Safe Work Practices for Handling Asbestos

DRAFT

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Introduction

Asbestos is a group of naturally occurring minerals used in many products because it adds strength, heat-resistance, and chemical resistance. Asbestos is a hazardous material. If employers and workers do not take proper precautions for work around asbestos, workers may develop serious chronic health problems or even die of an asbestos-related disease. To prevent these health problems, WorkSafeBC has developed requirements detailed in the Occupational Health and Safety Regulation.

Who should read this manual?

This manual is mainly for:

- consultants who provide services regarding asbestos identification and management
- employers whose operations may require workers to handle or work in an environment with asbestos or asbestos-containing materials
- workers who work with asbestos (removing and cleaning up asbestos waste materials).

Consultants and employers will find information to help them comply with the Occupational Health and Safety Regulation and ensure a safe environment for workers and others who may be affected by asbestos management, removal, or clean-up. Workers will find information to help them work safely with asbestos products or waste materials.

This manual provides information about asbestos and assists consultants and employers in developing suitable work procedures. For company owners who are required to have asbestos abatement carried out on their premises, the sections in this manual describing procedures for low-risk, moderate-risk, and high-risk work activities will provide an idea of the scope of such a project. These sections will also give company owners, property managers, and those who are not experienced with asbestos a better idea of the type of work done by consultants and asbestos abatement contractors.

In some places in this manual, the term *regular* is used (for example, "regular worksite inspections," "regular health and safety meetings"). The term is used in these cases because circumstances vary with each worksite and it is not possible to provide more specific requirements. Some employers may find it necessary to conduct inspections every work shift (during a continuous, high-risk removal), while other employers may need to do only monthly inspections (on sites where circumstances do not change very often). Some employers may need to hold safety meetings daily (if the workforce changes every day), while other employers may hold meetings monthly (in usual circumstances). A qualified health and safety professional must decide what *regular* means in each particular circumstance involving asbestos.

ALARA

The ALARA principle governs worker exposure to asbestos — all exposures must be kept **a**s **l**ow **a**s **r**easonably **a**chievable. Although the Regulation specifies exposure limits and action levels, every employer must further reduce or eliminate worker exposure *if it can reasonably be done.* Where possible, asbestos-containing materials should be replaced with products that do not contain asbestos.

Improvements in technology, and new work practices and procedures, will help employers decrease worker exposures and move closer to the ultimate goal of zero exposure to designated (hazardous) substances.

Note

This manual is not a definitive guide and does not replace the Occupational Health and Safety Regulation. It complements the Regulation and is a tool to help industry work safely.

Use this manual as a starting point

This manual provides generic information that employers can use to develop their own site-specific procedures. If a worker is or may be exposed to potentially harmful levels of asbestos, the employer must develop and implement an exposure control plan meeting the requirements of Section 5.54 of the Occupational Health and Safety Regulation. The employer must also ensure that surveys and risk assessments on asbestos-containing materials are conducted by a qualified person. Specific procedures must be based upon the risk assessments.

The word *must* used in this manual means that a particular safety step is required by the Regulation. The word *should* indicates that a particular action, although not specified in the Regulation, is recognized as an industry standard by occupational hygiene and/or safety professionals and will improve safety in the workplace.

The word *worker* includes supervisors, managers, and workers.

WorkSafeBC has produced a number of related safe practices manuals, such as *Breathe Safer*, a respirator manual. For copies, visit WorkSafeBC.com or contact the WorkSafeBC Bookstore (see the front of this manual).

Part 1: About asbestos

What is asbestos?

Asbestos is the term used to describe a group of naturally occurring fibrous mineral silicates. Three types of asbestos have been used commercially:

- *Chrysotile* (white asbestos) is the most commonly used form of asbestos. It is found in over 95% of asbestos-containing products.
- *Amosite* (brown asbestos) has been used in sprayed coatings, in heat insulation products, and in asbestos cement products where greater structural strength is required.
- *Crocidolite* (blue asbestos) is now rarely found in B.C. Before 1973 it was commonly used in sprayed coatings on structural steelwork for fire protection and for heat or noise insulation. It was also used in gasket materials and asbestos cement pipe.
- Actinolite, anthophyllite, and tremolite were rarely used in B.C., but actinolite and tremolite may be found as natural contaminants within vermiculite insulation.

Defining *asbestos-containing material*

The Occupational Health and Safety Regulation defines *asbestos-containing material* as containing 0.5% or more asbestos as determined by polarized light microscopy, electron microscopy, and/or gravimetric analysis. An exception is made for vermiculite-containing insulation materials (e.g., over 25% vermiculite), which are considered asbestos-containing if any asbestos (even less than 0.5%) is present.

This definition is not intended to include materials with negligible amounts of asbestos, or other situations where the asbestos insulation was properly removed and a few fibres remain sealed in place.

Health hazards of asbestos

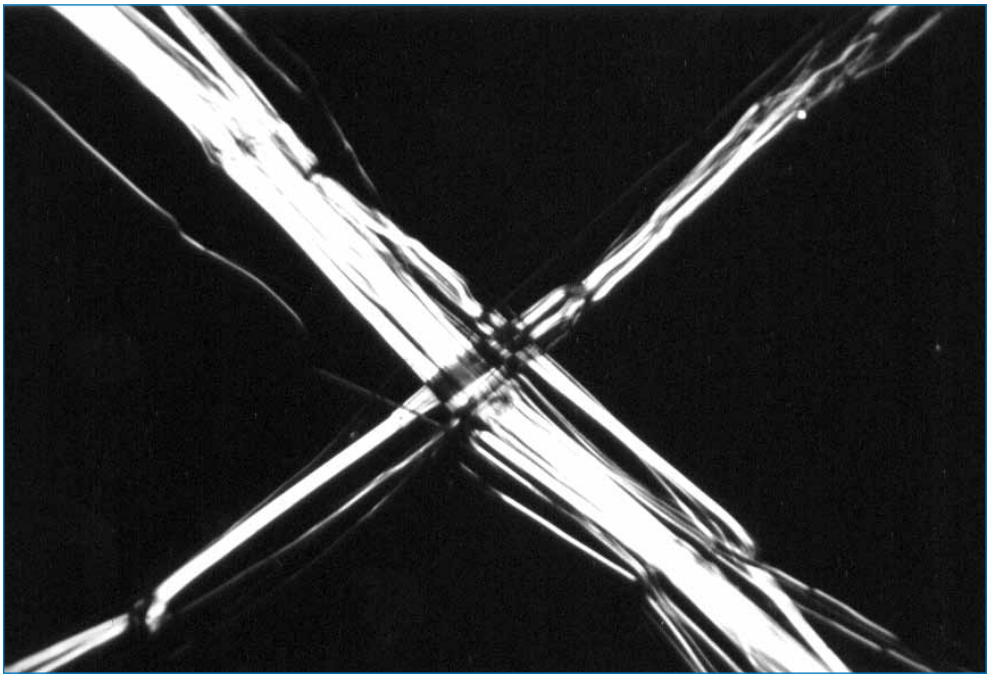
Asbestos is a hazardous material. Its fibres are extremely fine and can remain suspended in the air for hours; workers exposed to asbestos-contaminated air can inhale the fibres. If handled improperly, asbestos may cause serious chronic health problems and even death.

Asbestosis is a chronic lung disease resulting from prolonged exposure to asbestos dust. The fibres gradually cause the lung to become scarred and stiff, making breathing difficult.

Lung cancer may be caused by asbestos fibres in the lung. Although it is unknown exactly how asbestos causes lung cancer, research has shown that the combination of smoking tobacco and inhaling asbestos fibres greatly increases the risk of lung cancer.

Mesothelioma is a rare but aggressive form of cancer affecting the lining of the lungs or the abdominal cavity. There is a confirmed link between asbestos exposure and mesothelioma.

Pleural thickening may develop after heavy asbestos exposure. The lining of the lung (pleura) thickens and swells, causing shortness of breath and discomfort in the chest.



Asbestos fibres magnified many times.

Industry terms

This manual uses some words and phrases specific to the asbestos industry.

Asbestos-containing material

A manufactured article or other material, other than vermiculite insulation, that would be determined to contain at least 0.5% asbestos if tested in accordance with one of the following methods:

- Asbestos, Chrysotile by XRD, NIOSH Method 9000 (Issue 2, dated August 15, 1994) in the *NIOSH Manual of Analytical Methods*, published by the United States National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention
- Asbestos (bulk) by PLM, NIOSH Method 9002 (Issue 2, dated August 15, 1994)
- Test Method for the Determination of Asbestos in Bulk Building Materials (EPA/600/R-93/116, dated July 1993), published by the United States Environmental Protection Agency

Also, vermiculite insulation that would be determined to contain any asbestos if tested in accordance with the Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation (EPA/600/R-04/004, dated January 2004), published by the U.S. Environmental Protection Agency.

Asbestos inventory or survey

A written report that locates and describes, as far as reasonably practicable, the amount, condition, accessibility, and so on, of all asbestos-containing materials in a building or structure and/or where renovations or demolition are planned.

Asbestos management program

A workplace program that includes inventory and identification of asbestos-containing materials, hazard control, exposure control, risk assessment, and worker education and training.

Containment

An isolation system designed to effectively contain asbestos fibres within a designated work area where asbestos-containing materials are handled, removed, encapsulated, or enclosed. Glove bags are a type of containment.

Encapsulation

A process in which a material containing asbestos is treated with a product that penetrates the material and prevents the fibres from being released.

Enclosure

A physical barrier made of materials such as Gyproc (gypsum wallboard), plywood, metal, or polyethylene (poly) sheeting used to separate a friable asbestos-containing material from the habitable environment.

Friable asbestos-containing material

Asbestos-containing material that is crumbled or powdered or can be crumbled or powdered by hand pressure. Materials such as vinyl-asbestos floor tile or asbestos cement products have the potential to become friable if handled in an aggressive manner (for example, cut, drilled, or sanded using power tools) or dropped from a height.

Friable materials containing asbestos may appear:

- Fluffy or spongy (usually applied by spraying)
- Irregular, with a soft surface (usually applied by spraying)
- Textured, dense, with a fairly firm surface (usually applied by trowelling)
- Chalky, with a firm surface in preformed, fitted sections (placed around pipes as insulation), or in some ceiling tiles
- As dust and/or debris on horizontal and vertical surfaces

HEPA filter

Defined in the Occupational Health and Safety Regulation as a high-efficiency particulate air filter that is at least 99.97% efficient in collecting an aerosol particle 0.3 micrometre in size. Any HEPA filters used for asbestos applications must be at least 99.97% efficient. When used for respiratory protection, HEPA filters are now referred to as *NIOSH 100 series filters*, or "100" filters for short.

High-risk work activity

A work activity that involves working with or in proximity to asbestos-containing material if a high level of control is necessary to prevent worker exposure to airborne asbestos fibres.

Low-risk work activity

A work activity that involves working with or in proximity to asbestos-containing material, if the material is not being:

- Cut, sanded, drilled, broken, ground down, or otherwise fragmented *or*
- Disturbed in such a way that asbestos fibres may be released

Moderate-risk work activity

A work activity, other than a high-risk work activity, that involves working with or in proximity to asbestos-containing material that is being cut, sanded, drilled, broken, ground down or otherwise fragmented, or otherwise disturbed, where it is necessary to use personal protective equipment or engineering controls to prevent worker exposure to airborne asbestos fibres.

Negative air unit

A cabinet, usually portable, that contains a fan and one or more HEPA filters. Negative air units are used to exhaust air from a containment area, reducing the risk of contaminated air escaping into the workplace through a leak in the containment. Negative air unit efficiency must be tested using a suitable indicator chemical, such as dioctyl phthalate (DOP) or polyalphaolefin (PAO) aerosols.

NIOSH 100 series filter

A high-efficiency particulate air (HEPA) filter used for respiratory protection. These HEPA filters, called "100" filters for short, are at least 99.97% efficient in collecting an aerosol particle 0.3 micrometre in size, and carry an N, R, or P designation that specifies where and for how long the filter can be used.

Filter designation	For use in ...	Time-use limitations
N = No oil	Oil-free atmospheres only (atmospheres containing no oil mist)	May be reused only after considering cleanliness, filter damage, and increased breathing resistance
R = Oil-resistant	Oily atmospheres	A single shift only (or eight hours of continuous or intermittent use)
P = Oilproof	Oily atmospheres	Check the manufacturer's specified time-use limitations for each P-type filter

Practicable

Defined in the Regulation as "that which is reasonably capable of being done."

Qualified person

A person who has education, training, and experience in the management and control of asbestos hazards (see "Who is qualified to deal with asbestos" on page xx).

Note

For more information on respirators and respirator programs, see the WorkSafeBC manual *Breath Safer.*

Respirator

A device worn to prevent the inhalation of hazardous airborne substances. There are two basic types of respirators: air-purifying and air-supplying. So-called "single-use" or "disposable" respirators are not acceptable for working with asbestos.

Risk assessment

A comprehensive document, developed to select appropriate workplace controls, that evaluates the probability and degree of possible illness, injury, or death in a hazardous situation.

Risk of exposure to asbestos fibres

The likelihood of being exposed to airborne asbestos fibres when using or handling materials containing asbestos or being in proximity to such work. There is a much greater risk of exposure to asbestos fibres when handling friable asbestos materials than when handling hard, well-bonded asbestos materials such as vinyl-asbestos floor tile or asbestos cement products.

Regulation requirements

Several sections of the Occupational Health and Safety Regulation and their corresponding guidelines relate to asbestos exposure. The key requirements are found in the following:

Section 5.2, General information requirement

This section describes the requirement to identify a chemical or biological agent, its possible effects on health, and precautions required to protect worker health and safety. This information must be clearly communicated to workers.

Sections 5.48 to 5.59, Controlling exposure

These sections describe general requirements for controlling exposure to various hazardous materials in the workplace, including:

- Exposure limits
- Workplace monitoring to assess exposure levels
- Monitoring methods acceptable to WorkSafeBC
- Exposure control plans
- Types of risk controls
- Designated hazardous substances
- Investigating symptoms of overexposure

The current occupational exposure limit for asbestos (all forms) is 0.1 fibres per millilitre.

Guideline G5.53-4, Occupational hygiene methods acceptable to WorkSafeBC

The purpose of this guideline is to provide information on the publications that detail occupational hygiene methods (such as sampling and analytical methods) acceptable to WorkSafeBC.

Sections 6.1 to 6.32, Asbestos

These sections describe specific requirements to prevent workplace exposure to asbestos. Employers are responsible for the following:

- Conducting asbestos inventories or surveys (see "Asbestos survey" beginning on page xx)
- Conducting risk assessments to determine worker exposure and work classifications (see "Risk assessment" on page xx)
- Developing and implementing an exposure control plan (see "Exposure control plan" beginning on page xx) and a respirator

program (see "Respirator program" beginning on page xx) if workers are or may be exposed to asbestos
- Developing and implementing safe work procedures for handling and disposing of asbestos (see "Part 3 — Work procedures" beginning on page xx)
- Conducting air monitoring if workers are at risk of overexposure to airborne asbestos fibres (see "Monitoring the work environment" beginning on page xx)
- Posting warning signs at the boundary of work areas where asbestos exposures could occur
- Instructing and training workers who are at risk of exposure to asbestos
- Maintaining records of risk assessments, worker exposures, and worker training

Guidelines G6.1 to G6.32

These guidelines are specific to asbestos-containing materials and include the following:

- G6.1, Analysis of asbestos-containing material
- G6.1-1, Qualified person
- G6.3, Exposure control plan for asbestos
- G6.4, Inventory of asbestos-containing materials
- G6.5, Identification
- G6.6-1, Risk Assessment
- G6.6-2, Classification of risk
- G6.7, Control of friable asbestos
- G6.8, Procedures for abatement of asbestos-containing material during house and building demolition/renovation
- G6.10, Substitution
- G6.13, Authorized persons — Designated area
- G6.16, High risk work
- G6.19, Ventilation — Filter testing
- G6.24-1, Friction materials
- G6.24-2, Dry removal of friction material dust
- G6.24-3, Suitable work procedures
- G6.24-4, HEPA-filtered vacuum enclosure systems
- G6.27, Asbestos waste removal
- G6.31, Contaminated personal protective clothing — Information to laundry workers
- G6.32, Documentation — Types of records

Section 20.2, Notice of project

According to this section, if a construction activity involves the disturbance of asbestos, the owner or prime contractor must file a Notice of Project (NOP) with WorkSafeBC, in writing or by fax, at least 24 hours before starting the project. For more information or to file an NOP online, visit WorkSafeBC.com; under "Quick Links," click "Notice of Project."

Guideline G20.2(1)(c), Notice of project for asbestos — Ongoing work

This guideline provides information on the requirements for submission of a Notice of Project for asbestos (NOP-Asbestos) for short-duration intermittent repair or maintenance work. The guideline is for use by employers who conduct periodic repairs or other minor disturbances of asbestos-containing building materials as part of an ongoing operations and maintenance program. It is not intended for use by asbestos abatement contractors or restoration contractors.

Section 20.112, Hazardous materials (Demolition)

This section describes the requirements that employers and owners are responsible for before beginning work on the demolition or salvage of machinery, equipment, buildings, or structures.

The employer or owner must:

- Have a qualified person inspect the site to identify any asbestos-containing materials that may be handled, disturbed, or removed
- Have the inspection results available at the worksite
- Ensure that asbestos-containing materials are safely contained or removed

If asbestos-containing materials that were not identified in the survey are discovered during the work, the work must cease until the asbestos is contained or removed.

Guideline G20.112, Hazardous materials — Asbestos

The purpose of this guideline is to explain the hazards associated with the uncontrolled release of asbestos. It also provides information for owners, employers, consultants, workers, and other involved persons on what constitutes a compliant asbestos inspection, on arranging for and confirming the safe abatement of asbestos, and on what to do if additional materials suspected of containing asbestos are encountered during demolition or salvage work.

Who is qualified to deal with asbestos?

According to the Regulation, "qualified" means "a person who: (a) has knowledge of the management and control of asbestos hazards through education and training, and (b) has experience in the management and control of asbestos hazards."

When asbestos-containing materials may be present, a qualified person should be an occupational health and safety professional with occupational hygiene experience related to asbestos. These persons would include:

- Certified Industrial Hygienist (CIH), Registered Occupational Hygienist (ROH), or Registered Occupational Hygiene Technologist (ROHT) with education and experience specific to asbestos management and work procedures
- Certified Safety Professional (CSP), Canadian Registered Safety Professional (CRSP), or Professional Engineer with education and experience specific to asbestos management and work procedures
- An experienced asbestos abatement contractor with education and experience specific to asbestos management and work procedures
- An AHERA (U.S. *Asbestos Hazard Emergency Response Act*) Certified inspector (for asbestos building surveys only)

The following activities must be conducted by a qualified person:

- Preparation of asbestos inventories or surveys
- Risk assessments and work classifications (e.g., low, moderate, or high risk)
- Preparation of work procedures for the safe removal of asbestos waste
- Collection of samples of materials suspected of containing asbestos

In addition, only a qualified person should:

- Collect air samples to determine the concentration of asbestos fibres in the air
- Perform regular worksite inspections for high-risk work
- Perform post-abatement clearance inspections

Part 2: Programs and documentation

Responsibilities

Everyone in the workplace has health and safety responsibilities, including owners, employers, prime contractors, supervisors, workers, and consultants.

Owners

Owners have the following responsibilities:

- Provide and maintain the land and premises that are being used as a workplace to ensure the health and safety of anyone at or near the workplace
- Provide the employer or prime contractor at the workplace with information known to the owner that is necessary to identify the hazards, including asbestos
- Comply with the relevant sections of the Occupational Health and Safety Regulation and the *Workers Compensation Act* (the *Act*), as well as any applicable orders

Employers

Employers have the following responsibilities:

- Ensure the health and safety of all workers at the worksite
- Identify workplace hazards and assess the risks of injury associated with those hazards
- Conduct a risk assessment for asbestos exposure, develop an exposure control plan, write safe work procedures, and implement controls
- Ensure that workers and supervisors are adequately instructed and trained
- Keep written records of training (detailing who, what, and when)
- Establish and maintain an occupational health and safety program, including a written health and safety policy and a procedure for incident investigations
- Support supervisors, safety coordinators, and workers in their health and safety activities
- Take action immediately when a worker or supervisor reports a potentially hazardous situation
- Initiate immediate investigations into incidents
- Report exposure incidents to WorkSafeBC
- Provide adequate first aid facilities and services
- Provide and maintain personal protective equipment and clothing and as required
- Ensure that workers follow the requirements of the Regulation and the *Act*, and that they have access to these documents

What is a prime contractor?

In a workplace with multiple employers, the prime contractor is the directing contractor, employer, or other person who enters into a written agreement with the owner of that workplace to be the prime contractor. If there is no such agreement, then the prime contractor is the owner of the workplace.

Reference: Section 118(1) of the *Workers Compensation Act*

Prime contractors

Prime contractors have the following additional responsibilities:

- Ensure the coordination of health and safety activities for employers, workers, and others at the workplace
- Do everything that is reasonably practicable to establish and maintain a system or process that will ensure compliance with the relevant sections of the Regulation and the *Act*

Each employer at a multiple-employer workplace must give the prime contractor the name of the person the employer has designated to supervise his or her workers.

Supervisors

Supervisors have the following responsibilities:

- Instruct workers in safe work procedures
- Ensure that workers are familiar with and follow the exposure control plan
- Train workers for all tasks assigned to them, and regularly check that they are doing their work safely
- Ensure that only authorized, adequately trained workers operate tools and equipment or use hazardous materials
- Ensure that workers follow safe work procedures for handling, storing, and maintaining equipment and materials
- Enforce health and safety requirements
- Correct unsafe acts and conditions immediately
- Identify workers with problems that could affect safety at the worksite, and follow up with interviews and referrals where necessary
- Create health and safety rules, and inspect the workplace regularly for hazards

Workers

Workers have the following responsibilities:

- Know and follow health and safety requirements that apply to the job
- Ask the supervisor for training to perform work tasks and use equipment safely
- Participate in all required health and safety education and training
- Work safely, and encourage co-workers to do the same
- Use all required personal protective equipment and clothing
- Correct any unsafe conditions or immediately report them to a supervisor
- Immediately report any injury to a first aid attendant or supervisor
- Inform a supervisor of any physical or mental impairments that may affect work safety
- Make suggestions to improve health and safety

Consultants

Consultants:

- Should be occupational health and safety professionals with experience in the practice of occupational hygiene as it relates to asbestos management
- Must follow accepted occupational hygiene practices, including those related to:
  - Collection and identification of samples
  - Reporting of sample results
  - Performance of risk assessments
  - Development of safe work procedures
  - Implementation of exposure control methods
- Should provide documentation within a reasonable timeframe and clearly explain any results, conclusions, and recommendations

Health and safety program

According to the Occupational Health and Safety Regulation, employers must develop and implement an effective health and safety program for their workplace, and train workers and supervisors in relevant sections of the program.

A health and safety program helps ensure a safe, productive workplace by describing specific tasks and responsibilities for many different aspects of an employer's operation. An effective health and safety program for any workplace in which asbestos is handled or present must include:

- A written occupational health and safety policy that:
  - States the employer's commitment to health and safety
  - States the program's objectives
  - Defines the responsibilities and roles of the employer, supervisors, and workers
- Written safe work procedures and emergency response procedures
- Training for supervisors and workers
- Regular worksite inspections (the definition of "regular" depends on the conditions and number of shifts for each individual site)
- Regular health and safety meetings
- Accident investigation
- Records and statistics
- A joint health and safety committee or representative, if required

It is important to remember that every worksite is different. Although these general elements may be common to health and safety programs across the province, employers cannot expect to copy a program from another worksite. Instead, they must develop and implement a health and safety program unique to their own operation.

Asbestos management program

An effective asbestos management program consists of several elements. Employers, building owners, or property managers must:

- Keep an up-to-date inventory of all asbestos-containing materials in the workplace
- Ensure that all asbestos-containing materials are clearly identified
- Conduct a risk assessment of the potential for exposure to any of the asbestos-containing materials (this should be conducted only by a qualified person)
- Develop safe work procedures, including the correct use of personal protective equipment, for workers who may work near asbestos-containing materials (this should be done only by a qualified person)
- Instruct all workers who could be exposed to asbestos in all aspects of the asbestos management program
- Make manufacturers' manuals and instructions available to workers
- Prepare written work procedures specific to each worksite and make them available to all workers required to follow the procedures
- Ensure that work is carried out under the supervision of experienced and qualified supervisors
- Develop and implement an exposure control plan if workers will be exposed to asbestos fibres (for more information on exposure control plans, see page xx)
- Keep accurate and complete records regarding asbestos management

In addition to implementing an asbestos management program, employers or building owners must ensure that all friable asbestos-containing materials are either removed from the workplace (using procedures similar to those outlined in this manual), encapsulated, or enclosed. Asbestos-containing materials that are hidden from view but still accessible (such as materials above a T-bar ceiling) are not considered to be enclosed.

Asbestos survey

Note

For a definition of qualified person, see page xx.

The employer must ensure that a qualified person collects representative samples of suspected asbestos-containing materials and prepares a written (or computerized) inventory of all asbestos-containing materials in the workplace. This inventory must be kept at the workplace and must be kept current.

The asbestos inspection process is generally referred to as an asbestos survey, and the person conducting the inspection is often referred to as the surveyor. The asbestos survey includes a walk-through inspection, sample collection, sample analysis, and reporting and communicating the results. Surveyors must be familiar with proper walk-through and sample collection practices.

There are a number of recognized industry standards that provide guidance on conducting asbestos surveys. They include:

- Ontario Regulation 278/05 Designated Substance — "Asbestos on Construction Projects and in Buildings and Repair Operations"
- "Asbestos: The survey guide," Health and Safety Executive (HSE) of the United Kingdom
- "How to Manage Asbestos in School Buildings," EPA 910-B-96-001, U.S. Environmental Protection Agency.

Two types of asbestos surveys are required under the Occupational Health and Safety Regulation:

- The inventory in Section 6.4 is typically prepared for occupied buildings as part of an asbestos management program. Not all asbestos-containing materials may be identified in this survey, as some are hidden or would be damaged by sampling.
- The inventory in Section 20.112 is a pre-demolition or pre-renovation survey that must locate all asbestos materials in the building or structure before any work commences.

Asbestos surveyors must have the following documentation and programs in place:

- Asbestos exposure control plan
- Respirator program
- Bulk sample collection safe work procedure

They should also be able to provide proof of their training (such as an AHERA certificate), evidence that their laboratory is qualified to analyze asbestos samples, and a survey report template.

The first step in the asbestos survey is to identify asbestos hazards through a thorough and systematic walk-through inspection of the site. The site may be a building (commercial, industrial, residential), a structure, a machine, or

a piece of equipment. Asbestos identification and recognition is a specialized skill and it is essential that the surveyor be adequately instructed and trained in identifying materials known or likely to contain asbestos.

The following table lists some of the materials that commonly contain asbestos in older commercial and residential buildings.

Asbestos materials in commercial and residential buildings

Exterior	Interior insulation
• Asbestos cement pipes (e.g., drain pipes) • Roof felting • Asphalt shingles • Soffit boards • Stucco • Asbestos cement siding • Brick mortar • Window putty • Deck undersheathing • Asbestos cement shingles	• Spray-applied insulation (acoustic and fireproofing) • Vermiculite (blown-in) insulation (e.g., in attics) • Paper backing on fibreglass insulation
Flooring	**Heating (HVAC) and ducting**
• Vinyl sheet flooring and mastic • Vinyl floor tile and mastic • Poured flooring/levelling compound • Asphalt flooring	• Furnace duct tape • Furnace/boiler insulation • Pipe (mechanical) insulation • Hot water tank insulation • Mastic • Asbestos rope and gaskets • Asbestos cement board • Asbestos cardboard insulation
Walls and ceilings	**Other**
• Drywall mud • Plaster • Asbestos cement board • Textured coatings • Ceiling tiles	• Fireplace box and mantel • Artificial fireplace logs and ashes • Fire doors • Insulation on electrical wiring • Fire blankets • Chalkboards • Heat reflectors • Penetration firestopping • Light fixture backing (pot lights)

Note: This list does not include every product that may contain asbestos. It is intended as a general guide (see also the online WorkSafeBC Bulletin WS 03-03, "Asbestos hazards in demolition, renovation, and salvage," at www2.worksafebc.com/i/posters/2003/WS%2003_03.htm).

During the initial walk-through inspection, the surveyor systematically goes through each area and room in the building, to make a preliminary determination of whether asbestos could be present. This initial walk-through will involve observing the wall, ceiling, floor, and other materials, including any machinery or equipment (such as an old boiler or heating, ventilation, and air conditioning [HVAC] system) and hidden insulating materials. During this walk-through, the surveyor will also consider where to collect representative bulk samples of suspected asbestos material. Once the walk-through is complete, the surveyor has the necessary information to begin the sampling process.

Collecting bulk samples of materials suspected of containing asbestos

To confirm or discount the presence of asbestos, representative bulk samples must be collected by a qualified person. Multilayered materials, like multiple layers of old tile and linoleum flooring or multiple layers in wall or ceiling materials, will commonly be encountered. Careful consideration must be given to which layers of multilayered materials to sample. Ideally a sample should be collected from each suspect layer. The surveyor should identify the sample location in the building with a unique sample number.

The sampling technique and quantity of material sampled are two other important factors to consider. Sufficient quantities of material must be collected. Check the laboratory method for required sample quantities, or check with the laboratory analyst. For materials like vermiculite, ensure that the full depth of the material down to the bottom is sampled and that the quantity collected meets the requirements of the analytical method that will be used (for example, about 4 L of vermiculite insulation is required for the EPA/600/R-04/004 method).

Sample collection methods must minimize disturbance as well as minimize exposure to asbestos for the persons collecting the bulk samples. Use of protective clothing and the wearing of a properly fitted approved respirator are required. Persons collecting the samples must have a written sample collection procedure as part of their asbestos exposure control plan (an example of a bulk sample collection procedure is found on page xx). A respiratory protection program is also required.

The number of representative bulk samples collected should be consistent with recognized industry standards and principles of good occupational

hygiene practice. The following table provides guidance on the minimum number of bulk samples that should be collected to identify asbestos-containing materials that might be present in a building.

Bulk material sample collection guide

Type of material	Area of homogeneous material*	Minimum number of bulk samples to be collected**
Surfacing materials, including textured coatings, drywall mud, plasters, and stucco	Less than 90 m^2 (approximately 1,000 ft^2)	At least 3 samples of each type of surfacing material
	Between 90 and 450 m^2 (approximately 5,000 ft^2)	At least 5 samples of each type of surfacing material
	Greater than 450 m^2	At least 7 samples of each type of surfacing material
Sprayed insulation and blown-in insulation, including sprayed fireproofing and vermiculite insulation (including vermiculite insulation within concrete masonry units, or CMUs)	Less than 90 m^2 (approximately 1,000 ft^2)	At least 3 samples
	Between 90 and 450 m^2 (approximately 5,000 ft^2)	At least 5 samples
	Greater than 450 m^2	At least 7 samples
Flooring, including vinyl sheet flooring (and backing) and floor tiles	Any size	At least 1 sample per flooring type in each room (and 1 from each layer of flooring)
Mechanical insulation, including duct taping, pipe insulation, elbows and boiler/tank insulation	Any size	At least 3 samples
Mastics and putties, including duct mastic (around penetrations) and window putty	Any size	At least 3 samples
Roofing materials, including felting and shingles	Less than 90 m^2 (approximately 1,000 ft^2)	At least 1 sample (each layer of material must be sampled)
	Between 90 and 450 m^2 (approximately 5,000 ft^2)	At least 2 samples (each layer of material must be sampled)
	Greater than 450 m^2	At least 3 samples (each layer of material must be sampled)
Asbestos cement (transite) board and pipe	Any size	At least 1 sample
Other materials	Any size	At least 1 sample per type of material

* Homogeneous material is considered uniform in texture and appearance, was installed at one time, and is likely to be of only one type of material or formulation.

** If the material is assumed to contain asbestos, samples do not have to be collected. The professional judgment of a qualified person can be used to reduce the number of bulk samples of homogeneous materials. If fewer samples than the minimum recommended number are collected, surveyors should document the rationale for their position in the survey report.

Bulk sample analysis

Asbestos bulk samples should be analyzed by an accredited asbestos laboratory (at a minimum, the laboratory must be a participant in a quality control program). Methods currently accepted by WorkSafeBC for bulk sample analysis include:

- Asbestos, Chrysotile by XRD, NIOSH Method 9000 (Issue 2, dated August 15, 1994) in the *NIOSH Manual of Analytical Methods,* published by the United States National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention
- Asbestos (bulk) by PLM, NIOSH Method 9002 (Issue 2, dated August 15, 1994)
- Test Method for the Determination of Asbestos in Bulk Building Materials (EPA/600/R-93/116, dated July 1993), published by the United States Environmental Protection Agency
- Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation (EPA/600/R-04/004, dated January 2004), published by the U.S. Environmental Protection Agency

These methods include requirements for laboratory equipment, calibration, quality control, and result reporting. Refer also to the WorkSafeBC publication *Safe Work Practices for Asbestos Laboratories,* available through WorkSafeBC.com or through the WorkSafeBC Bookstore (see the front of this manual).

How do you quantify asbestos percentage below 0.5%?

To quantify asbestos percentages below 0.5%, one of the following procedures should be used (refer to EPA/600/R-93/116):

- 400-point count plus gravimetric reduction
- 1,000-point count
- Analytical transmission electron microscopy (TEM) plus gravimetric reduction

Confidence intervals should be included. For example, a result of 0.3% asbestos with 95% confidence limits of ±0.3% would not be considered to indicate the absence of asbestos, due to analytical variation.

If a qualified person suspects that an inaccessible material contains asbestos, the material must be treated as asbestos-containing until it has been proven otherwise.

The following Asbestos Inspection Results worksheet illustrates an acceptable method of summarizing asbestos survey results for an owner or contractor. For more information, refer to WorkSafeBC Occupational Health and Safety Guideline G20.112.

Asbestos Inspection Results

Project name:		**Date of survey:**	
Address:		**Survey company:**	
Description:		**Surveyor:**	
Previous renovations?		**Age of structure:**	
Laboratory name:		**Analysis method(s):**	

Area or room (directions from front of house)	**Building materials**	**Sampling location**	**Materialcollected (sample #)**	**Asbestos type and percentage**	**Approximate quantity of asbestos**

Risk assessment

A risk assessment must be conducted by a qualified person prior to the disturbance, repair, or removal of asbestos-containing materials. The purpose of the risk assessment is to gauge the location and condition of the material prior to the work, as well as any other potential hazards that might affect the workers. Risk assessments would normally include the following elements:

- Type and percentage of asbestos present
- Friability of the material
- Condition of the material (good, poor, debris present, etc.)
- Accessibility (can workers reach or make contact with the material?)
- Presence in an air plenum
- Potential for worker exposure (e.g., any air monitoring required?)
- Potential for occupant exposure
- Other potential hazards present (biological, chemical, electrical, confined spaces, heat or cold, etc.)
- Risk rating or classification (e.g., low, moderate, or high risk) and rationale
- Personal protective equipment to be used
- How the work area will be isolated from any occupants
- Name, signature, and phone number of the person completing the risk assessment, plus the date

In the Regulation

For more information about the requirements for exposure control plans, see Sections 5.54 and 6.3 of the Occupational Health and Safety Regulation.

Exposure control plan

What is an exposure control plan?

An exposure control plan explains the work procedures and other controls that will be used to reduce workers' risk of asbestos exposure. The plan must detail steps to eliminate risk or to control and reduce risk by either:

- Substituting with safer materials, where feasible,
  or
- Using engineering controls, administrative controls, or personal protective equipment (PPE)

Strict adherence to the ALARA principle (see page x) as well as exposure limits and appropriate respiratory and skin protection are essential elements of an exposure control plan. Employers must also ensure that qualified persons (see page xx) perform a formal risk assessment to determine which workers may be exposed to asbestos, and the extent of any exposure. The risk assessment applies not only to the asbestos itself but also to the methods used to remove or handle it.

Who needs an exposure control plan for asbestos?

An exposure control plan may be required by many employers, including:

- Construction and demolition contractors
- Asbestos abatement contractors
- Asbestos building surveyors
- Hazardous materials consultants
- School district maintenance facilities
- Commercial building management agencies
- City and municipal building inspectors
- Insurance adjusters
- City and municipal waste facilities
- Restoration contractors

Elements of an exposure control plan

Each workplace is unique, so an exposure control plan that is specific to the workplace or operation. Exposure control plans should be developed only by a qualified person.

Any exposure control plan must include the following:

- Statement of purpose
- Responsibilities of employers, supervisors, and workers

- Risk identification and assessment
- Risk controls
- Written safe work procedures
- Worker education and training
- Written records
- Hygiene facilities and decontamination procedures
- Health monitoring

A sample exposure control plan for cutting small amounts of asbestos-containing gypsum board is included in the Appendices (xx).

Statement of purpose

The purpose of an exposure control plan is to prevent harmful exposure of workers to chemicals (including asbestos) in the workplace. The following is an example of a typical statement of purpose:

> [Name of employer] is committed to providing a safe and healthy workplace for all of our staff. A combination of measures will be used to achieve this objective, including the most effective control technologies available. Our work procedures will protect not only our workers but also any other workers who enter our workplace. All employees must follow the procedures described in this plan to prevent or reduce exposure to asbestos-containing materials.

Responsibilities of employers, supervisors, and workers

Employers

Employers have the following responsibilities:

- Ensure that the resources (such as safe work procedures, worker training, PPE) required to implement and maintain the exposure control plan are readily available where and when they are required
- Select, implement, and document the appropriate site-specific control measures
- Ensure that supervisors and workers are educated and trained to an acceptable level of competency
- Ensure that workers use appropriate PPE (such as disposable coveralls, eye protection, and respirators)
- Conduct a periodic review of the plan's effectiveness, including a review of the available control technologies to ensure that these are selected and used when practicable

- Maintain records of training and inspections
- Ensure that a copy of the exposure control plan is available to workers

Supervisors

Supervisors have the following responsibilities:

- Ensure that workers are adequately instructed in the workplace controls
- Ensure that workers use appropriate PPE
- If workers require respirators, ensure that they have been fit-tested and that the results are recorded
- Direct work in a manner that eliminates or minimizes the risk to workers

Workers

Workers have the following responsibilities:

- Know the hazards of the workplace
- Follow established safe work procedures as directed by the employer or supervisor
- Use any required PPE as instructed
- Report any unsafe conditions or acts to the supervisor
- Know how and when to report exposure incidents

Hazard identification and risk assessment

Employers must ensure that potential workplace hazards are identified and that the risks associated with those hazards are assessed. If there may be asbestos-containing materials at the worksite that will be disturbed, the employer will need to do the following before work begins:

- Conduct an asbestos survey to identify potential hazards
- Assess the risks associated with those hazards
- Control the risks by eliminating or minimizing them

Exposure limit

The occupational exposure limit for airborne asbestos is 0.1 fibres per millilitre. As asbestos is a confirmed human carcinogen, the ALARA principle also applies, and workplace exposure must be reduced to levels as low as reasonably achievable.

Risk controls

Risk controls are measures that are used to eliminate the risk to workers or, if elimination is not possible, minimize the risk.

Hierarchy of controls

Some types of controls are more effective than others, but it may not always be practicable to use the more effective solution. Whenever possible, however, controls must be implemented in the following order of preference:

1. Substitute less hazardous materials or processes.
2. Use engineering controls, such as barriers, enclosures, and local exhaust ventilation.
3. Use administrative controls, such as signage and proper use of washing facilities.
4. Use personal protective equipment. PPE is considered the last line of defence and should be used only when other controls are not practicable, or in addition to other controls. The proper use, fit, and disposal of PPE must also be considered.

Workplace controls should be based on a risk assessment conducted by a qualified person.

Written safe work procedures

Written safe work procedures describe how to carry out specific tasks safely and efficiently. In general, safe work procedures are written for:

- Hazardous tasks
- Complicated tasks, so that important steps don't get missed
- Frequently performed tasks
- Less routine tasks, to remind workers of the hazards and how to control the risks

Written safe work procedures must specify any required PPE, when it must be used, and where it can be found. Post the procedures where they will be available to workers. These procedures must be submitted to WorkSafeBC along with a Notice of Project (NOP) prior to the start of an asbestos abatement project.

How to develop a written safe work procedure

Follow these five steps when developing a written safe work procedure:

1. Determine the overall task for which the safe work procedure is needed.
2. Break down the task into its basic steps.
3. Identify the hazards associated with each step.
4. Identify the actions needed to minimize the risks to workers from these hazards.

5. Prepare a list of the actions that workers must do when performing the task.

Hygiene facilities and decontamination procedures

Employers must also provide adequate work procedures and washing facilities to help control asbestos exposure, including:

- Good housekeeping procedures, including end-of-workday procedures
- Washing facilities
- Shower facilities as required (e.g., for high-risk and some moderate-risk work)
- Clean eating and drinking facilities

Worker education and training

Employers must ensure that workers are informed about the contents of the exposure control plan, and that they are educated and trained to work safely. Exposure control plans should describe worker education and training, and how they will be carried out. Education and training are particularly important for new workers.

Written records

The exposure control plan must be written down, and records should be kept for each component of the plan. For example, document education and training activities — keep track of who was trained, when the training took place, and what it included. Other documentation should include the following:

- Workplace inspections
- Health and safety meetings
- Accident investigations
- Health monitoring records

Health monitoring

An exposure control plan for asbestos should include medical monitoring of workers, such as annual lung function testing and periodic (every two to three years) chest X-rays for asbestos abatement workers.

Reviewing the plan

Review the exposure control plan at least once a year, and update it as necessary. During this process, consult with the joint health and safety committee (or the worker health and safety representative, if applicable).

Respirator program

Providing protective equipment and ensuring that workers use it are essential to any effective occupational health and safety program. Employers must develop and implement a written respirator program that is acceptable to WorkSafeBC and that meets the requirements of the Occupational Health and Safety Regulation. For more information on respirators, see Sections 8.32 to 8.45 of the Regulation.

A respirator program is a formal plan for using respirators at a specific worksite. Employers cannot simply hand out respirators and expect workers to use them properly. If respirators are necessary to protect workers, then an effective respirator program must be in place. Such a program will:

- Help protect the workers' health and prevent illnesses related to breathing hazards in the workplace
- Promote more effective use of respirators
- Make it easier to comply with WorkSafeBC requirements

Ideally, one person in the organization should be designated as the respirator program administrator and have overall responsibility for the program. Parts of the program can be delegated to others, but the final authority for running the program should rest with one administrator. It is important that whoever is assigned the responsibility for respirators has the knowledge to perform the job.

Employers must ensure that workers are trained in proper use and care of respirators. Employers must also provide fit testing (using a protocol acceptable to WorkSafeBC, such as described in CSA Standard Z94.4-02) when a worker is first fitted with a respirator, and once a year thereafter.

Fit-test kits are available from respirator suppliers. One type of test, the qualitative fit test, determines whether the worker can detect any amount of a test compound leaking through the respirator. Employers must keep records of these tests and of the fit-test program.

For more detailed information on respiratory protection, see "Respiratory protection" on page xx. A sample respirator program is provided in the Appendices (page xx.). You can also find more information on respiratory protection programs in the WorkSafeBC publication *Breathe Safer — How to use respirators safely and start a respirator program.*

Training, instruction, and supervision

Note

Training should be conducted by a qualified person (see page xx).

Written safe work procedures must form the basis of an employer's ongoing training program.

Employers must ensure that workers:

- Are trained and instructed in the safe handling, use, and disposal of any substances (such as chemicals) used in working with asbestos
- Are provided with Material Safety Data Sheets (MSDSs) for these substances
- Are informed of the health hazards associated with exposure to asbestos fibres and other materials used in the workplace
- Can demonstrate competency in doing their work according to the safe work procedures

Employers must document training and instruction and ensure effective supervision at all worksites.

Thermal stress

The human body naturally maintains temperatures between 36°C and 38°C. Thermal stress can occur when the body's core temperature rises above or falls below this range.

Any worker who shows or reports signs or symptoms of thermal stress (heat or cold) must be removed from further exposure and examined by either a physician or a Level 2 or 3 first aid attendant. Employers must ensure adequate access to this level of care.

Heat stress

When a person's body temperature rises above the normal range, the body tries to get rid of the excess heat. If the body continues to gain heat faster than it can get rid of it, body temperature will increase and the person will experience heat stress. Health problems that result from heat stress are known as heat-related disorders.

The tight-fitting, impervious nature of protective clothing used when working with asbestos may make workers susceptible to heat stress and heat-related disorders such as heat stroke or heat exhaustion.

On all jobs, employers must assess the risk of workers' exposure to conditions that exceed the heat action levels or the clothing correction values specified in Section 7.28 of the Regulation. If the risk assessment indicates the possibility of workers' exposure to unacceptable heat action levels, employers must implement an exposure control plan. The plan must include measuring the thermal index, keeping records of the results, and ensuring that workers are informed of the results. Employers must also ensure that workers know how to recognize the signs and symptoms of heat-related disorders and how to prevent them.

Cold stress

Similar requirements exist when a worker may be exposed to conditions that could cause the body's core temperature to drop below 36°C, which can result in cold stress. Cold stress can lead to health problems such as hypothermia and cold-related injuries such as frostbite.

The requirements for risk assessment, implementation of an exposure control plan, and instruction and training of workers are the same as for heat stress. In addition, if the thermal environment has an equivalent chill temperature below −7°C, a heated shelter must be provided. This may be necessary when workers are working on the exterior of a building or working in an unheated building during winter.

Inspection and testing of equipment

Employers must ensure that:

- Equipment is inspected before being used in the work process
- HEPA filters in vacuum cleaners and negative air systems are assessed using a suitable indicator chemical (such as DOP or PAO; see page xx) at least annually, after a HEPA filter is replaced, if the vacuum or ventilation unit is dropped or damaged, and before use in a high-risk work activity

The following information should be clearly posted on the equipment:

- Name of the testing agency
- Name of the tester
- Date of the test
- Results of the test

Recordkeeping

Work that involves the handling of asbestos-containing materials can range from major (a large friable-asbestos removal project) to minor (the replacement of a non-friable gasket). Whatever the size of the project, employers need to keep records of the actions taken to prevent exposure to asbestos fibres. Employers:

- Must keep records of asbestos inventories, risk assessments, inspections, and air-monitoring results for at least 10 years
- Must keep records of corrective actions, notices of project (NOPs), and training and instruction of workers for at least 3 years
- Should keep asbestos survey results as long as asbestos remains in the building or structure

Note

Despite the 10-year and 3-year time limits identified in the Occupational Health and Safety Regulation, employers are advised to keep all records for as long as the company exists because a WorkSafeBC officer may ask to see records at any time. If employers cannot produce records proving, for example, that they have trained workers or conducted risk assessments in the past, they may have to retrain workers or redo risk assessments.

Notice of project (NOP)

The owner or prime contractor must ensure that WorkSafeBC receives a Notice of Project (NOP) at least 24 hours before starting any asbestos-related construction projects asoutlined in Section 20.2(1)(c) of the Occupational Health and Safety Regulation. A copy of the completed form must be posted at the worksite.

If the work needs to be done immediately, as in the case of emergency repair or clean-up, work may start immediately but the NOP must be filed as soon after as possible. Every reasonable effort must be made to contact the local WorkSafeBC office if the NOP cannot be filed before the work starts.

A NOP must be filed if the construction activity includes any oth the following:

- The removal, encapsulation, or enclosure of materials containing friable asbestos
- The demolition, dismantling, or repair of any part of a building or structure in which asbestos-containing materials have been used, or in which asbestos products have been manufactured

The NOP must include:

- The name and address of the owner and the prime contractor (if any)
- The municipal address of the project
- The starting date and anticipated duration of the project
- The estimated total cost of labour and materials for the project
- Detailed written work procedures, specific to the task and to the worksite, that will be used to minimize the risk to workers of asbestos exposure

A copy of the asbestos risk assessment and site-specific safe work procedures must be included with the NOP.

Contracting out projects

An employer or the owner or property manager of a firm or building may contract out a project involving asbestos-containing materials. When a project involves the services of two or more contractors and their workers, the prime contractor (or owner, if there is no prime contractor) must coordinate the work activities of subcontractors on the worksite if those work activities may affect workers of more than one company.

The prime contractor or owner must ensure that:

- There is a written agreement between the prime contractor or owner and the other contractors that clearly establishes the responsibilities for the health and safety of workers, instruction and training of workers, supervision of work on the project, and any necessary air sampling and testing
- The project is adequately planned, and all contractors know and understand their responsibilities
- Each contractor complies with the requirements of the Regulation as they apply to the project
- The work of contractors is carried out in such a way that it does not cause undue risk of injury or occupational disease to workers who are not involved in the project but are working nearby or are affected by the project

NOP for ongoing asbestos work

WorkSafeBC Occupational Health and Safety Guideline G20.2(1)(c), *Notice of project for asbestos — Ongoing work* provides employers with information on the requirements for submission of a NOP-Asbestos for short-duration repair or maintenance work that may take place over an extended period of time. It is for use by employers who conduct periodic repairs or other minor disturbances of asbestos-containing building materials, as part of an ongoing operations and maintenance program.

The guideline allows the employer to carry out this work without submitting a separate NOP each time one of these routine tasks is performed. It is not intended for use by asbestos abatement contractors or restoration contractors.

For more information regarding the submission process and information required, refer to Guideline G20.2(1)(c) online at WorkSafeBC.com.

Part 3: Work procedures

Low-risk work activities

Low-risk work activities are those that involve working with or in proximity to asbestos-containing material if the material is not any of the following:

- Being cut, sanded, drilled, broken, ground down or otherwise fragmented,
- Being disturbed, such that asbestos fibres may be released

In other words, it would not be necessary to use personal protective equipment or engineering controls to prevent worker exposure to airborne asbestos fibres.

Activities that carry a low risk of exposure to airborne asbestos fibres include:

- Disturbing materials that contain less than 0.5% asbestos, provided that dust controls are in place
- Repairs to drywall that has asbestos-containing drywall filler, as long as the filler is not disturbed, such as adding new filler to the top of painted drywall (for example, to repair small holes and dents) and sanding the filler, provided there is no contact with the asbestos-containing mud beneath the paint
- Installing a screw, nail, or hanger (for example, to hang a sign or picture) on drywall that contains painted asbestos-containing filler
- Replacing a single asbestos-containing floor tile without breaking the tile
- Moving asbestos-containing waste material that is contained within a cleaned, properly sealed bag and then double-bagged (as described on page xx)

Workers involved in such activities should have some knowledge of the hazards of asbestos and the location of the materials.

Employers must clearly identify all locations of asbestos-containing materials, and ensure that all workers have been instructed in any work procedure restrictions needed to prevent disturbing asbestos-containing materials.

A WorkSafeBC officer may request to see asbestos air-monitoring results to confirm that these activities do not expose workers to asbestos fibres.

Note

All decisions about what constitutes a low-risk, moderate-risk, or high-risk work activity must be made by a qualified person through a proper risk assessment. For a definition of qualified person, see page xx.

Moderate-risk work activities

Moderate-risk work activities are those other than high-risk work activities that involve working with or in proximity to asbestos-containing material that is being cut, sanded, drilled, broken, ground down or otherwise fragmented, or otherwise disturbed. It is necessary to use personal protective equipment or engineering controls to prevent worker exposure to airborne asbestos fibres.

Moderate-risk work activities require specific procedures to ensure the safety of workers and others who may be affected by the activities. WorkSafeBC Occupational Health and Safety Guideline G6.8, Procedures for abatement of asbestos materials during house and building demolition/renovation, provides information to assist with the development of moderate-risk work procedures that meet the requirements of the Regulation.

Increased risks require upgraded controls

If the risk assessment performed by a qualified person identifies increased risks in activities normally considered moderate-risk, employers must upgrade controls to effectively address these risks. This may include implementing high-risk controls.

Activities that carry a moderate risk of exposure to airborne asbestos fibres include:

- Using hand tools to cut, shape, drill, grind, or remove non-friable manufactured products containing asbestos, such as asbestos cement pipe
- Backing mounting screws out of asbestos cement products (such as transite board) and removing the boards or tiles intact
- Buffing vinyl asbestos floor tiles with a coarse disc
- Collecting asbestos samples for laboratory analysis (see “Example procedure: Collection of bulk samples” on page xx)
- Removing any part of a false ceiling to gain access to a work area (for example, during inspection) when materials containing friable asbestos are, or are likely to be, lying on the surface of the false ceiling
- Removing drywall materials where joint-filling materials containing asbestos have been used
- Removing asbestos tape or paper on ductwork
- Removing vinyl-asbestos floor tile or other non-friable materials
- Removing an entire piece of equipment or pipe with the asbestos-containing material remaining effectively intact (“wrap and cut” procedure)

- Demolishing a block wall (for example, of cement) that has residual asbestos debris in its cavity (dust controls must be in place)
- Removing asbestos-containing asphalt roofing material
- Dismantling a treated enclosure upon completion of an asbestos removal project
- Setting up and removing a glove bag apparatus for the removal of pipe insulation
- Using a prefabricated glove bag to remove asbestos insulation from piping systems

Note: While the area outside a glove bag is considered a moderate-risk area, the work activity inside a glove bag is considered high-risk. If a glove bag is torn or punctured, the risk level outside the bag may increase (for example, from moderate-risk to high-risk) if a significant amount of debris is released or spilled.

Moderate-risk activities that should only take place under the supervision of a qualified consultant (not a consultant or contractor trained only to perform asbestos surveys) include:

- Using power tools (with HEPA-filtered local exhaust ventilation) to cut or drill through asbestos-containing materials
- Removing up to 10 m^2 (about 100 sq. ft.) of linoleum with asbestos backing, using hand tools or tools equipped with HEPA-filtered local exhaust ventilation
- Removing asbestos-containing vermiculite insulation from a concrete-block wall, through holes cut in the exterior of the wall
- Removing asbestos-containing vermiculite insulation from an attic space in an unoccupied residence, using a trailer-mounted industrial vacuum system (such as a VecLoader)

Note: Safe work procedures must be prepared by a qualified person and reviewed by a WorkSafeBC officer before work commences. The officer may request asbestos air-monitoring results to confirm the effectiveness of the work procedures and personal protective equipment.

Clean-up activities that carry a moderate risk of exposure to airborne asbestos fibres include:

- Using a HEPA vacuum to clean ceiling tiles or light fixtures with light to moderate contamination
- Using a HEPA vacuum to clean asbestos-containing debris from an area before setting up an enclosure

Emergency spill clean-up

Cleaning up an asbestos spill may require a high level of control. Because of the urgent nature of spill clean-up, however, the spill area should be isolated and cleaned immediately.

General moderate-risk procedures

Note

These procedures provide an outline only, and are not specific to any one workplace. Each individual owner, employer, or contractor must adapt the procedures to provide specific work instructions for each individual job.

Anyone involved in any moderate-risk work activity must follow written work procedures similar to those described here.

To ensure that anyone in or near the work area is not exposed to airborne asbestos fibres, the following must be done:

1. Clearly mark the designated work area boundary by placing barricades, fences, or similar structures around the work area.
2. Place signs around the work area warning people not to enter the work area unless authorized to do so.
3. Wear appropriate protective clothing:
   - Clothing material must resist penetration by asbestos fibres. Clothing must be impervious to penetration by asbestos fibres if workers are permitted to wear street clothing underneath.
   - Clothing must cover the body and fit snugly at the neck, wrists, and ankles.
   - Clothing must include a head covering and foot coverings (such as laceless rubber boots or "booties") that are acceptable for the specific worksite conditions.
   - Torn clothing must be immediately repaired or replaced
4. Wear a respirator fitted with a P100 (HEPA) filter. For more information about respirators, see "Respiratory protection" on page xx.
5. Do not use dry sweeping or compressed air to clean up or remove dust or materials from work surfaces or clothing.
6. Use polyethylene (poly) drop sheets and, if necessary, seal windows, doorways, and other openings to prevent the spread of asbestos dust to other work areas.
7. Before starting any work that is likely to disturb asbestos-containing materials on the surfaces of anything in the work area, clean up any damaged materials by damp-wiping or using a HEPA vacuum.
8. During the work, clean up dust and waste (wetted if possible) using a HEPA vacuum or by wet-sweeping or mopping (see "Waste handling and disposal" on page xx). Do not use pressure spraying equipment of any type to remove asbestos-containing materials.

9. Immediately upon finishing the work, complete the following tasks:
   - Wet drop sheets and barriers.
   - Fold them to contain any remaining dust.
   - Bag or place them in a sealable container.
   - Dispose of them as asbestos waste.
10. Before leaving the work area, complete the following tasks:
   - Before taking protective equipment and clothing outside the contaminated work area, clean them by damp-wiping or using a HEPA vacuum.
   - Leave any protective clothing worn in the work area in the designated storage area or facility for cleaning, or place disposable protective clothing in a sealable container and dispose of it as asbestos waste.
   - Launder non-disposable clothing as described on page xx.
11. Place asbestos waste in a sealable container and label the container to identify its contents, hazard(s), and the necessary precautions for handling the waste materials. To prevent any interference with the work activity, do not allow containers of asbestos waste to accumulate in the work area. Remove containers from the work area at the end of each work shift, if not more often, and ensure that the containers remain under effective control if they are stored at the worksite before being disposed of.
12. Before removing asbestos waste containers from the work area, clean their external surfaces by wiping with a damp cloth or using a HEPA vacuum. Double-bagging is a good practice and an industry standard.

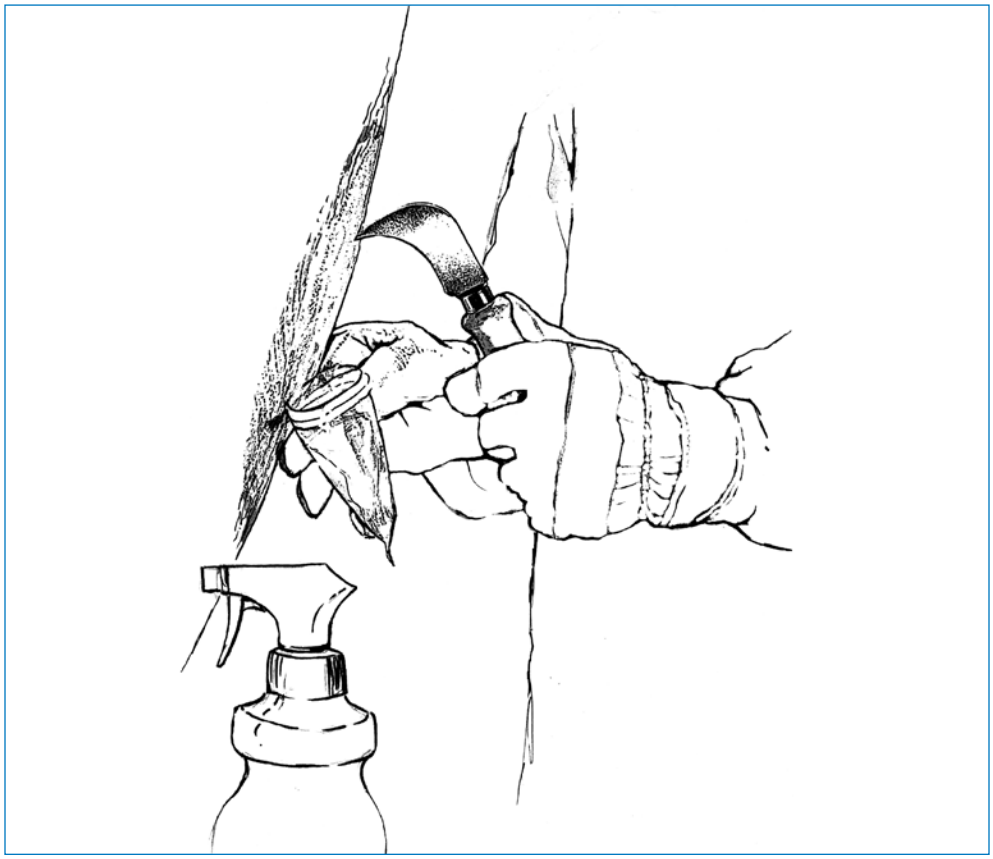
Example procedure: Collection of bulk samples

Bulk samples of materials suspected of containing asbestos must be collected by a qualified person and sent for laboratory analysis to determine their content.

Please note that these procedures represent minimum requirements. It may be necessary to upgrade personal protective equipment (such as respiratory protection) depending on the condition of the worksite and nature (for example, friability) of the materials.

1. Assemble all required personal protective equipment (PPE) and tools, including disposable Tyvek coveralls (or similar) with integral head covering that fits snugly at the wrists and ankles, booties, half-face respirator with P100 HEPA cartridges, water mister, water supply, cutter tool(s), scoop, sample collection bags, wiping cloth or disposable talc-free wet-wipes, disposal bags, duct tape, and so on.

2. Put on disposable Tyvek coveralls and, where deemed necessary, booties. Wear disposable gloves. Determine whether ankles and wrists of coveralls need to be sealed (this may be necessary when sampling very friable material such as vermiculite insulation).
3. Mark the boundary of the sampling area (for example, with barrier tape) and signage. Inform any nearby workers of the potential asbestos hazard and instruct them to stay outside the area. Any worker in the sampling area must use a respirator. Depending upon the condition of the materials, sampling may generate significant amounts of airborne fibres.
4. Put on and fit-check the half-face air-purifying respirator.
5. Identify location(s) from which to collect bulk sample(s).
6. To minimize release of dust, use a water mister to wet the material to be sampled.
7. Use sampling tools to collect the desired sample, minimizing disturbance of the material and collecting only the amount necessary. If pieces break off during sampling, clean up the debris using a HEPA vacuum or by wet-wiping. Where necessary, cover the area with poly drop sheets to catch and contain loose materials generated during sampling.



8. Place the collected sample in the sample bag and label the bag with collection details. Seal the sample bag. Samples should be double-bagged.
9. Using wet wipes, wet paper towels, or a wet cloth, wipe up any visible material that may have fallen or become dislodged during sample collection.
10. Place this waste material (including wipes) in a designated asbestos waste bag.
11. Use spray adhesive, tape, or caulking where appropriate to seal sample collection locations where the sample collection may have resulted in minor damage to the material sampled. (For example, after disturbing drywall or ceiling material, tape, caulk, or spray the area to seal it.)
12. Decontaminate (wipe) tools between sample collections and after completing all sample collections.
13. In a clean area, remove disposable Tyvek coveralls, booties, and gloves and place them in the designated waste bag. The method of waste disposal will depend on the quantity of the material generated.
14. In the clean area, remove and clean off the respirator. Use a wet cloth or wipe to clean any exposed skin areas.
15. Do a final check of all equipment.
16. Complete sample analysis forms (such as the chain-of-custody form), update sampling notes, and submit samples to the lab.

High-risk work activities

Note

All decisions about what constitutes a low-risk, moderate-risk, or high-risk work activity must be made by a qualified person through a proper risk assessment. For a definition of qualified person, see page xx.

High-risk work activities involve working with or in proximity to asbestos-containing material if a high level of control (such as an air-tight containment structure and powered air-purifying respirators or air-supplied respirators) is necessary to prevent worker exposure to airborne asbestos fibres.

High-risk work activities require specific procedures and containment to ensure the safety of workers and others who may be affected by the activities. WorkSafeBC Occupational Health and Safety Guideline G6.8, Procedures for abatement of asbestos materials during house and building demolition/renovation, provides information to assist with the development of high-risk work procedures that meet the requirements of the Regulation.

Increased risks require upgraded controls

If the risk assessment performed by a qualified person identifies increased risks in activities normally considered moderate-risk, employers must upgrade controls to effectively address these risks. This may require implementing high-risk controls.

Activities that carry a high risk of exposure to airborne asbestos fibres include:

- Removing, encapsulating, or enclosing materials containing friable asbestos during the repair, alteration, maintenance, demolition, or dismantling of any part of a building, structure, machine, or piece of equipment
- Cleaning, maintaining, or removing air-handling equipment in buildings where sprayed fireproofing materials containing asbestos have been applied to the airways or ventilation ducts or have been used as spray-on insulation
- Removing asbestos-containing textured materials from ceilings and/or walls
- Repairing, altering, or dismantling any part of a boiler, furnace, kiln, or similar device in which insulating materials containing asbestos have been used or applied
- Using power tools (without water or dust controls) to cut or drill through asbestos-containing materials
- Removing more than 10 m^2 (about 100 sq. ft.) of linoleum with asbestos backing

- Removing asbestos-containing vermiculite insulation (except as indicated under "Moderate-risk work activities" on page xx)
- Removing any asbestos-containing materials in circumstances where there would be a significant release of fibres

Anyone involved in any high-risk work activity must follow written work procedures similar to those described below.

> **Note**
>
> The high-risk procedures described here provide an outline only, and are not specific to any one workplace. Each individual owner, employer, or contractor must adapt the procedures to provide specific work instructions for each individual job.

Example procedure: Isolating the high-risk asbestos work area

To ensure that the designated asbestos work area is properly isolated, the following must be done:

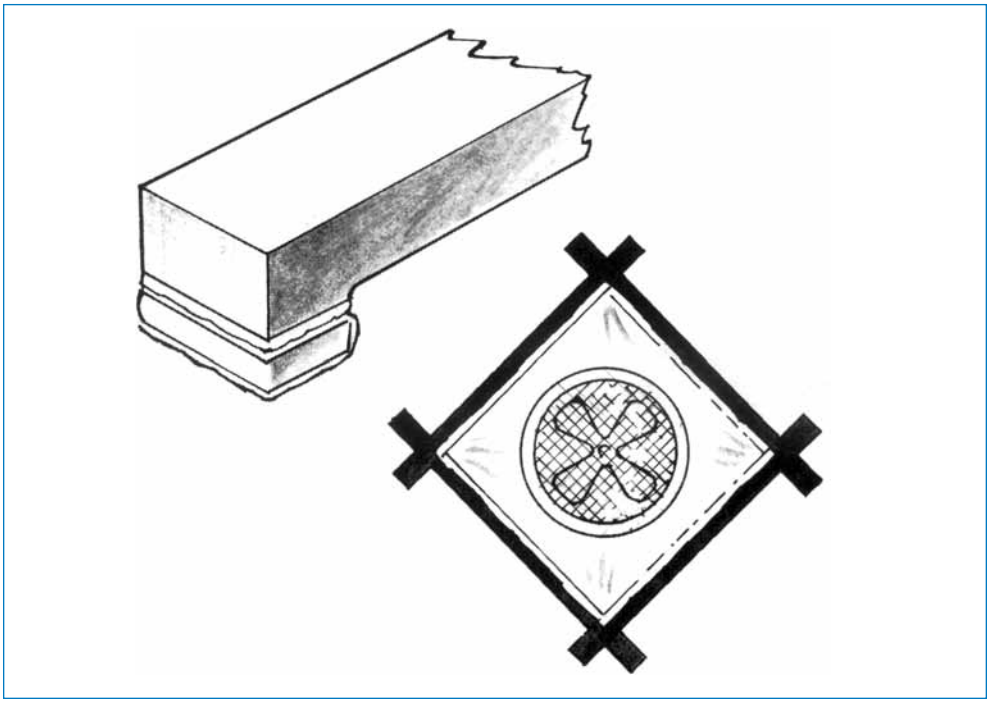
1. Place signs around the work area warning people not to enter the work area unless authorized to do so.
2. Form an airtight containment by enclosing the entire work area to prevent the escape of asbestos fibres. The most common way to do this is by enclosing the work area with polyethylene (poly) sheeting—at least 0.15 mm (0.006 in. or 6 mil.) thick — or a similar impervious material, held in place with duct tape.

   Where such a containment is impracticable, specify the alternative work procedures that will be used to minimize the risk to workers of asbestos exposure.

   When removing pipe insulation, workers may use a glove bag apparatus as a containment system to isolate the work operations causing asbestos fibre release.
3. Maintain a lower air pressure (negative pressure) in the containment than in the surrounding area so that air always flows into the contaminated area from the clean outside areas.
   - Test the air flow using a smoke tube.
   - Maintain negative pressure in the containment until site decontamination work is complete and a visual inspection and air clearance monitoring confirm that fibre levels are low enough to permit dismantling of the containment.
   - Discharge exhaust air to the outdoors through HEPA filter(s).
   - Ensure that the air flow pattern in the work area is such that the decontamination facility's clean room and shower room are safe for workers not wearing respirators.

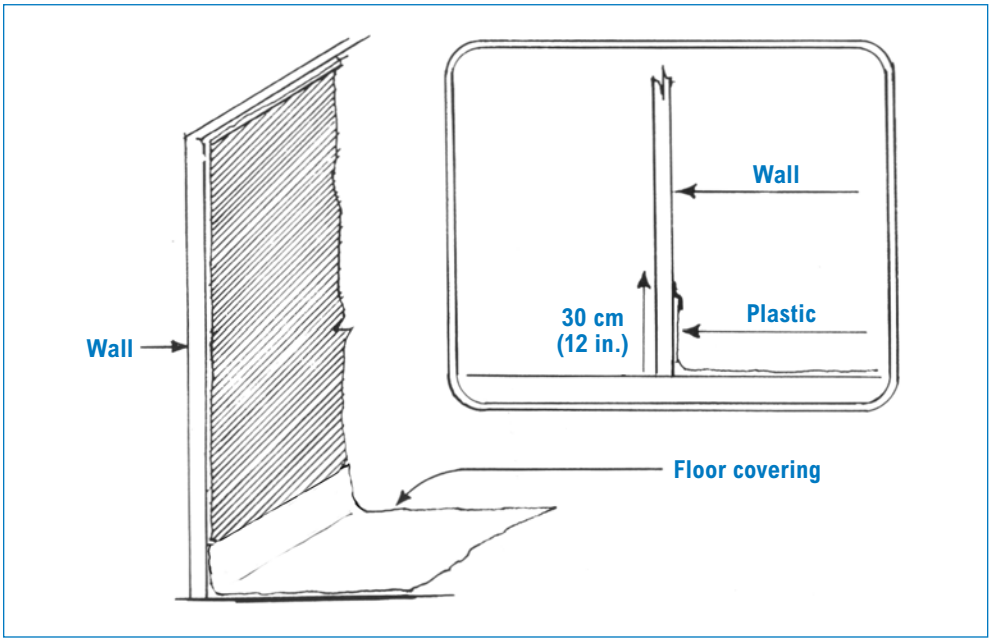
- Containment ventilation must remain operational (in place and running). It must not be removed until the work has been completed and the air clearance has been granted.

4. Seal off stairways, elevators, and any other openings with poly sheeting and tape.
5. Shut down and lock out the air heating and ventilation system to the containment area and seal the ducts (including outside duct openings) with poly sheeting.



6. Clean and completely cover or enclose with poly sheeting all non-removable fixtures, such as lockers, large machinery, and equipment. Clean all fixtures and equipment that can be reasonably removed by damp-wiping or using a HEPA vacuum, and remove them from the containment area.

7. Cover the floor with poly sheeting. Make sure that the poly sheeting extends at least 30 cm (12 in.) up the walls.

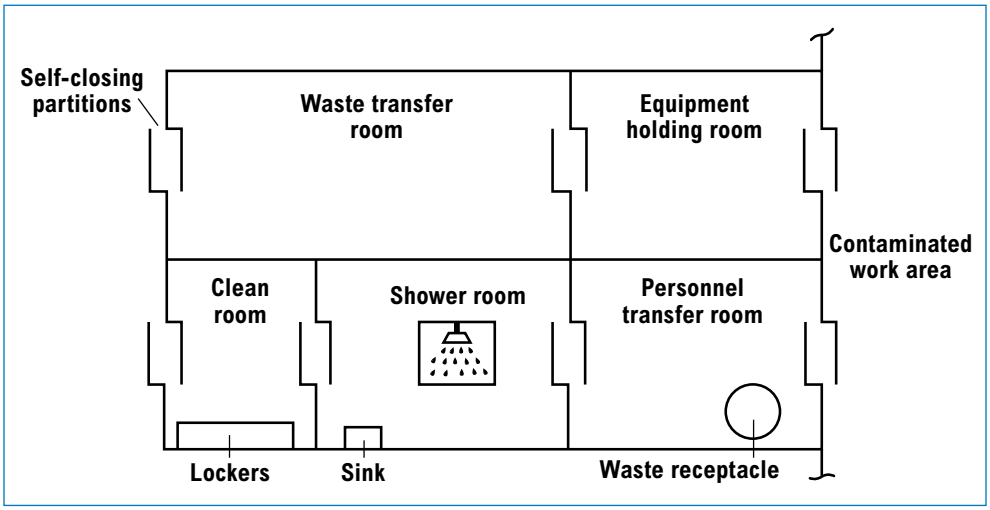


8. Whenever there is a danger of electrical shock, such as during wet removal or encapsulation of materials containing friable asbestos, take appropriate precautions. Use power sources with ground fault circuit interrupters (GFCIs) or equivalent protection against electrical shock for all electrical equipment operated inside the containment. As required, physically lock out all existing electrical circuits or lighting to prevent electric shock or unintentional start-up of electrical equipment inside the containment.

   If existing lighting is to be used, clearly specify this in the work procedures submitted with the NOP, and include additional safety precautions that will be used to keep moisture away from the live contacts.
9. Inspect the containment isolating the asbestos work area at least daily. The containment must be inspected during every work shift for gaps, leaks, or breaks. Correct any defects immediately.

Example procedure: Decontaminating workers

The designated work area must include a decontamination facility that enables workers to leave the area without carrying any asbestos fibres on their bodies or their clothing.



A decontamination facility consists of a shower room and a series of connected rooms separated by air locks.

To ensure that proper decontamination is achieved, the following must be done:

Entering the contaminated work area

1. Enter the clean room, remove all street clothes and personal belongings, leave them in the clean room, and change into protective clothing (disposable coveralls).
2. Put on an appropriate respirator and ensure that it fits and works properly.
3. Pass through the shower room into the personnel transfer room and finish putting on any other personal protective equipment required for the work, such as footwear or safety headgear.
4. Enter the contaminated work area to perform the work activities.

Note: Protective clothing worn throughout the job may be stored and put on in the personnel transfer room, as long as acceptable laundering facilities exist and appropriate time intervals for cleaning protective work clothing are established.

Leaving the contaminated work area

1. Before entering the personnel transfer room, remove all gross asbestos materials using wet wipe-down procedures or a HEPA vacuum.
2. In the personnel transfer room, remove all protective clothing and equipment except the respirator. Place disposable protective clothing and any waste materials in poly bags for disposal.
3. Enter the shower room and shower while wearing the respirator (an adequate supply of tempered water and soap must be provided). After having an initial shower and thoroughly rinsing the respirator facepiece and its harness, remove the respirator and finish showering. If the respirator filters become wet, they should be discarded and replaced.

   Note: Showers must not be removed from the containment area until the work has been completed and air clearance has been granted.
4. Enter the clean room and dress in street clothes. Thoroughly clean and disinfect the respirator, then store it in the clean room until its next use.

   Note: Wet filters are not normally reused (see the respirator manufacturer's instructions). Filters may be disposed of in the work area or taped and taken out of the work area for disposal.
5. Keep hand tools and supplies in the equipment holding room. Use this room as well when transferring asbestos waste containers or any equipment that has been decontaminated to the waste transfer room.

   Note: Partitions between rooms in the decontamination facility (see the illustration on page xx) must be self-closing so that each room can function as an air lock. These partitions are normally constructed of overlapping sheets of heavyweight poly sheeting suspended to form a curtain. Workers must not open more than one such partition per room at any one time.

Example procedure: Controlling airborne asbestos fibres

To ensure that the release of airborne asbestos fibres is properly controlled, the following must be done:

1. Place warning signs at all access points into the permanent enclosure. The signs must warn of the danger from asbestos-containing materials and should identify appropriate precautions.
2. Ensure that any permanent enclosure of asbestos-containing materials is effectively airtight. Do not locate electrical, plumbing, or ventilation services inside a permanent asbestos enclosure.

3. Pass air from the negative-air unit through a HEPA filter and discharge the air outdoors.
4. Never remove dry materials containing friable asbestos without prior approval from WorkSafeBC.
5. Saturate asbestos-containing materials with water before handling or removing them. Surfactants (wetting agents) must be used with the water to help thoroughly wet asbestos-containing materials.
6. Do not use dry-sweeping to clean up asbestos-containing materials. Never use compressed air for any cleaning purposes.
7. Control water streams and application of sealants or encapsulants to prevent excessive fibre generation. Use airless or low-pressure application systems. Pressure sprayers must not be used to remove or wet down asbestos-containing materials.
8. When cleaning up small amounts of asbestos-containing materials, use only HEPA vacuums, or wet-mop or wipe the materials. Gross amounts of asbestos materials inside an asbestos containment can be shovelled into bags.
9. Use water to continually mist the air near workers who are removing asbestos or cleaning up waste materials.
10. When repairing asbestos-containing materials:
    - Disturb the least possible amount of the materials.
    - Seal exposed friable ends or edges that have resulted from repair or maintenance procedures before removing the work enclosure.
    - Wash any surfaces that will remain exposed after repair work is complete, then vacuum and treat the surfaces with an effective sealant or glue.
11. Clean all surfaces exposed to asbestos contamination by vacuuming or damp-wiping.
12. After removing asbestos-containing materials, wash or vacuum exposed surfaces and treat with a sealant or glue designed to seal invisible residual fibres to the substrate.
13. If asbestos is encapsulated, test the encapsulated-asbestos materials to ensure that the encapsulant has penetrated the materials and that the encapsulant has not disturbed the bond between the friable asbestos materials and their supporting surface.
14. Identify encapsulated asbestos materials. Identification must indicate both the dangers and the precautions to be taken while working on or near the materials.
15. Complete a final decontamination, including washing down and vacuuming the enclosure, to remove all visible signs of asbestos

contamination from the enclosure and the equipment. Complete this decontamination before sealing the surfaces from which asbestos has been removed.

16. Complete a final visual inspection of the entire enclosure.
17. Before dismantling the enclosure, take final air clearance measurements of airborne asbestos fibres.

Example procedure: Laundering contaminated clothing

Employers must ensure that workers who launder contaminated clothes, whether on-site or at a separate business, are informed of the hazards of asbestos and the procedures required for handling contaminated clothing.

Before sending contaminated clothing to a laundry facility, the following should be done:

1. Clean the clothing using a HEPA vacuum.
2. Place the clothing in waterproof poly bags.
3. Seal and label the bags.

Cleaned clothing should be packaged and used only for asbestos work.

Example procedure: Disposing of asbestos waste materials

To ensure that asbestos waste is properly disposed of, the following must be done:

1. Place waste materials in impervious containers — poly bags at least 0.15 mm (0.006 in. or 6 mil.) thick — inside the enclosed asbestos work area, seal the containers, and label or tag them "ASBESTOS." Asbestos waste should be double-bagged.
2. Before removing the sealed containers from the equipment holding room and before removing them from the waste transfer room, decontaminate the outside of the containers by damp-wiping or by cleaning with a HEPA vacuum.
3. In the equipment holding room, package the sealed impervious containers so that they will not be punctured during handling and transportation to the disposal site. This is normally done by double-bagging them.
4. Ensure that a continuous clean-up and disposal program is in place to prevent unnecessary accumulation of waste materials containing

asbestos. By the end of each workday, and preferably by the end of each work shift, place all asbestos waste materials in sealed containers.

Make prior arrangements with the appropriate authorities to deliver asbestos waste to assigned dump sites. Inform transport drivers of precautions they must take. Transport vehicles may be required to display signs or placards specifying the nature of the cargo (see the *Transport of Dangerous Goods Act*).

5. Ensure that disposal sites conform to provincial and municipal requirements. (Check with the regional office of the British Columbia Ministry of Environment.)

Example procedure: Removing asbestos-containing pipe insulation

The removal of asbestos-containing pipe insulation is a high-risk work activity that does not require the usual decontamination steps as long as workers use glove bags — prefabricated bags equipped with integral gloves — according to the manufacturer's instructions. A glove bag is a containment device installed on the pipe using straps to seal the ends of the bag around the pipe. Some glove bags are designed for and allow progressive movement along the pipe, and are also considered to be a form of containment.

When using glove bags, follow the manufacturer's instructions and wear appropriate personal protective equipment (at a minimum, this should include disposable coveralls and a half-face respirator equipped with HEPA cartridges).

When using a glove bag to remove asbestos-containing pipe insulation, the following must be done:

1. Thoroughly clean any surfaces exposed by the removal of the asbestos insulation. After removing each section of asbestos insulation, immediately clean the surfaces with a vacuum cleaner equipped with a HEPA filter. If a proper vacuum cleaner is not available, use damp cloths or sponges.
2. Keep the surfaces free of wet sludge that could release asbestos fibres after drying.
3. Treat all cloths, sponges, rags, wire brushes, and so on as asbestos waste.
4. Remove the glove bag and repeat vacuum cleaning of all surfaces in the work area, including waste containers, reusable tools, and equipment.
5. Seal the exposed ends of the remaining asbestos insulation. Inspect and seal the pipe with glue.

When removing pipe insulation without a glove bag, workers must follow all the procedures for high-risk work activities (see page xx).

Work on high-temperature pipe systems must be discussed with the local occupational hygiene officer before work procedures are submitted with the NOP.

Air sampling

Consultants and air-monitoring technicians who collect ambient, clean room, occupational, and clearance air samples should have specific education and training in the following:

- Requirements for asbestos air sampling using NIOSH Method 7400, "Asbestos and Other Fibers by PCM"
- Sampling equipment and procedures
- Pump and rotameter calibration procedures

A NIOSH 582 Certificate course (or equivalent) provides education on these points, as well as:

- Set-up and alignment of the microscope
- Filter preparation and mounting
- Fibre counting
- Statistical evaluation

Consultants or technicians conducting air sampling must have the following documentation:

- Pump calibration program, including written calibration procedures
- Pump calibration log sheet
- Calibration chart or table (if rotameters are used)
- Battery maintenance program
- Sample log sheet
- Sample chain-of-custody form

Independent third-party air monitoring

Third-party sampling for airborne asbestos fibres during an abatement project should be performed by a qualified person, on behalf of the building owner or the prime contractor. Such a person may also be subcontracted by the asbestos abatement contractor, but should not be an employee of that contractor. Air-monitoring technicians should be employees of an asbestos laboratory or an asbestos consulting agency. It is not an accepted industry practice for asbestos abatement (or other) contractors to perform their own asbestos air monitoring.

Equipment calibration

Sampling pumps must be calibrated with the cassettes attached, immediately before and after each air sample is collected in the field. Pumps must be calibrated against a primary standard. Primary standards are those that involve the measurement of volume based on the physical

dimensions of an enclosed space. These include a number of electronic bubble meters that measure flow rates when soap bubbles pass through a transparent chamber of known volume. Dry-piston flowmeters also meet the definition of a primary standard.

Electronic primary flowmeters are available in a variety of flow rate ranges, usually "low," "standard" (between 1 and 7 L/min), and "high" (up to 30 L/min). Standard-type flowmeters must not be used to calibrate pumps to higher flow rates (for example, more than 8 L/min).

Rotameters and thermal mass flowmeters are considered "secondary" standards. They can be used in the field, provided they are calibrated against a primary standard. Rotameters measure air flow using a ball inside a vertical tube, whereas thermal mass flowmeters use changes in heat loss from a small electric sensor to calculate flow.

Pumps should be fully charged before use.

Air sampling at moderate-risk sites

Occupational air sampling

Occupational air samples are collected to determine or assess the adequacy of work procedures and controls, or when changes to work procedures occur. When a worker may be at risk of overexposure to an airborne contaminant, periodic air monitoring is required under Section 5.53, Workplace monitoring, of the Regulation. A WorkSafeBC officer may also require that occupational air monitoring be conducted to determine whether an employer's safe work procedures and controls provide adequate protection.

When collecting occupational air samples, the following must be done:

- Collect occupational samples from the worker with the highest exposure risk (closest to the asbestos-containing material).
- Attach the sampling cassette to the worker's clothing so that the cassette is hanging down in the worker's breathing zone.
- Keep the worker under observation at all times during the sampling. This means that the technician must either enter and remain in the work area during the course of the sampling, or observe the worker from outside the barrier tape or enclosure.
- Sample for at least 20 minutes at a flow rate of about 2.5 L/min, for a total volume of at least 48 L, otherwise the filters may be overloaded with particulate.

- Submit field blanks to the laboratory along with the occupational samples.
- Analyze filters and notify workers of the results within 24 hours.

Ambient air sampling

Ambient air samples should be collected daily when there are unprotected persons in the immediate vicinity of the work area.

When collecting ambient air samples, the following must be done:

- Set the flow rate at 2.5 L/min or less, otherwise the filters may become overloaded with particulate. Sample for at least 4 hours.
- Place the sampling cassettes about 1.5 m (4-5 ft.) from the ground and at least 30 cm (1 ft.) from any walls. The cassettes should be pointed downward at about 45 degrees.
- Submit field blanks to the laboratory along with the samples.
- Analyze filters and notify workers of the results within 24 hours.

Air clearance sampling

Air clearance sampling may be required, depending on the nature of the facility and the type of asbestos work performed. For example, a school district may request air clearance sampling following the removal of asbestos-containing floor tile from a classroom.

Sampling may be performed using "passive" or "aggressive" (using fans or blowers to move air around) methods. Aggressive clearance sampling is recommended in situations where the asbestos has been very difficult to remove or "lock down" (such as where asbestos debris has been washed into cracks and crevices) or following an improper or incomplete abatement job. Analysis with transmission electron microscopy (TEM) should be used under these circumstances, as TEM can distinguish between asbestos and non-asbestos fibres. (Analysis with phase contrast microscopy, on the other hand, counts all fibre types and might lead to false positive results.)

When collecting air clearance samples, the following must be done:

- Collect samples before the enclosure is dismantled or the barrier tape is removed, and while the negative air units (if used) are still operating.
- Collect at least one sample for every 270 m^3 (9,600 cu. ft.) of work area. If the work area is 270 m^3 or less, collect at least two samples.
- In order to use flow rates greater than 8-10 L/min, use cassettes that have been approved by the manufacturer for use at higher flow rates, and calibrate the pumps using a high-flow primary calibrator (most "standard" primary calibrators are not rated for flow rates greater than

about 8 L/min). This is because although NIOSH Method 7400 allows flow rates as high as 16 L/min, flow rates greater than 8-10 L/min may damage the filters in the cassettes. To comply with NIOSH Method 7400, collect at least 2000 L of air.
- Place the filter cassettes about 1.5 m (4-5 ft.) from the ground and at least 30 cm (1 ft.) from any walls. The cassettes should be pointed downward at about 45 degrees.
- Submit field blanks to the laboratory along with the samples.
- Analyze filters and notify workers of the results within 24 hours.
- If filters are damaged (for example, due to a high pump flow rate), repeat the sampling.
- Ensure that the concentration of asbestos fibres in the work area after all the asbestos waste has been removed and the area has been decontaminated does not exceed 0.02 fibres per millilitre.

For all air samples, as soon as possible but no later than 24 hours after collecting samples, make the sampling results available to the workers involved and to the occupational health and safety committee, if any, at the worksite. Make the sampling results available to a WorkSafeBC officer upon request.

Always use sampling and analysis procedures acceptable to WorkSafeBC, such as NIOSH Method 7400, "Asbestos and Other Fibers by PCM." The NIOSH *Occupational Exposure Sampling Strategy Manual* provides information on sampling strategies and the collection of air samples. This document is available for download at www.cdc.gov/niosh/docs/77-173/.

Air sampling at high-risk sites

Air samples must be take to determine asbestos fibre concentration, both during the asbestos work and before the containment is removed. The minimum sampling requirements are as follows.

Occupational air sampling

Occupational air samples are collected to determine or assess the adequacy of work procedures and controls, or when changes to work procedures occur.

When collecting occupational air samples, the following must be done:
- Collect occupational samples from the worker with the highest exposure risk (closest to the asbestos-containing material).
- Attach the sampling cassette to the worker's clothing so that the cassette is hanging down in the worker's breathing zone.

- Keep the worker under observation at all times during the sampling. This means that the technician must either enter and remain in the work area during the course of the sampling, or observe the worker from outside the containment (for example, through a transparent panel).
- Sample for at least 20 minutes at a flow rate of about 2.5 L/min, for a total volume of at least 48 L.
- Submit field blanks to the laboratory along with the occupational samples.
- Analyze filters and notify workers of the results within 24 hours.

Ambient air sampling

Ambient air samples must be collected daily when there are unprotected persons in the immediate vicinity of the containment.

When collecting ambient work samples, the following must be done:

- Set the flow rate at 2.5 L/min or less, otherwise the filters may become overloaded with particulate. Sample for at least 4 hours.
- Place the sampling cassettes about 1.5 m (4-5 ft.) from the ground and at least 30 cm (1 ft.) from any walls. The cassettes should be pointed downward at about 45 degrees.
- Submit field blanks to the laboratory along with the samples.
- Analyze filters and notify workers of the results within 24 hours.

Clean room air sampling

During removal and clean-up operations, air samples must be collected for every shift. Sampling must cover at least half of the total duration of the work shift and at least one decontamination sequence at the end of the work shift.

When carrying out clean room air sampling, the following must be done:

- Set the flow rate at 2.5 L/min or less, otherwise the filters will become overloaded with particulate.
- Place the sampling cassette about 1.5 m (4-5 ft.) from the ground and at least 30 cm (1 ft.) from the clean room walls. The cassette should be pointed downward at about 45 degrees.
- Submit field blanks to the laboratory along with the samples.
- Analyze filters and notify workers of the results within 24 hours.

Air clearance sampling

Samples must be collected before the containment is dismantled and while the negative air units are still operating. Aggressive clearance sampling is

recommended in situations where the asbestos has been very difficult to remove or "lock down" (such as where asbestos debris has been washed into cracks and crevices) or following an improper or incomplete abatement job.

When collecting air clearance samples, the following must be done:

- Collect at least one sample for every 270 m^3 (9,600 cu. ft.) of containment. If the containment is 270 m^3 or less, collect at least two samples.
- In order to use flow rates greater than 8-10 L/min, use cassettes that have been approved by the manufacturer for use at higher flow rates, and calibrate the pumps using a high-flow primary calibrator (most "standard" primary calibrators are not rated for flow rates greater than about 8 L/min). This is because although NIOSH Method 7400 allows flow rates as high as 16 L/min, flow rates greater than 8-10 L/min may damage the filters in the cassettes. To comply with NIOSH Method 7400, you should collect at least 2,000 L of air.
- Place the filter cassettes about 1.5 m (4-5 ft) from the ground and at least 30 cm (1 ft) from the containment walls. The cassettes should be pointed downward at about 45 degrees.
- Submit field blanks to the laboratory along with the samples.
- Analyze filters and notify workers of the results within 24 hours.
- If filters are damaged (for example, due to a high pump flow rate), repeat the sampling.
- Ensure that the concentration of asbestos fibres in the containment area after all the asbestos waste has been removed and the area has been decontaminated does not exceed 0.02 fibres per millilitre.

Following the air clearance, workers must use moderate-risk work procedures when demolishing the containment.

For all air samples, as soon as possible but no later than 24 hours after collecting samples, make the sampling results available to the workers involved and to the occupational health and safety committee, if any, at the worksite. Make the sampling results available to a WorkSafeBC officer upon request.

Always use sampling and analysis procedures acceptable to WorkSafeBC, such as NIOSH Method 7400, "Asbestos and Other Fibers by PCM." The NIOSH *Occupational Exposure Sampling Strategy Manual* provides information on sampling strategies and the collection of air samples. This document is available for download at www.cdc.gov/niosh/docs/77-173/.

Inspect the containment and all decontamination facility rooms for gaps and breaks at least daily (inspections must be documented). Complete a visual check as well as a smoke-tube test to ensure that air flows from the clean areas into the contaminated areas. Measuring the air pressure differential between clean and contaminated areas is also recommended.

Before air clearance sampling takes place, a final visual inspection of the work area must be conducted and all asbestos waste removed.

Keep a record of such inspections for at least 10 years.

Asbestos clearance document

Following the completion of an asbestos abatement job and prior to removal of the containment, a clearance document or letter may be required by an employer or a WorkSafeBC officer. This document can be provided by the:

- Project consultant
- Prime contractor
- Asbestos abatement contractor
- Demolition contractor
- Asbestos building surveyor

The document should include the following information:

- Date
- Address of the abatement project
- Name of the abatement contractor
- Description of the scope of work that was performed (for example, what was removed and when)
- Reference to the hazardous materials survey (name of the surveyor or company, and when the survey was conducted)
- Notice of Project — Asbestos (NOP-Asbestos) number
- Waste manifest documentation
- Name of the consultant, surveyor, or contractor who performed the final visual inspection
- A statement indicating that the abatement was conducted in accordance with regulatory requirements (both the Occupational Health and Safety Regulation and the BC Ministry of Environment regulations)
- Name and signature of the surveyor, consultant, or contractor who collected the air clearance samples

Waste handling and disposal

Before any work involving asbestos takes place, the employer must ensure that procedures for the safe removal of asbestos dust and debris from the work area are set out in writing by a qualified person (see "Who is qualified to deal with asbestos?" on page xx).

Waste must be removed:

- While work is in progress, at intervals necessary to eliminate or minimize the risk of exposure
- At the end of each work shift
- At the completion of work involving asbestos

The following methods are most appropriate for the safe removal of asbestos dust and debris:

- Use a HEPA vacuum.
- Wipe surfaces with a damp cloth or sponge to remove residual amounts of asbestos dust and debris.
- Wet-sweep or wet-mop to remove larger amounts of asbestos dust and debris.
- Use a shovel or similar tool to place larger amounts of dampened asbestos debris into a sealed container or doubled 6 mil asbestos bags.

A combination of these methods might be required, depending on the nature of the work and the risk level. Every worker must be instructed and trained in these written procedures.

Ensure that asbestos is properly disposed of in accordance with the appropriate provincial and municipal environmental requirements.

If performed incorrectly, demolition and salvage work can cause harmful dust exposures in a variety of workers and other persons, including owners, developers, demolition workers, inspectors, transportation workers, landfill workers, and the public. Asbestos fibres will be released if work proceeds before asbestos-containing materials are properly identified and safely removed. For example, during demolition of interior walls and ceilings, demolition or salvage workers may be exposed to airborne asbestos fibres in the dust from gypsum board filling compound (sometimes called drywall mud) and from textured ceilings and walls. Vermiculite attic insulation containing asbestos fibres can spill out of the attic when the ceiling material is removed.

Asbestos-containing dusts from these demolition activities can contaminate the site and disperse to neighbouring properties, where other persons can be exposed to them. As demolition debris is loaded into a disposal truck, the excavator operator and the truck driver can be exposed to asbestos-containing dusts, which can also drift into neighbouring properties. As the disposal truck travels to the landfill site, dust that contains asbestos can blow out of the truck, spreading asbestos dust along its travel route. When the truck discharges its asbestos-contaminated load at the landfill, unprotected workers at the site can be exposed to the airborne hazard. These demolition practices are unacceptable and do not comply with the Occupational Health and Safety Regulation.

Section 20.112(a) of the Regulation requires that before work begins on the demolition or salvage of machinery, equipment, buildings, or structures, the employer or owner must have a qualified person inspect the site to identify asbestos-containing material that may be handled, disturbed, or removed. This is separate from the inventory required by Section 6.4 of the Regulation. The inventory prepared under Section 6.4 is required for the protection of workers who may occupy a building. Although it may not include asbestos that wasn't readily accessible (for example, because it was hidden behind concrete walls or under a number of layers of flooring), the inventory required by Section 6.4 will be a useful aid in conducting the inspection specified in Section 20.112. The latter inspection will locate and identify all asbestos prior to demolition and renovation activities.

A copy of the inspection results must always be available at the site whenever workers are present. The site documentation should include the inspection results from the survey, and any drawings, plans, or specifications that

show the locations of asbestos. Workers must have the information about the asbestos hazards on hand to use as a reference in planning their work in order to avoid exposure to asbestos-containing materials.

Risk assessment for identified asbestos

When the presence of asbestos is confirmed through bulk sample analysis, or when material is assumed to contain asbestos (for example, asbestos furnace duct tape, asbestos cement transite board, or asbestos exterior shingles), a risk assessment must be conducted before demolition work begins, to determine the exposure risk of workers and other persons. The risk assessment must be conducted by a qualified person and helps define the scope of work for the abatement of asbestos (see "Who is qualified to deal with asbestos?" on page xx).

Asbestos encountered during demolition

If any asbestos is unexpectedly encountered during demolition, such as in walls or some other concealed space or location that was missed during the pre-demolition inspection process, work must cease until a risk assessment has been conducted by a qualified person and subsequent control measures (usually removal of the asbestos) has been implemented.

This means that demolition workers need some basic awareness and skill in order to recognize materials likely to contain asbestos. Having the ability to recognize building materials and products that may contain asbestos is part of the training and instruction that demolition, renovation, and salvage employers need to provide to their workers who may be exposed to asbestos (for asbestos training requirements, see Section 6.11 of the Regulation).

Safe removal of asbestos

All asbestos slated for removal must be removed using safe work practices and procedures before demolition occurs. For more guidance on procedures for demolition and renovation activities, see Occupational Health and Safety Guidelines G6.8, Procedures for abatement of asbestos-containing material (ACM) during house and building demolition/renovation, and G20.112, Hazardous materials — asbestos. These guidelines are available on WorkSafeBC.com or from your local WorkSafeBC office (see inside back cover).

Workers and other persons must not be exposed to asbestos during the demolition of a building or structure. The asbestos removal practices and any containment procedures must minimize the release of airborne asbestos fibres and must comply with all applicable asbestos requirements in Part 6 of the Regulation.

Containment ventilation equipment (negative air units) must be run 24 hours a day as long as the work is in progress. Ventilation equipment must not be removed from the decontamination enclosure until the work has been completed and an air clearance granted.

Note

Electrical power may not be available at the demolition site. If this is the case, supplementary power must be provided (for example, using portable generators or through installation of a power pole). Check local bylaws to determine how long generators can be run over a 24-hour period. Water must also be available for dust control and decontamination purposes (for example, for a wash station or shower). Tempered water is required for high-risk work.

Asbestos that may remain in place during demolition

Some asbestos-containing materials may remain in place during the demolition of residential structures, provided they are three storeys or lower and low enough to allow adequate wetting of both the interior and exterior surfaces. A qualified consultant (not a consultant or contractor trained only to perform asbestos surveys) should be present during the demolition and should have prepared or approved the work procedures that will be used to protect workers. Work procedures must be reviewed by a WorkSafeBC officer before the work begins.

Asbestos-containing materials that may remain in place during demolition include:

- Exterior stucco
- Asphalt roofing materials and shingles
- Window caulking
- Mastics (such as flooring mastic)
- Vinyl asbestos floor tile, provided that the total area is less than 20 m^2 (about 200 sq. ft.)

No bulldozers, explosives, or burning should be used during demolition. In order to minimize the generation of dust, only track hoes and end loaders or equivalent should be used.

The building should be thoroughly wetted with water both inside and out before demolition, during demolition, and during the handling and loading of debris. Water should be delivered as a mist; pressure washers (high-pressure water) must not be used. If visible dust is emitted, the demolition work must stop until the problem has been corrected.

Workers at the site and operating the demolition equipment must wear both a respirator (minimum half-face elastomeric type with P100 cartridges) and disposable Tyvek coveralls. Occupational air samples should be collected during the course of the work.

If the demolition waste meets the requirements of the BC Hazardous Waste Regulation (contains less than 1% asbestos), it may be placed in a lined bin and disposed of as ordinary construction debris. However, the presence of trace amounts of asbestos in the waste must be indicated by signage or documentation, so that municipal disposal workers can take appropriate precautions to protect themselves.

The BC Building Code and various municipal bylaws also have requirements regarding demolition procedures. The owner or employer should check with the appropriate local authority for further details.

Ten steps to compliance with asbestos abatement requirements of Section 20.112 of the Regulation for a pre-1990 house/building demolition

1. A pre-1990 house/building is to be demolished or renovated.
2. The building owner (or owner's representative) or the employer (e.g., builder, demolition contractor) retains a qualified person (usually a consultant) to perform a risk assessment and asbestos survey before conducting work where asbestos may be disturbed.
3. The qualified person inspects the house/building, collects representative bulk samples, and has the samples analyzed by a qualified laboratory.
4. The qualified person prepares a report that identifies all inspection results (including drawings, plans, or specifications), risk assessment, and scope of work for the abatement of the asbestos.
5. The report containing the inspection results is provided to the owner/employer. The inspection results must be available at the worksite whenever workers are on site.
6. The owner or employer retains trained asbestos abatement workers. A NOP with written work procedures is submitted to WorkSafeBC before commencement of asbestos removal work.
7. Safe removal and disposal of identified asbestos occurs.
8. After the asbestos removal the owner or employer receives written confirmation that the asbestos specified for removal on the NOP has been removed. A copy of the inspection results is on site.
9. The owner authorizes demolition of the house/building to proceed. The demolition employer proceeds to demolish house using safe work procedures. Copy of inspection results and post-abatement reports are on site.
10. If any asbestos is found during demolition, all work is to cease until a risk assessment is done and the asbestos is safely contained or removed. In this case, go back to step 7.

Part 4: Personal protective equipment

Protective clothing

All workers must wear protective clothing that:

- Is made of a material that resists penetration by asbestos fibres
- Covers the body and fits snugly at the neck, wrists, and ankles
- Covers the head
- Covers the feet (laceless rubber boots are strongly recommended)
- Can be immediately repaired or replaced if torn

The use of disposable protective clothing is recommended.

Asbestos workers often have to wear tight-fitting, impervious protective clothing while working in hot, confined areas where there is not a lot of air movement. As a result, they may be at a higher risk of experiencing heat stress and resulting heat-related disorders. For more information on heat stress, see "Thermal stress" on page xx.

Reduce exposure with personal protective equipment

Personal protective equipment (PPE), including respirators and protective clothing, is essential in controlling worker exposure to asbestos. Workers should be familiar with and understand the equipment requirements of their employer's written exposure control program.

Despite the necessity of PPE, employers and workers should remember that it is always a supplementary line of defence and should not be relied upon exclusively. The other controls mentioned in this manual must also be used to minimize exposure to airborne asbestos.

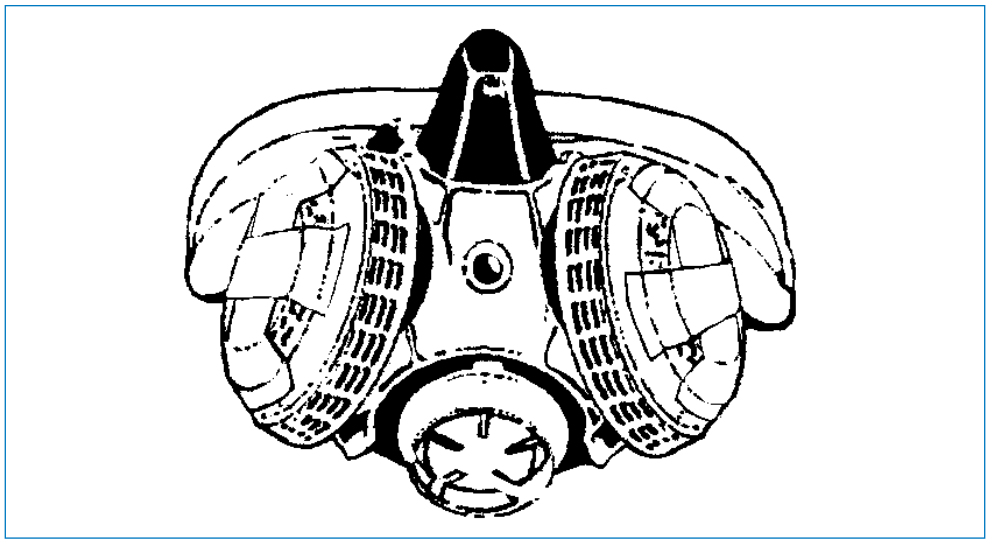
In most cases, workers must use respirators during all stages of a project in which the risk of exposure to airborne asbestos fibres exists or could develop. During initial set-up at a site, the type of asbestos and the amount of contamination in the area will determine the need for a respirator. For example, with non-friable materials such as vinyl asbestos tile, workers normally do not need a respirator until the actual work begins. With other materials, workers may need a respirator even during survey and set-up.

The need for and type of respirators are two of the elements that will have been determined during the risk assessment—which establishes whether the work involves low-risk, moderate-risk, or high-risk activity—and during the development of the exposure control plan and the site work procedures.

Respirators for use around asbestos fall into one of two categories: air-purifying respirators or air-supplying respirators. So-called "single-use" or "disposable" respirators are not acceptable for working around asbestos.

Air-purifying respirators (APRs and PAPRs)

Air-purifying respirators (APRs) for protection against asbestos have P100 (HEPA) filters to remove asbestos fibres from the air around workers and protect them from breathing in asbestos fibres. *Powered air-purifying respirators* (PAPRs) use a battery-powered blower to continuously pull air through the P100 (HEPA) filter and into the facepiece. Both APRs and PAPRs may be either half-facepiece or full-facepiece respirators, and will have different assigned protection factors. For more information, see the WorkSafeBC publication *Breathe Safer* and Part 8 of the Occupational Health and Safety Regulation.



Workers can use half-facepiece, dual-cartridge respirators with P100 (HEPA) filters in asbestos concentrations up to 1 fibre/mL.

Workers can use full-facepiece PAPRs with P100 (HEPA) filters in asbestos concentrations up to 10 fibres per millilitre.

Note

All types of air-supplying respiators used for protection against asbestos fibres must be equipped with backup P100 (HEPA) filters or an escape bottle in case the air souce is cut off.

Air-supplying respirators (SARs and SCBAs)

Unlike air-purifying respirators, air-supplying respirators provide an attached supply of breathing air. The two basic types of air-supplying respirators are supplied-air respirators (SARs, or airline respirators) and self-contained breathing apparatus (SCBAs).

Supplied-air respirators feed clean air through a hose called an airline, which is attached to either an air tank or an air compressor. Supplied-air respirators may be either pressure-demand or continuous-flow types:

- Pressure-demand respirators maintain a positive pressure in the facepiece, which allows clean air to leak out without allowing contaminated air to leak in.
- Continuous-flow respirators deliver a constant supply of air to the facepiece, which also maintains a positive pressure.

Self-contained breathing apparatus provide a supply of air from a cylinder. Asbestos-related activities rarely require the use of SCBAs. When they do, however, asbestos-related activities require pressure-demand SCBAs, which draw air into the facepiece whenever pressure in the facepiece goes down due to leakage or inhalation.

Choosing the right respirator

Employers must establish a respiratory protection standard for a specific job by selecting an appropriate respirator based on anticipated or established airborne asbestos concentrations for that job. The following table outlines appropriate respirator choices, which are determined by maximum use concentrations as detailed in Table 8-1 of the Regulation.

As the asbestos fibre concentration approaches the maximum use concentration for the respirator being used, workers must switch to a respirator with a higher protection factor.

Asbestos (all types) maximum use concentration (in fibres per millilitre*)	Minimum respirator choice for the specified maximum use concentration	
	Air-purifying respirators with P100 (HEPA) filters	Air-supplying respirators
Up to 1 f/mL	• Half-facepiece respirator • Loose-fitting facepiece or hood, powered (PAPR)	—
Up to 5 f/mL	• Full-facepiece respirator	—
Up to 10 f/mL	• Powered full-facepiece respirator (PAPR) • Hood or helmet facepiece, powered (PAPR), provided the manufacturer has demonstrated a protection factor of at least 1,000	—
Up to 100 f/mL	—	• Pressure-demand full-facepiece supplied-air respirator (SAR)
Up to 100 f/mL	—	• Continuous-flow full-facepiece supplied-air respirator (SAR)
Up to 1,000 f/mL	—	• Pressure-demand Self-contained breathing apparatus (SCBA)

* Fibres per millilitre (f/mL) is equivalent to fibres per cubic centimetre.

When using respirator air filters, workers must use NIOSH P100 series filters (HEPA filters). Before workers can use respirators that are not NIOSH-approved or Mine Safety and Health Administration (MSHA)–approved, the respirators must meet other standards acceptable to WorkSafeBC. Employers must submit the respirator in question and its documentation to WorkSafeBC.

Checking for proper operation and fit

Employers must provide fit testing when a worker is first fitted with a respirator and once a year thereafter. For more detail on employer fit-testing responsibilities, see the "Fit test" section of the "Sample respiratory program" on pages xx-xx.

Using one of the following procedures, workers must check the operation and fit of respirators (a fit check) before each use.

Note

To ensure a proper fit, workers must be clean-shaven where the respirator facepiece seals with the face.

Non-powered air-purifying respirators (APRs)

1. Check the fit of the APR using one of the following methods:
   - Block the inhalation valves by placing your hands over the filters and inhaling. If the respirator is sealed correctly, cutting off the air supply will cause the facepiece to collapse.
     or
   - Block the exhalation valve and blow into the respirator. If the respirator is sealed correctly, the facepiece will bulge.
2. If the facepiece does not collapse or bulge, either it is not sealed correctly or the valves are leaking. Correct the problem and recheck.

Powered air-purifying respirators (PAPRs)

1. Install a new battery in the blower unit and remove the blower hose from the facepiece.
2. Test the battery using a PAPR flow tester to ensure an adequate flow of air, in accordance with the manufacturers' specifications.
3. Install filters in the PAPR unit and retest it on the flow tester to ensure that the filters are not plugged. Dispose of the filters as asbestos waste if the flow tester indicates inadequate air flow or if the cartridges become wet. Re-attach the blower hose to the facepiece.
4. Put on the facepiece and adjust the straps to ensure a proper fit.
5. Switch on the PAPR and hold the palm of one hand over one facepiece exhaust port. With the other hand, feel the release of air from the other exhaust port. If no air is released, take a deep breath and blow sharply into the facepiece. This should free the stuck diaphragm in the exhaust port and allow air to be released. Do this step for both exhaust ports.
6. For loose-fitting facepiece, or hood or helmet facepiece PAPRs, check the fit in accordance with the manufacturer's instructions.

Supplied-air respirators

Supplied-air respirators must be fit-tested in accordance with CSA Standard Z94.4-02. You can find information on the fit testing and proper use of supplied-air respirators in the WorkSafeBC publication *Breathe Safer: How to use respirators safely and start a respirator program.*

Part 5: Emergencies and incidents

Preparing for emergencies

Employers must conduct site-specific risk assessments and prepare for emergencies. Written emergency procedures must describe what to do in the event of any likely incident—for example, what to do if a worker's air supply fails, how to avoid contamination if a fire breaks out, or how to deal with an injury.

Employers must prepare a written emergency plan for each individual worksite. This plan must include written procedures for evacuating workers from the contaminated work area in a medical emergency. Employers must develop these procedures in consultation with emergency response agencies such as ambulance and fire departments. Employers must also assign a worker (for example, an occupational first aid attendant) to coordinate the implementation of the procedures.

As soon as a written emergency plan is developed, employers must:

- Conduct emergency drills to determine whether the procedures work in practice and to thoroughly familiarize workers with their roles in an actual emergency
- Keep records of emergency drills to monitor efficiency
- Provide each worker with a copy of the plan and provide enough training to ensure that workers clearly understand the procedures
- Post the procedures and other relevant information (such as telephone numbers) in appropriate, prominent locations

Medical emergency procedures

If a medical emergency occurs in an asbestos work area as a result of an incident or collapse, standard protective measures may be temporarily ignored if they would otherwise cause an immediate threat to the worker's life or recovery. For example, a worker's respirator may be immediately removed so that mouth-to-mouth resuscitation can be performed, or a worker's contaminated clothing may be left on if a spinal injury is suspected.

If protective equipment and clothing can be left in place without interfering with the emergency care of the injured worker in a contaminated area, they should not be removed until the worker has been brought to an uncontaminated area. On-site decontamination procedures should be carried out only if they do not interfere with medical emergency procedures.

When first aid, ambulance, or other emergency personnel have to enter a contaminated area, they must be warned of the hazard and be provided with, and told how to use, respirators, coveralls, and head protection before entering the area. (In view of the hazard, some emergency responders may refuse to enter the contaminated area.)

Employers must ensure that emergency procedures and preparations provide emergency personnel with clear instructions, provisions, and the means to adequately decontaminate or clean up themselves and the injured worker before leaving the worksite. For example, first aid or ambulance personnel accompanying an injured worker can remove contaminated equipment and clothing in the equipment holding room to minimize the risk of contaminating areas outside the containment area.

Injured workers who have not been decontaminated must be covered in such a way as to minimize contamination of clean areas. The cover should not hinder access to the worker by first aid or ambulance personnel. Someone familiar with the handling and disposal of asbestos-contaminated clothing should accompany the injured worker to the hospital. If the worker is still contaminated with asbestos upon arrival at the hospital, the employer must inform hospital staff of this and instruct them on the appropriate disposal of contaminated clothing. The employer's written emergency procedures must detail the collection and handling of contaminated materials in such a situation.

Investigating incidents

Investigation of incidents is important for preventing accidents. As far as possible, the investigation must:

- Determine the cause of the incident
- Identify any unsafe conditions, acts, or procedures that contributed to the incident
- Recommend corrective action to prevent similar incidents

Employers must conduct a formal investigation to discover the causes of an incident. Any of the following should be considered an incident:

- An individual encounters asbestos unexpectedly.
- An air sample indicates high asbestos levels in a clean room or outside area.
- An individual sustains an exposure that has the potential to cause serious injury or death. (**Note:** Because the health effects of asbestos tend to show up years after exposure, the seriousness of an exposure should not be judged by whether or not the individual requires immediate medical attention.)

The formal investigation must also examine measures that will prevent similar situations in the future. Employers must forward copies of the investigation report to their occupational health and safety committee and to WorkSafeBC.

What is an incident?

The Occupational Health and Safety Regulation defines an incident as "an accident or other occurrence which resulted in or had the potential for causing an injury or occupational disease."

Emergency information

Fill in this information now, before an emergency occurs.

Ambulance telephone	
Fire department telephone	
Doctor/first aid telephone	
Hospital telephone	
Contacts to notify in emergency situations:	
Name	Telephone
Name	Telephone
Name	Telephone
Name	Telephone
Name	Telephone
Name	Telephone
Name	Telephone
Name	Telephone
Name	Telephone
Name	Telephone

Appendices

- Sample exposure control plan for cutting small amounts (<3 m^2) of gypsum board containing asbestos
- Sample respirator program for asbestos work

Sample exposure control plan for cutting small amounts (<3 m²) of gypsum board containing asbestos

Contractor company information

- Name
- Address
- Contact information (names and phone numbers)

Worksite information

- Project name
- Address

Health hazards from asbestos exposure

Asbestos is a hazardous material. Its fibres are extremely fine and can remain suspended in the air for hours. Workers exposed to asbestos-contaminated air can inhale the fibres. If handled without precautions, such as appropriate respiratory protection, asbestos may cause serious chronic health problems or even death.

- Asbestosis is a chronic lung disease resulting from prolonged exposure to asbestos dust. The fibres gradually cause the lungs to become scarred and stiff, making breathing difficult.
- Asbestos fibres in the lungs may cause lung cancer. Smoking tobacco in combination with inhaling asbestos greatly increases the risk of developing lung cancer.
- Mesothelioma is a rare, rapidly progressing form of cancer affecting the lining of the chest or the abdominal cavity. There is a strong link between asbestos exposure and mesothelioma.

Due to the relationship between asbestos exposure and cancer, exposure to asbestos fibres must be kept as low as reasonably achievable.

Note

Cutting asbestos-containing gypsum board or drywall mud without proper controls can release asbestos fibres into the air. Breathing in asbestos fibres can cause asbestosis (a serious lung disease characterized by scarring and thickening of the lungs), mesothelioma, and other lung cancers. These diseases can result in death.

Purpose and responsibilities

We have a duty to protect our workers from exposure to asbestos fibres when asbestos-containing materials are disturbed. Studies show that the cutting or breaking of asbestos-containing gypsum board or drywall mud can release asbestos fibres into the air. Effective controls are available to protect workers from exposure to these fibres.

We know that a combination of control measures will be required to achieve this objective. We commit to being diligent in our efforts to select the most effective control technologies available, and to ensure that the best practices, as described in this exposure control plan (ECP), are followed at our worksites.

The work procedures we establish for cutting asbestos-containing gypsum board will protect not only our workers but also all other workers on-site.

The employer is responsible for:

- Ensuring that the materials (such as tools, equipment, personal protective equipment [PPE]) and other resources (such as worker training) required to fully implement and maintain this ECP are readily available where and when they are required
- Conducting a periodic review (at least annually) of the effectiveness of the ECP—this includes a review of available asbestos control technologies to ensure that these are selected and used when practicable
- Ensuring that all required tools, equipment, and PPE are readily available and used as required by the ECP
- Ensuring that supervisors and workers are educated and trained to an acceptable level of competency
- Maintaining records of training, fit-test results, crew talks, and inspections (for example, of equipment, PPE, and work methods/practices)
- Coordinating the work with other employers to ensure a safe work environment

Our asbestos program administrator [insert name here] is responsible for:

- Administering the overall program, including the maintenance of records
- Reviewing the program on an annual basis with the joint health and safety committee

Supervisors are responsible for:

- Providing adequate instruction to workers on the hazards associated with the cutting of asbestos-containing gypsum board
- Selecting and implementing the appropriate control measures
- Ensuring that workers using respirators have been properly fit-tested and that the results are recorded
- Directing the work in a manner that ensures the risk to workers is minimized and adequately controlled
- Liaising with other employers to ensure a safe work environment

Workers are responsible for:

- Using the assigned protective equipment in an effective and safe manner
- Following established work procedures as directed by the supervisor
- Reporting any unsafe conditions or acts to the supervisor
- Knowing how to report exposure incidents

Risk identification and assessment

Asbestos is a fibrous mineral that's very tough and resistant to chemicals and heat. Until 1990, it was regularly used in a large number of building products, including ceiling texture, drywall mud, flooring, and attic insulation. If these materials are disturbed (such as when they are drilled, sawed, sanded, or broken up during renovations or demolition), workers can breathe in asbestos fibres. If people breathe in enough asbestos fibres, their lungs can suffer damage, making breathing very difficult and potentially resulting in cancer and death.

Gypsum board taping or finishing compounds (also known as drywall mud) can contain from less than 1% to 3% asbestos fibres. Rarely, the gypsum board itself may also contain small amounts of asbestos.

When cutting asbestos-containing gypsum board, the use of proper dust controls, PPE, and safe work procedures can help reduce worker exposure to asbestos.

Exposure limit

The 8-hour occupational exposure limit (EL) for asbestos (all forms) is 0.1 fibres per millilitre (fibres per cubic centimetre).

Because asbestos exposure is linked to lung cancer, the ALARA principle also applies: workplace exposures must be reduced to levels ***a****s* ***l****ow* ***a****s* ***r****easonably* ***a****chievable.*

Control of asbestos fibres

The Occupational Health and Safety Regulation requires employers to select asbestos controls based on the following hierarchy:

1. Engineering controls (for example, local exhaust ventilation using a HEPA vacuum)
2. Administrative controls (for example, cutting when other workers are not in the area)
3. Personal protective equipment (for example, respirators and disposable coveralls)

Respirators will be used in conjunction with other controls, such as local exhaust ventilation (LEV), to reduce worker exposure to asbestos fibres.

A HEPA vacuum will be used for cleanup and decontamination.

Acceptable control methods for cutting asbestos-containing gypsum board

The work methods that appear in Table 1 are acceptable, provided that the respirator selection and other controls are adhered to. The control options in the following table will be used to eliminate or reduce the risk to workers from the hazards of exposure to asbestos fibres.

Table 1

Work activity	Dust suppression	Other controls	Personal protective equipment
Small cuts of less than 1 m^2, using a knife or a hand-powered gypsum board saw	• Water misting	• Remove all unnecessary objects from the work area. • Use plastic drop sheets. • Use barriers (e.g., tape barrier) to restrict access to the work area and identify the hazard.	• Half-face respirator with P100 series (HEPA) filters • Disposable coveralls (e.g., Tyvek type)
Larger cuts (less than 3 m^2) or multiple cuts in one area, using a knife or a hand-powered gypsum board saw	• Water misting • HEPA vacuum extraction	• Remove all unnecessary objects from the work area. • Use plastic drop sheets. • Use barriers (e.g., tape barrier) to restrict access to the work area and identify the hazard.	• Half-face respirator with P100 series (HEPA) filters • Disposable coveralls (e.g., Tyvek type) with head covering
Larger cuts (less than 3 m^2) or multiple cuts in one area, using a Kett saw	• HEPA vacuum extraction	• Remove all unnecessary objects from the work area. • Use plastic drop sheets. • Use barriers (e.g., tape barrier) to restrict access to the work area and identify the hazard.	• Half-face respirator with P100 series (HEPA) filters • Disposable coveralls (e.g., Tyvek type) with head covering

Respirators

- Each worker will be fit-tested if a respirator is required.
- If a worker is required to wear a respirator that requires an effective seal with the face for proper functioning, the worker must be clean-shaven where the respirator seals with the face.
- When the worker notices a resistance to breathing, the respirator filters must be replaced.
- Respirators will be used, cleaned, and stored in accordance with the respirator program.

Other personal protective equipment and hygiene

- Workers will wear disposable coveralls (e.g., Tyvek) when working with asbestos-containing materials or entering a work area contaminated with asbestos.
- Other personal protective equipment, such as protective eyewear or hearing protection, will be worn as required.
- On active construction sites that require equipment such as hard hats or high-visibility vests, this PPE will be worn in work or sampling areas. If equipment worn in a contaminated area cannot be adequately decontaminated, the equipment will be disposed of.

Safe work planning

- Select one or more of the methods described in Table 1.
- Establish a barrier around the work zone to restrict access by unprotected workers.
- Place polyethylene sheeting below the work area to catch any debris released during the work activity.
- Inspect all dust-control equipment and tools to make sure they are in good working order.
- Use and maintain all tools and equipment as specified by the manufacturer. For example, test the effectiveness of HEPA filters using dioctyl phthalate (DOP) testing or similar means at least annually and any time a HEPA filter is replaced in a vacuum cleaner or ventilation system.
- When working on a multi-employer site, provide the general contractor with a copy of the asbestos exposure control plan and safe work

procedures. Review the procedures and work schedule to determine whether additional measures are required to reduce worker exposure to asbestos fibres.

- Ensure that workers inspect their respirators before beginning work.
- If a Kett saw is used, visually monitor dust release from the equipment during use. When tools and equipment are working properly, very little dust should be visible in the air. Stop work if excessive dust is observed.

Clean-up and decontamination

There are a number of different methods of decontamination. Selection of the correct method will depend on factors such as the work activities being conducted, the type of PPE worn, the nature of the containment, and the extent of the contamination. The following procedure can be considered a general guideline for decontamination after moderate-risk activities:

1. All decontamination must take place within the restricted zone.
2. Use a certified HEPA-filtered vacuum cleaner or wet methods (washcloths, mops, etc.) to remove all visible asbestos-containing materials in the work area.
3. Wet-wipe all equipment and PPE. Wiping rags should only be used once. If using a bucket to wet the rags, wet the rags before wiping, and do not rewet the rags.
4. Damp-wipe the work area.
5. Place waste material (including wipes) in a designated waste bag.
6. Carefully roll up any polyethylene drop sheets and place them in a designated waste bag.
7. In a clean area, remove and discard disposable coveralls (and booties) in the designated waste bag.
8. Use a wash bucket and wet cloths to wipe any potentially contaminated exposed skin area (forehead, cheeks, etc.).
9. Seal the waste bag, wet-wipe the outside of it, and then place it in a second bag. Label the outer bag to identify its contents, hazard(s), and the necessary precautions for handling the waste materials. All asbestos waste must be disposed of in a duly authorized hazardous waste landfill.
10. Remove and clean respirators. Use duct tape to cover HEPA cartridge inlets.
11. Wash face, then hands.

Worker training for asbestos exposure

Training will be conducted by the employer or the employer's designate. Records of attendance, dates of training, and training material will be documented and retained. Additional training or reference material on asbestos exposure will be made available to employees upon request.

Training topics:

- Asbestos recognition
- Health hazards of asbestos exposure (including signs and symptoms of asbestosis and mesothelioma)
- Operations and materials that can produce asbestos exposures
- Engineering controls and safe work practices used to protect workers
- The importance of proper equipment control and maintenance
- Proper use of respirators and the respirator program
- Personal hygiene procedures to reduce exposures
- The details of the exposure control plan for asbestos.

Health surveillance

Workers who are regularly exposed to asbestos fibres will receive regular medical examinations from their family physicians. These examinations may include lung function testing and chest X-rays.

Workers will report any symptoms of asbestos exposure to the employer and WorkSafeBC for tracking and investigation.

Annual review

This ECP will be reviewed at least annually and updated as necessary by the employer, in consultation with the workplace health and safety committee or the worker health and safety representative.

Sample respirator program for asbestos work

Purpose

[Company name] has determined that our workers in [locations/departments] are potentially exposed to the following respiratory hazards during routine operations:

Asbestos	
Respirable silica	

The purpose of this program is to ensure that respirators used by our workers provide effective protection against airborne contaminants in our workplace(s).

Note that before considering respirators as a way to control exposure, the employer is required to first consider engineering or administrative controls to eliminate or minimize the risk of exposure. Examples of such controls include ventilation, enclosing the process, substituting less hazardous products, and other effective means.

Responsibilities

Employer

The employer is responsible for:

- Implementing a written respirator program and designating a respirator program administrator
- Ensuring that the worksite is evaluated for breathing hazards
- Eliminating or minimizing all breathing hazards
- Providing and maintaining respirators needed for any airborne hazard present at the worksite, and ensuring that workers use the equipment when required
- Providing materials for workers to use to clean their respirators
- Providing supervisors with the education and training necessary to ensure that workers use respirators safely
- Providing workers with the education, training, and supervision necessary for safe use of respirators

- Developing emergency evacuation procedures and ensuring that supervisors and workers receive appropriate training in any workplace where workers may need to be rescued or evacuated because of breathing hazards
- Ensuring that all illnesses or injuries resulting from breathing hazards and requiring medical aid are reported and recorded
- Requiring a medical assessment if there is a concern about a worker's ability to wear a respirator

Program administrator

The program administrator [insert name] is responsible for:

- Assessing the type and amount of exposure
- Selecting the appropriate respirators
- Implementing training and instruction programs
- Administering the overall program, including the maintenance of records
- Reviewing the program on an annual basis

Supervisors

Supervisors are responsible for ensuring that:

- Workers are aware of breathing hazards at the worksite(s)
- Respirators are available when required
- Workers use respirators correctly as required
- Workers are clean-shaven
- Respirators are properly cleaned, inspected, maintained, and stored
- Workers are aware of any equipment or clothing that may interfere with respirator use
- Working conditions are monitored in order to alert supervisors to exposure to higher concentrations of a contaminant or to a new contaminant
- Workers are aware of potential issues that may develop during respirator use, such as discomfort, skin irritation, or breathing difficulty
- The program administrator is notified of concerns or conditions that might affect workers' respiratory protection

Workers

Workers are responsible for:

- Understanding and following safe work procedures
- Using their respirators as instructed

- Understanding the limitations of their respirators and following the manufacturers' instructions
- Inspecting their respirators before use
- Immediately reporting any equipment problems to their supervisors
- Properly cleaning and storing their respirators

Respirator selection

The selection of a respirator must be appropriate to the contaminant, its concentration, and the level of protection provided by the respirator (i.e., the protection factor and maximum use concentration).

Only respirators bearing NIOSH/MSHA (US Mine Safety and Health Administration) approval or other respirators acceptable to WorkSafeBC will be provided to workers.

The following respirators are available to workers and are to be worn for the work activities listed below.

Work activity	Contaminants	Type of respirator
Moderate-risk asbestos abatement	Asbestos (and silica where drywall is removed)	• Half-facepiece respirator • Loose-fitting facepiece or hood, powered (PAPR)
High-risk asbestos abatement	Asbestos (and silica where drywall is removed)	• Powered full-facepiece respirator (PAPR)

Always read cartridge or filter labels and instruction manuals prior to use and be certain the correct cartridge or filter is selected.

For example:

- Organic vapour cartridge respirators may not provide adequate protection against isocyanate-based automotive paints.
- Only fume-rated particle masks provide protection against welding fumes.

Respirator fitting

To fit properly and provide protection, respirators that are designed to fit the face, such as rubber half-masks, must have an effective seal.

Workers using this type of respirator must be clean-shaven in the area where the respirator seals with the face (i.e., no visible stubble). Workers will receive a fit test once a year.

[insert name] will arrange fit testing and keep records of the results of these tests.

Worker training

Every worker who may have to wear a respirator will be trained in the proper use of the respirator. Both the worker and his/her supervisor will receive this training. The training includes:

- Description of the type and amount of exposure
- Description of the respirator
- The intended use and limitations of the respirator
- Proper wearing, adjustment, and testing for fit
- Cleaning and storage methods
- Inspection and maintenance procedures.

This training is repeated as often as necessary, at least annually, to ensure that workers remain familiar with the proper use of the respirators. A record will be kept of this training.

The training program is evaluated at least annually by [insert name] to determine that it continues to be effective.

Always refer to the manufacturer's respirator instruction manual for information.

Proper use of respirators

- Corrective eyewear or other equipment must not interfere with the seal of the respirator.
- No covering that passes between the respirator facepiece and the wearer's face can be used.

- Respirators will be inspected before and after each use. Straps, valves, cartridges, other respirator parts, and general cleanliness will be checked. See the respirator instruction manual.
- User seal checks will be performed, where applicable, by respirator users each time they put on their respirators.
- High contaminant levels and other factors such as high humidity can affect filters or cartridges. Workers noticing a resistance to breathing, a smell or taste of chemicals within the respirator, or an irritation must immediately leave the work area and report to their supervisor. After an investigation rules out other reasons, such as failure of ventilation systems, respirators must be checked and new filters or cartridges installed.
- When wearing respirators, workers experiencing any of the following must leave the contaminated area:
  - Nausea
  - Dizziness
  - Eye irritation
  - Unusual odour or taste
  - Excessive fatigue
  - Difficulty breathing.
- The program administrator will determine whether or not a worker may be allowed to wear a respirator. Where there is any doubt on the part of the worker or program administrator about the worker's ability to wear a respirator, the worker is to be examined by a physician. Certain medical conditions, such as lung disease (e.g., asthma or emphysema) or heart disease, may affect the worker's ability to wear a respirator.

Cleaning, maintenance, and storage of respirators

Respirators will be maintained, cleaned, and stored as described by the manufacturer's instructions. Where respirators are shared, they will be cleaned and sanitized after each use. Follow the manufacturer's recommendations for sanitizing.

The following procedure can be used to clean and sanitize most respirators:

1. Remove any filters, cartridges, or canisters.
2. Wash the respirator (and associated parts) in warm water mixed with a mild detergent (or a mild detergent plus bleach).
3. Rinse the respirator in clean, warm water.

4. Wipe the respirator with disinfectant wipes (70% isopropyl alcohol) or a sanitizing foam to kill germs.
5. Air-dry in a clean area.
6. Reassemble the respirator (e.g., replace the cartridges).
7. Place in a clean, dry plastic bag (or other container).

Defective respirators must not be used. If during an inspection a worker discovers a fault or defect in a respirator, he/she will bring it to the attention of the supervisor. The worker or supervisor will attempt to repair the defective respirator. If the respirator cannot be repaired, it will be given to the program administrator. The program administrator will then do one of the following:

- Perform a simple fix, such as the replacement of a valve or head strap, or
- Take the respirator out of service until it can be repaired, or
- Dispose of the defective respirator and provide a new one.

A supply of replacement parts, filters, cartridges, and so on is available at [location].

After inspection, cleaning, and necessary repairs, respirators will be properly stored in plastic bags, storage cabinets, or lockers.

Respirator fitting procedures

User seal checks

When you are satisfied that you have found a respirator that fits, there are two simple checks to test the seal. You must do at least one of these checks each time you put on your respirator.

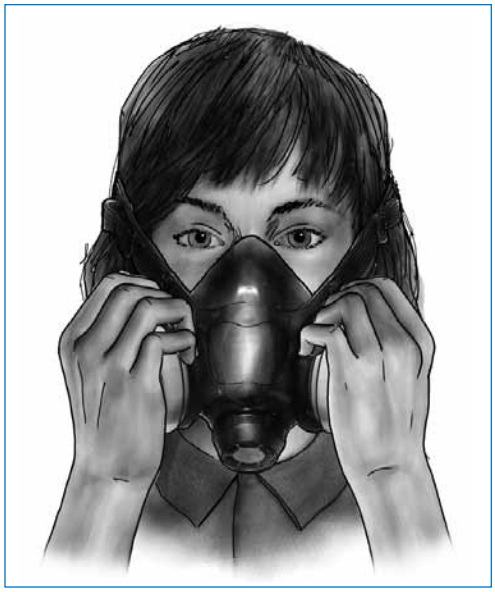
Before doing any seal check, make sure your respirator has all its inlet and exhaust valves. Make sure that the valves are in good condition and lie flat. Doing these checks will help you tell whether you have a good seal and whether the valves are in place and working.

If the respirator is to be used with any other personal protective equipment − such as goggles, hearing protection, or a hard hat − all seal checks must be done while you are wearing this equipment.

Negative-pressure user seal check

This test is called a "negative-pressure" user seal check because you create a slightly negative air pressure inside the respirator facepiece by inhaling. Follow these instructions:

1. Put on the respirator and other associated personal protective equipment. Tighten the head straps until the respirator feels snug but comfortable. Wear the respirator for a few minutes so that it will warm up and conform to your face better.
2. Close off the inlet opening of the cartridges or filters by covering them gently with the palms of your hands, a plastic bag, a special adapter, or gloves (in some cases, you may have to remove the cartridges so you can cover the inlet valves). If you are carrying out this test while wearing a power air-purifying respirator (PAPR) or an air-supplied respirator, close off or disconnect the hose to stop the air flow.
3. Breathe in slightly to create a vacuum.
4. Hold for 10 seconds.
5. If you have a good seal, the facepiece should collapse slightly against your face and stay collapsed. No air should leak into the facepiece past the sides, top, or bottom.



For a negative-pressure seal check, close off the inlet openings with your palms and inhale gently.

If the facepiece doesn't collapse and stay collapsed, there is an air leak. Check the exhalation valve(s) and try repositioning the respirator on your face and adjusting the head straps. Carry out the negative-pressure seal check again. If you cannot get a seal after a few attempts, try another size, make, or model of respirator. Repeat the check until you find a respirator that passes the seal check.

Positive-pressure user seal check

This test is similar to the negative-pressure user seal check except that you breathe out slightly while gently covering the exhaust valve with your palm. This creates positive pressure in the facepiece. If you have a good seal, the facepiece will bulge or puff out slightly from your face. Again, no air should leak past the sides, top, or bottom of the respirator.

1. Put on the respirator and other associated personal protective equipment. Tighten the head straps until the respirator feels snug but comfortable. Wear the respirator for a few minutes so that it will warm up and conform to your face better.

For a positive-pressure seal check, cover the exhaust valve and breathe out slightly.

2. Close off the exhaust valve opening by covering it with the palm of your hand.
3. Breathe out slightly to force air into the facepiece.
4. Hold for 10 seconds.
5. If you have a good seal, the facepiece should bulge out and stay out. No air should leak out of the facepiece past the sides, top, or bottom.

If the air does leak out, check the inhalation valves and try repositioning the respirator on your face and adjusting the head straps. If you cannot get a seal after a few attempts, try on another size, make, or model of respirator. Repeat the check until you find a respirator that passes the seal check.

Note that the configuration of some air-purifying respirators may make it impossible to conduct an effective positive-pressure check without dislodging the facepiece. Consult the manufacturer's instructions to see whether the positive-pressure user seal check applies to the respirator.

Fit testing

After the respirator has passed either the positive- or the negative-pressure user seal check, another test of the seal, called a *fit test*, must be done and the results recorded.

When fit tests are performed, workers must be clean-shaven and must wear all other protective equipment that they need, such as goggles and hard hats. Prescription eyeglasses must not interfere with the seal of the respirator (specialty eyeglasses are available). Ideally, fit tests should be done under operating conditions similar to those that workers would experience at the worksite.

There are two types of fit testing: qualitative and quantitative. In qualitative fit testing, workers with poorly sealing respirators will detect an irritant, an odour, or a taste when exposed to a test agent. In quantitative fit testing, specialized equipment is used to actually measure the amount of the test agent leaking into the facepiece.

Our workplace utilizes qualitative fit-testing procedures conducted in accordance with CSA Standard CAN/CSA-Z94.4-02, *Selection, Use, and Care of Respirators.* Irritant smoke or bitter aerosol will be used to fit-test our workers.

Irritant smoke fit test

In this test, a worker wearing a respirator is exposed to an irritating smoke (stannic chloride). If the respirator fits properly, no smoke will leak into the facepiece and be detected by the worker. If smoke does leak in, it will cause an involuntary reaction in the worker, such as coughing. It is important to follow instructions carefully to avoid exposing workers to any unnecessary smoke irritation. The smoke can be irritating to the eyes and airways.

Caution: This test agent may be an irritant to the worker being fit-tested or to the tester. Do not use this test agent to fit-test workers with respiratory sensitivities. The tester should consider wearing a respirator if a number of fit tests are being performed.

Irritant smoke threshold screening

1. Break off both ends of the smoke tube and insert one end into the rubber bulb (watch for the other, exposed sharp end).
2. Squeeze the bulb to force air through the tube and produce smoke.
3. Warn the worker that the smoke can be irritating and that he or she should keep eyes closed throughout the test.
4. Carefully direct a small amount of the smoke in the worker's direction.
5. Discard used tubes in sharps containers at the end of the test.
6. After the worker coughs, proceed with the fit-test procedure.

Irritant smoke fit-test procedure

The worker should put on the respirator and all other personal protective equipment, such as eye protection or a hard hat. A successful seal check must be done before the fit test.

Irritant smoke tests must be conducted with facepieces equipped with combination organic vapour/acid gas (OV/AG) and P100 (HEPA) filter cartridges. After the respirator has passed the fit test, the facepiece can be fitted with the appropriate filter or cartridge necessary for protection in the workplace.

Do not place a hood or bag over the head of the test subject. The test must be performed in a location with sufficient ventilation to prevent contamination of the work area and ventilation system.

Use a well-ventilated room or area to carry out the irritant smoke tests (both threshold screening and the fit test).

The following exercises shall be performed while the respirator seal is being challenged by the smoke:

1. Normal breathing.
2. Deep breathing. Make sure breaths are deep and regular.
3. Turning head from side to side. Make sure movement is complete.
4. Nodding head up and down. Make sure motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his/her head is in the fully up position.
5. Talking. Slowly and distinctly, count backward from 100.
6. Normal breathing.

Each exercise shall be performed for one minute.

The tester will do the following:

1. While the worker performs the first fit-test exercise (above), pass the smoke stream around the perimeter of the facepiece. You should direct the smoke at the facepiece seal, starting with the smoke stream about 30 cm (12 in.) away from the respirator. Go around the seal a total of three times, gradually bringing the smoke to within 5 cm (2 in.) of the respirator. If the worker does not detect the stream of smoke by coughing, continue with the next fit-test exercise. Repeat this step for each of the six exercises.
2. Because the smoke can be irritating, do not direct puffs of smoke at the eyes, and keep the smoke tube at least 5 cm (2 in.) away from unprotected skin. Ask workers to keep their eyes closed if they are being fitted with a half-facepiece respirator.
3. If the worker does not cough, then no smoke has leaked into the facepiece, and the respirator has passed the fit test. Fill out the fit-test record.

Caution: Testers must be careful with the sharp, broken end of the smoke tube. Coughing workers may unexpectedly jab themselves if they make sudden movements. The fit tester may wish to cover the broken end of the tube with a short length of tubing. Always discard used tubes in sharps containers at the end of the test.

Bitter aerosol taste fit test

In this test, a worker is exposed to a spray containing denatonium benzoate. It has an extremely bitter taste. The worker wears a respirator equipped with any particulate filter and puts on a test enclosure or hood that covers the

head and shoulders. The fit tester exposes the worker to the bitter aerosol by spraying the test solution into the enclosure. Because it is a very bitter solution, it can be easily detected by the worker if it leaks through the face seal. If the worker cannot taste the bitter aerosol after the predetermined number of squeezes, it means that the respirator fits properly.

A bitter aerosol fit-testing kit can be purchased from suppliers of safety equipment. These kits contain premixed solution as well as instructions for administering the fit test.

Workers should not eat, drink (except plain water), smoke, or chew gum for at least 15 minutes before taking the bitter aerosol fit test.

Before conducting the test, make sure the worker being fit-tested can detect the bitter taste by performing a threshold screening check. The threshold screening should be done under a test hood, and the worker being tested should not wear a respirator.

Caution: This test agent may affect workers with respiratory sensitivities.

Bitter aerosol threshold screening

1. Instruct the worker to breathe through a slightly open mouth with the tongue extended.
2. Ask the worker to let you know when a bitter taste can be detected.
3. Insert a nebulizer containing the threshold check solution into an opening located at the front of the test hood. Direct the spray away from the worker's breathing zone.
4. Rapidly squeeze the bulb of the nebulizer 10 times and ask whether the worker can taste the bitter aerosol.
5. If the worker cannot taste the bitter aerosol, rapidly squeeze the nebulizer bulb 10 more times and ask again whether the worker can taste it. If the response is still negative, squeeze the nebulizer bulb 10 more times.
6. Once the worker reports tasting the bitter taste, proceed with the fit test. If the worker cannot detect the bitter taste after 30 squeezes, perform a different fit test.

Bitter aerosol fit-test procedure

The worker should put on the respirator and all other personal protective equipment, such as eye protection or a hard hat. A successful seal check must be done before the fit test.

A bitter solution is sprayed into the test hood for the bitter aerosol fit test.

1. Prepare a solution made of bitter aerosol and salt solution in warm water and pour the solution into a nebulizer.
2. Have the worker put on a test hood while wearing the respirator. The front portion of the hood should be clear of the respirator and provide sufficient room for free head movement.
3. Instruct the worker to breathe through a slightly open mouth with the tongue extended. Ask the worker to let you know if a bitter taste can be detected.
4. Insert the nebulizer filled with prepared solution into the opening in the test hood directly in front of the worker's nose and mouth. Direct the spray away from the worker's breathing zone.
5. Firmly squeeze the bulb of the nebulizer containing the test solution either 10, 20, or 30 times, depending on the worker's sensitivity to the bitter aerosol (as determined by threshold screening).
6. Instruct the worker to perform the six fit-test exercises under "Bitter aerosol threshold screening" above, and tell you if a bitter taste can be detected.
7. Every 30 seconds, replenish the aerosol concentration by squeezing the nebulizer bulb half the number of squeezes used previously (i.e., use 5, 10, or 15 squeezes). Squirt the solution into the test hood.
8. If the worker reports tasting the bitter aerosol, the respirator has failed the fit test. If the worker cannot detect the bitter aerosol, the respirator has passed the fit test.

Respirator selection information form		
Process/operation information		
Work area location:	Various locations	
Work area characteristics (open area, confined space, etc.):	Generally within buildings — not confined spaces; some exterior removal work	
Location of hazardous area relative to safe area:	Barrier tape, barricades, or enclosures separate work areas from safe areas	
Work description/operation:	Removal of asbestos-containing materials from buildings by scraping, cutting, sawing, shovelling, etc.; construction and teardown of enclosures	
Anticipated length of time that respirator will be used:	Full shift — up to 8 hours per day	
Worker activity level (light, moderate, or heavy):	Moderate to heavy work	
Information for each breathing hazard		
Step 1	Oxygen level (if below 19.5%, air-purifying respirators cannot be used)	20.9%
Steps 1, 2	Air contaminant and concentration	Asbestos (moderate-risk work) — up to 0.5 fibres per millilitre (f/mL) Asbestos (high-risk work) — up to 5 f/mL Silica — up to 0.02 mg/m^3
Step 3	8-hour TWA limit	Asbestos — 0.1 f/mL Silica — 0.025 mg/m^3
Step 4	IDLH concentration	
Step 5	Can the contaminant cause eye irritation?	Yes, from particulates
Step 5	Can the contaminant irritate skin or be absorbed through skin?	No

Step 6	Respirators under consideration and assigned protection factors	Half-face elastomeric — PF 10 Loose-fitting facepiece or hood, powered (PAPR) — PF 25 Powered full-facepiece respirator (PAPR) — PF 100
Step 7	Hazard ratio (minimum protection factor) = expected contaminant concentration divided by the 8-hour TWA	Asbestos (moderate-risk work) = 5 Asbestos (high-risk work) = 50 Silica = 1
Step 8	Maximum use concentration (MUC) = 8-hour TWA multiplied by the assigned protection factor	Half-face elastomeric (for asbestos) = 1 f/mL Loose-fitting facepiece or hood, powered (PAPR) (for asbestos) = 2.5 f/mL Powered full-facepiece respirator (PAPR) (for asbestos) = 10 f/mL Half-face elastomeric (for silica) = 0.25 mg/m^3 Loose-fitting facepiece or hood, powered (PAPR) (for silica) = 0.63 mg/m^3 Powered full-facepiece respirator (PAPR) (for silica) = 2.5 mg/m^3
Step 9	Air-supplying or air-purifying respirator?	Air-purifying respirators
Step 10	State of contaminant	Asbestos — fibre Silica — particulate
Step 11	Adequate warning properties (odour, irritation, etc.)?	None

Recommended approved respirator(s):	Half-face elastomeric can be used for moderate-risk asbestos work (and silica)
	Loose-fitting facepiece or hood, powered (PAPR) can be used for moderate-risk asbestos work (and silica)
	Powered full-facepiece respirator (PAPR) can be used for high-risk asbestos work (and silica)
Recommended approved filter or cartridge:	P100 HEPA filters

Inspection checklist for air-purifying respirators	
Filtering facepiece	
Check for:	☐ Holes in the filters ☐ Worn-out (torn, no longer elastic) or missing straps ☐ Missing or curled valves ☐ Folds, creases, or distortion in the facepiece
Air-purifying respirators with replaceable cartridges or filters	
Check the facepiece for:	☐ Dirt ☐ Cracks, tears, holes ☐ Warped surfaces ☐ Broken fittings (for example, strap holders) ☐ Cracked, scratched, or loose-fitting lenses (full-face models) ☐ The presence of filter seal gaskets (if the respirator has gaskets)
Check the head straps for:	☐ Wear and tear ☐ Lack of elasticity, knots ☐ Broken or faulty buckles
Check the valves for:	☐ Soap residue or dirt on valves or on the valve seat ☐ Cracks, tears, hardening, or warps in the valves or the valve seat ☐ Missing or damaged valve cover ☐ Valves that are curled under the valve seat
Check that the cartridges or filters are:	☐ Made by the same manufacturer as the respirator ☐ The correct type for the hazard ☐ Fitting securely in the facepiece (threads are not worn) ☐ Free from cracks or dents ☐ Marked with the date they were put into service
Powered air-purifying respirators (PAPRs)	
In addition to the previous checklist items, check the:	☐ Condition of battery pack, wires, and connections ☐ Air flow (does it meet manufacturer's specifications?) ☐ Condition of breathing tube (if respirator has one)

Respirator fit-test form

Name of worker:	Date:

Does the worker wear/have:

☐ Eyeglasses ☐ Contact lenses

☐ Dentures ☐ Facial hair

If yes to any of the above, discuss how the respirator seal will be affected (workers must be clean-shaven where the respirator seals with the face). Other comments regarding counselling on eyeglasses, dentures, contact lenses, and facial hair:

Does the worker have any medical concerns about wearing a respirator?

☐ Yes ☐ No

If yes, refer the worker for a medical assessment.

Fit-test procedure

Fit testing must be repeated annually to ensure that a proper face seal is maintained.

Check when completed successfully:

☐ Correct positioning of respirator and strap adjustment

☐ Negative- and positive-pressure user seal check

Qualitative fit testing using:

☐ Irritant smoke with HEPA/organic vapour cartridges

☐ Bitter aerosol with particulate filter

☐ Isoamyl acetate (banana) oil with organic vapour cartridges

☐ Saccharin with particulate filter

☐ Other _____

Qualitative fit testing:

☐ Pass

☐ Fail

Respirator(s) fit-tested by worker

When a worker wears different makes and models of respirators, fit testing must be done on each make and model of respirator and the results must be recorded. The worker should also wear all other required personal protective equipment, such as hearing and eye protection, while undergoing the test.

	Make	Model	Size
1			
2			
3			

Points discussed with the worker	
☐ Respirator selection ☐ Respirator limitations ☐ Storage and maintenance ☐ Cartridge dating, change frequency, and limitations ☐ Where to get replacement parts	
Fit-test date:	Next fit-test date:
Fit-tested by:	
Comments:	