STANDARDS RESEARCH

Asbestos Management in Canada: Assessing the Need for a National Standard

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Table of Contents

List of Tables

List of Figures

Executive Summary

Asbestos has been widely used in a range of industries for over a century. Canada was once the world's largest producer of asbestos and remained a major exporter of chrysotile asbestos until 2012. Although much of the asbestos was exported, Canada was also a major consumer of asbestos. Exposure to asbestos fibres can cause inflammation, scarring, and genetic damage on a cellular level. It is a potent carcinogen that causes mesothelioma, as well as cancer of the lung, larynx, and ovaries. In addition, it causes asbestosis, a chronic, fibrotic lung disease that decreases the lungs' elasticity and makes it more difficult to breathe. Because asbestos-related diseases have a long latency, the diseases being diagnosed today are the result of historical exposure that occurred many years ago. Over the last 30 years, strict regulations governing the use of asbestos have been implemented and complete asbestos bans have been introduced. As a result, the most common source of exposure today is the release of fibres from asbestos-containing products and building materials (ACM).

The aim of this research project was to explore potential gaps and best practices in asbestos management in Canada and to determine if there is a need for the development of a national standard. An environmental scan was conducted of regulations for managing and controlling workplace exposure to asbestos in Canada and in selected international jurisdictions. The scan's findings were supplemented by a literature review and a series of 31 key informant interviews designed to elicit information on if and where a new standard could benefit stakeholders across a range of asbestos management roles.

Effective management of asbestos is contingent on accurately identifying its location and condition, assessing the risk of exposure to workers and the public, and selecting an appropriate strategy to eliminate or control the risk. Despite the presence of a relatively robust regulatory framework, the following key gaps and inconsistencies in how asbestos management is currently regulated in Canada were identified via the environmental scan and key informant interviews:

- **Jurisdictional responsibility:** Legislative responsibility and oversight of asbestos management is divided between federal, provincial, territorial, and municipal authorities. This creates compliance challenges for employers and consultants working in different jurisdictions and enforcement challenges for regulators.
- **Asbestos definitions:** Across the country, there are conflicting definitions of what constitutes asbestos and ACM. This not only complicates the identification and documentation of asbestos, but also creates challenges in the assessment of risk, the selection of appropriate control measures to mitigate risk, and the management and safe disposal of asbestos waste.
- **Training:** There are significant differences across the country in the approaches taken to (a) train asbestos-exposed workers and supervisors and (b) determine competency of people engaged in certain critical activities along the asbestos management spectrum.
- **Awareness:** There is a general lack of public awareness about the presence of asbestos in the built environment. Because this asbestos is inadequately documented, the people who live and work in these buildings have a high risk of exposure.

There is an appetite for a national asbestos management standard in Canada. Such a standard could add value by (a) being a driving force for cross-Canada harmonization of asbestos regulations and best practices, which would level the playing field for those working in multiple jurisdictions; (b) establishing minimum competency levels, and supporting enforcement efforts; and (c) ensuring equitable protection of all Canadians.

"Although the federal government banned asbestos in 2018, its legacy in Canada will remain for decades to come because of asbestos-containing materials in many of our buildings, as well as former mine sites and extensive tailing piles in need of remediation."

1 Introduction

1.1 Asbestos and Canada

Asbestos is the generic, commercial term used to refer to a group of six naturally occurring silicate mineral fibres that can be pulled into a fluffy consistency and used to strengthen products, making them long-lasting and fire-resistant [1-3]. Asbestos has been widely used in a range of industries (e.g., construction, electricity generation, firefighting, heavy industry, military applications, mining, and shipbuilding) for over a century because of its unique properties. These include heat and fire resistance; tensile strength; thermal and electrical insulating capacity; resistance to wear, friction, chemical, and biological degradation; and the ability to be woven [1-4]. These qualities have made asbestos useful in many industries, but they also make asbestos exposure highly toxic.

Canada was once the world's largest producer of asbestos, with mines in Quebec, Newfoundland, British Columbia, and Ontario [5]. Canada remained a major exporter of chrysotile asbestos until the last Canadian mines, located in Quebec, ceased operating in 2012. Although much of the asbestos was exported, Canada was also a major consumer of asbestos, which was used extensively for construction materials and in ship building, as well as in manufacturing for products such as cement pipes and friction materials. Another major source of asbestos was vermiculite imported between 1964 and 1990 from Libby, Montana, which was contaminated with amphibole asbestos [1, 6]. Although the federal government banned asbestos in 2018, its legacy in Canada will remain for decades to come because of asbestos-containing materials in many of our buildings, as well as former mine sites and extensive tailing piles in need of remediation. The saddest legacy of all is the many cases of cancer and lung disease among exposed people, much of it fatal.

Exposure to asbestos can occur through natural sources (e.g., the weathering of minerals containing asbestos); however, the principal source of exposure is via human-caused or human-influenced sources [1-4, 7]. Inhalation or ingestion of asbestos fibres can cause inflammation, scarring, and genetic damage on a cellular level [1, 4, 7]. It is a potent carcinogen that causes mesothelioma, a rare and aggressive cancer that is almost exclusively caused by asbestos exposure, as well as cancer of the lung, larynx, and ovaries, among others [1-4, 7]. In addition, it causes asbestosis, a chronic, fibrotic lung disease in which scar tissue forms in the lungs, decreasing the lungs' elasticity and making it more difficult to breathe [1, 3, 4].

According to the Canadian Cancer Society, an average of 500 Canadians (not including those living in Quebec[1]) are diagnosed with mesothelioma each year [8]. The number of mesothelioma cases diagnosed

1 Cancer incidence data are not available for Quebec for diagnosis years after 2010.

each year in Canada has been steadily increasing for many decades [9]. In 1992, there were approximately 175 new cases diagnosed in Canada (excluding Quebec) and, in 2017 (the most recent year with data on incidence), that number had increased to 445 [9]. Of these 445 Canadians, 76% (n = 340) were men and 24% (n = 105) were women [10]. Based on historical data showing that Quebec had approximately 32% of all Canadian cases, the number of newly diagnosed cases in Canada is more likely closer to 640 [9]. Survival from mesothelioma is extremely poor, with most individuals surviving less than a year [9, 11]. In 2017, (the most recent year with data on mortality), 490 Canadians died from mesothelioma [8].

Exposure to asbestos and similar fibres, such as erionite, is the only well-established cause of mesothelioma [7]. In 2019, the Occupational Cancer Research Centre (OCRC) estimated the burden of occupational cancer in Canada and summarized the number of cancer cases that could be prevented by removing exposure to the 13 carcinogens that contribute the most to the country's cancer burden. The OCRC found that workplace exposure to asbestos accounted for 81% of the mesotheliomas diagnosed in Canada, with the remaining mesotheliomas likely being due to environmental asbestos exposure that could have resulted from asbestos-containing materials (ACM) in the home and outdoor sources, including former mines and industrial sites [3]. More than half of the mesotheliomas caused by occupational asbestos exposure were diagnosed among workers who were employed in the manufacturing and construction sectors [3]. The direct and indirect societal cost of mesothelioma was $482 million, with an average cost of $1.13 million per person diagnosed [12].

Although mesothelioma is almost exclusively caused by asbestos exposure, other cancers also result from asbestos exposure [3, 7]. For example, asbestos increases the risk of lung cancer in both smokers and non-smokers, and the five-year survival rate for lung cancer in Canada is 19%, among the lowest of all common cancers [13]. Lung cancer is most often attributed to smoking and people diagnosed with it are much less likely to receive workers' compensation. The OCRC's Burden of Occupational Cancer in Canada Project estimates that there are approximately four asbestos-caused lung cancers for every case of mesothelioma diagnosed in Canada [3]. The project estimated that in 2011 the total annual cost to Canadian society was $2.35 billion for lung cancer and mesothelioma cases caused by asbestos exposure [12]. This figure does not include the costs related to other asbestos-caused cancers and asbestosis [12].

Because asbestos-related diseases may be diagnosed up to 50 years after asbestos exposure, the diseases being diagnosed today are the result of historical exposure that occurred many years ago. Historically, the highest exposed populations were workers employed in mining and milling operations, manufacturing of asbestos products, and in the construction and shipbuilding industries [2, 4]. Family members were also at risk of exposure because of asbestos-contaminated clothing brought home by the worker[2] [3]. Over the last 30 years, many jurisdictions have implemented strict regulations governing the use of asbestos or have introduced a complete ban on its import, export, and use. As a result, the most common source of current occupational exposure is the release of fibres from pre-existing asbestos-containing products and building materials [1]. Examples of building materials in which asbestos may be found include sprayed on fibre, thermal insulation, acoustic plaster sound proofing, lagging, cement materials, brake linings in machines, electric, water, draining and flue pipes, millboard, sprayed limpet, fireproofing, roofing, mastics, and gutters [14-16].

Data from the Occupational Disease Surveillance System indicate that mesothelioma and asbestosis continue to impact people employed in a wide variety of occupations and industries in Canada [17-20]. CAREX Canada estimates that approximately 152,000 Canadian workers still have occupational exposure to asbestos each year [21]. Industries with the highest number of exposed workers are

2 This type of exposure is referred to as "para-occupational" or "take-home" exposure.

construction, automotive repair and maintenance, ship and boat building, and remediation and other waste management [21]. Approximately 88% of exposed workers are employed as specialty trade contractors or in building construction; automotive repair and maintenance, ship and boat building, and remediation account for the remaining 12% [21]. Within these sectors, carpenters and cabinetmakers are the most exposed to asbestos, followed by construction trades helpers and labourers [21]. Other occupations with potential exposure include electricians, plumbers, plaster and drywall installers, and auto mechanics [21].

In Canada, the federal government committed to a government-wide asbestos strategy in 2016 and implemented an asbestos ban in 2018. However, asbestos is still present in older buildings[3], legacy products[4], and newly imported asbestos-containing products [3, 22]. Because some of this asbestos is inadequately documented and labelled, it poses a major exposure risk to people who live and work in these buildings. Over the coming decades, Canada will need to address these potential sources of exposure and gradually eliminate asbestos and ACM from the built environment. This will entail the adoption of regulatory solutions that address the identification and documentation of ACM, risk assessment, remediation, training of asbestos remediation workers, and safe disposal.

1.2 Purpose of the Research

The aim of this research was to explore potential gaps and best practices in asbestos management in Canada and to determine if there is a need for the development of a national standard. An environmental scan was conducted to identify regulations, guidelines, and standards for managing and controlling exposure to asbestos in the workplace in Canada and in selected international jurisdictions. The findings of the scan were supplemented with an examination of the peer-reviewed and grey literature and a series of key informant interviews designed to elicit information on gaps in how asbestos is currently managed in Canada and to identify areas where a new standard (or a suite of standards) could benefit stakeholders across a range of asbestos management roles (i.e., regulators, employers, workers, consultants, and abatement contractors).

2 Methods

Beginning in June 2020, the following activities were undertaken to achieve the research objectives: (a) an environmental scan of the occupational health and safety (OHS) legislation and regulations across Canadian and in selected international jurisdictions and (b) a review of the scientific (i.e., peer-reviewed) and grey literature. The findings of the scan and the literature review were supplemented by a series of 31 key informant interviews conducted between November 2020 and February 2021.

2.1 Environmental Scan of Canadian and International Jurisdictions

The environmental scan sought to identify regulations, guidelines and standards for managing and controlling exposure to asbestos in the workplace. The scan's scope was delineated by the following terms: "asbestos", "asbestos-containing materials", "asbestos management", "asbestos control", "asbestos abatement", "asbestos remediation", and "asbestos disposal". Within each jurisdiction, the starting point for the search was the official website of the organization with responsibility for occupational health and safety (OHS). Using the hyperlinks and search engines located within the official website, relevant documents were downloaded and webpages pertaining to asbestos management were downloaded and/or bookmarked. All relevant statutes in Canada (as well as the regulations, policies, and guidelines made pursuant to the legislation) were examined to identify any reference to asbestos or asbestos management. Where a policy instrument appeared to be germane to the project, the language of the applicable section was extracted verbatim and recorded. While Canadian jurisdictions

3 In insulation and other building materials, such as roof shingles, ceiling and floor tiles, siding, asbestos-containing cements and plaster products.

4 Includes products that historically contained asbestos, such as insulation or friction materials (e.g., brake linings, automobile clutch pads).

were the primary focus, the scan also included selected international jurisdictions known to be leaders in the areas of OHS and/or asbestos management (i.e., Australia, the United States[5], the United Kingdom, and the European Union[6]). A series of cross-cutting tables were created to summarize the identified regulatory requirements, to examine similarities and differences between jurisdictions and to identify any gaps in the regulatory approaches adopted and implemented in Canada. A subset of these tables is included in Appendix D.

2.2 Review of the Scientific and Grey Literature

With the assistance of a health sciences librarian at McMaster University, an iterative strategy was developed to search the scientific and grey literature. Search terms included "asbestos" and "asbestos-containing material" in combination with terms such as "hazard identification", "exposure", "exposure surveillance", "waste management", "public building", "registry", "regulation", "education", and "training". In total, eight bibliographic databases[7] of peer-reviewed and grey literature were searched. Articles were restricted to those published since 2000 that focused on topics related to asbestos management (i.e., identification and documentation, risk assessment, remediation, training, safe disposal and waste management, asbestos registries, and health monitoring). Articles were excluded if they were commentaries or letters to the editor, exposure studies without an intervention, studies that were non-occupational or not about asbestos, animal studies, clinical-related (i.e., clinical guidelines, asbestos-related disease screening), predictive or modelling studies, articles about workers' compensation, or asbestos bans.

After the screening criteria were applied, 122 articles remained to be further assessed for eligibility. Following a full-text review, an additional 63 articles were excluded, leaving 59 articles for qualitative review. The following data were abstracted from these 59 articles and were summarized in tabular format: general citation information, objectives, country/countries, population(s), setting(s), intervention(s), main outcome(s), and relevance to this report.

2.3 Key Informant Interviews

To gain a better understanding of current approaches to asbestos management in Canada, individuals with subject matter expertise were identified and interviewed. Key informants were selected based on the following criteria: pan-Canadian representation, diversity of perspectives, and coverage across a range of asbestos management roles. Potential key informants were invited via email to participate and those that self-selected were subsequently contacted to arrange a Zoom™ interview. Some who were approached expressed an interest in participating but indicated that COVID-19 related commitments prevented them from doing so; others did not reply to the email invitation.

The 31 individuals interviewed represented federal, provincial, and territorial regulators with responsibility for workplace health and safety; industry and/or industry health and safety associations; organized labour; consultants with expertise in asbestos management, remediation, or abatement; and non-governmental organizations working on asbestos awareness. See Table 1 for demographic characteristics of key informants and Appendix A for list of participating organizations.

Prior to the interview, key informants were provided with background information on the project's objectives, the findings of the environmental scan and literature review, and the list of interview questions (see Appendix B). Questions were designed to elicit and gather perspectives on the core activities encompassed by an asbestos management program,

5 The scan included the federal jurisdiction (i.e., the Occupational Safety and Health Administration) and certain key states (Washington State and California).
6 The scan included the European Union and the Netherlands.
7 PUBMED, MEDLINE, Embase, CINAHL, CENTRAL, EPA Hero, Google Scholar, NIOSHTIC.

Table 1: Number of Key Informants Interviewed, by Stakeholder Group and Jurisdiction

Stakeholder Group	N	Jurisdiction	N
Government – Regulator	8	Canada	4
Government – Insurer	1	British Columbia	9
Industry (Association)	4	Alberta	2
Industry (Company)	5	Saskatchewan	4
Labour	5	Ontario	7
Consulting	6	Quebec	1
Non-Governmental Organization	2	Nova Scotia	1
Total:	31	Prince Edward Island	2
		Yukon	1
		Total:	31

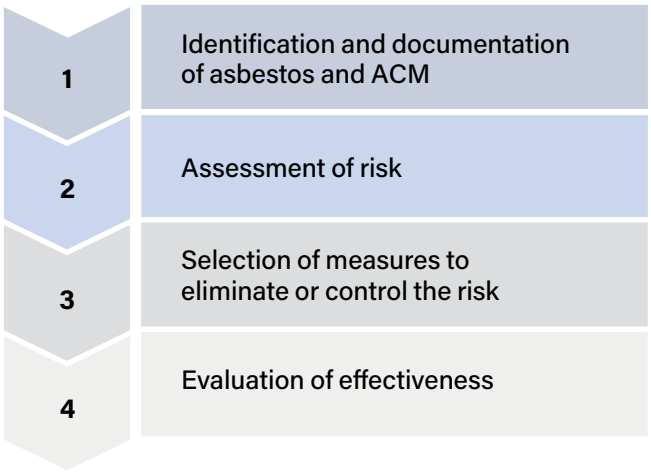
best practices in the management of asbestos, whether there is a need for asbestos management standard(s) in Canada, and potential barriers and facilitators to the uptake and implementation of a standard should one be developed. Our core objective was to identify potential opportunities for an asbestos management standard (or standards) to address gaps in workplace protections and to advance harmonization of applicable regulatory frameworks. Each interview took approximately 60 minutes and was conducted by one member of the study team (AK). The interviews were recorded in Zoom™, transcribed using Otter™ voice meeting note software, and analyzed for common themes using Quirkos™ qualitative data analysis software. Before each interview began, consent was obtained from each key informant that they agreed to participate in the interview and for the interview to be recorded for transcription and data analysis purposes.

3 The Asbestos Management Process

3.1 Steps in the Asbestos Management Process

Asbestos management is a multi-factorial process that encompasses the entire life cycle of asbestos, from mining and milling the raw mineral, through its use in industrial and commercial applications, abatement, and ultimate disposal [23, 24]. In light of the Canadian government's 2018 ban on the import, sale, use, and manufacture of asbestos, this report does not examine the issues associated with the mining and milling of asbestos. Rather, it focuses on the management of previously extracted and processed asbestos in the workplace and the built environment. For the purposes of this research report, the asbestos management process encompasses the four key steps shown in Figure 1.

Figure 1: Key Steps in the Asbestos Management Process



"There is some debate in both the scientific and policy spheres whether the most appropriate strategy is to manage asbestos in place or to remove and safely dispose of it."

In the workplace and in the built environment, effective management of asbestos and ACM is contingent on having accurate and reliable data on location and condition, assessing the risk of asbestos exposure to the health and safety of workers and the public, and selecting an appropriate strategy to eliminate or control the risk of asbestos exposure [24, 25]. There is some debate in both the scientific and policy spheres whether the most appropriate strategy is to manage asbestos in place (i.e., encapsulate or enclose) or to remove and safely dispose of it – and, if removal is the preferred strategy, whether it should be opportunistic (i.e., during building renovations or when its condition deteriorates) or risk-based (i.e., in which the priority for removal is determined based on the condition of the ACM and the severity of risk posed) [24, 26-30]. In Australia, for example, it was decided that while the ultimate goal was to remove all asbestos, a prioritized risk approach should be used to facilitate the process [24]; in the European Union, some member states require complete removal of asbestos once identified, while others use risk-based management approaches [26]. The question of whether it is better to manage asbestos in place versus removing it was identified as a high priority evidence gap by attendees at a 2015 workshop in the United Kingdom (UK) that was jointly sponsored by the Health and Safety Executive and the Government Office for Science [30].

3.1.1 Identification of Asbestos

Within the workplace and the built environment, identification and documentation of ACM ensures that workers performing work involving asbestos, as well as those living and working in an area where asbestos is present, not only are aware of the hazard but also are adequately protected from potential exposure. As the first step in the asbestos management process, the asbestos inventory or survey must provide accurate and sufficient information so that a suitable risk assessment can be carried out in Step 2 and a written plan to manage the risks can be produced in Step 3.

Typically, the asbestos survey will have three main goals [31]:

1. To identify (as far as reasonably practicable) and record the location, extent, and product type of any known or presumed asbestos and ACM;
2. To inspect and record the accessibility, condition (i.e., friability), and surface treatment of any known or presumed asbestos and ACM; and
3. To determine and record the type of asbestos, by collecting representative samples for analysis by an accredited laboratory or by making an expert judgement based on product type and its appearance.

Two necessary requirements for the accurate identification of asbestos and ACM are a clear and consistent definition of what constitutes asbestos and ACM, and reliable, validated methods for sampling and analysis. The need for improved techniques to quantify low-level exposure to asbestos was identified as the second highest evidence gap at the 2015 UK workshop on managing ACM in the built environment [30].

Organizations such as the US National Institute for Occupational Safety and Health (NIOSH), the US Environmental Protection Agency (EPA), the US Occupational Safety and Health Administration (OSHA), the Quebec Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST), the International Organization for Standardization (ISO), and ASTM International (ASTM) have developed standardized methods for sampling and analysis of airborne and bulk asbestos. These methods utilize polar light microscopy (PLM), phase contrast light microscopy (PCM), transmission electron microscopy (TEM), or scanning electron microscopy (SEM) to count fibres in order to determine the concentration of asbestos in bulk or air samples [4, 32]. PCM is a relatively fast and inexpensive method that can accurately assess asbestos concentrations for fibres with a minimum length of 5 µm, a diameter greater than 0.25 µm and an aspect ratio[8] of 3:1, but it cannot differentiate between asbestiform and non-asbestiform fibres [4, 32]. Compared to PCM, TEM is relatively slow and more costly, but it can differentiate reliably between asbestiform and non-asbestiform fibres as well as between different forms of asbestos, and it can detect smaller fibres. All methods require specialized knowledge to carry out the analysis for total fibre counts. Attendees at the 2015 UK workshop (a) noted that SEM and TEM techniques were being used in several European countries (France, Germany, the Netherlands, and Switzerland) to identify fibres and determine levels of exposure to airborne fibres and (b) recommended that further research be undertaken to develop techniques to measure exposure at levels lower than are currently feasible [30].

3.1.2 Risk Assessment

Once the presence of asbestos and ACM has been accurately and reliably established, the next step in the asbestos management process is to assess risk by evaluating (a) the likelihood of exposure to airborne asbestos from the identified or assumed sources and (b) the severity of risk posed. This is critical to ensuring that control measures appropriate to the level of risk are selected and implemented.

As shown in Table 2, factors related to the likelihood of worker exposure include the condition of materials, water damage, exposed surface area, accessibility, activity and movement, air distribution systems, friability, and asbestos content [27, 28]. The severity of risk can be determined by using a numerical rating system[9] [27] or a risk assessment "decision tree" [28, 29].

3.1.3 Selection of Appropriate Controls

The third step in the asbestos management process is the selection of control measures that are appropriate to the risk. The fundamental goal is to protect workers from asbestos, either by avoiding the risk or by reducing and managing the risk where risk avoidance is not possible [33-35]. The ideal strategy with asbestos is to **avoid risk** via elimination (i.e., completely removing the need for and the use of asbestos) or substitution (i.e., replacing the asbestos with a safer, less hazardous alternative) [34-36]. Where risk cannot be avoided, the next best strategy is to **reduce the risk** via technical measures (i.e., engineering controls), organizational measures (i.e., administrative controls), and/or personal measures (i.e., personal protective equipment, behavioural change) [35].

As shown in Figure 2, these measures are ranked in order from most to least effective: elimination, substitution, engineering controls (e.g., isolating or separating individuals from asbestos by, for example, enclosure or encapsulation; keeping asbestos out of an individual's breathing zone via local exhaust ventilation), administrative controls (e.g., changes in work practice), and personal protective equipment (e.g., respirators, protective clothing) [33-35, 37]. This ranking is referred to as the "hierarchy of controls". Control measures are selected by starting at the top of the hierarchy with the methods that are more protective and working down to those that are least effective.

8 The ratio of length to width of an asbestos fibre. An aspect ratio of 3:1 means that a fibre is three times as long as it is wide.

9 For example, each factor is assigned a numerical score to indicate the potential for exposure, where factors with a low potential for exposure are assigned "0" or "1", while those with a high potential for exposure are assigned "4". Once all factors are scored, the scores are combined using a mathematical formula, and remedial actions are chosen based on the range in which the overall score falls.

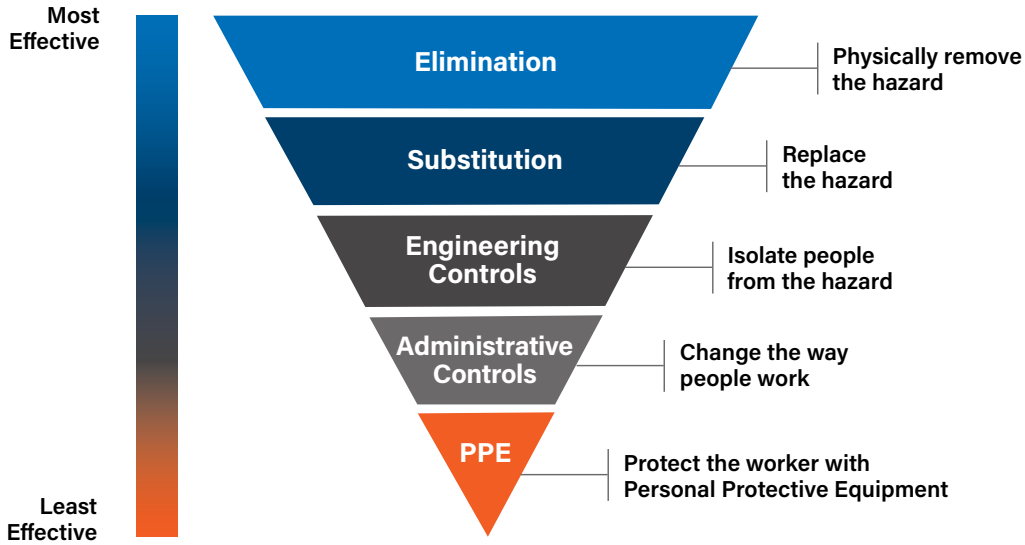
Table 2: Factors Related to the Likelihood of Airborne Exposure to Asbestos

Factors Affecting the Likelihood of Exposure	Risk of Exposure
Accessibility: How easily will the asbestos fibres become airborne?	
Totally enclosed, behind a fixed ceiling	Minimal
Inaccessible, beyond the reach of the public	Low
Accessible in a low-activity area	Moderate
Accessible in a high-activity area (i.e., hallway, stairwells)	High
Condition: Based on a visual examination, what is the existing state of the material?	
Is the material in good condition, showing no apparent damage?	Minimal
Does the material have mild damage?	Low
Does the material have moderate damage?	Moderate
Does the material have severe damage (e.g., missing areas, hanging loose, water damage)?	High
Friability: To what extent can the material be broken apart if contact is made with it?	
Is the material firmly bound?	Minimal
Is the material slightly friable?	Low
Is the material moderately friable?	Moderate
Does the material break apart easily?	High
Other Factors	
Air Distribution Systems: Is the material present in the air moving systems?	The answers to these questions determine level of risk assigned
Asbestos Content: What is the percentage of asbestos contained in the material?	
Water Damage: What is the extent of water damage?	
Surface Area: What is the exposed surface area of the friable material?	
Activity and Movement: What are the patterns of air movement? Is there building vibration from machinery or other sources? What are the activity levels of the workers?	

Although considered the last option in the traditional hierarchy of controls, respiratory protective equipment plays a crucial role in all asbestos management processes. Well-developed respiratory protection programs for asbestos workers should include considerations of expected concentrations of asbestos, protection factor values, potential for other hazardous substances, type of asbestos operation, temperatures, facial characteristics of the wearer, medical fitness, length of work, comfort, movement requirements, other personal protective equipment, and verbal communication needs [38]. The following are key components of an effective respiratory protection program [39]:

- A written change-out schedule for air purifying gas/vapor filters;
- Use of the manufacturer instructions or NIOSH certification labels to adjust the airflow for air-line respirators;
- Adoption of a written respirator program that determines how respirators are used;
- Written procedures that incorporate regularly scheduled evaluations of respirator effectiveness;
- Assessment of workers for medical fitness to wear respirators;
- Written procedures for maintaining respirators;

Figure 2: Hierarchy of Controls (adapted from NIOSH [33])



- Fit-testing of tight-fitting respirators;
- Administration of the program by a trained person;
- Provision of training on the need/use/capabilities/ limitations of respirators;
- Air-line respirator couplings that are incompatible with other gas systems (e.g., nitrogen, argon or other asphyxiants) at the site; and,
- Trained respirator program administrator responsible for directing or overseeing the use of respirators at the site.

A 2009 survey of nearly 300,000 establishments of varying sizes in the United States found that while respirators were widely used to protect workers against exposure, many of the respiratory protection programs in place did not incorporate all of these components and, as a result, they were inadequately protective [39].

3.1.4 Evaluation of Effectiveness

The fourth and final step in the asbestos management process is the evaluation of whether the selected control measures are effective at keeping exposure below the occupational exposure limits (OELs) and that they are providing adequate protection. This is confirmed by monitoring airborne levels of asbestos exposure and comparing the sampling results against the OEL to ensure that the measured levels are within the recommended range. There are four principal approaches to measuring exposure to airborne hazards in the workplace: personal sampling, area sampling, source sampling, and surface sampling [40, 41]. The type of monitoring required will depend on the circumstances.

- The purpose of **personal sampling**, which involves placing a sampling device in the worker's breathing zone, is to characterize an individual's exposure in order to assess the effectiveness of control measures or to determine compliance with relevant exposure limits [40, 41].
- The purpose of **area sampling** (which involves placing a sampling device in the general vicinity of the worker and/or hazardous process) and **source sampling** (which involves placing a sampling device immediately adjacent to a hazardous source) is to provide information on whether control measures (like isolation and ventilation) are effective [40, 41].

"In addition to exposure monitoring, it may also be necessary to undertake health monitoring of workers."

- The purpose of **surface sampling**, which involves manual techniques like wiping down or placing a piece of tape on a surface, is to determine whether airborne particulates or fibres have settled out of the air and deposited on surfaces that may be touched by workers [40, 41].

In addition to exposure monitoring, it may also be necessary to undertake health monitoring of workers [37, 41-45]. The purpose of this type of monitoring, which may be mandated by legislation, is to evaluate the effects of exposure and to proactively monitor exposed workers to identify changes in their health status arising as a result of exposure [37, 41, 44, 45].

The importance of this step is highlighted by the findings of several recent peer-reviewed research studies in the European Union and North America undertaken to evaluate the performance and the effectiveness of control measures used to protect workers from exposure [46-49]. These studies found that under certain working conditions, mean fibre concentrations in the workers' breathing zones were much higher than the applicable exposure limits and that selected control measures were inadequately protective. Examples of inadequate control measures included poor capture efficiency in 85 portable high-efficiency air filtration devices used during interior renovation of a building[10] [48]; inadequately sized negative pressure units, poorly conducted wetting procedures, and inadequate decontamination facilities at a former military test facility where the walls and ceiling had been treated with sprayed-on asbestos insulation [49]; and insufficient protection provided by the class of respirator worn by workers during abatement of amosite and chrysotile-containing materials [47].

3.2 Key Success Factors in the Overall Effectiveness of the Asbestos Management Process

3.2.1 Competent and Appropriately Trained Workers and Supervisors

Appropriate training and education of workers working with or exposed to asbestos is vital in the overall success of an asbestos management process [50]. Specialized abatement workers, general employees, contractors, industrial hygienists, and facility managers may all be exposed to asbestos, yet each possesses a different state of knowledge and training regarding asbestos management [15]. Everyone involved must be provided with the training and education necessary to attain the knowledge and skills needed to safely perform all tasks along the asbestos management spectrum.

The importance of education and training cannot be overstated – particularly for those in occupations with a higher probability of coming into contact with ACM during their work. This is illustrated by the findings of two survey-based research studies that examined

10 The scope of work entailed demolition and replacement of typical building materials (concrete, gypsum wallboard, vinyl floor tile).

awareness about asbestos among building managers and construction workers in the European Union. In one study, building managers trained in asbestos safety awareness (ASA) were found to be significantly more aware of their responsibilities to protect workers at risk of asbestos exposure. Most (28 of 30 surveyed) had commissioned an asbestos inventory in their workplace buildings to comply with legal requirements governing external contractors who refurbish and demolish buildings [51]. The authors concluded that ASA training, which can be tailored to different contexts, appears to have a positive impact on the occupational management of asbestos [51]. Another study of 125 construction workers who transformed older urban buildings in Istanbul and who were likely to be exposed to asbestos found that (a) 70.4% of the workers had no information about asbestos and (b) although the workers wore PPE, they did not select it to protect themselves from the hazards of asbestos [52]. The study found that the asbestos knowledge score of white collar workers was significantly higher than the blue collar workers' score, but the results showed that white collar workers (such as the site chief or job security specialist) were not qualified enough to provide exposed workers with the necessary training and education [52]. The authors concluded that more education and awareness campaigns are needed to raise the level of knowledge about the hazards of asbestos [52].

An effective training and education curriculum must take into account the baseline education and training needs of each stakeholder, as well as their needs for ongoing continuing education [24, 53]. Curriculum components can be adjusted to suit learner needs but should include the following [28, 53, 54]:

- Characteristics of asbestos and its health risks, as well as the additional risk caused by smoking and potential exposure to other occupational and environmental lung carcinogens;
- Applicable asbestos legislation and regulations including, for example, worker and employer rights and responsibilities, prohibited activities, exposure limit values, monitoring requirements, and required measures to protect workers from exposure;
- Identification of asbestos in the workplace and the built environment (types of asbestos, uses of asbestos, and where it is likely to be found);
- Factors that influence exposure to asbestos and preventive measures that reduce exposure (including the hierarchy of controls, safe work practices, personal protective equipment, good personal hygiene practices);
- How the hierarchy of controls apply in a given workplace context, including opportunities for elimination and substitution of asbestos;
- Selection and correct use of respiratory personal protective equipment, its cleaning and maintenance to ensure good working order, and its proper storage;
- The correct use, cleaning or disposal of personal protective clothing and other personal protective equipment such as disposable coveralls, footwear, and respirator;
- Proper installation, operation, maintenance, and cleaning of equipment such as the isolation enclosure, negative pressure air system, asbestos removal tools and equipment, and the decontamination facility;
- Emergency procedures (e.g., what to do in the event of an accidental release of airborne asbestos fibres); and,
- The purpose of exposure monitoring and medical examinations conducted as part of a health monitoring program.

3.2.2 A Strong OHS Regulatory Framework

Occupational health and safety (OHS) laws are intended to establish a minimum level of protection for all workers and for those in specific industries. In the context of asbestos management, these laws apply to workplaces covered by OHS laws and to the built environment (i.e., commercial and residential premises) where work (as defined by statute) is undertaken. Typically, the OHS legislative and regulatory framework incorporates general duty clauses, as well as hazard-specific requirements, and sets out the parameters for enforcement and compliance (which, depending on the

hazard, may be performance-based[11] or prescriptive[12]). The adoption and enforcement of regulated exposure standards is the most commonly used approach to prevent workplace exposure to hazardous substances. Some jurisdictions may also require supplementary strategies (e.g., symptom screening or disease surveillance) where a substance is deemed to be particularly hazardous. Regulatory approaches to preventing exposure to asbestos include an outright government ban on its manufacture and/or use, limits on levels of exposure, and prescriptive or performance-based guidelines on safe use [55].

The overall impact of a regulatory framework depends on a range of factors, including the context in which they are implemented (i.e., industry and jurisdiction), the nature of the regulations, an evidence-informed process to keep them up to date, and the specific activities undertaken to enforce compliance [56-59]. Enforcement activities shown to influence compliance include inspectors having combined enforcement and advisory roles, regular and/or focused inspections with citations and/or penalties for non-compliance, and awareness campaigns [57-60].

In the context of asbestos, evaluating the effectiveness of legislation (such as government bans) and regulations (such as lower occupational exposure limits) is challenging because of the long latency period between exposure and the emergence of asbestos-related diseases [58, 61]. However, in the European Union where asbestos bans (and prohibitions on spray applications) were implemented decades ago, studies suggest that legislation and regulations aimed at reducing (or eliminating) exposure to asbestos, raising awareness, and changing behaviour appear to have been successful at reducing the prevalence of asbestos-related cancers and diseases [57, 58, 61, 62]. These studies highlight the importance of the successful implementation of legislation and regulations, as well as structured requirements to collect information on asbestos exposure, screen for asbestos-related health outcomes, and systematically capture these data in centralized data repositories [58, 61, 63].

4 The Regulatory Framework for Asbestos Management in Canada

4.1 Division of Responsibility in Canada for Asbestos Management

Responsibility for asbestos management in Canada is shared between regulators at the federal, provincial, territorial, and municipal levels. The legislative instruments (i.e., statutes, regulations, and codes of practice) that govern how asbestos is to be managed fall into three main areas: occupational health and safety, environmental protection, and public health (see Table 3). At present, the management of asbestos in Canada is governed by 37 different pieces of OHS legislation (22 "general" and 15 "industry-specific"), 18 different pieces of environmental legislation, 2 pieces of public health legislation, and 14 pieces of "other" legislation (includes requirements governing the transportation of dangerous goods, hazardous products, employment standards, apprenticeship/trade certification, building codes, home inspectors, and real estate brokers). See Appendix C for a list of these statutes and regulations, by jurisdiction.

4.1.1 Occupational Health and Safety

All 14 OHS regulators in Canada have general duty clauses in their governing statute and/or subordinate regulations that require employers to provide workers with a safe work environment that is free of recognized hazards. Every *OHS Act* in Canada imposes a general duty on employers and on workers. These statutes (and in some cases, their regulations) also impose general duties on other workplace parties (e.g., suppliers, owners, supervisors, prime contractors), although the specific party varies by jurisdiction. In addition to the general duty clause(s), every jurisdiction in Canada has provisions in their OHS statutes or regulations specifically aimed at protecting workers from occupational exposure to asbestos and ACM. As shown in Table 3, nine of the 14 regulators have industry- and/or asbestos-specific requirements

11 A performance-based regulation is goal-oriented. It establishes the endpoint and allows the employer to identify the most suitable means of achieving it.
12 A prescriptive regulation specifies the endpoint and the means by which it is to be achieved.

embedded within their general OHS regulations and four have adopted additional regulations governing asbestos abatement and/or management. Where regulators have enacted industry-specific regulations, they apply to mining, construction, abrasive blasting, oil and gas, the maritime industry, and transportation (i.e., trains or aviation). Only one jurisdiction in Canada (Manitoba) has enacted a regulation that sets out the administrative penalties to be levied on an employer for failing to comply with specific requirements governing the alteration, renovation, or demolition of asbestos-containing materials [64].

4.1.2 Environmental Protection

Outside of the industrial/commercial/residential built environment, responsibility for asbestos falls under the ministry responsible for protection of the environment. In these instances, the environmental protection/management laws require responsible parties to appropriately manage/dispose of asbestos waste and to remediate contaminated sites. As shown in Table 3, ten jurisdictions in Canada have provisions within either their environmental protection/management statute or subordinate regulations that address asbestos and/or asbestos management. Of these, seven jurisdictions have enacted regulations governing how asbestos waste is to be managed and disposed of. The federal ban on asbestos and asbestos-containing products was enacted in 2018 as a regulation (i.e., *Prohibition of Asbestos and Products Containing Asbestos Regulations SOR/2018-196*) made pursuant to the *Canadian Environmental Protection Act,* which governs pollution prevention, the protection of the environment, and human health via the management of toxic and hazardous chemicals in Canada [65, 66]. The regulations apply to any person who manufactures, imports, sells, or uses asbestos or products containing asbestos, but they exempt certain industries (e.g., military, nuclear, and chlor-alkali plants).

4.1.3 Public Health

Issues related to public exposure to asbestos tend to be dealt with under public health legislation. One Canadian jurisdiction (Saskatchewan) has enacted a regulation pursuant to the *Public Health Act* to create an asbestos registry of public buildings [67]. The Saskatchewan Asbestos Registry of Public Buildings is designed to share information about the presence of asbestos in buildings owned and used in connection with schools, regional health authorities and affiliates, the provincial government, and Crown corporations [68, 69]. Reporting is mandatory under Saskatchewan's *Public Health Act* [69].

4.1.4 Other Legislation and Regulations

As shown in Table 3, other pieces of legislation with requirements governing asbestos are found at the federal level (i.e., *Transportation of Dangerous Goods Regulations*, *Hazardous Products Act and Regulations*), at the provincial/territorial levels (e.g., building codes, home inspection licensing regulations, apprenticeship and trade certification regulations, real estate brokers regulations), and, in some instances, at the local or municipal level (e.g., landfill requirements, planning, and approvals of building/demolition permits).

4.2 Regulations Governing Management and Control of Asbestos in Canadian Workplaces

4.2.1 How Asbestos and ACM are Defined in the OHS Regulations

Across Canada, OHS regulators use and define a range of different terms for asbestos and ACM, including "asbestos", "asbestos-containing material", "asbestos material", "asbestos dust", and "respirable asbestos fibre". In most jurisdictions, these terms are defined in the OHS regulations; in some, however, they are defined in guidelines or codes of practice. As illustrated below, there is general consistency in how the regulators define "asbestos" across the country, but there is considerable variation between jurisdictions in the minimum threshold of asbestos required for a material to be considered an ACM. For a more detailed breakdown of the findings, by jurisdiction, see Tables 14, 15, and 16 in Appendix D.

4.2.1.1 Asbestos

Nine of the 14 OHS regulators define asbestos to include the fibrous form of crocidolite, amosite, chrysotile, anthophyllite, actinolite, or tremolite (see Appendix D,

Table 3: Current Regulatory Frameworks for Asbestos Management in Canada

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Occupational Health & Safety (OHS)														
Occupational Health & Safety Act		X												
OHS regulations	X	X	X	X		X	X			X	X	X	X	X
OHS code		X												
Asbestos abatement regulations							X							
Designated substances regulations					X									
Exposure control regulations					X									
Occupational health regulations											X			
Quality of work environment						X								
Prevention programs						X								
Administrative penalty regulations				X										
Asbestos code of practice								X	X					
Industry-specific OHS regulations														
Mining	X			X			X				X	X	X	
Construction	X				X	X					X			
Abrasive blasting											X			
Federally regulated workplaces[1]														X
Environmental Management/Protection														
Environmental Protection Act		X												X
Asbestos mines/mill release regulations														X
Substances on the export control list														X
Prohibition of asbestos and ACM														X
Clean air/pollution control regulations							X							
Landfilling & incineration regulations						X								
Waste management regulations	X		X		X			X		X	X			
Contaminated sites regulations	X													
Environmental assessment							X	X						
Environmental emergency regulations								X						
Activities designation regulations								X						
Public Health														
Public Health Act			X											
Asbestos registry for public buildings			X											
Other statutes and/or regulations														
Transportation of dangerous goods														X
Hazardous products[2]														X
Employment standards/minimum wage				X										
Apprenticeship/trade certification		X	X		X			X			X			
Building code					X								X	
Real estate brokers				X										
Home inspectors	X	X												

[1] Includes maritime industries, oil and gas, on-board trains, and aviation.
[2] There are two legislative instruments: the *Hazardous Products Act* and the *Hazardous Products Regulations*.

"Most regulators deem a material likely to contain asbestos as an ACM until it is determined to be asbestos free."

Table 14). Three regulators also include mixtures of any of these minerals in their definitions. Two regulators define asbestos to mean a "manufactured article or other material that contains 1% or more asbestos by weight", but no mention of the specific forms of asbestos is made. Two regulators define asbestos to include "all forms of asbestos" but do not list the specific forms. British Columbia is the only jurisdiction that does not include a definition of asbestos in its regulations. Five regulators (Saskatchewan, Quebec, Newfoundland and Labrador, Northwest Territories, and Nunavut) define "asbestos dust" in their regulation. Four of them (all but Saskatchewan) define it on the basis of asbestos particles or fibres being airborne or being likely to become airborne after settling out in the working environment.

4.2.1.2 Asbestos-Containing Materials

Thirteen regulators include a definition of "asbestos-containing material" or "asbestos material" in their OHS regulations (n = 11) or asbestos abatement guidelines (n = 2). Yukon is the only jurisdiction that does not include a definition of ACM in its regulations (see Appendix D, Table 15). While the exact language differs across jurisdictions, the definitions generally state that ACM include materials (i.e., manufactured articles, products, building materials) that contain a minimum percentage of asbestos. Five regulators explicitly include "vermiculite insulation" as a separate category of ACM. In Nunavut and the Northwest Territories, the regulators' definitions appear to be circular – that is, they clarify that ACM means "a material that contains or is likely to contain asbestos" (which is itself defined as a manufactured article or other material that contains 1% or more asbestos by weight at the time of manufacture). Quebec excludes gypsum board and joint compounds manufactured after January 1, 1980 from its definition of asbestos-containing materials and products.

For non-vermiculite ACM, 13 regulators (all but Yukon) consider a material to be ACM based on the minimum percentage of asbestos it contains. The minimum percentage of asbestos ranges from 0.1% to 1% in 12 jurisdictions. In one jurisdiction (Alberta), a material is considered to be ACM if it contains any quantity or percentage of asbestos.

- One regulator sets the threshold for all ACM at 0.1%, three regulators set the threshold at 0.5%, and six regulators set the threshold at 1%.
- Two regulators set the threshold on the basis of friability. Both set the threshold for non-friable materials at 1%; but for friable materials, one sets its threshold at 0.1%, the other sets its at 0.5%.
- Three regulators specify that the minimum percentage of asbestos is based on dry weight, while one regulator's definition is based on the volume of asbestos.

Nine regulators specify the bulk sampling and analytical method to be used to determine if a material is an ACM in their definition (see section 4.2.2 for more information). Most regulators deem a material likely to contain asbestos as an ACM until it is determined to be asbestos free.

4.2.1.3 Friable

Thirteen of the 14 Canadian regulators define "friable" either as a stand-alone term or in relation to an asbestos-containing material (see Appendix D, Table 16). Across these jurisdictions, there are slight variations in the modifiers used to describe what friable means. Ten regulators state that a friable material is one that is or can be crumbled, pulverized, or powdered; nine of these also include the phrases "when dry" and "by hand pressure" in their definitions. One regulator does not use the term "pulverized" (British Columbia); two do not use "pulverized" or "powdered" (Alberta and Manitoba).

4.2.2 Identification and Documentation of Asbestos and ACM in the Workplace

As shown below, the OHS regulatory requirements for identifying and documenting the presence of asbestos and ACM in the workplace are inconsistent across Canada. For a more detailed breakdown of the findings, by jurisdiction, see Tables 17 and 18 in Appendix D.

4.2.2.1 Hazard Identification

Ten of the 14 OHS regulators require that the presence of asbestos and ACM be identified in the workplace by a competent/qualified person and that representative samples be collected (see Appendix D, Table 17). Nine regulators specify the methods that must be used to confirm the identification of ACM. Five jurisdictions mention EPA Method 600/R-93/116 (asbestos in bulk building materials); three mention EPA Method 600/R-04/004 (fibrous amphibole in vermiculite attic insulation); seven mention NIOSH Method 9002 (asbestos, bulk, by polarized light microscopy); and three mention NIOSH Method 9000 (asbestos, chrysotile, by X-ray diffraction).

4.2.2.2 Inventory of Asbestos and ACM in the Workplace

Twelve of the 14 OHS regulators require that an inventory of all ACM in a workplace be created and maintained (see Appendix D, Table 18). However, the inventory elements prescribed in the regulation (or recommended in guidelines) vary by jurisdiction. All 12 regulators require that the inventory include information on location of the asbestos-containing material, and eight require that the type of asbestos or ACM be documented and that the state (i.e., the friability) of the material be noted. Only seven regulators have a requirement that the inventory be kept up to date, that any changes to the location or condition of the ACM be recorded, and that the ACM be inspected annually, at a minimum. As part of creating the inventory, nine regulators require that employers have a "competent" or "qualified" person identify all locations in which asbestos or ACM might be found and to determine the type and percentage of asbestos that may be present (see Section 4.2.6 for further information on competency and qualifications). Some regulators also require that samples be collected and analyzed using methods that are appropriate, approved, or created by the US Environmental Protection Agency (EPA), the US National Institute of Occupational Safety and Health (NIOSH), or the Quebec Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST).

4.2.2.3 Inventory of Asbestos and ACM in Public Buildings

Saskatchewan and the federal government are the only two Canadian jurisdictions that maintain a publicly accessible, online inventory of asbestos in public buildings. Under Saskatchewan's *Public Health Act,* it is mandatory that information be provided to the provincial asbestos registry about the presence of asbestos in buildings owned and used in connection with schools, regional health authorities and affiliates, the provincial government and Crown corporations [67]. Other building owners may also voluntarily provide information to the registry. At the federal level, there is a requirement under regulations and standards made pursuant to the *Canada Labour Code R.S.C., 1985, c. L-2* that an Asbestos Management Plan be in place for any building and engineering asset owned or leased by the federal government [70, 71]. Information on the presence of asbestos or ACM in these buildings is captured in the National Asbestos Inventory [72].

4.2.3 Assessment of the Risk Posed by Asbestos and ACM

Five of the 14 OHS regulators require that the risk of exposure to asbestos and ACM be assessed by a "competent" or "qualified" person. See Section 4.2.6 for further information on competency and qualifications. Some regulators specify the factors to be considered in the risk assessment, while others assign categories of risk to activities or workplaces they deem to be low, moderate, or high risk. See Table 19 in Appendix D for a more detailed breakdown of the findings, by jurisdiction.

4.2.3.1 Factors to be Considered in the Risk Assessment

The factors required by OHS regulators for assessment of the risk posed by the presence of asbestos and ACM in the workplace varies across the country.

- **Location:** Ten regulators require that the risk assessment consider factors related to the location of the material. These include location of the material (four jurisdictions), accessibility (seven jurisdictions), the potential for fibre release and/or worker exposure (seven jurisdictions).
- **Type of ACM:** Twelve regulators require that the risk assessment consider factors related to the type of ACM. These include type of ACM (six jurisdictions), asbestos content (six jurisdictions), and friability (eight jurisdictions).
- **Condition of the Material:** Seven regulators require that the risk assessment consider factors related to the condition of the material. These include evidence or likelihood of water, physical, or other damage (six jurisdictions). Two regulators (Saskatchewan, Manitoba) also require that the risk assessment consider present abatement status.
- **Other Factors:** Four regulators require that the risk assessment consider factors other than those listed above. These include exposed surface area (three jurisdictions), level of work activity in the vicinity of the asbestos work (four jurisdictions), and the air distribution system (four jurisdictions).

4.2.3.2 Predetermined Categories of Risk

In nine jurisdictions, the OHS regulations deem certain activities and/or workplaces to be of low, moderate, or high risk (for the list of jurisdictions, see Appendix D, Table 19. This categorization determines the types of control measures that are required, as well as the need for exposure monitoring. To illustrate the range of activities covered and how the risk categories compare across jurisdictions, the wording of these predetermined categories of risk has been extracted from the regulations and reprinted verbatim in Appendix E. What is apparent from Appendix E is that the mapping of activities to risk category, as well as the terms used to define risk, are not consistent across the country. For example, three jurisdictions (British Columbia, Quebec, and the federal government) use the terms "low", "moderate", and "high" risk. Five jurisdictions (Ontario, New Brunswick, Prince Edward Island, Northwest Territories, and Nunavut) map risk category to numbers (i.e., "1", "2", and "3") and one jurisdiction (Alberta) maps risk category to letters (i.e., "A", "B", and "C"). However, as shown in Table 4, the terms used and the meaning of the categories are not consistently applied.

Table 4: Variation in Terms Assigned to and Meaning of Risk Categories

Category of Risk			Jurisdictions
Low	Moderate	High	British Columbia, Quebec, Federal Government
Type 1	Type 2	Type 3	Ontario
Class 1	Class 2	Class 3	New Brunswick
Type I	Type II	Type III	Prince Edward Island
Part C	Part B	Part A	Alberta
Part 3	Part 2	Part 1	Northwest Territories, Nunavut

4.2.4 Control of Exposure to Asbestos and ACM

All 14 OHS regulators in Canada require that employers control the risk of exposure to hazardous substances generally – and to asbestos specifically – in their workplaces. In most jurisdictions, the hierarchy of controls is embedded (explicitly or implicitly) into the regulatory framework and most regulators require that one or more control measures in the hierarchy of controls be used to prevent asbestos exposure. Some regulators explicitly state that (a) control measures must be implemented in order from most effective to least effective and/or (b) the ALARA principle must be applied in the selection of those controls. The application of the ALARA principle means that measures must be taken to keep a worker's exposure **as low as reasonably achievable** below the exposure limits (and in some cases to as close to zero as possible). It is generally applied in circumstances where substitution of a less hazardous material is not practicable. Additional measures include prohibitions on asbestos use and specific requirements to be followed for asbestos removal and containment.

4.2.4.1 Prohibitions on Asbestos Use and Activities

All of the 14 OHS regulators set out prohibitions on the use of certain types of asbestos or on the types of activities that are permitted. For a more detailed breakdown of the findings, by jurisdiction, see Table 20 in Appendix D.

- **Type of Asbestos Used:** Eight regulators have prohibitions stating that crocidolite may not be brought into or used in the workplace. Two regulators have created an exception to this prohibition: one for waste intended for removal (British Columbia), another for workplaces authorized to handle ACM intended for disposal (Manitoba). In addition to crocidolite, one regulator (Quebec) also prohibits the use of amosite. Only one regulator (Prince Edward Island) has enacted a complete prohibition on the use, application, or installation of any ACM; another (Ontario) has a prohibition on the application and installation of a material containing 0.1% or more asbestos (dry weight) that can become friable.
- **Type of Activity:** Fourteen regulators across Canada prohibit certain activities involving the use and application of asbestos and ACM. While the specific activities that are prohibited vary across the country, the most commonly prohibited activity is the spraying of asbestos or ACM. Ten regulators explicitly prohibit spraying as a means of application or installation of asbestos; four prohibit the application of friable ACM; two prohibit the removal of asbestos insulation or other ACM by pressure spraying equipment; six prohibit the cleanup or removal of asbestos by compressed air, three by dry sweeping/mopping, and two by other means of dry removal; four prohibit the application of liquid sealant to visibly deteriorated friable ACM or to materials/surfaces with insufficient strength to support the weight of the sealant; and four expressly prohibit employers from employing workers under the age of 18 in certain prescribed asbestos processes. Only eight expressly prohibit eating, drinking, or smoking in areas where asbestos work is being performed.

4.2.4.2 Selection of Control Measures

All 14 OHS regulators have embedded one or more elements of the hierarchy of controls into their regulatory framework. In some, but not all, jurisdictions, the regulatory language is explicit that the control measures must be implemented in order from most effective to least effective. For a more detailed breakdown of the findings, by jurisdiction, see Table 21 in Appendix D.

- **Elimination:** Two regulators explicitly mention the need to eliminate ACM. However, the regulations in six jurisdictions also include a more general provision that employers must eliminate hazardous substances.
- **Substitution:** Four regulators explicitly mention the need to find a substitute for ACM. However, the regulations in eight jurisdictions also include a more general provision that employers must find suitable substitutes. Two of these further specify that when selecting a substitute, the hazards of the substitute must be known and/or the substitute must reduce the risk to the worker.
- **Isolation:** Eleven of the 14 regulators mention encapsulation or enclosure of ACM. Nine mention glove bags and nine mention containment.

- **Engineering Controls:** Every regulator in Canada sets out requirements for the use of ventilation to control air contaminants in the workplace. All 14 regulators require HEPA-filter equipped vacuum cleaners to be used for asbestos work. Local exhaust ventilation is required by 11 regulators and containment ventilation is mentioned by twelve. Filter testing is required at least annually by regulation or under the code of practice in seven jurisdictions.
- **Administrative Controls:** All 14 regulators require that wet methods be used to control exposure to asbestos and that procedures be implemented to prevent the spread of asbestos. In six jurisdictions, there are requirements for procedures to protect work surfaces. Eight regulators have requirements that work procedures be developed to repair damaged ACM.
- **Personal Protective Equipment:** All 14 regulators have requirements that workers wear respiratory protection while handling or removing asbestos. Ten prescribe the type of respirator to be worn (or reference CSA Standard Z94.4 – *Selection, Use, and Care of Respirators*) and the type of filters to be used, while all 14 state that the respirator must be "adequate" for the anticipated exposure. All 14 regulators have language in their OHS regulations or codes of practice that require workers to wear protective clothing when handling asbestos. Ten prescribe that the clothing must be of a material that is resistant to penetration by asbestos, while seven prescribe that it fit snugly at wrists, neck, and ankles.

4.2.4.3 Exposure Standards

Across Canada, two types of exposure standards for asbestos are adopted and enforced under the OHS regulatory framework: occupational exposure limits and clearance sampling limits.

- **Occupational Exposure Limits:** All 14 OHS regulators adopt and enforce occupational exposure limits (OELs) to protect workers from exposure to hazardous chemicals. However, only 11 appear to have adoped an OEL for asbestos. Three regulators do not include an exposure limit for asbestos in their Tables of Contamination Limits (Saskatchewan, Northwest Territories, Nunavut), although their regulations include a requirement that employers prevent asbestos exposure to the extent that is reasonably possible. For a more detailed breakdown of the findings, by jurisdiction, see Table 22 in Appendix D.

  Nine regulators have set their 8-hour time-weighted average (TWA) OEL for asbestos at 0.1 fibres/cubic centimetre (f/cc). This limit, which is based on the ACGIH® T*hreshold Limit Values (TLVs) and Biological Exposure Indices (BEIs),* applies to all forms of asbestos. Two regulators (Quebec and Yukon) have 8-hour and 15-minute OELs that vary by type of asbestos. In these jurisdictions, the 8-hour OELs range from 0.2 f/cc (for amosite) to 1.0 f/cc (for actinolite, anthophyllite, chrysotile, and tremolite). The 15-minute limit ranges from 1.0 f/cc (for crocidolite) to 5.0 f/cc (for actinolite, anthophyllite, chrysotile, tremolite, and fibrous talc). The regulators in both of these jurisdictions are reportedly reviewing their current OELs for asbestos to bring them in line with other Canadian exposure standards.
- **Clearance Sampling Limits:** In 11 jurisdictions, there is an explicit requirement for clearance sampling, while in 2 jurisdictions, it is an implied requirement. Across these jurisdictions, there is a 20-fold variation in the exposure standard for clearance sampling. For a more detailed breakdown of the findings, by jurisdiction, see Table 23 in Appendix D. Clearance sampling must confirm that levels are below 0.01 f/cc in seven jurisdictions, below 0.02 f/cc in one jurisdiction, 0.05 f/cc in one jurisdiction, 0.1 f/cc in federally regulated workplaces, and 0.2 f/cc in one jurisdiction. In two of the three jurisdictions that do not explicitly require clearance sampling (Northwest Territories and Nunavut), the regulations include a requirement that workers may be permitted to enter an affected area without approved respirators provided that air monitoring verifies that airborne asbestos levels are less than 0.01 f/cc.

4.2.4.4 Containment and Disposal of Asbestos Waste

Most, but not all, OHS regulators in Canada set out requirements for how asbestos waste generated in the workplace is to be contained and disposed of. For a more detailed breakdown of the findings, by jurisdiction, see Table 24 in Appendix D. See also Section 4.3.1.3 for how the management and disposal of asbestos waste is regulated under the environmental protection regulatory framework.

- **Asbestos Containment:** Thirteen of the 14 regulators set out requirements for how asbestos waste is to be contained. Twelve require that the waste asbestos be put into labelled and sealed containers. Labels must identify the contents of the container (nine jurisdictions), warn about the health hazard (five jurisdictions), warn against inhalation (three jurisdictions), include information about safe handling (three jurisdictions) and personal protective equipment (one jurisdiction). Eight regulators state that a sealed container is to be impervious to asbestos and/or damage. Two further clarify that doubled polyethylene bags of at least 6-mm thickness are deemed to be acceptable asbestos waste containers, while one prescribes that waste be placed in 0.15-mm polyethylene bags and double-bagged or placed in a drum.
- **Asbestos Disposal:** Six regulators stipulate that containers are to be cleaned (either by wet methods or by a HEPA-filter equipped vacuum) before removal from the site. Two regulators also set out that the transport and disposal of the asbestos waste cannot create a downstream OHS hazard (i.e., to workers at the landfill) and require that this be an element of a worker training program. Two regulators require that the asbestos waste must be transported by a driver trained in the hazard, and one specifies that it must be transported in accordance with the federal *Transportation of Dangerous Goods Act.* Only three OHS regulators set out in their regulations that the waste must be disposed of in approved landfills and two require that the hazard must be communicated to the disposal site.

4.2.5 Monitoring of Exposure and Health Outcomes

All Canadian OHS regulators require that employers control a worker's exposure below the applicable occupational exposure limits. However, not all jurisdictions explicitly require that employers collect measurements to monitor exposure. For the jurisdictions that require air samples to be collected, there is little consistency on what types of samples should be collected (i.e., area vs. personal air samples) and very few prescribe the sampling methods to be used. Some Canadian regulators require health monitoring but provide very little guidance on when it is appropriate or how to conduct it.

4.2.5.1 Exposure Monitoring

The OHS regulations and/or codes of practice in most Canadian jurisdictions require that personal and/or area sampling be conducted to measure levels of airborne asbestos. Generally, air sampling is required before, during, and after abatement work, as well as prior to the removal of enclosure. Some, but not all, jurisdictions explicitly state that sampling must be conducted by "competent" or "qualified" personnel. Three regulators permit exceptions to the requirement to sample under the following circumstances: when glove bags are used as containment (British Columbia), inside buildings to be demolished[13] (Ontario), and outdoor projects (Ontario, New Brunswick). For a more detailed breakdown of the findings, by jurisdiction, see Table 25 in Appendix D.

- **Personal:** Nine OHS regulators require that personal samples be collected. Seven set out the circumstances under which personal sampling must be conducted (British Columbia, Alberta, Manitoba, Quebec, Newfoundland and Labrador, Nova Scotia, Prince Edward Island).
- **Area:** Twelve OHS regulators require that area samples be collected, although the conditions that trigger this requirement varies across the country. Depending on the jurisdiction, the need for area sampling is determined by the nature of the operation (e.g., high-risk activities trigger the requirement in seven jurisdictions; moderate-risk activities trigger the requirement in three jurisdictions); by the presence of workers in an adjacent area (two jurisdictions); or by a change in the process or control measures (three jurisdictions). Three regulators also provide exceptions in certain situations for the requirement to sample. Where specified, the frequency at which samples must be collected varies from "at least once per shift" to

13 Only "operation workers" are permitted to enter.

"intermittently" to "as necessary". Some jurisdictions specify the locations in which the sampling must be performed (i.e., perimeter sampling, areas outside and adjacent to enclosed asbestos work areas, inside the containment area).

- **Clearance:** Twelve regulators explicitly require that sampling must be conducted at the completion or after final cleanup of a project. However, as highlighted above in Section 4.2.4.3, only 11 explicitly set out the exposure standard that must be met and that standard varies across the country.

4.2.5.2 Health Monitoring

Eleven regulators have some kind of requirement for health monitoring of asbestos-exposed workers. In some jurisdictions, it is required under a specific provision in regulations made pursuant to the *OHS Act;* in others, it is mandated "as required by a delegated provincial authority" or "where required". All eleven regulators require that the cost of health monitoring be borne by the employer. For a more detailed breakdown of the findings, by jurisdiction, see Table 26 in Appendix D.

- **Data to be Collected:** The data that must be collected and/or the tests that must be performed vary by jurisdiction. In ten jurisdictions, workers must be given pulmonary function tests at defined intervals and the tests, which must be performed by a pulmonary function technician, must include forced vital capacity and forced expiratory volume. In six jurisdictions, workers must be given chest X-rays at defined intervals. Only six jurisdictions require that a worker's exposure history be documented. This includes both occupational exposures and significant non-occupational exposures.
- **Frequency of Testing:** Five jurisdictions require that workers be assessed at baseline (i.e., within 30 days of starting an asbestos-exposed job or within six years of hire in the case of one jurisdiction) and ten require that workers be periodically assessed. The frequency of subsequent testing varies by jurisdiction, ranging from once per year to once every five years depending on the duration and extent of exposure. For example, one jurisdiction's periodic medical examination includes annual lung function tests, annual occupational exposure history, and a chest X-ray (every five years or every two years for workers with more than 20 years of exposure). Another requires that "exposed workers" undergo the following types of medical assessment: pre-employment (within 30 days of first exposure) and periodic (at two-year intervals for first 10 years of exposure, at one-year intervals thereafter for duration of exposure). In this jurisdiction, exposed workers are defined as "those having likely exposure to airborne asbestos in an amount equal to or greater than 25% of the occupational exposure limit for at least 10 days in a 12-month period".

4.2.6 Competency and Training Requirements

4.2.6.1 Competency

Across Canada, different terms are used to refer to competence or qualifications in relation to asbestos management: "competent", "competent person", "competent worker", "qualified contractor", "qualified individual", and "qualified person". While the specific language used to define the terms varies across jurisdictions, competency is generally determined on the basis of a demonstrated combination of knowledge, skills, and experience. Qualifications are also determined on that basis, but the definitions often include reference to successful completion of a course, certificate program, recognized degree program, or the achievement of a particular professional designation. For a more detailed breakdown of the findings, by jurisdiction, see Table 27 in Appendix D.

Nine regulators include a definition of competence in their regulations and/or guidelines. Of these, two define "competent", three define "competent worker", and four define "competent person". Five regulators also include definitions of "qualified worker", "qualified person" (or "individual") and "qualified contractor". In some jurisdictions, guidelines expand on the definition provided in the regulations. For example, the *Asbestos Management Standard,* published by Public Services and Procurement Canada, expands on the definition in the regulations to include familiarity with all relevant legislation and regulations, as well as knowledge of any potential or actual danger to OHS in the workplace [70]. Examples include professional engineer, industrial hygienist, or someone who has another professional designation for the purposes of the standard that are related to asbestos management [70].

"Jurisdictions across the country use different terminology to convey the combination of knowledge, skills, and experience required to meet the definition of competency and/or qualifications."

Jurisdictions across the country use different terminology to convey the combination of knowledge, skills, and experience required to meet the definition of competency and/or qualifications. The language most commonly used is that an individual is competent or qualified because they possess the knowledge, training (or skills), and experience to perform the assigned (or required) duty or task.

4.2.6.2 Training

All 14 regulators require that workers handling asbestos must be trained. However, the language describing this requirement varies across jurisdictions. Depending on the jurisdiction, workers must be "adequately instructed and trained", "complete an approved training course", "receive training appropriate to the risk", or "receive direction and training". The extent of information that the regulations and/or guidelines include on the topics to be covered varies between jurisdictions, but most require that workers be taught about the hazards of asbestos (12 jurisdictions), how to identify ACM in the workplace (eight jurisdictions), safe work procedures (12 jurisdictions), selection and use of appropriate personal protective equipment (13 jurisdictions), and correct operation of required controls (ten jurisdictions). Few regulators prescribe that the training must be hands-on or experiential. Three jurisdictions (Newfoundland and Labrador, Prince Edward Island, Yukon) require that asbestos abatement be performed by a contractor with a valid certificate or other form of accreditation. For a more detailed breakdown of the findings, by jurisdiction, see Table 28 in Appendix D.

4.3 Other Relevant Regulations Governing Asbestos Management in Canada

4.3.1 Environmental Regulations

4.3.1.1 Definitions of Asbestos and ACM

As noted in Section 4.1.2, certain aspects of asbestos management (i.e., transportation, disposal) fall under the authority of the ministry responsible for protection of the environment. These typically include transportation and disposal of asbestos and asbestos-containing materials. Five Canadian jurisdictions include a definition of "asbestos waste" or "waste asbestos" in regulations made pursuant to their environmental statute (British Columbia, Ontario, Quebec, Nova Scotia, and Prince Edward Island). There is alignment between the definition of asbestos-containing material and waste asbestos under the OHS and environmental regulatory frameworks in Quebec and Prince Edward Island, but not in British Columbia, Nova Scotia, and Ontario. In those jurisdictions, waste asbestos is defined in the environmental regulations on the basis of 1% of asbestos-containing material, by weight – which is twice as high as the definition in the OHS regulations. In Ontario, the environmental regulations defines asbestos waste to mean "solid or liquid waste that contains asbestos in more than a trivial amount", but does not specify a minimum percentage. Under the applicable OHS regulations in these three jurisdictions, a material is considered to be asbestos-containing if it contains a minimum percentage of 0.5% asbestos, by weight.

4.3.1.2 Prohibitions on Import/Export, Use, Sale, and Manufacture

The *Prohibition of Asbestos and Products Containing Asbestos Regulations* prohibits the following: the import, sale and use of asbestos; the import, sale, use and manufacture of asbestos-containing materials; and the export of all forms of asbestos to most countries [65, 73]. The regulations currently include exemptions to allow the continued use of asbestos in certain industries (i.e., military, nuclear and chlor-alkali plants) and in road infrastructure produced before the ban came into force [65, 73]. In most of these situations, permit holders and individuals performing an excluded activity must prepare an asbestos management plan that complies with Schedule 1 of the Regulations and submit an annual report to the Minister of Environment and Climate Change Canada [73].

4.3.1.3 Management and Disposal of Asbestos Waste

Seven jurisdictions have enacted regulations under their environmental protection/management statutes that govern how asbestos waste is to be managed and disposed of (British Columbia, Saskatchewan, Ontario, Quebec, Nova Scotia, Prince Edward Island, and Yukon). With the exception of Yukon's regulation (which only states that "if asbestos is handled at the dump, it must be handled and disposed of in accordance with the *Occupational Health Regulations*" [74]), these regulations set out requirements for how asbestos waste is to be managed once it has left the workplace. Generally, this covers the transportation, storage, and disposal of asbestos waste, as well as any applicable permitting and reporting requirements [75-80]. The regulations in Ontario and Nova Scotia also include requirements for labelling of containers and for workers to wear appropriate protective clothing and personal protective equipment [77, 79]. Ontario's waste management regulation is the only one to stipulate that asbestos waste is to be transported from the location at which it was generated by "a driver trained in the management of asbestos waste" [77]. It does not, however, expand on what such training entails. There were some, but not many, instances where what was required under the environmental framework aligned with the OHS framework (e.g., in Ontario, the OHS regulations also require that drivers transporting asbestos waste be trained).

4.3.2 Other Labour Laws – Apprenticeship & Scope of Practice

Training and education of workers working with or exposed to asbestos is a critical component of an effective asbestos management process. In addition to the training requirements set out in the OHS regulatory framework, there are several other pieces of legislation in Canada that address competency and training through provincial apprenticeship requirements. Four jurisdictions with such regulations are Alberta *(Insulator Trade Regulation)* [81], Ontario *(Scope of Practice – Trades in the Construction Sector)* [82], Nova Scotia *(Insulator (Heat and Frost) Trade Regulations)* [83], and Yukon *(Apprentice Training and Tradesperson's Qualifications Regulations)* [84]. In addition, the Manitoba *Construction Industry Minimum Wage Regulation* designates asbestos abatement workers as skilled tradespersons[14] and designates two trainee levels[15] [85].

4.3.3 Real Estate Laws

At present, there are no generally applicable requirements in Canada for asbestos inventories and risk assessments to be performed in residential or commercial buildings. Asbestos is mentioned in the *British Columbia Home Inspector Licensing Regulation,* but only in the context of whether or not the licensee will inspect for asbestos [86]. Under the Manitoba *Real Estate Brokers Regulation,* the seller is required to disclose the presence of asbestos on the property disclsosure statement [87]. Specifically, they are required to answer the following question: "Are you aware if any building on the property contains — or do you have any reason to believe that it once contained — asbestos insulation, zonolite/vermiculite insulation…?"

14 Defined as "a person who has worked 2,400 or more cumulative hours" in the trade.

15 Defined to mean "a person, other than a skilled tradesperson, who is employed" in the trade "on a construction project in the sector or on a major building construction project".

5 Key Gaps, Challenges, and Opportunities

Despite the presence of a relatively robust regulatory framework, the environmental scan identified a number of gaps and inconsistencies in how asbestos management is regulated in Canada. These gaps and inconsistencies are seen along the entire spectrum of the asbestos management process and were confirmed by subject matter experts during the key informant interviews.

5.1 Key Gaps and Challenges Created by the Current Regulatory Framework

5.1.1 Gap #1: Division of Legislative Responsibility for Asbestos Management

While the legislative instruments that address public and workplace exposure to asbestos are broadly consistent in the outcomes they are seeking to achieve, the division of responsibility has resulted in a variety of approaches taken to address the many facets of asbestos management. Although the federal government has specific areas of responsibility in OHS, the environment and public health, the provinces and territories are responsible for enacting and enforcing their own legislation and regulations in these areas. As a result, the laws governing asbestos management not only vary within a province (depending on which regulatory regime applies) but also across provinces because of differences in regulatory scope and application. This regulatory approach to asbestos management is not unique to Canada. In Australia, for example, asbestos oversight also takes place at multiple levels of government, with each level operating according to its particular legislative mandate and each creating its own approach to address the facets of asbestos management that fall under its authority [24].

During the key informant interviews, nearly all of the subject matter experts identified this division of government responsibility and the lack of alignment between different regulatory regimes – both within and between jurisdictions – as critical challenges to the effective management of asbestos in Canada. As Table 5 illustrates, key informants indicated that these regulatory silos are particularly problematic and create challenges for enforcement. For example, within each province and territory, there are regulatory silos that are created by the different regulatory frameworks that govern OHS vs. environment vs. public health vs. municipalities. For employers and consultants working in multiple jurisdictions, the impact of these silos is further compounded by regulatory differences between (a) the provinces and territories and (b) the federal government and the provinces and territories. For regulators, these silos often constrain their ability to intervene. Provincial OHS regulators reported that because the requirements governing the disposal of waste asbestos falls under the environmental regulations, they have no authority to tell a contractor how to dispose of an asbestos-containing material. Federal OHS regulators reported that because abatement contractors fall under provincial authority, they have no authority to inspect a worksite in a federal building where abatement is being performed to enforce compliance with the federal regulations. This gap can result in some asbestos-exposed workers and community members being more or less protected from asbestos exposure than others, even in the same industry or jurisdiction.

The overlapping – and occasionally competing – responsibility for managing asbestos has led to several interjurisdictional initiatives designed to facilitate coordination and harmonization of asbestos management approaches. At the national level, the Occupational Safety and Health (OSH) Committee of the Canadian Association of Administrators of Labour Legislation (CAALL) is spearheading an effort to harmonize OHS regulations. At the provincial level, the Government of British Columbia established a cross-ministerial working group[16] in 2017 to "identify, review and report on outstanding risks that asbestos poses for British Columbians and the environment and additional strategies and initiatives that the British Columbia government and its agencies could undertake to further protect people and the environment from the

16 Led by the BC Ministry of Labour, the working group included representatives from WorkSafeBC, the Ministry of Environment and Climate Change Strategy, the Ministry of Health, and the Ministry of Municipal Affairs and Housing.

Table 5: Key Themes that Emerged in the Interviews about the Current Regulatory Framework

Key Themes	Government	Industry	Labour	Consultant	NGO
Regulatory silos					
Asbestos removal falls under OHS regulations, while disposal of asbestos waste falls under the environmental regulations	X	X	X	X	X
No sharing of information between the different levels of government with responsibility for asbestos management	X				
Enforcement					
An agency's ability to intervene constrained by legislative authority					
Permitting process for demolition/renovation varies by municipality		X	X		
The need for demolition/renovation permits often not enforced		X	X		
No oversight to ensure commercial buildings are inspected before sale				X	
Significant challenges with how asbestos waste is currently managed			X		

dangers of asbestos" [88]. The working group's 2018 report entitled "Keeping Workers, the Public and the Environment Safe from Asbestos" identified the following gaps and challenges [88]:

- The *BC Building Code* focuses on the health and safety of occupants, not workers;
- Many renovation jobs do not require renovation or demolition permits;
- Even when permits are required, many contractors do not comply; and
- There are conflicts in how "hazardous asbestos material" is defined.

Several of these gaps and challenges were also identified by our key informants.

5.1.2 Gap #2: Lack of a Standardized Approach to how Asbestos is Defined and Identified

As discussed in Section 3.1.1, two necessary requirements for accurate identification of asbestos and ACM are (1) a clear and consistent definition of what constitutes asbestos and ACM and (2) reliable and validated sampling and analytical methods.

The environmental scan highlighted gaps and inconsistencies in how the regulations define asbestos and ACM across Canada, in the specific steps an employer must take to identify and document the presence of asbestos in the workplace, and the testing methods to be used to determine the presence of asbestos or ACM. Conflicting definitions of "hazardous asbestos material" was also identified as problematic by the BC cross-ministerial working group [88]. These gaps and inconsistencies are not unique to Canada. Similar challenges and inadequacies in the identification and documentation of asbestos in the built environment have been reported in Australia [24].

During the key informant interviews, all stakeholder groups expressed concern with the lack of a standardized approach to (a) how asbestos inventories are conducted and (b) how and when sampling is performed. They highlighted the need to ensure that (a) the information collected during an inventory is accurate and reliable, (b) the information is collected by an appropriately qualified individual, and (c) samples are taken and analyzed appropriately. As shown in Table 6, the lack of clear and consistent regulatory direction on how surveys are to be conducted and how samples are to be analyzed was flagged as

Table 6: Key Themes that Emerged in the Interviews about Asbestos Identification

Key Themes	Government	Industry	Labour	Consultant	NGO
Inconsistencies in the regulatory framework					
Asbestos management regulations are inconsistent across the country	X	X	X	X	X
Risk category that triggers the need for testing varies across Canada	X				
Analytical methods required by regulation vary across the country	X	X	X	X	
Asbestos surveys/inventories					
The accuracy of the information depends on who is doing it	X	X	X	X	
The information that must be collected varies across the country	X	X	X	X	X
Often performed by people without appropriate qualifications	X	X	X	X	X
Analytical methods					
Current criteria based on non-specific fibre counting methods	X	X			
Few laboratories in Canada are accredited to perform TEM analysis		X	X	X	
Cannot reliably measure asbestos at levels specified in regulations		X		X	
Accuracy of the results depends on homogeneity of the sample		X		X	
Few people understand the difference between available techniques		X	X	X	

being particularly problematic. Some of the smaller jurisdictions reported that the lack of laboratories in their region that were accredited to perform any type of asbestos analysis created significant challenges for employers to comply with the testing requirements and for regulators to enforce compliance. Employers and consultants commented on the limitations of the available analytical methods[17], noting that it was often necessary to confirm the presence of asbestos in a two- or three-stage process (i.e., first with light microscopy [with or without gravimetric reduction], then by electron microscopy). Both stakeholder groups reported that, even in the larger jurisdictions, the lack of laboratories accredited in TEM methods meant that they had to send samples out of province or out of the country for analysis. Because this additional step extends a project's length and increases overall costs, they noted that many small contractors either choose to rely on the less accurate light microscopy methods (which may be offered by non-accredited laboratories) or they don't comply with the regulations.

Stakeholders consulted by the BC cross-ministerial working group identified the following similar challenges in its 2018 report [88]:

- Consultants and asbestos surveyors who may not be properly trained or qualified;

17 For example, NIOSH Method 7400 notes that, depending on fibre type, it may not be possible to detect asbestos fibres thinner than 0.5-0.15 microns in diameter.

Table 7: Key Themes that Emerged in the Interviews about Asbestos Risk Assessments

Key Themes	Government	Industry	Labour	Consultant	NGO
Inconsistencies in the regulatory framework					
Lack of agreement across Canada on how risk is classified	X			X	
The level of risk that triggers the need for testing varies across Canada	X				
Categorization of risk					
Tends to be determined through an abatement/remediation lens	X			X	
The level of risk associated with an activity determines the need for testing	X				

- Testing laboratories not properly qualified or accredited and not performing work in accordance with recognized analytical standards or quality assurance programs;
- Abatement companies having potential conflicts of interest because they also perform their own air and bulk sample testing; and
- Air monitoring services being provided by companies with insufficient or improper training and qualifications.

5.1.3 Gap #3: Lack of a Standardized Approach to Classifying and Assessing Severity of Risk

The environmental scan highlighted gaps and inconsistencies across Canadian regulators as to whether a risk assessment is required and, if so, how it is to be conducted. During the key informant interviews, regulators and consultants expressed concern that (a) the current approach to risk assessment in Canada tends to be focused on asbestos abatement and (b) in jurisdictions using predetermined categories of risk, there is a lack of agreement in how risk is classified. For more information on these predetermined categories of risk, see Section 4.2.3.2, Table 19 in Appendix D, and Appendix E.

5.1.4 Gap #4: Lack of a Standardized Approach to Controlling the Risk of Exposure

The environmental scan found that all 14 OHS regulators have requirements for employers to control the risk of exposure to asbestos in their workplaces but identified that gaps and inconsistencies exist in the specific control measures that are required. During the key informant interviews, most participants reported that interjurisdictional differences and inconsistencies in the regulatory framework created challenges – particularly for employers working in more than one province or territory – but did not identify any specific exposure control requirement as being particularly problematic.

5.1.5 Gap #5: Lack of a Standardized Approach to Training and Determining Competency

The environmental scan highlighted gaps and inconsistencies across Canada in how OHS regulators define competency and determine if asbestos-exposed workers are adequately trained. During the key informant interviews, every stakeholder group emphasized that proper training was a critical component of effective asbestos management programs and indicated that the lack of a standardized approach to training and determining competency was a critical challenge. As shown in Table 8, the lack of consistency across the country was a primary theme that emerged from the interviews. The consequence of this lack of consistency is that training and certification is not transferable between jurisdictions, which creates challenges for those working in multiple jurisdictions.

Key informants across all stakeholder groups reported that competency is often determined on the basis of having completed a training program of a defined length, which ranges from a few hours up to five days

Table 8: Key Themes that Emerged in the Interviews about Training and Competency

Key Themes	Government	Industry	Labour	Consultant	NGO
Inconsistencies in the regulatory framework					
Lack of consistency across Canada on what constitutes competency	X	X	X	X	X
Lack of agreement across Canada on training approaches	X	X	X	X	X
Lack of enforcement contributes to lack of compliance		X	X	X	
Competency					
Often determined on basis of having completed a training program	X	X	X	X	
No standard of competency for certain critical activities	X	X	X	X	
Training					
Regulations require that workers be trained, but employers decide how training is to be delivered	X		X	X	
Quality of training tends to be measured by length not content	X	X		X	

depending on the jurisdiction. Regulators, industry and consultants questioned this model, with some key informants noting that there is a tendency across the country to take the longest program and make that the "standard" without a clear understanding of whether a five-day course is any more effective than a shorter one. Many expressed the opinion that the quality of a training program should be determined by content and curriculum rather than by its duration. The absence of a standard of competency for people involved in certain critical activities (e.g., contractors, environmental consultants, abatement consultants, asbestos consultants) was identified as a critical gap. Regulators expressed frustration with the enforcement challenges that this gap created and several reported instances of contractors who kept their costs low by hiring vulnerable workers with no training (e.g., young workers, day labourers from labour pools, ex-convicts) to perform removal of asbestos and ACM.

The BC cross-ministerial working group report identified similar concerns about the qualifications and competencies of the parties engaged in asbestos abatement and disposal [88], including:

- Contractors engaged in demolition and renovation activity without the necessary competencies;
- Contractors who do not comply with their responsibilities under the law, either because they lack awareness or because they are wilfully negligent;
- Consultants and asbestos surveyors who may not be properly trained or qualified;
- Testing laboratories not properly qualified or accredited and not performing work in accordance with recognized analytical standards or quality assurance programs;
- Abatement companies having potential conflicts of interest because they also perform their own air and bulk sample testing;
- Air monitoring services being provided by companies with insufficient or improper training and qualifications; and
- Worker and supervisor training programs with inconsistent and varied curricula.

Across all stakeholder groups interviewed for this research project, there was agreement that a standardized approach to training should incorporate book or online learning, in-person training, and hands-on experiential training where individuals have the opportunity to set up a glove bag or an enclosure, to

"Many key informants observed that the conflicting regulatory definitions of what constitutes asbestos and ACM created challenges for the safe disposal of asbestos waste and for protecting landfill workers from exposure."

perform a glove bag removal, and to demonstrate that they have the ability and understanding to build a proper enclosure. The following are two examples of best practices that were cited by multiple key informants:

- The Asbestos Model Accreditation Plan required by the US EPA under the *Asbestos Hazard Emergency Response Act (AHERA),* which was founded on the principle of managing ACM in place [89-91], and
- The competency and eligibility requirements for asbestos license holders, asbestos removal supervisors, and asbestos removal workers mandated in Australia under Part 8.10 of the *Work Health and Safety Regulation 2011* [92].

5.1.6 Gap #6: Lack of a Standardized Approach to the Handling of Asbestos Waste

Many key informants observed that the conflicting regulatory definitions of what constitutes asbestos and ACM (i.e., environmental vs. OHS vs. municipal bylaws) created challenges for the safe disposal of asbestos waste and for protecting landfill workers from exposure. Generally, the waste management procedure involves notifying an acceptable landfill operator in advance, ensuring that the waste is appropriately sealed or bagged, ensuring the waste is secured during transportation, and unloading the waste in a designed location within the landfill [16]. The findings of the environmental scan and the key informant interviews suggest that these procedures are potentially complicated by multiple regulatory frameworks and multiple stakeholders (including the waste generator, the waste collector and transporter, and the ultimate waste manager). Proactive approaches have been used by waste facility operators in Canada, including ensuring that the waste received is accompanied by a document specifying that assessments were made to ensure no hazardous materials are contained within the loads [93].

The issues associated with the management and disposal of asbestos waste are not unique to Canada. Stakeholders in Australia have expressed concerns about the potential for illegal dumping of asbestos waste and the adequacy of the available infrastructure for the safe disposal of asbestos [24]. There, it was concluded that a review should be undertaken of the adequacy of available infrastructure for supporting both current and future asbestos waste disposal needs, along with initiatives for safe disposal and storage at sites licensed to accept asbestos. In order to support a similar infrastructure in a Canadian context, a national standard or harmonized guidelines should consider providing guidance on a safe disposal infrastructure and on handling and transportation, as well as clearly delineating appropriate roles and responsibilities for all stakeholders.

In its 2019 report on the national burden of occupational cancers, the Occupational Cancer Research Centre (OCRC) recommended the development of a mandatory (i.e., enforceable) national standard and regulatory framework for asbestos disposal [3]. Specifically, the OCRC recommended that the standard (a) be based on best practices in asbestos disposal; (b) provide supports to employers

and owners of older buildings and homes to help them address asbestos safely while minimizing exposure during disposal; and (c) mandate that all major construction projects be required to consider proper asbestos remediation and disposal as part of the planning and tendering processes [3]. The report emphasized the importance of ongoing inspections of workplaces and enforcement of the existing regulations, as well as the creation of consistent education and training materials as part of a broader certification process for workers performing this work, until such a standard can be developed [3].

5.1.7 Gap #7: Lack of Awareness about Asbestos and ACM in the Built Environment

Currently, one of the main sources of asbestos exposure is the built environment (i.e., buildings built mainly before 1990). Because much of this asbestos is inadequately documented and labelled, it poses a major exposure risk to people who live and work in these buildings. As noted elsewhere in this report, no jurisdiction in Canada currently has generally applicable requirements for asbestos inventories and risk assessments to be performed in residential buildings.

During the key informant interviews, every stakeholder group noted that workers are likely to be highly exposed to asbestos during residential and commercial construction and renovation projects and many expressed frustration with the challenges experienced in these sectors. As shown in Table 9, the key themes that emerged were gaps in the current regulatory frameworks and the overall lack of awareness about asbestos in the built environment – both of which create significant challenges for enforcement and compliance. Across all stakeholder groups, key informants expressed frustration with the absence of a standard of competency for people involved in certain critical activities (e.g., contractors, environmental consultants, abatement consultants, asbestos consultants). The absence of such a standard was perceived to contribute to the widespread presence of "fly-by-night" contractors who were either unaware of or wilfully negligent in complying with their duties under the *OHS Acts* and regulations, who misclassify the type of work being performed (e.g., as a Type 1 or Type 2 project, when in fact, it is a Type 3 project), and who routinely hired untrained or precariously employed workers (e.g., young workers, day labourers, labour pools, ex-convicts) to perform asbestos removal

Table 9: Key Themes that Emerged in the Interviews about Asbestos in the Built Environment

Key Themes	Government	Industry	Labour	Consultant	NGO
Gaps in the regulatory framework					
Permits issued at the municipal level, but no requirement for owners to declare or demonstrate they've done a hazard assessment	X	X	X	X	
No formal registration or licensing of abatement contractors	X				
Contractors not required to hire licensed, certified, or trained workers	X	X	X	X	X
Challenges for enforcement					
No mechanism for municipalities to notify OHS regulators	X	X			
Uncertified/untrained "fly-by-night" contractors	X	X	X	X	X
Lack of awareness					
About asbestos, in general, and in the built environment specifically	X	X	X	X	X
About the need to hire properly certified people to do removal	X	X	X	X	X

"Preventing occupational exposure to asbestos is a complex issue that necessitates a coordinated, comprehensive approach by multiple government agencies and multiple levels of government."

and abatement activities. Several key informants also expressed frustration with the perception that there is no asbestos in buildings built after 1990. An industry stakeholder and several consultants shared examples of instances where sampling results revealed the presence of asbestos in buildings constructed in the 1990s and early 2000s.

Similar concerns were expressed by stakeholders consulted by the BC cross-ministerial working group. In the working group's 2018 report, the following challenges were identified [88]:

- Municipal renovation/demolition permits are not required for many renovation jobs (i.e., removal of drywall);
- Appropriate demolition permits are not being obtained, despite being required for many ACM-removal jobs;
- The BC Building Code (which is based on the National Building Code) is based on new construction, not existing buildings; and
- The BC Building Code is focused on the health and safety of building occupants, not workers.

5.2 Opportunities for Standardization

Preventing occupational exposure to asbestos is a complex issue that necessitates a coordinated, comprehensive approach by multiple government agencies and multiple levels of government [3, 56]. A multi-faceted asbestos management standard could provide the framework for such an approach and create a level playing field for employers – particularly those who work in multiple jurisdictions – and provide equal protection for all Canadians.

5.2.1 The Value of a Standardized Approach to Asbestos Management

Of the 31 key informants interviewed, the majority (n = 25) saw value in creating a standard on asbestos management, although a small minority (n = 6) questioned the need. Those who supported the need for a standard were representative of all stakeholder affiliations, while those who questioned the need represented regulators, organized labour and employers. The key reason offered to support the need for a standard was that it would be a driver for establishing minimal competency levels and harmonizing regulations and asbestos management practices across the country, which in turn would level the playing field, making it easier for companies operating in multiple jurisdictions to do business and to comply with the regulations. The principal reason put forward by those who questioned the need for a standard was that a regulatory framework for managing asbestos already exists. In their opinion, what was needed was better enforcement of the existing constellation of federal, provincial, and territorial regulations; more innovative solutions; or a standard focused on the management of hazardous materials more broadly.

Table 10: Preferred Standards Approach, by Stakeholder Group

Stakeholder Group	Preferred Approach		Rationale
	Single	Suite	
Government	X	X	▪ Need cradle-to-grave approach ▪ Need to break it down into pieces; may not be able to adopt everything, so a suite of standards offers flexibility for some sections to be adopted as regulations and others as guidelines
Industry (employers)	X		▪ Having everything in one document makes it easier to read, but a supplementary guidance document should be includeds
Industry health and safety association	X	X	▪ Not sure a "one-size-fits-all" approach would be appropriate ▪ Some aspects of asbestos management definitely need to be standardized
Labour (workers)	X	X	▪ Either approach would work ▪ A suite of standards offers more flexibility ▪ A single standard might be easier to maintain but would likely be more expensive to purchase
Consultants		X	▪ Breaking the topic up into multiple standards might make it easier to handle

5.2.1.1 Single Standard vs. a Suite of Standards

During the discussion about the need for a standard, key informants were prompted about whether they thought there was a need for a single standard or a suite of standards. While there was general agreement on the need for a "cradle-to-grave" approach to asbestos management, there was no clear consensus on the type of standard that should be developed (Table 10). Some preferred a single overarching standard that offers everything in one place because it would be easier to maintain and keep up to date, although several proponents of a single standard noted that a single, longer standard would be more expensive to purchase. Others advocated for a suite of standards, arguing that it would be easier for regulators to select the areas they were weak on and to integrate them into their regulatory framework, rather than aiming for wholesale adoption of a lengthy standard. Still others could see the value in either approach. Regardless of the approach taken, the key informants emphasized that there will be a need for supplementary guidance documents to assist with interpretation and implementation.

5.2.1.2 Areas of Asbestos Management Perceived to be Most in Need of Standardization

The two areas of asbestos management most frequently mentioned by key informants as being in need of standardization were (a) hazard identification and risk assessment and (b) training and competency. Other less frequently mentioned areas along the cradle-to-grave spectrum where a standardized approach would be useful included waste management/disposal, procurement[18], and equipment certification[19]. Some of the key informants saw value in the latter two suggestions but indicated that enforcement might be a challenge.

18 In light of the federal asbestos ban, one consultant suggested there is a need for a standardized approach to procurement of products that may contain asbestos.

19 In questioning the need for an overarching asbestos management standard, one industry representative suggested that the issue of substandard equipment needs to be addressed first. To support his argument, he highlighted examples of protective suits, vacuum bags, HEPA filters, and vacuum cleaners being sold for use in asbestos abatement that aren't certified to any standard.

Table 11: Perceived Barriers and Facilitators to the Uptake of an Asbestos Management Standard

Perceived Barriers and Facilitators	Government	Industry	Labour	Consultant	NGO
Perceived Barriers					
An overly prescriptive standard	X				
A standard that merely restates what is already in the regulations		X	X		X
Requirements that are not easily achievable				X	
Cost of purchasing a standard		X	X		
Increased project costs	X	X	X	X	X
Employer readiness/employer capacity	X	X	X	X	
Perceived Facilitators					
A suite of standards, rather than a single standard	X				
Adoption into regulatory framework	X	X	X	X	X
Achievable, practicable requirements, based on best practices		X		X	
Stakeholder participation in the development of the standard		X	X	X	
Availability of government/financial incentives			X	X	

5.3 Perceived Barriers and Facilitators to the Uptake of an Asbestos Management Standard

Key informants were invited to share their thoughts on the barriers and facilitators to the uptake of a national standard. A summary of their perceptions is provided in Table 11. Some of the key barriers that emerged were the cost of purchasing a standard and of complying with the requirements, the capacity of small employers to implement and comply with a standard, and the relationship of the standard to the existing regulatory framework. The key facilitators to the uptake were adoption of the standard into regulation, stakeholder participation and engagement in the development of the standard, requirements that are achievable and practicable, and the availability of incentives to encourage adoption of the standard. Government, industry, labour, and consultants emphasized that to be effective, standards must be enforceable and that they are only enforceable when adopted into regulation – otherwise, they are merely best practice guidelines that employers can voluntarily choose to comply with (or not). One regulator also noted that the language used in the standard also influenced whether or not it could be adopted into regulation. For example, a regulator can only reference the "shalls" of a standard in regulations, not the "shoulds" – the former is enforceable, the latter is not. Several labour and consultant stakeholders suggested that the standard could get traction if there were government or other financial incentives for adoption. For example, the government could offer financial incentives to adopt, similar to the urea formaldehyde and foam insulation incentives offered in the past; or, the insurance industry could require building owners and managers to meet the national standard in order to be insured.

Across the stakeholder groups, there was agreement that although a national standard would definitely increase project costs and smaller employers would likely experience challenges with complying, a standard that is embedded in regulations offers the advantage of (a) creating a level playing field for industry, contractors, environmental consultants, abatement consultants, and asbestos consultants, and (b) ensuring that workers and the general public in Canada are equitably protected from asbestos exposure in the workplace and in the built environment.

6 Conclusions

Although the federal government implemented an asbestos ban in 2018, asbestos is still present in the workplace and built environment. Much of this asbestos is inadequately documented and poses a major risk of exposure to people who live and work in these buildings. Over the coming decades, Canada will need to address these potential sources of exposure and gradually eliminate asbestos and ACM from the built environment. This will entail the adoption of regulatory solutions that address the identification and documentation of ACM, risk assessment, remediation, training of asbestos remediation workers, and safe disposal of asbestos waste.

This report synthesizes the findings of an environmental scan, a review of the scientific (peer-reviewed) and the grey literature, and interviews with 31 key informants across Canada. As the environmental scan highlights, the management of asbestos in Canada is addressed by multiple legislative and regulatory frameworks, including occupational health and safety, environmental protection, and public health. This division of responsibility has contributed to a lack of alignment between regulatory regimes, both within and across jurisdictions, and has created some regulatory silos. The limits of authority imposed by legislation complicates the sharing of information, constrains a regulator's ability to intervene in situations outside their jurisdiction, and hampers enforcement. In response to this overlapping – and occasionally competing – responsibility for managing asbestos, several interjurisdictional initiatives have been undertaken with the goal of facilitating regulatory harmonization and coordination of asbestos management practices.

Across Canadian jurisdictions, there are some significant differences and inconsistencies in how asbestos is managed under the existing regulatory frameworks. This interjurisdictional variation can result in uncertainty, especially for employers and consultants working in one or more provinces, and creates gaps in the equitable protection of workers.

Despite the presence of a relatively robust regulatory framework, the environmental scan identified a number of gaps and inconsistencies in how asbestos management is regulated in Canada. These gaps and inconsistencies, which are seen along the entire spectrum of the asbestos management process, include the following:

- Legislative responsibility for and oversight of different aspects of asbestos management is divided between federal, provincial, territorial, and municipal authorities. As a result, the laws governing asbestos management not only vary **within** a given jurisdiction but they also vary **across** jurisdictions because of differences in regulatory scope and application. This not only creates compliance challenges for employers and consultants working in different jurisdictions but also results in enforcement challenges for regulators who may be unable to intervene because they are constrained by the limits of their legislative authority.
- Across the various regulatory frameworks, there are conflicting definitions of what constitutes asbestos and ACM, both within and between jurisdictions. These definitional conflicts not only complicate the identification and documentation of asbestos in the workplace and built environment but also create challenges in the assessment of risk, the selection of appropriate controls to control exposure, and the management and safe disposal of asbestos waste.
- There are significant differences across the country in the approaches taken to (a) train asbestos-exposed workers and supervisors and (b) determine competency of people engaged in certain critical activities along the asbestos management spectrum. This includes contractors engaged in demolition and renovation, asbestos surveyors, abatement contractors, abatement consultants, environmental consultants, asbestos consultants, people providing air monitoring, and laboratory analytical services. The lack of a standardized approach to training and the absence of a standard of competency was identified as a critical gap by key informants.
- There is a general lack of awareness about the presence of asbestos – and the extent to which it is present – in the built environment. This is currently one of the main sources of asbestos exposure, particularly in buildings built before 1990 – although as pointed out by the key informants, asbestos is also present is many buildings built in the 1990s and

later. Because much of this asbestos is inadequately documented and labelled, it poses a major exposure risk to people who live and work in these buildings. At present, no jurisdiction in Canada has generally applicable requirements for asbestos inventories and risk assessments to be performed in residential buildings.

As noted in this report, these issues and challenges are not unique to Canada. For example, in Australia, which has a similar federated model of government, asbestos oversight also takes place at multiple levels of government and Australian stakeholders identified many of the same issues and challenges in a recent review commissioned by the Australian government.

The two areas of asbestos management most frequently mentioned by key informants as being in need of standardization were (a) hazard identification and risk assessment and (b) training and competency. The feedback from key informants reinforced the findings of the environmental scan that there is considerable variation between jurisdictions in how these aspects of the asbestos management are regulated. Although there was overall support from the key informants for the creation of an asbestos management standard, there was no clear consensus on whether a single standard or a suite of standards should be developed. While a single overarching standard offers the advantage of everything being in one place and making it easier to update and maintain, a suite of standards may be more amenable to regulators who may wish to select the areas they are weak on and to integrate them into their regulatory framework, rather than aiming for wholesale adoption of a lengthy standard. If a single standard is developed, consideration could be given to creating an asbestos-specific management standard similar in breadth and scope to *Z1006:16 (R2020) Management of Work in Confined Spaces.*

If a suite of standards is developed, priority should be given to creating standards on (a) hazard identification and risk assessment and (b) training and competency in order to address the gaps in the regulatory regime and to level the playing field. For these standards, it may not be necessary to create new, stand-alone standards. Existing standards could be leveraged to establish standardized protocols for identifying and documenting asbestos and ACM, assessing the risk of exposure, developing control measures, and reviewing/monitoring their effectiveness. Examples of existing standards that could be used include, but are not limited to, the following:

Hazard Identification

- CSA Z1002, *Occupational Health and Safety — Hazard Identification and Elimination and Risk Assessment and Control*
- ISO 10312:2019 *Ambient air — Determination of asbestos fibres — Direct transfer transmission electron microscopy method*
- ISO 13794:2019 *Ambient air — Determination of asbestos fibres — Indirect-transfer transmission electron microscopy method*
- ISO 16000-27:2014 *Indoor air — Part 27: Determination of settled fibrous dust on surfaces by SEM (scanning electron microscopy) (direct method)*
- ASTM D6281-15 *Standard Test Method for Airborne Asbestos Concentration in Ambient and Indoor Atmospheres as Determined by Transmission Electron Microscopy Direct Transfer (TEM)*
- ASTM D6480-19 *Standard Test Method for Wipe Sampling of Surfaces, Indirect Preparation, and Analysis for Asbestos Structure Number Surface Loading by Transmission Electron Microscopy*
- ASTM D6620-19 *Standard Practice for Asbestos Detection Limit Based on Counts*
- ASTM D7712-18 *Standard Terminology for Sampling and Analysis of Asbestos*[20]
- ASTM E1368-14 *Standard Practice for Visual Inspection of Asbestos Abatement Projects*[21]
- ASTM E1494-18 *Standard Practice for Testing Physical Properties of Friable Surfacing Materials*
- ASTM E2356-18 *Standard Practice for Comprehensive Building Asbestos Surveys*

20 This item is currently undergoing revision.
21 This item is currently undergoing revision.

- ASTM D7201-06(2020) *Standard Practice for Sampling and Counting Airborne Fibers, Including Asbestos Fibers, in the Workplace, by Phase Contrast Microscopy (with an Option of Transmission Electron Microscopy)*

Risk Assessment

- CSA Z1002, *Occupational Health and Safety – Hazard Identification and Elimination and Risk Assessment and Control*
- CSA IEC 31010:20 *Risk Management – Risk Assessment Techniques*
- ASTM D7886-14(2019) *Standard Practice for Asbestos Exposure Assessments for Repetitive Maintenance and Installation Tasks*

Training & Competency

- CAN/CSA-Z1001-18, *Occupational Health and Safety Training*

Regardless of the standards approach taken, a national asbestos management standard or a suite of standards could add value by:

1. **Being a driving force for harmonization** of asbestos regulations and the coordination of best practices in asbestos management across the country – and, in particular, **fostering interjurisdictional consistency** in:
   a. How ACM is defined;
   b. How asbestos and ACM in the workplace and the built environment are identified and documented;
   c. The methods used to assess risk;
   d. The selection of control measures appropriate to the risk posed; and
   e. The evaluation of effectiveness.
2. **Establishing minimum competency levels** for contractors, consultants, laboratories, and workers performing asbestos work, thereby levelling the playing field and making it easier for companies operating in multiple jurisdictions to do business and to comply with the regulations.
3. **Supporting regulators' efforts to enforce compliance** with the regulations by creating supplementary guidance documents to assist with the interpretation and implementation of the standard.

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Appendices

Appendix A: Organizations/Affiliations of Key Informants

Table 12: List of Key Informants by Stakeholder Category, Organization and Jurisdiction

Stakeholder Category	Organization	Jurisdiction
Government – Regulator	WorkSafeBC	British Columbia
Government – Regulator	Ministry of Labour Relations and Workplace Safety	Saskatchewan
Government – Regulator	Ministry of Labour, Training and Skills Development	Ontario
Government – Regulator	Commission des normes, de l'équité, de la santé et de la sécurité du travail	Quebec
Government – Regulator	NS Department of Labour and Advanced Education	Nova Scotia
Government – Regulator	Workers Compensation Board of PEI	Prince Edward Island
Government – Regulator	Yukon Workers' Compensation Health and Safety Board	Yukon
Government – Regulator[1]	Employment and Social Development Canada, Labour Program	Canada
Government – Insurer	Saskatchewan Workers' Compensation Board	Saskatchewan
Industry (Association)	Saskatchewan Construction Safety Association	Saskatchewan
Industry (Association)	Infrastructure Health & Safety Association	Ontario
Industry (Association)	Construction Association of Prince Edward Island	Prince Edward Island
Industry (Association)[2]	BC Maritime Employers Association	British Columbia/Canada
Industry (Company)[1]	University of British Columbia	British Columbia
Industry (Company)	University of Calgary	Alberta
Industry (Company)	Walker Industries	Ontario
Industry (Company)	Metro Vancouver	British Columbia
Labour	LDS Health & Safety Resources Ltd.	Canada
Labour	BC Insulators Union	British Columbia
Labour	Ontario Building Trades	Ontario
Labour[2]	Occupational Health Clinics for Ontario Workers	Ontario
Labour[2]	Canadian Union of Public Employees	Canada
Consulting	Aura Health and Safety Corporation	British Columbia
Consulting	Pinchin Ltd.	Canada
Consulting	EHS Partnerships Ltd.	Alberta
Consulting[3]	Environmental Consulting and Occupational Health (ECOH) Environmental Abatement Council of Canada (EACC)	Ontario/Canada
Consulting	Canadian National Demolition Service	Ontario/Canada
Consulting	BGIS	Canada
Non-governmental organization	Saskatchewan Asbestos Disease Awareness Organization	Saskatchewan
Non-governmental organization[2]	Asbestos Free Canada	Canada

Notes:
[1] Two key informants from this organization were interviewed.
[2] Member of the Project Advisory Panel.
[3] Key informant represented both organizations.

Appendix B: Key Informant Interview Guide

Preliminary questions:

1. Do you consent to participating in this interview for the research we are conducting on the need for asbestos management standards in Canada?
2. Do you also consent to an audio recording of this interview for transcription and data analysis purposes?

Some background and context before beginning interview:

We've been contracted by the CSA to explore potential gaps and best practices in asbestos management in Canada and to determine if there is a need for the development of a CSA Group Standard. We've conducted a literature review and an environmental scan to examine the following topics: identification and documentation of asbestos-containing materials, risk assessment, remediation, training of asbestos remediation workers, safe disposal, categorization/registration of sites where asbestos has been identified, and registration of worker exposures.

Questions about key informant's role:

3. What organization do you work with and what is its jurisdiction? What is your role there?
4. What work have you done in the area of asbestos management? If any?

Questions to explore the need for asbestos management standard(s):

5. How would you define an "asbestos management program"? What are the core activities/elements that are encompassed by such a program?
6. What do you consider are the best practices in the management of asbestos?
7. Do you see a need for an asbestos management standard in Canada?

   If yes, have we considered all the elements that you perceive are necessary for such a program? Should we include other things?

   Prompt if needed by referencing the literature review themes (asbestos abatement, hazard identification, exposure surveillance, waste management, asbestos management in public buildings, education and training) and environmental scan themes (definitions, hazard identification and risk assessment, prevention and protective measures, containment and disposal, competency and training, exposure monitoring and measurement, health monitoring).

   If no, why don't you see the need?
8. Are there examples of standards or best practices that you think should inform the development of a Canadian standard?
9. Do you have a sense more broadly of what the perspectives of other organizations or industries might be about the need for an asbestos standard? Would they embrace a standard or would there be resistance to adoption/implementation?
10. If the CSA Group were to develop one or more asbestos standards, what do you think some of the barriers/challenges are to their uptake and implementation?
11. Is there anything that needs to be in place nationally or at the provincial/territorial level in order for an asbestos standard (or standards) to be implemented?
12. We are interviewing representatives of labour, employers, safety associations, remediation experts, government, and so on. Are there others we should be talking to about this?
13. Is there anything else you'd like to add or do you have any questions for me?

Appendix C: List of Legislative Instruments Governing Asbestos Management in Canada

Table 13: Legislative Instruments by Jurisdiction.

Jurisdiction	Legislative Instrument
Federal	**Statutes:** Hazardous Products Act (HPA), RSC 1985, c H-3 Canadian Environmental Protection Act (CEPA), SC 1999, c 33 **Regulations:** Hazardous Products Regulations, SOR/2015-17 (HPA) Asbestos Mines and Mills Release Regulations, SOR/90-341 (CEPA, 1999) Export of Substances on the Export Control List Regulations, SOR/2013-88 (CEPA, 1999) Prohibition of Asbestos and Products Containing Asbestos Regulations, SOR/2018-196 (CEPA, 1999) Canada Occupational Health and Safety Regulations, SOR/86-304 (Canada Labour Code) Aviation Occupational Health and Safety Regulations, SOR/2011-87 (Canada Labour Code) Oil and Gas Occupational Safety and Health Regulations, SOR/87-612 (Canada Labour Code) On Board Trains Occupational Health and Safety Regulations, SOR/87-184 (Canada Labour Code) Maritime Occupational Health and Safety Regulations, SOR/2010-120 (Canada Labour Code) Transportation of Dangerous Goods Regulations, SOR/2001-286 (Transportation of Dangerous Goods Act, 1992)
British Columbia	**Regulations:** Occupational Health and Safety Regulation, BC Reg 296/97 (Workers Compensation Act) Hazardous Waste Regulation, BC Reg 63/88 (Environmental Management Act) Home Inspector Licensing Regulation, BC Reg 12/2009 (Business Practices and Consumer Protection Act) Contaminated Sites Regulation, BC Reg 375/96 (Environmental Management Act)
Alberta	**Statutes:** Occupational Health and Safety Act, SA 2020, c O-2.2 Environmental Protection and Enhancement Act, RSA 2000, c E-12 **Regulations:** Occupational Health and Safety Regulation, Alta Reg 62/2003 (Occupational Health and Safety Act) Occupational Health and Safety Code 2009 Order, Alta Reg 87/2009 (Occupational Health and Safety Act) Insulator Trade Regulation, Alta Reg 284/2000 (Apprenticeship and Industry Training Act) Home Inspection Business Regulation, Alta Reg 75/2011 (Consumer Protection Act)

Jurisdiction	Legislative Instrument
Saskatchewan	**Statutes:** Public Health Act, 1994, SS 1994, c P-37.1 **Regulations:** The Asbestos Registry for Public Buildings Regulations, RRS c P-37.1 Reg 16 (Public Health Act, 1994) The Occupational Health and Safety Regulations, 1996, RRS c O-1.1 Reg 1 (Occupational Health and Safety Act, 1993) The Apprenticeship and Trade Certification Regulations, 2020, RRS c A-22.3 Reg 2 (Apprenticeship and Trade Certification Act, 2019) Hazardous Substances and Waste Dangerous Goods Regulations, RRS c E-10.2 Reg 3 (Environmental Management and Protection Act, 2010)
Manitoba	**Regulations:** Administrative Penalty Regulation, Man Reg 89/2014 (Workplace Safety and Health Act) Workplace Safety and Health Regulation, Man Reg 217/2006 (Workplace Safety and Health Act) Construction Industry Minimum Wage Regulation, Man Reg 119/2006 (Construction Industry Wages Act) Employment Standards Regulation, Man Reg 6/2007 (Employment Standards Code) Real Estate Brokers Regulation, Man Reg 56/88 R (Real Estate Brokers Act) Operation of Mines Regulation, Man Reg 212/2011 (Workplace Safety and Health Act)
Ontario	**Regulations:** Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations, O Reg 278/05 (Occupational Health and Safety Act) Designated Substances, O Reg 490/09 (Occupational Health and Safety Act) Control of Exposure to Biological or Chemical Agents, RRO 1990, Reg 833 (Occupational Health and Safety Act) General - Waste Management, RRO 1990, Reg 347 (Environmental Protection Act) Scope of Practice - Trades in the Construction Sector, O Reg 275/11 (Ontario College of Trades and Apprenticeship Act, 2009) Building Code, O Reg 332/12 (Building Code Act, 1992)
Quebec	**Regulations:** Regulation respecting occupational health and safety, CQLR c S-2.1, r 13 (Occupational Health and Safety Act) Regulation respecting the quality of the work environment, CQLR c S-2.1, r 11 (Occupational Health and Safety Act) Safety Code for the Construction Industry, CQLR c S-2.1, r 4 (Occupational Health and Safety Act) Regulation respecting prevention programmes, CQLR c S-2.1, r 10 (Occupational Health and Safety Act) Regulation respecting the landfilling and incineration of residual materials, CQLR c Q-2, r 19 (Environment Quality Act)

Jurisdiction	Legislative Instrument
Newfoundland & Labrador	**Regulations:** Asbestos Abatement Regulations, 1998, NLR 111/98 (Occupational Health and Safety Act) Asbestos Exposure Code Regulations, CNLR 1144/96 (Mines Act) Occupational Health and Safety Regulations, 2012, NLR 5/12 (Occupational Health and Safety Act) Air Pollution Control Regulations, 2004, NLR 39/04 (Environmental Protection Act) Environmental Assessment Regulations, 2003, NLR 54/03 (Environmental Protection Act)
Nova Scotia	**Regulations:** Asbestos Waste Management Regulations, NS Reg 53/95 (Environment Act) Environmental Emergency Regulations, NS Reg 16/2013 (Environment Act) Insulator (Heat and Frost) Trade Regulations, NS Reg 215/2016 (Apprenticeship and Trades Qualifications Act) Environmental Assessment Regulations, NS Reg 26/95 (Environment Act) Activities Designation Regulations, NS Reg 47/95 (Environment Act) **Enforceable codes of practice:** Asbestos in the Workplace: A Guide to Assessment & Management of Asbestos in the Workplace Asbestos in the Workplace: A Guide to Removal of Friable Asbestos Containing Material
New Brunswick	**Regulations:** Code of Practice for Working with Material Containing Asbestos Regulation, NB Reg 92-106 (Occupational Health and Safety Act)
Prince Edward Island	**Regulations:** Occupational Health and Safety Act General Regulations, PEI Reg EC180/87 (Occupational Health and Safety Act) Waste Resource Management Regulations, PEI Reg EC691/00 (Environmental Protection Act)
Yukon	**Regulations:** Occupational Health Regulations, YOIC 1986D/164 (Occupational Health and Safety Act) Solid Waste Regulations, YOIC 2000/11 (Environment Act) Apprentice Training and Tradesperson's Qualifications Regulations, YOIC 2003/241 (Apprentice Training Act)
Northwest Territories	**Regulations:** Occupational Health and Safety Regulations, NWT Reg 039-2015 (Safety Act) Mine Health and Safety Regulations, NWT Reg 125-95 (Mine Health and Safety Act)
Nunavut	**Regulations:** Building Code Regulations, Nu Reg 009-2018 (Building Code Act) Occupational Health and Safety Regulations, Nu Reg 003-2016 (Safety Act) Mine Health and Safety Regulations, NWT Reg (Nu) 125-95 (Mine Health and Safety Act)

Appendix D: Summary Tables Comparing Asbestos Regulations Across Canada

Table 14: Cross-Jurisdictional Comparison of how "Asbestos" is Defined in Canadian OHS Regulations

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Fibrous forms of														
Crocidolite			X	X	X	X	X		X	X	X			X
Amosite			X	X	X	X	X		X	X	X			X
Chrysotile			X	X	X	X	X		X	X	X			X
Anthophyllite			X	X	X	X	X		X	X	X			X
Actinolite			X	X	X	X	X		X	X	X			X
Tremolite			X	X	X	X	X		X	X	X			X
Mixture containing any of the above			X	X		X								
Manufactured article containing >1% asbestos by weight												X	X	
All forms of asbestos		X						X						

Table 15: Cross-Jurisdictional Comparison of How "ACM" Is Defined in Canadian OHS Regulations

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Where defined														
In regulation	X		X	X	X	X	X		X	X		X	X	X
In guideline or code of practice		X						X						
What's included in the definition														
Manufactured article or other material	X											X	X	X
Product or building material		X												
"Any" material or "a" material			X		X	X	X	X	X	X				
Vermiculite insulation	X		X	X				X		X				
Minimum % of asbestos														
In non-vermiculite ACM														
At least 0.1% asbestos				X		X								
At least 0.5% asbestos	X		X		X			X						
At least 1.0% asbestos			X	X			X		X	X		X	X	X
Any quantity/percentage of asbestos		X												
In vermiculite														
Any asbestos	X		X	X				X						

Table 16: Cross-Jurisdictional Comparison of How "Friable" is Defined in Canadian OHS Regulations

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Material that can be crumbled, pulverized, or powdered			X		X	X	X	X	X	X		X	X	X
– When dry, by hand pressure			X		X	X	X	X	X	X		X	X	X
Material that is already crumbled, pulverized, or powdered			X		X	X	X		X	X		X	X	
Material that is crumbled or powdered	X													
Material that can be crumbled or powdered by hand pressure	X													
Material that, when dry, can be crumbled by hand		X												
Material that can be crumbled with hand pressure				X										

Table 17: Cross-Canada Comparison of OHS Regulations – Identification of ACM

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Collection of representative samples	X	X	X	X	X	X		X	X	X				X
Collection by competent/qualified person	X	X		X	X	X	X	X	X	X				X
Analysis by qualified/accredited laboratory		X		X		X	X	X	X	X				X
Bulk sampling and analytical methods														
NIOSH methods														
X-ray diffraction (Method 9000)	X	X						X						
PLM (Method 9002)	X	X		X				X				X	X	X
EPA methods														
Asbestos in bulk building materials (EPA/600/R-93/116)	X	X		X	X			X						
Fibrous amphibole in vermiculite attic insulation (EPA/600/R-04/004)	X			X				X						
IRSST methods						X								

Table 18: Cross-Canada Comparison of OHS Regulations – Asbestos Inventories

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Prepared by competent person[1]	X		X	X		X		X		X		X	X	X
Requirement to keep current	X		X	X	X			X		X				X
Annual inspections			X	X	X	X				X		X	X	
Core inventory elements														
Accessibility		X	X	X										X
Location[2]	X	X	X	X	X	X		X	X	X		X	X	X
Condition/Characteristics	X		X							X				X
– State of the material/friability	X		X	X	X					X		X	X	X
– Quantity (area or linear length)				X										X
– Type of asbestos or ACM	X		X	X	X	X		X		X				X
– Percentage of sample that is asbestos	X			X		X		X		X				X

Notes:
[1] NT and NU require the employer to perform inventory and allow the employer to delegate to a qualified person.
[2] Some jurisdictions (e.g., BC) specify that the inventory must include information on known and presumed location of ACM.

Table 19: Cross-Canada Comparison of OHS Regulations – Asbestos Risk Assessments

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Risk to be assessed by qualified person	X		X				X		X					X
Key factors to be considered in the risk assessment														
Location of the material			X	X	X				X					
– Accessibility	X	X	X	X								X	X	X
– Potential for fibre release or exposure	X		X	X			X					X	X	X
Type of ACM			X	X		X			X	X				X
– Asbestos content		X		X					X	X		X	X	
– Friability	X	X		X	X		X					X	X	X
Condition of the material	X	X		X								X	X	X
– Evidence/likelihood of damage[1]	X	X	X									X	X	X
Exposed surface area		X										X	X	
Activity and movement[2]		X	X									X	X	
Predetermined categories of risk														
Low, moderate, high risk	X	X			X	X			X	X		X	X	X

Notes:
[1] Includes water damage, physical damage, delaminating, or other sign of deterioration.
[2] Includes air movement, building and/or equipment vibration, worker and building occupant activity levels.

Table 20: Cross-Canada Comparison of OHS Regulations – Asbestos Prohibitions

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Types of asbestos prohibited														
Crocidolite	X	X	X	X		X	X					X	X	
Amosite						X								
Any asbestos-containing material										X				
Prohibited activities														
Spraying of asbestos or ACM	X	X	X	X	X	X	X			X		X	X	
Application of friable ACM[1]				X	X	X			X					
Removal of asbestos insulation or other ACM by pressure spraying equipment	X			X										
No cleanup or removal of asbestos by														
- Compressed air	X			X	X	X			X					X
- Dry sweeping or dry mopping	X			X					X					
- Other means of dry removal									X					X
Eating, drinking, or smoking in contaminated area		X		X	X	X		X	X	X	X			
No encapsulation of visibly deteriorated friable ACM or materials/surfaces with insufficient strength to support weight					X		X		X	X				
No underage workers[2]			X	X								X	X	

Notes:

[1] Application of friable ACM for thermal insulation is prohibited in Ontario, Quebec, and New Brunswick.

[2] Employers are prohibited from employing workers under the age of 18 in certain asbestos processes. In Manitoba, this prohibition is set out in the Employment Standards Regulations, not in the OHS Regulations.

Table 21: Cross-Canada Comparison of OHS Regulations – Asbestos Control Measures

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
General requirement to control exposure	X	X	X	X	X	X	X		X	X	X	X	X	X
Plan to manage or control asbestos	X	X	X	X	X		X	X	X	X		X	X	X
Measures to control exposure														
Elimination	X	X												
Substitution	X		X				X							X
Isolation														
– Containment	X	X		X	X	X	X	X	X	X				X
– Glove bags	X	X		X	X		X	X	X	X				X
– Encapsulation or enclosure	X	X	X	X	X	X	X			X		X	X	X
Engineering controls														
– Containment ventilation (HEPA-filtered)	X	X		X	X	X	X	X	X	X		X	X	X
– Local exhaust ventilation (HEPA-filtered)	X	X	X	X	X	X	X		X	X		X	X	
– HEPA-filter equipped vacuum cleaner	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Administrative controls														
– Procedures to protect work surfaces	X	X	X		X	X			X					
– Procedures to prevent spread	X	X	X	X	X	X	X	X	X	X	X	X	X	X
– Removal via wet methods	X	X	X	X	X	X	X	X	X	X	X	X	X	X
– Procedures to repair damaged ACM	X		X		X	X			X	X		X	X	
Personal Protective Equipment (PPE)														
PPE – respiratory	X	X	X	X	X	X	X	X	X	X	X	X	X	X
– Air-supplied respirator (e.g., PAPR)	X	X		X	X	X	X	X	X	X				X
– "Adequate" for anticipated exposure	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PPE – protective clothing	X	X	X	X	X	X	X	X	X	X	X	X	X	X
– Material resistant to penetration	X	X	X	X	X	X				X		X	X	X
– Snug fit at wrists, neck, ankles	X	X		X	X	X			X	X				

Table 22: Cross-Canada Comparison of OHS Regulations – Occupational Exposure Limits

Jurisdiction	8-hour TWA (fibres/cc)	15-min STEL (fibres/cc)
British Columbia	0.1	
Alberta	0.1	
Saskatchewan	None listed	
Manitoba	0.1	
Ontario	0.1	
Quebec		
– Actinolite	1.0	5.0
– Anthophyllite	1.0	5.0
– Amosite	0.2	1.0
– Chrysotile	1.0	5.0
– Crocidolite	0.2	1.0
– Tremolite	1.0	5.0
Newfoundland & Labrador	0.1	
Nova Scotia	0.1	
New Brunswick	0.1	
Prince Edward Island	0.1	
Yukon		
– Amosite	0.2	2.0
– Chrysotile	0.5	5.0
– Tremolite	0.5	5.0
– Talc (fibrous)	0.5	5.0
Northwest Territories	None listed	
Nunavut	None listed	
Canada	0.1	

Table 23: Cross-Canada Comparison of OHS Regulations – Clearance Sampling Exposure Standard

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Level not to exceed 0.01 f/cc		X	X	X	X	X		X		X				
Level not to exceed 0.02 f/cc	X													
Level not to exceed 0.05 f/cc									X					
Level not to exceed 0.1 f/cc														X
Level below 0.2 f/cc											X			
Level as close to zero as possible														X

Table 24: Cross-Canada Comparison of OHS Regulations – Management of Asbestos Waste

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Containment of asbestos waste														
Labelled containers	X	X		X	X	X	X	X	X		X	X	X	
– Identify contents		X		X	X	X			X		X	X	X	X
– Warn against inhalation		X				X					X			
– Warn about health hazard		X		X	X	X					X			
– Safe handling of hazardous product				X	X	X								
Sealed containers	X	X		X			X	X			X			X
– Rigid containers					X									
– Impervious to damage/asbestos		X	X		X				X		X	X	X	X
Cleanup and disposal of asbestos waste														
Frequency of cleanup: promptly, frequently, at least once per day, at end of work shift			X	X					X					X
Containers to be cleaned before removal	X			X	X			X		X				X
Storage and transport														
Must not create downstream OHS hazard			X							X				
Transport by driver trained in hazard					X					X				
Transport in designated vehicles					X									
Transported in accordance with TDG Act									X					
Disposal														
Waste to be removed from workplace promptly, immediately, frequently, at regular intervals, as soon as practicable	X				X					X				X
Disposal in approved landfills					X			X		X				
Hazard communicated to disposal site					X			X						

Table 25: Cross-Canada Comparison of OHS Regulations – Asbestos Exposure Monitoring

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Personal Monitoring														
Breathing zone samples	X	X		X	X	X	X	X		X				X
Area Monitoring														
Type of asbestos activity or process														
– High-risk activities	X	X	X	X	X				X	X				
– Moderate-risk activities		X		X						X				
Presence of workers in adjacent area		X									X			
Change in process/controls/filters				X		X	X							
End of project (clearance sampling)	X	X	X	X	X	X	X	X	X	X	X			X
Location and frequency of area samples														
– Vicinity of containment; once/day	X		X				X	X		X				X
– Cleanup room; once per day	X													X
– Inside containment; as necessary	X		X		X									X
Sampling and analytical methods														
NIOSH Methods[1]		X												
– Method 7400					X			X		X				X
– Method 7402					X					X				
IRSST Methods						X		X						

Notes:

[1] Section 20 of the Alberta Occupational Health and Safety Code references the 4th edition of the NIOSH Manual of Analytical Methods (NMAM) "as amended up to and including the 2nd supplement (January 15, 1998)". All other jurisdictions reference the most current version of the NMAM.

Table 26: Cross-Canada Comparison of OHS Regulations – Health Monitoring of Asbestos-Exposed Workers

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Required data/tests														
Identity of worker & employer		X			X									
Worker's job(s) or occupation(s)					X		X			X	X			
Comprehensive medical history		X		X							X	X	X	X
Chest X-ray		X		X	X	X	X			X	X			
Pulmonary function tests		X	X	X	X	X				X	X	X	X	X
Other necessary diagnostic tests			X			X						X	X	X
Respiratory health questionnaire				X	X	X								
Date of exam, X-ray, and spirogram		X												
Occupational exposure history		X	X	X			X			X	X			
– Results of exposure monitoring					X									
– Time-weighted average exposure					X									
– Use and type of respiratory PPE					X						X			
– Training records							X							
Smoking history		X									X			
Physician report/medical certificate		X				X	X		X					
Frequency of assessment														
At start of exposure (pre-placement)		X		X		X				X	X			
– Within 6 years of hire						X								
Periodic assessment					X									
– Every year										X	X			
– Every 2 years		X	X	X						X	X	X	X	X
– Every 3 years						X								
– Every 5 years					X					X				
After exposure (acute, >50% of OEL)					X						X			
Exit exam					X									
Cost to be borne by employer		X	X	X	X		X		X	X	X	X	X	X

Table 27: Cross-Canada Comparison of OHS Regulations – Definition of Competency/Qualifications

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Competent (person or worker)		X	X	X	X			X	X	X		X	X	
Qualified (worker, person, contractor)	X						X					X	X	X
Knowledge														
Management and control of asbestos	X													
Adequately qualified		X												
Possessing knowledge to perform duty				X	X			X	X	X	X	X	X	X
Familiar with relevant legislation					X			X	X	X	X			
Knowledge of all potential/actual danger					X			X	X	X	X			
Skills														
Suitably trained		X												
Being trained to perform task/duty			X											
Possessing training to perform duty				X	X			X	X	X	X	X	X	X
Experience														
Management and control of asbestos	X													
Sufficient experience		X												
Possessing experience to perform duty				X	X			X	X	X	X	X	X	X
Other														
Successful completion of course							X			X				
Hold valid asbestos contractor certificate										X				

Table 28: Cross-Canada Comparison of OHS Regulations – Asbestos Training

	BC	AB	SK	MB	ON	QC	NL	NS	NB	PE	YT	NT	NU	CA
Type of training														
Adequate instruction and training	X													
Complete approved training course		X	X		X		X			X				
Training/direction appropriate to risk			X	X	X	X			X		X	X	X	X
Key topics covered in training program/curriculum														
Regulatory context/employer obligations		X		X		X	X			X		X	X	
Hazards of asbestos	X	X	X	X	X	X	X		X	X	X	X	X	
– Synergistic effect of smoking		X									X			
Means of identifying ACM at worksite	X	X	X	X		X	X		X	X				
Safe work procedures	X	X	X	X	X	X	X	X	X	X		X	X	
Prohibited activities				X										
Correct selection/use of PPE	X	X	X	X	X	X	X	X	X	X	X	X	X	
– Respiratory fit testing		X			X		X		X	X				
– Decontamination		X			X		X		X			X	X	
Correct operation of required controls	X	X	X	X		X	X	X		X		X	X	
– Hands on training		X					X			X				
Health monitoring requirements	X			X			X					X	X	
Other requirements														
Training delivered by qualified person		X		X	X				X	X				
Evaluation of training effectiveness		X		X			X							
Valid asbestos contractor certificate							X			X	X			

Appendix E: How Low, Moderate and High Categories of Risk are Defined, by Jurisdiction

Table 29: Definitions of Risk by Jurisdiction

Note: the text in this table has been reprinted verbatim from relevant regulatory instruments

	"Low risk"	"Moderate risk"	"High risk"
BC	**"low risk work activity"** means a work activity that involves working with or in proximity to asbestos-containing material if, at the time the work activity is being carried out, both of the following apply: 1. the asbestos-containing material is not being (i) cut, sanded, drilled, broken, ground down or otherwise fragmented, or (ii) disturbed such that the asbestos-containing material may release airborne asbestos fibre; 2. it is not necessary to use personal protective equipment or engineering controls in respect of that activity to prevent exposure of a worker to airborne asbestos fibre;	**"moderate risk work activity"** means a work activity, other than a high risk work activity, that involves working with or in proximity to asbestos-containing material if, at the time the work activity is being carried out, one or both of the following apply: 1. the asbestos-containing material is being (i) cut, sanded, drilled, broken, ground down or otherwise fragmented, or (ii) disturbed such that the asbestos-containing material may release airborne asbestos fibre; 2. it is necessary to use personal protective equipment or engineering controls, or both, in respect of that activity to prevent exposure of a worker to airborne asbestos fibre;	**"high risk work activity"** means a work activity that involves working with or in proximity to asbestos-containing material if a high level of control is necessary in respect of that activity to prevent exposure of a worker to airborne asbestos fibre;
AB	**Part C – Low Risk Asbestos Processes** 1. The installation or removal of manufactured asbestos-containing products where sanding, cutting or similar disturbance is not required 2. The use of hand tools to cut, shape, drill or remove a manufactured asbestos-containing product 3. The removal of drywall material where asbestos joint filling compounds have been used 4. The use of personal protective equipment made of asbestos-containing textiles 5. The transporting or handling of asbestos-containing materials in sealed containers 6. The cleaning or disposing of minor amounts of asbestos debris that has come loose or fallen from a friable surface 7. The removal of small samples of asbestos-containing material for the purpose of identification.	**"moderate risk work activity"** means a work activity, other than a high risk work activity, that involves working with or in proximity to asbestos-containing material if, at the time the work activity is being carried out, one or both of the following apply: 1. the asbestos-containing material is being (i) cut, sanded, drilled, broken, ground down or otherwise fragmented, or (ii) disturbed such that the asbestos-containing material may release airborne asbestos fibre; 2. it is necessary to use personal protective equipment or engineering controls, or both, in respect of that activity to prevent exposure of a worker to airborne asbestos fibre;	**"high risk work activity"** means a work activity that involves working with or in proximity to asbestos-containing material if a high level of control is necessary in respect of that activity to prevent exposure of a worker to airborne asbestos fibre;

	"Low risk"	"Moderate risk"	"High risk"
ON	**Type 1 operations**: 1. Installing or removing ceiling tiles that are asbestos-containing material, if the tiles cover an area less than 7.5 square metres and are installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated. 2. Installing or removing non-friable asbestos-containing material, other than ceiling tiles, if the material is installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated. 3. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if, i. the material is wetted to control the spread of dust or fibres, and ii. the work is done only by means of non-powered hand-held tools. 4. Removing less than one square metre of drywall in which joint-filling compounds that are asbestos-containing material have been used.	The following are **Type 2 operations**: 1. Removing all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling. 2. The removal or disturbance of one square metre or less of friable asbestos-containing material during the repair, alteration, maintenance or demolition of all or part of machinery or equipment or a building, aircraft, locomotive, railway car, vehicle or ship. 3. Enclosing friable asbestos-containing material. 4. Applying tape or a sealant or other covering to pipe or boiler insulation that is asbestos-containing material. 5. Installing or removing ceiling tiles that are asbestos-containing material, if the tiles cover an area of 7.5 square metres or more and are installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated. 6. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if, i. the material is not wetted to control the spread of dust or fibres, and ii. the work is done only by means of non-powered hand-held tools. 7. Removing one square metre or more of drywall in which joint filling compounds that are asbestos-containing material have been used. 8. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters. 9. Removing insulation that is asbestos-containing material from a pipe, duct or similar structure using a glove bag. 10. Cleaning or removing filters used in air handling equipment in a building that has sprayed fireproofing that is asbestos-containing material. 11. An operation that, i. is not mentioned in any of paragraphs 1 to 10, ii. may expose a worker to asbestos, and iii. is not classified as a Type 1 or Type 3 operation.	The following are **Type 3 operations**: 1. The removal or disturbance of more than one square metre of friable asbestos-containing material during the repair, alteration, maintenance or demolition of all or part of a building, aircraft, ship, locomotive, railway car or vehicle or any machinery or equipment. 2. The spray application of a sealant to friable asbestos-containing material. 3. Cleaning or removing air handling equipment, including rigid ducting but not including filters, in a building that has sprayed fireproofing that is asbestos-containing material. 4. Repairing, altering or demolishing all or part of a kiln, metallurgical furnace or similar structure that is made in part of refractory materials that are asbestos-containing materials. 5. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material, if the work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters. 6. Repairing, altering or demolishing all or part of any building in which asbestos is or was used in the manufacture of products, unless the asbestos was cleaned up and removed before March 16, 1986.

	"Low risk"	"Moderate risk"	"High risk"
QC	Sites where **low-risk work** is carried out: **a.** the installation, handling or removal of manufactured goods containing asbestos, provided they are and remain in a non-friable condition, such as: i. vinyl tiles; ii. acoustic tiles; iii. Gaskets; iv. seals; v. asbestos cement products; **b.** the sawing, cutting, shaping or drilling of a product mentioned in subparagraph a of this paragraph with a hand tool or a power tool fitted with a dust-collection device equipped with a high-efficiency filter; **c.** the removal of drywall installed with asbestos joint-filling compounds;	Sites where **moderate-risk work** is carried out: **a.** the total or partial removal of false ceilings for the purpose of gaining access to a work area where friable materials containing asbestos are found; **b.** Tthe enclosure of friable material containing asbestos, subject to subparagraph c of paragraph 3; **c.** the removal of friable material containing asbestos where, in the removal process, the work area is sealed off from the worker's breathing area; **d.** any work that is liable to produce asbestos dust emissions and that is not classified as low or high risk; **e.** the handling or removal of small quantities of friable material containing asbestos having a volume of debris not exceeding 0.03 m3 for each minor renovation or regular specific maintenance job;	Sites where **high-risk work** is carried out: **a.** subject to subparagraphs c and e of paragraph 2, the handling or the removal of friable material containing asbestos; **b.** the cleaning or removal of a ventilation system, including rigid ducts, in buildings where the insulation contains asbestos applied by spraying; **c.** the enclosure of friable material containing asbestos by the spray application of a sealant; **d.** the repair, alteration or demolition of kilns, boilers or similar devices made entirely or partly of refractory materials containing asbestos; **e.** the use of a power tool not fitted with a dust-collection device equipped with a high-efficiency filter to grind, cut, drill or abrade a product mentioned in subparagraph a of paragraph 1; **f.** subject to subparagraph e of paragraph 2, the handling or removal of friable material containing crocidolite or amosite; **g.** subject to subparagraph e of paragraph 2, the total or partial removal of false ceilings on which friable materials containing asbestos is found.

	"Low risk"	"Moderate risk"	"High risk"
NB	**Class 1 — Operations** For the purposes of this *Code of Practice,* operations under Class 1 are: **a.** the installation or removal of manufactured products containing asbestos, including products such as vinyl or acoustic tiles, gaskets, seals, packing, friction products, or asbestos cement products; **b.** the cutting, drilling or shaping of a product mentioned in paragraph (a) by the use of hand operated tools; **c.** the use of power tools having a dust collection device equipped with a HEPA filter to cut, grind, or abrade a product mentioned in paragraph (a); **d.** the removal of drywall where asbestos joint-filling compounds have been used; **e.** the opening of ceiling tiles for inspection purposes; **f.** the clean-up of small quantities of friable asbestos debris that has detached from insulation; **g.** the opening of brake drums, and replacement or repair of brake pads; and **h.** repair or replacement of clutches.	**Class 2 — Operations** For the purposes of this *Code of Practice,* operations classified under Class 2 are: **a.** the removal of a false ceiling, or part of it, to obtain access to a work area, where a significant quantity of friable material containing asbestos is likely to be lying on the surface of the false ceiling; **b.** the minor removal or minor disturbance (less than 30 square feet of surface area) of friable material containing asbestos during the repair, alteration, maintenance or demolition of a building, aircraft, ship, locomotive, railway car or vehicle or any machinery or equipment, or part thereof, or where the minor removal or disturbance is not a Class 1 operation; **c.** the application of tape or a sealant or other covering to pipe or boiler insulation containing asbestos; **d.** the removal of pipe insulation containing friable asbestos with the help of a commercial containment bag (glove bag); **e.** the enclosure of asbestos-containing material; **f.** the use of a power tool not having a dust collection device equipped with a HEPA filter to cut, grind or abrade a product mentioned in paragraph 5.2(a); and **g.** any operation not mentioned in paragraphs (a) to (e) that may cause exposure of an employee to asbestos, and that is not classified as a Class 1 or a Class 3 operation.	**Class 3 — Operations** For the purposes of this *Code of Practice,* operations classified under Class 3 are: **h.** the removal, other than the minor removal, of material containing asbestos during the repair, alteration, maintenance or demolition of a building, aircraft, ship, locomotive, railway car or vehicle, or any machinery or equipment or part thereof; **i.** the spray application of a sealant to friable material containing asbestos; **j.** the cleaning or removal of air-handling equipment, including rigid ducting, in a building that has sprayed-fireproofing containing asbestos; **k.** an outdoor operation involving the removal or stripping of friable asbestos-containing materials; and, **l.** the repair, alteration or demolition of a kiln, metallurgical furnace or similar device or part thereof, made in part of refractory materials containing asbestos.

	"Low risk"	"Moderate risk"	"High risk"
PE	**Type I Removal Operations** means removal operations that present a minimal risk of releasing asbestos fibres into the air, such as the removal of asbestos-containing material that is non-friable, work that can be done without damaging the asbestos-containing material, including the use of non-powered handheld tools as long as water is used to control fibre release, and **a.** removal of asbestos-containing material ceiling tiles where the total area to be disturbed is less than 1 square meter without damage; **b.** removal of non-friable asbestos-containing material without damage; **c.** removal of vinyl asbestos floor tile, asbestos cement products, and millboard where water is used to control fibre release; and **d.** removal of less than one square meter of drywall where joint-filling compounds with asbestos-containing material were used.	**Type II Removal Operations** means removal operations that present a medium risk of asbestos exposure to workers, such as the removal or minor disturbance of friable asbestos-containing material with a surface area of less than 0.09 of a square meter or 1 square foot during the repair, alteration, maintenance or demolition of all or part of a building, or any machinery or equipment, or where the minor removal or disturbance exceeds the scope of a Type I Removal, including **a.** using a mechanical or electrically powered tool, fitted with a HEPA filter dust collector, to cut, shape or grind non-friable manufactured products containing asbestos; **b.** removing all or part of a false ceiling to gain access to a work area where friable asbestos-containing material is, or is likely to be, lying on the surface of the false ceiling; **c.** removing, encapsulating, enclosing or disturbing a surface area of less than 0.09 of a square meter or 1 square foot of friable asbestos-containing material during the repair, alteration, maintenance, demolition or dismantling of a building, structure, machine, tool or equipment, or parts of any of them; **d.** performing glove bag operations; **e.** dry removal of non-friable asbestos-containing material where the material may be cut, broken, or otherwise damaged during removal; and **f.** removing a surface area of up to 9.3 square meters or 100 square feet of contiguous ceiling tile containing asbestos or sheet vinyl flooring having an asbestos backing.	**Type III Removal Operations** means removal operations during the repair, alteration, maintenance or demolition of all or part of any building, machinery or equipment that present the highest risk of asbestos exposure to workers, including **a.** spraying of an encapsulant over friable asbestos using a low-pressure sprayer; **b.** using a power tool not having a dust collection device equipped with a HEPA filter to cut, grind or abrade asbestos-containing material; **c.** any indoor operation involving the removal or stripping of friable asbestos-containing material; and **d.** repairing, altering or demolishing a boiler, furnace or similar device or any part of it that is made in part of asbestos-containing material.

	"Low risk"	"Moderate risk"	"High risk"
NT	**Part 3 – Low Risk Asbestos Processes** 1. The installation or removal of manufactured asbestos-containing products when sanding, cutting or similar disturbance is not required. 2. The use of hand tools to cut, shape, drill or remove a manufactured asbestos-containing product. 3. The removal of drywall material where asbestos joint filling compounds have been used. 4. The use of personal protective equipment made of asbestos-containing textiles. 5. The transporting or handling of asbestos-containing materials in sealed containers. 6. The cleaning or disposing of minor amounts of asbestos debris that has come loose or fallen from a friable surface. 7. The removal of small samples of asbestos-containing material for the purpose of identification.	**Part 2 – Moderate Risk Asbestos Processes** 1. The use of a power tool equipped with HEPA filtration to cut, shape or grind any asbestos-containing surface or product. 2. The removal of a false ceiling or part of a false ceiling where friable asbestos-containing material is, or is likely to be, lying on the surface of the false ceiling. 3. The removal, the encapsulation or enclosure or the disturbance of minor amounts of friable asbestos-containing material during the repair, alteration, maintenance, demolition, or dismantling of a structure, machine or equipment or part of a structure, machine or equipment.	**Part 1 – High Risk Asbestos Processes** 1. The removal, encapsulation, enclosure or disturbance of anything but minor amounts of friable asbestos-containing material during the repair, alteration, maintenance, demolition, or dismantling of any part of a plant. 2. The cleaning, maintenance or removal of air-handling equipment in buildings where sprayed fireproofing asbestos-containing materials have been applied to the airways or ventilation ducts. 3. The dismantling or the major alteration or repair of a boiler, furnace, kiln or similar device, or part of a boiler, furnace, kiln or similar device, that is made of asbestos-containing materials. 4. The use of power tools not equipped with HEPA filtration to grind, cut or abrade any asbestos-containing surface or product.
NU	**Part C – Low Risk Asbestos Processes** 1. The installation or removal of manufactured asbestos-containing products when sanding, cutting or similar disturbance is not required. 2. The use of hand tools to cut, shape, drill or remove a manufactured asbestos-containing product. 3. The removal of drywall material where asbestos joint filling compounds have been used. 4. The use of personal protective equipment made of asbestos-containing textiles. 5. The transporting or handling of asbestos-containing materials in sealed containers. 6. The cleaning or disposing of minor amounts of asbestos debris that has come loose or fallen from a friable surface. 7. The removal of small samples of asbestos-containing material for the purpose of identification.	**Part B – Moderate Risk Asbestos Processes** 1. The use of a power tool equipped with HEPA filtration to cut, shape or grind any asbestos-containing surface or product. 2. The removal of a false ceiling or part of a false ceiling where friable asbestos-containing material is, or is likely to be, lying on the surface of the false ceiling. 3. The removal, the encapsulation or enclosure or the disturbance of minor amounts of friable asbestos-containing material during the repair, alteration, maintenance, demolition, or dismantling of a structure, machine or equipment or part of a structure, machine or equipment.	**Part A – High Risk Asbestos Processes** 1. The removal, encapsulation, enclosure or disturbance of anything but minor amounts of friable asbestos-containing material during the repair, alteration, maintenance, demolition, or dismantling of any part of a plant. 2. The cleaning, maintenance or removal of air-handling equipment in buildings where sprayed fireproofing asbestos-containing materials have been applied to the airways or ventilation ducts. 3. The dismantling or the major alteration or repair of a boiler, furnace, kiln or similar device, or part of a boiler, furnace, kiln or similar device, that is made of asbestos-containing materials. 4. The use of power tools not equipped with HEPA filtration to grind, cut or abrade any asbestos-containing surface or product.

	"Low risk"	"Moderate risk"	"High risk"
CA	*low-risk activity* means an activity that involves the handling of asbestos-containing material or is carried out in proximity to non-friable asbestos-containing material and that includes **a.** the installation or removal of ceiling tiles that are made of non-friable asbestos-containing material and cover an area of less than 7.5 m^2, **b.** the installation or removal of other non-friable asbestos-containing material, if the material is not being broken, cut, drilled, abraded, ground, sanded or vibrated and dust is not being generated, **c.** the breaking, cutting, drilling, abrading, grinding, sanding or vibrating of non-friable asbestos-containing material, if the material is wetted to control the spread of dust or fibres and the activity is carried out only by means of non-powered hand-held tools, and **d.** the removal of less than 1 m^2 of drywall in which joint cement containing asbestos has been used;	*moderate-risk activity* means an activity that involves the handling of asbestos-containing material or is carried out in proximity to friable asbestos-containing material, that is not otherwise classified as a low-risk activity or high-risk activity and that includes **a.** the removal of all or part of a false ceiling to gain access to a work area, if asbestos-containing material is likely to be found on the surface of the false ceiling, **b.** the removal or disturbance of 1 m^2 or less of friable asbestos-containing material during repair, alteration, maintenance or demolition work in a work place, **c.** the enclosure of friable asbestos-containing material, **d.** the application of tape, sealant or other covering to pipe or boiler insulation that is asbestos-containing material, **e.** the removal of ceiling tiles that are asbestos-containing material, if the tiles cover an area of greater than 2 m^2 and are removed without being broken, cut, drilled, abraded, ground, sanded or vibrated, **f.** the breaking, cutting, drilling, abrading, grinding, sanding or vibrating of non-friable asbestos-containing material, if the material is not wetted to control the spread of dust or fibres and the activity is carried out only by means of non-powered hand-held tools, **g.** the removal of 1 m^2 or more of drywall in which joint cement that is asbestos-containing material has been used, **h.** the breaking, cutting, drilling, abrading, grinding, sanding or vibrating of non-friable asbestos-containing material, if the activity is carried out by means of power tools that are attached to dust-collecting devices equipped with HEPA filters, **i.** the removal of insulation that is asbestos-containing material from a pipe, duct or similar structure using a glove bag, and **j.** the cleaning or removal of filters used in air-handling equipment in a building that has sprayed-on fireproofing that is asbestos-containing material;	*high-risk activity* means an activity that involves the handling or disturbance of friable asbestos-containing material or is carried out in proximity to friable asbestos-containing material, that requires a high level of control to prevent exposure to excessive concentrations of airborne asbestos fibres and that includes **a.** the removal or disturbance of more than 1 m^2 of friable asbestos-containing material in a work place, even if the activity is divided into smaller jobs, **b.** the spray application of a sealant to a friable asbestos-containing material, **c.** the cleaning or removal of air-handling equipment, other than filters, in a building that has sprayed-on fireproofing or sprayed-on thermal insulation that is asbestos-containing material, **d.** the repair, alteration or demolition of all or part of a kiln, metallurgical furnace or similar structure that contains asbestos-containing material, **e.** the breaking, cutting, drilling, abrading, grinding, sanding or vibrating of non-friable asbestos-containing material, if the activity is carried out by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters, and **f.** the repair, alteration or demolition of all or part of a building in which asbestos is or was used in the manufacture of products, unless the asbestos was cleaned up and removed;

CSA Group Research

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