ii. Monitor workers' use of decontamination facility.

iii. Monitor workers' use of protective equipment and supplies.

iv. Observe health and safety performance of workers and service providers.

v. Monitor workers for compliance with asbestos waste management and disposal procedures.

vi. Monitor performance of service providers relative to their roles and responsibilities on the project.

(f) Ensure proper performance of workers and service providers

i. Ensure workers comply with correct work procedures and codes of practice.

ii. Act as an example for adherence to safe work practices.

iii. Discipline workers as required.

iv. Ensure competence of workers for assigned tasks.

v. Ensure service providers complete the services as detailed in their contract.

(g) Review job schedule

i. Check for crew rotation to avoid heat stress and improve efficiency.

ii. Consult with employer and project manager on the assignment of workers for optimal performance.

(h) Ensure compliance with work procedures and codes of practice

i. Ensure workers are trained with respect to work procedures and codes of practice.

ii. Review established work procedures and respiratory, confined space and asbestos codes of practice (as necessary) with workers.

iii. Explain to workers the consequences of failing to comply with the work procedures and codes of practice.

iv. Ensure workers use all hazard controls and properly use designated personal protective equipment required for the work.

(2) Job planning

(a) Review specifications and work procedures

i. Collect information needed for work requirements.

ii. Review specifications, documentation and work procedures with the employer and other involved parties such as the owner, client, architect, health and safety consultant, health and safety committee worker representative, occupant, etc. as appropriate.

(b) Determine needs of client, employer and/or contractor

i. Identify client, employer and contractor responsibilities.

ii. Determine specific client, employer and contractor requirements.

iii. With the health and safety consultant or in-house technical staff, determine the scope of air monitoring required.

iv. Identify and inform the client, employer and/or contractor of parties potentially affected by the abatement project both on and off site.

v. Outline site security requirements.

(c) Evaluate site conditions

i. Identify water and power sources.

ii. Identify health and safety hazards.

iii. List pre-job deficiencies of site conditions.

iv. Determine if background airborne fibre concentration measurements are required.

v. Identify locations for decontamination unit, waste storage, assembly room, disposal room, entry, exit and any other required spaces.

(d) Determine specific work requirements

i. Identify site-specific concerns that affect contingency plans.

ii. Identify specific job requirements such as water and electricity.

iii. Identify hazard controls (for hazards in addition to asbestos).

(e) Schedule work

i. Determine resource, materials and equipment requirements.

ii. Schedule ordering of necessary materials, tools and equipment.

iii. Set up work schedule to include rotation of workers.

iv. Schedule sequence of work tasks.

v. Schedule the duration and frequency of work periods.

vi. Schedule construction of decontamination facility.

vii. Schedule disposal of waste materials.

viii. Schedule additional requirements such as shift work.

(f) Coordinate schedule

i. Establish work schedule with workers, other trades people and affected parties.

ii. Coordinate material requirements with suppliers.

iii. Coordinate air-monitoring requirements.

iv. Coordinate analysis of air samples with laboratory.

(g) Assign work

i. Plan and assign workers and equipment according to the task and worker experience.

ii. Check worker understanding of assigned task(s).

(3) Health and safety

(a) Identify and record site-specific health and safety hazards

i. Prior to work starting, visually inspect site for specific health and safety hazards.

ii. Perform regular daily inspections to monitor for unexpected health and safety hazards.

(b) Demonstrate a knowledge of requirements, responsibilities and rights under OHS legislation

i. Select work procedures that comply with requirements in OHS legislation.

ii. Determine the appropriate respiratory protective equipment to be used.

iii. Identify the monitoring of worker health as required by OHS legislation.

iv. Outline right-to-refuse provisions and roles and responsibilities of work site parties to workers.

v. Understand process to follow in the event of a work refusal.

vi. Define discriminatory action and understand the complaint resolution process within the *OHS Act*.

vii. Outline and explain to workers health and safety legislation that relates to the work site.

viii. Cooperate with others who are exercising a duty under the OHS legislation (e.g. project manager, service providers, OHS officers).

(c) Implement health and safety control measures

i. Correct health and safety concerns identified during inspections or by reports from workers, contractors or service providers.

ii. Ensure that work plan and procedures are implemented.

iii. Ensure that workers have been adequately trained and are competent to do their assigned work.

iv. Protect others who are required to come on the work site.

v. Ensure worker asbestos training is current and any person who enters a restricted area has a valid asbestos worker certificate.

vi. Determine the need for worker heath assessments.

vii. Implement site security plan.

viii. Conduct regular work site health and safety meetings (e.g. toolbox talks) with work site personnel to disseminate information and identify hazards that may require additional controls.

(d) Establish a work site emergency response plan and procedures

i. Ensure fire protection equipment is provided and personnel are trained in equipment use.

ii. Establish emergency entry/exit plan and ensure entry/exit points are clearly marked inside and outside of the containment.

iii. Ensure that competent first aiders are available for each work shift and advise all personnel of their location.

iv. Ensure a fully stocked first aid kit, suitable for the number of workers on the work site, is available.

v. Ensure that supervisors and workers understand and can perform the procedures required in the event of a medical emergency.

(e) Act on worker health problems

i. Ensure that staff rotation occurs as planned and revise plan as required.

ii. Ensure that workers are checked on an ongoing basis to recognize symptoms of heat stress.

iii. Ensure that immediate action is taken when workers experience symptoms of heat stress.

iv. Ensure that asbestos-exposed workers are provided with health assessments as required by health and safety legislation.

(4) Job execution

(a) Verify work plan and specific work requirements

i. Visually check work site daily to ensure adherence to work plan and work procedures.

ii. Ensure proper construction of containment at the start of the project and dismantling of containment at job completion.

iii. Ensure proper decontamination of all equipment prior to it leaving the site.

(b) Inspect isolation of work and storage areas

i. Examine integrity of enclosure.

ii. Check installation and operation of negative pressure air system.

iii. Ensure negative pressure is maintained in containment.

iv. Check proper set-up and housekeeping of decontamination facility at the beginning of the job and on an ongoing basis.

v. Check proper set-up of storage areas at the beginning of the job and on an ongoing basis.

(c) Advise trades, contractors and self-employed persons of specific work site hazards and schedules

i. Coordinate work schedules with other work site personnel as determined in the work plan.

ii. Advise other work site personnel of hazards on the job that could affect them and work site controls that must be used.

iii. Provide requirements for personal protective equipment and training.

iv. Review any changes to schedule with work site personnel.

(d) Coordinate air monitoring

i. Ensure that air monitoring is performed by a competent person, as required in the work plan.

ii. Ensure that samples are forwarded promptly to the laboratory for analysis.

iii. Review monitoring results with work site personnel and change work procedures where necessary.

iv. Determine if more monitoring is necessary during changes to work procedures.

(e) Maintain work schedule

i. Monitor the work schedule to make sure work is completed as planned.

ii. Reschedule changes with work site personnel, employer, client and/or owner.

(f) Order and/or purchase supplies and equipment

i. Plan equipment and material needs with project manager on a daily basis.

ii. Order material and equipment as needed.

iii. Verify that ordered material and equipment arrives.

iv. Receive and distribute supplies.

9.4 Health and safety consultant (service provider) competency profile at asbestos abatement project work sites

Standards of performance

(1) Health

(a) Identify suspected asbestos-containing materials

i. Identify and locate where asbestos-containing materials may be present.

ii. Carry out bulk sampling for identification of asbestos in materials.

iii. Conduct sample analysis (if competent to do so) or direct qualified analyst/laboratory to conduct analysis.

iv. Interpret bulk sampling results and explain their significance to the employer, supervisor and client.

(b) Recognize asbestos health hazards at the work site

i. Visually inspect the work site for indicators of asbestos exposure.

ii. Locate asbestos hazards.

iii. Assess the hazards based on bulk and air sampling results.

iv. Anticipate the health hazards associated with changes to work site procedures.

(c) Recognize other health hazards associated with asbestos abatement

i. Know and be able to describe symptoms of heat stress, dermatitis, noise exposure, common chemical hazard exposure, ergonomic and other non-asbestos health stressors.

ii. Visually inspect the work site and identify other health hazards.

iii. Monitor workers for signs of distress.

iv. Identify if monitoring for non-asbestos health hazards is required and advise the employer.

v. Interpret and assess results of monitoring for non-asbestos health hazards.

(d) Advise on work procedures

i. Review and discuss work site procedures with employer, owner, contractor and/or client.

ii. Advise on developing codes of practice for asbestos, respiratory protective equipment, other chemical hazards (as required) and confined spaces.

iii. Monitor work procedures, identify areas of potential non-compliance and provide recommendations for improvements.

(e) Evaluate health hazard knowledge of work site personnel

i. Evaluate knowledge of work site personnel on health hazards, abatement procedures and control measures.

ii. Develop recommendations to correct skill or knowledge deficiencies in work site personnel.

(f) Conduct monitoring for asbestos health hazards

i. Evaluate work site for key hazard areas prior to asbestos abatement.

ii. Determine number, location and type of air samples to be collected.

iii. Ensure sample collection is completed by competent personnel and sample analysis done by a qualified analyst/laboratory.

iv. Ensure integrity of air samples during sample collection (e.g. pumps operating properly, sample equipment worn by workers).

v. Review laboratory reports and interpret data.

(g) Evaluate suitability of personal protective equipment

i. Describe and provide recommendations to implement best practices and requirements for personal protective equipment and respiratory protective equipment.

ii. Ensure that personal protective equipment and respirators have been appropriately selected for the specific hazards at the work site.

iii. Check that respirators are properly selected, fitted, used and maintained at the work site.

iv. Calculate a change-out schedule for respirator cartridges, as appropriate and required.

v. Review the code of practice for respirators with supervisors, contractors, self-employed persons and the employer, and monitor that it has been implemented at the work site.

vi. Observe and provide corrections of the inappropriate use and maintenance of protective equipment and clothing.

(h) Evaluate effectiveness of control measures

i. Examine work site equipment (e.g. negative air pressure system, ventilation system, HVAC equipment), for proper operation.

ii. Evaluate integrity of enclosure and effectiveness of area segregation.

iii. Check that negative pressure is maintained in the enclosure.

iv. Check effectiveness of use of water for dust control.

v. Evaluate post-abatement air monitoring results.

vi. Evaluate the work site for proper worker, equipment and work site decontamination procedures.

vii. Monitor procedures used for asbestos waste handling and housekeeping.

(i) Advise on controls for health hazards

i. Advise on the integrity of containment structure and procedures to maintain negative pressure in the containment.

ii. Report health hazard concerns to the employer, supervisor and client.

iii. Recommend strategies for control of hazards and assist with implementation, if required.

(j) Monitor compliance with health and safety legislation

i. Describe and understand current OHS legislation under the *OHS Act*, Regulation and Code.

ii. Monitor work site to ensure safe work procedures are followed.

iii. Monitor work site to ensure it conforms to the codes of practice.

iv. Advise supervisor and employer immediately if health distress is observed in work site personnel.

v. Inspect for compliance with OHS legislation.

(2) Safety

(a) Recognize safety hazards

i. Identify and evaluate potential safety hazards associated with asbestos abatement projects.

ii. Visually inspect the work site for safety hazards including electrical, scaffolding, tripping, slipping and fire hazards.

(b) Advise on controls for safety hazards

i. Report safety concerns to the employer, contractor, supervisor and/or client.

ii. Advise the employer, contractor, supervisor and/or client on implementation of controls for safety hazards.

iii. Assist in resolving work site safety hazards.

(c) Advise on safe work procedures

i. Assist in developing safe work procedures and codes of practice.

ii. Assess and provide support for the training of personnel.

(d) Advise on emergency equipment and procedures

i. Identify potential emergency hazards.

ii. Assist in developing and improving the emergency response plan.

iii. Monitor safe handling of equipment and make recommendations as necessary.

iv. Assist in delivering emergency procedure training sessions.

v. Monitor work site for compliance with requirements associated with emergency situations (fire regulations, building code and first aid standards) and report non-compliance to employer, contractor, supervisor and/or client.

(e) Evaluate safety hazard knowledge of work site personnel

i. Evaluate work practices of site personnel for adherence to safety procedures.

ii. Develop recommendations to correct skill or knowledge deficiencies in workers and supervisors.

(f) Monitor compliance with health and safety legislation

i. Describe and understand current health and safety legislation under the *OHS Act*, Regulation and Code.

ii. Monitor work site to ensure that safe work procedures are followed.

iii. Monitor work site for conformance to the codes of practice.

iv. Inspect for compliance with OHS legislation.

(3) Environment

(a) Recognize environmental hazards

i. Identify potential and existing conditions that could present environmental hazards on asbestos abatement work sites.

ii. Inspect air and water filtration systems on abatement projects for signs of damage.

iii. Inspect integrity of enclosure for leaks and conduct leak testing, as required.

iv. Inspect waste disposal, labelling and transportation procedures.

(b) Evaluate environmental hazards

i. Examine area for air, water and soil contamination.

ii. Identify potential hazards that could impact public health and safety.

iii. Review waste disposal, labelling and transportation procedures.

(c) Advise on controls for environmental hazards

i. Recommend improvements to air or water filtration systems.

ii. Recommend sampling, packaging and disposal procedures.

(d) Evaluate work site personnel's environmental hazard knowledge.

i. Assess the skills of work site personnel in dealing with environmental hazards and waste disposal procedures.

ii. Develop recommendations to correct skill or knowledge deficiencies in workers and supervisors.

(e) Monitor compliance with environmental legislation

i. Know and advise on current federal, provincial and municipal environmental, transportation and disposal legislation.

ii. Inspect for compliance with environmental, transportation and disposal legislation.

(4) Communication

(a) Establish lines of communication

i. Identify lines of communication and establish the communication link.

ii. Establish reporting procedure with government, employer, contractor, supervisors and/or client as well as the joint work site health and safety committee or health and safety representative, if there is one.

iii. Determine and document the persons responsible for decisions at the work site and their level of authority.

iv. Set out a communication process with the government, employer, contractor, supervisors and/or client as well as the joint work site health and safety committee or health and safety representative, if there is one.

v. Establish roles and expectations.

(b) Provide health, safety and environmental instruction

i. Train employers, contractors and supervisors how to properly select, fit, use and maintain respiratory protective equipment.

ii. Train employers, contractors and supervisors on emergency, decontamination and safe work procedures.

iii. Assist in delivering training sessions to workers and self-employed persons, as requested.

iv. Explain health, safety and environmental legislation requirements to work site personnel.

(c) Establish reporting process

i. Communicate verbally and in writing through established communication links.

ii. Prepare agendas, as directed, for meetings.

iii. Prepare presentations, as directed, allowing room for discussion.

iv. Establish a recordkeeping procedure.

v. Collect, interpret and evaluate data.

vi. Prepare reports to document work site conditions and/or abatement work conducted, as required.

vii. Solicit feedback on reports, recommendations and actions from the employer, contractor, supervisor and/or client.

(5) Project preparation and coordination

(a) Assess scope of work

i. Review work requirements.

ii. Review decontamination requirements.

iii. Determine if an adequate assessment of the scope of the work has been made.

iv. Negotiate adjustments to the scope of work if gaps are identified.

v. Assess work requirements on an ongoing basis and report needs to employer, contractor, supervisor and/or client.

(b) Review project plans and specifications

i. Collect and review the employer, contractor or client's plans and specifications and building plans and specifications, if available.

ii. Identify approach to the project.

iii. Evaluate work site-specific requirements in the context of best practices for asbestos abatement, hazard control and compliance with OHS legislation.

iv. Recommend adjustments to plans and specifications, if necessary.

(c) Develop consultant's work plan

i. Plan work activities to meet employer, contractor and/or client's needs.

ii. Develop personnel schedules and allocate equipment resources.

iii. Anticipate changes and develop contingency plans.

(d) Coordinate activities with others

i. Organize consulting activities to align with the work plan for the project.

ii. Coordinate contingency plans with employer, contractor, supervisor and/or client.

iii. Negotiate special needs/activities with employer, contractor, supervisor and/or client.

(6) Compliance with OHS legislation

(a) Know OHS requirements

i. Outline and discuss responsibilities and requirements of work site parties as described in the *OHS Act*, Regulation and Code.

ii. Understand circumstances when an acceptance or approval may be required under the OHS legislation.

iii. Cooperate with others who are exercising a duty under the OHS legislation (e.g. supervisor, service providers, OHS officers).

iv. Comply with OHS legislation in the conduct of the consultant's work.

(b) Ensure work is done by competent personnel

i. Ensure field personnel have the necessary skills and training to be considered "competent" as defined in the *OHS Act*.

ii. Monitor performance of field personnel to ensure compliance with OHS legislation and work site procedures.

iii. Ensure reports and documentation prepared by field personnel are reviewed by senior technical staff before they are issued.

iv. Provide field and technical staff with ongoing training to maintain their skills.

(c) Ensure services provided allow for compliance with OHS legislation

i. If legislation requires work to be done by competent personnel, ensure they are competent or supervised by a competent worker.

ii. Follow requirements in legislation for conducting air monitoring and ensure laboratory is using a method specified in legislation.

iii. Ensure employer, contractor, supervisor and/or client is provided with advice that aligns with OHS legislation (e.g. removal of asbestos prior to demolition of a structure).

iv. Assist with the preparation of applications for an acceptance or approval, if one is required under the OHS legislation.

v. Have violence and harassment prevention plan in place for the consultant's work.

(d) Ensure work activities do not create health and safety hazards to others

i. Ensure field staff conduct their work to ensure airborne asbestos fibres are controlled.

ii. Report to employer, contractor and/or supervisor any unsafe conditions or equipment identified during work site inspections or the conduct of the consultant's work.

iii. Ensure field staff refrain from violent or harassing behaviours.