Developing a Silica Exposure Control Plan

Employers have a duty to protect their workers from silica dust exposure on construction projects. Studies show that when common construction work tasks involving the sanding, drilling, chipping, grinding, cutting, sawing, sweeping, and blasting of concrete and concrete products are conducted without using dust controls, workers are exposed to airborne silica concentrations at levels far above the occupational exposure limits. Long-term or heavy short-term exposures to airborne silica dust can cause a disabling, sometimes fatal lung disease called *silicosis*. Crystalline silica dust (e.g., quartz dust) is also a carcinogen.

This guidance document is intended to assist employers to development an exposure control plan (ECP) that meets the requirements of the Occupational Health and Safety Regulation and protects workers from overexposure to silica dust. The document provides information on each of the required elements of an ECP, as follows:

- What is silica?
- Purpose of the ECP
- Responsibilities
- Risk identification, assessment, and control
- Education and training
- Safe work procedures
- Health monitoring
- Documentation

Each section of this document includes text in boxes that helps explain the purpose of each part of the ECP and gives some guidance about the type of information to include in each section. The remainder of the text (following the boxed text) is information that may be appropriate to your silica work operations and can be copied and pasted into your firm's plan.

Appendix A is a table that can be used as a risk assessment tool and an aid for making decisions regarding engineering controls and personal protective equipment (including respiratory protection). The table is divided into

- **Tasks**—Different work activities, such as grinding, chip hammering, and abrasive blasting
- **Control methods**—Recommended practices for isolating the work area (barriers and enclosures), local exhaust ventilation, and wetting methods
- **Personal protective equipment**—Recommended respiratory (and other) protection for different work activities (including air purifying respirators, pressure demand respirators, and disposable coveralls)
- **Comments**—Other information that might be important, depending on the engineering controls and personal protective equipment that are selected for the project.

For example, when grinding concrete walls, the recommendations could include

- Erect a barrier to prevent entry into the work area by unprotected workers.
- Use grinders with local exhaust ventilation.

- Use full or half-face air purifying respirators (depending on the nature of the work).
- Use eye protection, which must be worn with a half-face respirator.
- Wear disposable coveralls (depending on the nature of the work).
- Always consider using hearing protection when powered equipment is used.

What is silica?

Silica is the second most common mineral on earth and makes up nearly all of what we call "sand" and "rock." Silica exists in many forms—one of these, "crystalline" silica (including quartz), is the most abundant and poses the greatest concern for human health.

Some common materials that contain silica include:

- Rock and sand
- Topsoil and fill
- Concrete, cement, and mortar
- Masonry, brick, and tile
- Granite, sandstone, and slate
- Asphalt (containing rock and stone)
- Fibrous-cement board containing silica

Silica is so common that many workplace activities that create dust can expose workers to airborne silica. In British Columbia, the Occupational Health and Safety Regulation has established occupational exposure limits (OELs) for five different forms of silica; three of these are amorphous, and two are crystalline (quartz and cristobalite). The form most likely to cause serious problems for worker health is quartz.

How are workers exposed to silica?

Silica is a primary component of many common construction materials, and silica-containing dust can be generated during many construction activities, including

- Abrasive blasting (e.g., of concrete structures)
- Jackhammering, chipping, or drilling rock or concrete
- Cutting brick or tiles
- Sawing or grinding concrete
- Tuck point grinding
- Road construction
- Loading, hauling, and dumping gravel
- Demolition of structures containing concrete
- Sweeping concrete dust

Unprotected workers performing these activities, or working in the vicinity, can be exposed to harmful levels of airborne silica. Workers in other industries can also be exposed to silica, for example in the manufacture of toothpaste or pottery, or when loading coal (which can contain quartz) into the hold of a ship.

Health hazards

Crystalline silica dust can cause a disabling, sometimes fatal disease called silicosis. The fine particles are deposited in the lungs, causing thickening and scarring of the lung tissue. The scar tissue restricts the lungs' ability to extract oxygen from the air. This damage is permanent, but symptoms of the disease may not appear for many years.

A worker may develop any of three types of silicosis, depending on the concentrations of silica dust and the duration of exposure:

- Chronic silicosis—develops after 10 or more years of exposure to crystalline silica at relatively low concentrations
- Accelerated silicosis—develops 5 to 10 years after initial exposure to crystalline silica at high concentrations
- Acute silicosis—develops within a few weeks, or 4 to 5 years, after exposure to very high concentrations of crystalline silica

Initially, workers with silicosis may have no symptoms; however, as the disease progresses, a worker may experience:

- Shortness of breath
- Severe cough
- Weakness

These symptoms can worsen over time and lead to death.

Exposure to silica has also been linked to other diseases, including bronchitis, tuberculosis, and lung cancer.

Purpose of the ECP

Statement of purpose
The purpose of an exposure control plan is to set out your firm's approach to protecting workers from harmful exposure to airborne silica dust.

We have a duty to protect our workers from silica exposure on our worksites. Studies show that construction work tasks involving [*list examples of work activities here*] generate airborne silica levels well in excess of safe levels. Effective controls are available to protect workers from harmful exposure.

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

The work procedures we establish will protect not only our workers but all workers on our worksites.

Responsibilities

Responsibilities
Assignment of responsibilities for developing, implementing, and maintaining the ECP depends on the scope of the work and the size of the workplace. Examples of responsibilities for the employer, supervisors, and workers are provided below. Some of these points may have to be removed or new points added, depending on how your firm is organized.

Due to the significant risk posed by respirable silica, it is critical that all personnel involved in operations that could potentially create silica dust take specific action to ensure that, as much as possible, a hazard is not created.

The employer is responsible for

- Ensuring that the materials (e.g., tools, equipment, personal protective equipment) and other resources (i.e., worker training materials) required to fully implement and maintain this exposure control plan (ECP) are readily available where and when they are required.
- Providing a job-specific ECP for each project, which outlines in detail the work methods and practices that will be followed on each site. Considerations will include
  - Availability and delivery of all required tools/equipment
  - Scope and nature of grinding work to be conducted
  - Control methods to be used
  - Level of respiratory protection required
  - Coordination plan
- Conducting a periodic review of the effectiveness of the ECP. This would include a review of the available dust-control technologies to ensure these are selected and used when practical.
- Initiating sampling of worker exposure to concrete dust when there are non-standard work practices for which the control methods to be used have not been proven to be adequately protective.
- Ensuring that all required tools, equipment, and personal protective equipment are readily available and used as required by the ECP.
- Ensuring supervisors and workers are educated and trained to an acceptable level of competency.
- Maintaining records of training, fit-test results, crew talks, and inspections (equipment, PPE, work methods/practices).
- Coordinating the work with the prime contractor and other employers to ensure a safe work environment.

The supervisor (foreman and lead hand) is responsible for

- Obtaining a copy of the ECP from the employer, and making it available at the worksite
- Selecting, implementing, and documenting the appropriate site-specific control measures

- Providing adequate instruction to workers on the hazards of working with silica-containing materials (e.g., concrete) and on the precautions specified in the job-specific plan covering hazards at the location
- Ensuring that workers are using the proper respirators and have been fit-tested, and that the results are recorded
- Directing the work in a manner that ensures the risk to workers is minimized and adequately controlled
- Communicating with the prime contractor and other sub-contractors to ensure a safe work environment

The worker is responsible for

- Knowing the hazards of silica dust exposure
- Using the assigned protective equipment in an effective and safe manner
- Setting up the operation in accordance with the site-specific plan
- Following established work procedures as directed by the supervisor
- Reporting any unsafe conditions or acts to the supervisor
- Knowing how and when to report exposure incidents

Risk identification, assessment, and control

Risk identification and assessment

A key step in developing a silica exposure control plan is to identify the work activities that would put workers at risk of exposure.

- *Work activities that may generate airborne silica dust*—For silica, the route of exposure is through the inhalation of airborne dust. The employer should have a qualified person review the planned work activities to identify those that may generate airborne silica.
- *Identify workers at risk of exposure*—For example, workers who finish concrete would be at greater risk of exposure than plumbers or electrical workers.
- *Amount of exposure*—Some work activities generate more dust than others, and the amount of exposure should be estimated. Published resources are available that provide air sampling data and compare silica dust levels from various construction activities.
- *Duration of exposure*—Workers who grind concrete for a full shift would be at greater risk than workers jackhammering for an hour.

Worker exposure measurements

The Occupational Health and Safety Regulation lists an occupational exposure limit (OEL) for respirable crystalline silica (including quartz) of 0.025 milligrams per cubic metre (mg/m^3). This is a concentration to which nearly all workers could be exposed for eight hours a day, five days a week, without adverse health effects. However, as a suspected carcinogen, crystalline silica is also an ALARA substance, and exposures must be reduced to levels **a**s **l**ow **a**s **r**easonably **a**chievable below the OEL.

Studies show that when construction work tasks involving the drilling, chipping, grinding, cutting, and sawing of concrete and concrete products are conducted without using effective dust controls, workers are exposed to airborne silica concentrations at levels far above the OEL.

If a contractor wishes to use dust control methods for which worker exposure data is not available, the employer may need to conduct air sampling in order to ensure that the control methods are adequate. Remember, workers can be exposed to silica dust during cleanup activities and may expose their families if contaminated clothing is improperly handled.

Risk control options (see Regulation section 5.55, Type of controls)
Effective control options must be used to eliminate or reduce the risk to workers from the hazards of silica dust exposure. The following hierarchy of control measures must be followed:

- Elimination/substitution (e.g., using products with less silica or using work methods that would eliminate the need for surface grinding)
- Engineering controls (e.g., water, local exhaust ventilation, enclosure)
- Administrative controls (e.g., coordination of tasks with subcontractors, signage)
- Personal protective equipment (e.g., coveralls, respiratory protection)

Our firm commits to developing knowledge and expertise about these controls, and to establishing policies/procedures to protect workers from harmful exposure and to minimize reliance on respirators. Effective engineering controls such as HEPA vacuum attachments and wetting methods, which control silica dust at its source, are readily available in B.C. These controls have been proven to reduce airborne dust levels significantly when selected and operated in accordance with best practices. We know that engineering controls alone do not reduce airborne silica to safe levels; so in most cases other control measures, including respiratory protection, will be necessary.

The Occupational Health and Safety Regulation directs employers to use the best control technology available for the task and circumstance. If we take on a job that could release an unusually high amount of dust, and we are unsure of the adequacy of our control measures, we will conduct air sampling in order to ensure that control methods are protective.

We will reduce or eliminate worker exposure to silica dust by selecting a combination of the following controls listed in order of preference:

1. Elimination and substitution
2. Engineering
3. Administrative
4. Personal protective equipment

Elimination and substitution

Formwork example
Reasonable efforts must be taken to identify all practical approaches to eliminate or reduce the need for surface grinding. The parties who will typically take on this responsibility are the prime contractor, construction manager, formwork contractor, project architect, and project engineer. Means used to reduce surface grinding could include

- Selecting better grades of concrete that are less susceptible to imperfection
- Using better design and grades of formwork
- Using realistic architectural standards
- Using a system to identify problem formwork and ensure action taken to correct
- Planning work so that concrete grinding can be completed when wet so that dust release can be significantly reduced

We recognize the importance of planning the work in order to minimize the amount of silica dust generated.

- During the project planning phase, we will advocate for the use of methods that reduce the need for cutting, grinding, or drilling of concrete surfaces (e.g., formwork planning).
- Whenever possible, we will schedule work when concrete is still wet, because we know that much less dust is released at that time.

Engineering control of dust

Selecting an appropriate control measure depends on the specifics of the operation. In some cases, local exhaust ventilation (LEV) is more effective at controlling exposure (e.g., during grinding operations) than wetting methods. In a different application, wetting may be more effective (e.g., during cutting operations) than LEV. However, using LEV may reduce the amount of final cleaning required, as the silica dust is captured.

Our dust control systems may employ three well-established techniques:

- Local exhaust ventilation (LEV)
- Wet dust suppression (WDS)
- Restricting or isolating the work activity with barriers or full enclosures (this may be the only option where LEV or WDS is not practical or effective)

Local exhaust ventilation (LEV)—safe work practices

LEV systems

These systems include a shroud (a suction casing that surrounds the wheel/stone), a hose attachment, and a vacuum system. The dust-laden air is collected within the shroud, drawn into the hose attachment, and conveyed the length of the corrugated hose to the vacuum, where it is filtered and discharged.

Many grinders can be purchased with LEV dust control attachments, which are uniquely designed for the equipment and the work activity (e.g., there are specific grinders with LEV manufactured for tuck point grinding). Where a shroud cannot be purchased for a grinder, shrouds can be custom fabricated for grinders of all different sizes. For example, shrouds for corner and 90-degree areas can be fabricated or purchased.

Silica dust is very abrasive to LEV equipment, which must be regularly inspected for damage and properly maintained.

When LEV is used in our work, we will employ the following systems and safe work practices:

- Vacuum attachment systems to capture and control the dust at its source whenever possible.
- Dust control systems (used regularly and well maintained).

- Grinding wheels operated at the manufacturers' recommended rpm (operating in excess of this can generate significantly higher airborne dust levels).
- Retrofit shrouds or exhaust cowlings for corner grinding; use manufacturer-specified rpm speeds and a well-maintained HEPA vacuum.
- Diamond stone grinders, which allow for the use of a more efficient suction casing on the grinder, whenever practicable.
- HEPA or good quality, multi-stage vacuum units approved for use with silica dust. [The vacuum units should be capable of creating a target airflow of at least 70 cfm. This should achieve a face velocity at the shroud of about 1.3 m/s (260 fpm)—the higher the face velocity, the more dust captured at source.]
- Work planning, so that concrete grinding can be completed when wet (dust release can be significantly reduced).
- Good housekeeping work practices (for example, use vacuums with high-efficiency particulate air (HEPA) filters, or use wet sweeping).
- Train workers and supervisors on how to properly use and maintain the equipment.

Wet methods for dust control—safe work practices

Water spray systems

These systems are designed to apply water to the cutting or grinding surface to wet the surface and prevent the resulting dust from becoming airborne. Many construction tools/equipment types can be purchased with wet spray attachments. Water can also be manually applied to the concrete surface before and during the work (grinding, drilling, cutting, etc).

Wetting is very effective at reducing dust release at the source and, in fact, may be more effective than local exhaust ventilation for slab and masonry cutting. A drawback to this method of dust control is that the dust is not collected—the wet slurry must be cleaned up so that the dust does not dry and become airborne.

Many of the tools used in concrete finishing can be fitted with wetting attachments. These grinders generally have smaller grinding surfaces that can be used in unique work locations such as window casements.

Water spray systems are available for both stationary and portable masonry and other concrete- or block-cutting tools (e.g., saws).

Work surfaces can also be wetted manually or using a water "mister" (e.g., during concrete chipping and jackhammering). A separate water supply system would have to be available on site from a plumbed facility or a portable pressurized tank.

Note Water spray can effectively reduce exposure levels but is not feasible in many applications (e.g., tuck point grinding and cutting fibrous cement board) because water can result in material discoloration and expansion, building damage, and waste water disposal problems.

Use of water spray controls presents potential safety hazards, which include electrocution, slipping, and potentially hypothermia.

When water spray systems are used in our work, we will follow these safe work practices:

- Pneumatic grinders will be used instead of electric-powered grinders if water is the method of control.
- Pressure and flow rate of water will be controlled in accordance with tool manufacturers' specifications (for cutting saws, a minimum of 0.5 litres of water per minute [0.13 gallons/minute] should be used).
- When sawing concrete or masonry, we will use only saws that provide water to the blade.
- Wet slurry will be cleaned from work surfaces when the work is completed, using a wet vacuum or wet sweeping.

Barriers and enclosures—safe work practices

Barriers

Barriers are used to isolate the work area from the rest of the project and to prevent entry by unauthorized workers. They do not prevent dust drift and should only be used where natural ventilation is sufficient and dust release is controlled. Barriers will be constructed to notify other workers that concrete grinding work is underway and access to the immediate work zone is restricted to authorized personnel.

Enclosures

Enclosures can contain a dusty atmosphere. They can consist of a partial structure (poly draping or partial plywood hoarding) or a full enclosure equipped with some capacity for maintaining a lower than ambient pressure inside (negative pressure). For partial enclosures, airflow in the enclosure could be created by setting up a ventilating (blower) fan where the dusty air would be discharged to an unoccupied outdoor location. This option should only be used when dust levels are low or to supplement LEV or wet methods such as in stairwells.

Full enclosures can be fitted with a negative air unit that pumps air from inside the structure. Negative air units draw dusty air through a large HEPA filter panel before the air is discharged outside the enclosure. Another option to create airflow in the enclosure is to set up ventilating (blower) fans where the dusty air can be discharged to an unoccupied outdoor location.

Commercially available, collapsible (pop-up) enclosure structures are readily available in various sizes.

When barriers or enclosures are used in our work, we will follow these safe work practices:

- The site foreman will determine the type and design of barrier or enclosure (based on the work activity and the work area) and ensure it is constructed in accordance with the workplan. Barriers may be simple hazard-flagging ribbon or more restrictive hoarding.
- We will use commercially available negative air units when constructing a full enclosure.

Administrative controls

Administrative controls involve activities that are not directly related to the actual physical work, but are important strategies to support the exposure control plan and ensure that all workers are protected from exposure to silica dust. Examples of administrative controls include

- Posting warning signs
- Rescheduling grinding at different times than other work
- Relocating unprotected workers away from dusty work

We will follow these safe work practices:

- Exposure control plans and the site risk assessment/workplan will be submitted to the general contractor prior to the start of work.
- We will establish procedures for housekeeping, restricting work areas, personal hygiene, worker training, and supervision.
- As part of our project planning, we will assess when silica dust may be generated and plan ahead to eliminate or control the dust at the source. We recognize that awareness and planning are key factors in the prevention of silicosis.
- Warning signs will be posted to warn workers about the hazards of silica and to specify any protective equipment required (for example, respirators).
- Work schedules will be posted at the boundaries of work areas contaminated with silica dust.
- Work that generates silica dust will be conducted after hours, when access to other unprotected workers cannot be restricted.

Site-specific exposure control plan

The employer may require a specific exposure control plan (ECP) for each worksite. This plan would be based upon the corporate ECP and would include the following:

- Contractor name, address, and contact information (names and phone numbers)
- Worksite information (project name, location, and site contacts)
- Scope of work and list of tasks
- Site-specific hazards and risk assessment
- Dust (and other) control procedures and equipment
- Safe work procedures
- Worker training checklist

Examples of site-specific ECP forms are included in Appendix B.

We will develop a site-specific exposure control plan to cover project-specific issues (e.g., scope of work, project location and site-specific hazards) and to be kept available at the worksite.

Personal protective equipment

Respirators

- Respirators should not be relied on as a primary means of preventing or minimizing exposure to silica dust.
- Select respiratory protective equipment (RPE) very carefully, as different types can give widely varying levels of protection. Employers may be able to rely on available exposure data to select the appropriate respiratory protection. Improper selection can result in serious worker exposure.
- A review of several research reports indicates that when effective engineering controls (e.g., LEV and wet methods) are used, a half-face air purifying respirator may be adequate to protect workers from harmful exposure to silica dust. When engineering controls are not feasible, it is likely that powered air purifying or air-line respirators will be required for worker protection.
- Guidance on the selection and use of RPE is contained in the WorkSafeBC publication *Breath Safer*. Further information can be obtained from respirator manufacturers. Occupational hygienists can provide information on approval and suitability.
- The Occupational Health and Safety Regulation requires the development of a respiratory protection program that sets out in detail how respiratory protective equipment will be selected, supervised, and maintained. Resource materials are available from WorkSafeBC and from safety supply firms that supply respirators.

Respiratory protection

- All workers who wear respirators will do so in adherence with our respirator program.
- Respiratory protection will be selected based upon the site-specific risk assessment.
- Only NIOSH-approved respirators will be used.
- Workers who wear respirators will be clean-shaven. Filtering facepiece respirators give little or no protection to workers with beards, and even a minor growth of stubble can severely reduce the effectiveness of respiratory protection.
- All workers who wear respirators will be fit-tested.
- Workers will be properly trained in the use of respirators, and a high standard of supervision, inspection, and maintenance will be followed.

Protective clothing

Workers will wear protective clothing as specified in our task-specific safe work procedures to prevent contamination of worker clothing. Workers will not use compressed air to clean themselves, their clothing, or their equipment.

Education and training

The employer must ensure that workers are informed about the contents of the ECP and provided with adequate education and training to work safely with and around materials that contain silica.

We will train all workers potentially exposed to airborne silica dust in the following:

- Hazards associated with exposure to silica dust
- The risks of exposure to silica
- Signs and symptoms of silica disease
- Safe work procedures to be followed (e.g., setup of enclosures, disposal of silica waste, personal decontamination)
- Use of respirators and other personal protective equipment (e.g., donning and doffing of personal protective equipment, and cleaning and maintenance of respirators)
- Use of control systems (e.g., LEV and wet methods)
- How to seek first aid (for example, the location and use of eyewash stations)
- How to report an exposure to silica dust

Records of training will be kept, as specified in the Occupational Health and Safety Regulation.

Safe work procedures

Employers must develop site-specific, written work procedures for controlling the risk of exposure to silica. These procedures must be made readily available to workers.

Safe work procedures and hygiene practices are on-the-job activities that reduce the exposure potential from contaminated surfaces and work areas. Silica can also accumulate on the hands, clothing, and hair. From there it can be disturbed, re-suspended in air, and inhaled. Workers should therefore be able to wash and shower at the end of each shift. There should be no smoking, eating, or drinking in contaminated areas, and lunches should be stored in an uncontaminated area. It is important to follow safe work and hygiene practices whenever silica is present.

Safe work procedures must include task specific instructions, such as

- Safe operation of all equipment, including dust control attachments and related equipment
- Setting up enclosures
- Vacuum maintenance
- Cleanup procedures
- Worker decontamination procedures (hygiene facilities to permit proper handwashing are a basic expectation under all ECPs)

Health monitoring

Workers who are exposed to silica dust on an ongoing basis should be enrolled in a medical monitoring program, which might include physical examinations, chest x-rays, and lung function testing.

Documentation

Records must be kept of the following:

- All workers who are exposed to respirable silica dust while on the job
- Worker education and training sessions
- Respirator fit-testing
- Equipment maintenance and repair
- Worksite inspections

The exposure control plan must be reviewed at least annually and updated as necessary by the employer, in consultation with the workplace health and safety committee or the worker health and safety representative.

Appendix A: Risk assessment and controls table

Task		Control methods	Personal protective equipment	Comments
Grinding	Concrete interior/exterior walls, ceilings, and other flat surfaces	• Barrier or enclosure systems are required to restrict access to the work area. • Local exhaust ventilation (LEV)—use concrete grinders with HEPA vacuum attachments. • Grinding using wet method of dust control may be an option for specific circumstances. These circumstances must be listed on the site workplan. • Personal protective equipment.	• Half-mask air purifying respirator equipped with 100 series HEPA filters. • Full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters, when heavy work and poor dilution ventilation in work area. • Disposable coveralls are recommended for all grinding work and are required for stairwell and similar work. • Eye protection should be worn when using a half-face respirator.	• Vacuum systems equipped with HEPA filtration are the best control options for flat surface grinding. Ensure they are well designed for this type of work. A variety of suitable systems are readily available. • Very little visible dust should be present in the air. • Inspect the LEV unit frequently to ensure it is operating properly and the filters are not overloaded. • Hearing protection should be worn when using powered equipment. • When LEV and wet grinding systems cannot be used, dry grinding is permitted, provided a full enclosure system is constructed. Workers should wear full-face respirators and disposable coveralls.
	Window casements and other working areas with space or other constraints	• Barrier or enclosure systems are required to restrict access to and contain the work area. • Local exhaust ventilation (LEV) should be used when practical and effective. • Wetting methods of control can be used to supplement LEV or when LEV methods are not practical or effective. • Personal protective equipment.	• Half-face or full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters. • Eye protection should be worn when using a half-face respirator.	• Due to space constraints, it may not be possible to use an LEV-equipped grinder. • Water flow and the rpm of the grinder should be properly adjusted for the material being worked on. • Caution—water may produce a slipping hazard. • Hearing protection should be worn when using powered equipment. • Electric shock hazards need to be assessed and controlled when using wet methods (pneumatic grinders may be a another option).

Task		Control methods	Personal protective equipment	Comments
Grinding	Tuck point grinding	• Barrier or enclosure systems are required to restrict access to and contain the work area. • Local exhaust ventilation (LEV)—use specially designed tuck point grinders with HEPA vacuum attachments. • A specially designed oscillating tool is available for mortar removal. The tool can be purchased with an LEV attachment. • When LEV cannot be used, construct an enclosure including a negative air unit for dilution ventilation. • Personal protective equipment.	• Full-face air purifying respirator equipped with 100 series HEPA filters. • For challenging jobs where LEV or wetting control cannot be used, full-facepiece supplied-air respirators operated in pressure-demand mode or full-facepiece supplied air respirators operated in continuous-flow mode will be required. • Disposable coveralls should be worn for tuck point grinding work.	• Hearing protection should be worn.
	Enclosed areas (e.g., stairwells, elevator shafts)	• Full enclosure systems are required to restrict access to and contain the work area. • LEV—use concrete grinders with HEPA vacuum attachments. • Have dedicated grinders available with corner and flat-end shrouds. • Some wet grinding may be acceptable—the approved tasks must be listed on the site workplan. • Personal protective equipment.	• Full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters. • If effective dilution ventilation within the work area enclosure cannot be established, then full-facepiece supplied-air respirators operated in pressure-demand mode or full-facepiece supplied air respirators operated in continuous-flow mode will be required. • Disposable coveralls must be worn • Hearing protection should be worn.	• LEV attachments for concrete grinders are not effective for certain non-flat grinding surfaces; therefore, full-facepiece supplied-air respirators operated in pressure-demand mode or full-facepiece supplied air respirators operated in continuous-flow mode will be required. • HEPA filters should be checked routinely throughout the work shift to ensure they are not clogged with silica dust.
	Floor grinding	• Barrier or enclosure systems are required to restrict access to and contain the work area. • Local exhaust ventilation—a variety of specially designed floor grinding systems are available equipped with HEPA filtration. These systems should be used when practical. • Wet grinding may be an option, provided acceptable slurry cleanup procedures are documented and followed. • Personal protective equipment.	• Half-face air purifying respirator equipped with P100 series HEPA filters. • Full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters, when working in an enclosed area and visible dust is observed. • Disposable coveralls should be considered. • Eye protection should be worn when using a half-face respirator. • Hearing protection should be considered when using powered equipment.	• Portable shot blaster (floor smoothing) systems equipped with dust controls are available for floor grinding. • When large amounts of concrete are to be removed, filter systems should be more substantial (e.g., two vacuums connected in series—one large course filter system followed by a finer filter system). This will improve efficiency of the overall unit. • Vacuum systems will likely need to be cleaned and inspected frequently.

Task		Control methods	Personal protective equipment	Comments
Drilling	Walls, floors, and ceilings	• Barriers to restrict access to the work area. • Dust capture tool (e.g., a dust cap, LEV, or wetting method). • Personal protective equipment.	• Half-mask air purifying respirator equipped with P100 series HEPA filters. • Eye protection should be worn when using a half-face respirator. • Waterproof equipment where appropriate. • Hearing protection should be considered when using powered equipment.	• Hammer drills (variety of sizes) are available. Some units are equipped with local exhaust ventilation attachments (with HEPA filters). • A "dust cap" is a dust-capturing device that fits between the drill and the working surface (on the end of the drill). This is useful for overhead ceiling and wall drilling. A few different types are available. • When water is used as a dust control, the slipping hazard must be considered and managed. • Large concrete drills can be purchased that are equipped with a water spray attachment. Any wet slurry must be cleaned up when the work is completed.
Chip hammer-ing and jackham-mering	Walls, floors, and ceilings	• Barriers must routinely be established to restrict access to these work areas. Enclosure systems must be constructed when controls are not effective at reducing visible airborne dust. • Local exhaust ventilation (see comment) when practical. • Wet methods can be used and are often very effective for floor hammering. • Personal protective equipment.	• Half-face or full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters, depending on the effectiveness of the controls. • Disposable coveralls should be worn when using full-face respirators. Waterproof PPE (and clothing) required when wetting methods are used. • Eye protection should be worn when using a half-face respirator. • Hearing protection should be considered when using powered equipment.	• LEV could include a negative air unit or HEPA vacuum positioned near the working surface. These controls may be practical when chip hammering walls or other vertical surfaces or locations where water cannot be used. • Wet methods could include a portable airless sprayer, air mister, or hose sprayer. Slurry should be cleaned up when the work is completed to avoid secondary dust exposure hazard. • Caution—water may produce electrocution and slipping hazards.

Task		Control methods	Personal protective equipment	Comments
Cutting of concrete slab and concrete masonry products		• Barrier or enclosure systems are required to restrict access to and contain the work area. • Wetting methods of control can be very effective and should be used as a first choice when saw cutting concrete or concrete products (see comment). • LEV systems for concrete saws must be considered as a dust control when wet methods cannot be used. • Personal protective equipment.	• Half-face or full-face air purifying respirator with 100 series HEPA filters when wet or LEV controls used. • Disposable coveralls should be worn when using full-face respirators. • Eye protection should be worn when using a half-face respirator. • Hearing protection should be considered when using powered equipment.	• A water flow rate of 0.5 litres per minute (0.13 gallons/minute) is the recommended minimum for saws equipped with wetting controls. • Caution—water may produce electrocution and slipping hazards. • Slurry cleanup of interior surfaces must be part of the workplan.
Abrasive blasting of concrete surfaces	Exterior and interior concrete surfaces	• Barrier systems are required when dust can be controlled at the source. • Full enclosure system required when source control of dust cannot be established • Blasting units that capture the dust (e.g., shot recycle systems) should be used when practical. • Blast systems that discharge a wet slurry shot should be used when practical. • Personal protective equipment.	• Full-face supplied-air helmet or hood respirator with a neck shroud, operated in continuous-flow mode. • Heavy waterproof protective clothing should be worn. • Hearing protection should be considered when using powered equipment.	• Caution—water may produce electrocution and slipping hazards. • Slurry cleanup of interior surfaces must be part of the workplan.
Cleanup	General cleanup	• Barrier to restrict access to and contain the work area. • Full enclosure systems can be used in dust-sensitive areas or when unprotected workers cannot be restricted from entering cleanup work areas. • Use vacuum (HEPA-equipped) when practical. • Wetting of dust prior to sweeping/scooping to be used when practical. • Planning for bulk/coarse debris cleanup followed by fine-dust cleanup can reduce the amount of dry sweeping. • Dust suppressants should be used if dry sweeping is the only practical option.	• Half-face air purifying respirator when vacuum systems or wet sweeping methods are used. • Full-face or powered air purifying respirator (PAPR) with P100 series HEPA filters for all other cleanup. • Eye protection should be worn when using a half-face respirator. • Hearing protection should be considered when using powered equipment.	• Dust-suppressing agents or absorbents are only marginally effective in minimizing airborne dust during sweeping. • Safe work procedures must be followed. • Rolling a seam of dust suppressant into fine, settled dust is reported to work better than a wide-spread scattering.

Task		Control methods	Personal protective equipment	Comments
Cleanup	Vacuum bag/filter changing and maintenance of LEV	• Barrier to restrict access to the work area. Signage marking an area removed from other workers may be adequate.	• Half-face air purifying respirator with P100 series HEPA filters. • Eye protection should be worn when using a half-face respirator.	• Safe work procedures must be established and followed. • Many vacuums are designed to collect the dust in a bag (rather than loose in the canister) that can be tied and disposed without generating airborne dust. Any new vacuum systems purchased should have this design feature.
Cutting fibrous cement board		• A variety of dust control options are acceptable: o Fibre cement shears o Score and snap knife o Dust-reducing saws (circular and jig) equipped with HEPA vacuum o Wetting method if practical	• Half-face air-purifying respirator with N100 series HEPA filters when using saws. • N95 dust mask when using fibre cement shears indoors.	• A number of equipment manufacturers make saws (and saw blades) specially designed for cutting fibre cement board that can be purchased with HEPA. • Carbide score and snap knives have been shown to be an efficient and productive means of cutting fibrous cement board.

Notes

LEV = local exhaust ventilation
PAPR = powered air-purifying respirator

Appendix B: Sample site-specific exposure control plan forms

SILICA DUST EXPOSURE CONTROL PLAN

Date control plan completed:		
Prime contractor:	Superintendent:	
Project manager:	CSO/First aid attendant:	
Project:	Address:	
Company completing work:		
Address:	Contact:	
Contact phone:	Contact fax:	
On-site supervisor(s):		
Worker(s):		
Scope of work to be completed:		
Work start date:	Duration: ☐ Days ☐ Months ☐ Years	
Employer responsible for:		
Supervisor responsible for:		
Worker responsible for:		

HAZARDS IDENTIFIED (other than silica dust)	**CONTROL MEASURE(S)**
☐ Falls	
☐ Slipping	
☐ Confined space	
☐ Workers above	
☐ Workers below	
☐ Noise	
☐ Electrical	

Overview of work procedure (How are you going to work safely?):

Workers trained in (training records must be available for review):			
Proper use of grinding equipment	Y☐ N☐	Proper use of admin controls	Y☐ N☐
Proper use of engineering controls	Y☐ N☐	Proper use of PPE	Y☐ N☐
Proper disposal methods	Y☐ N☐	Other (fall protection, swing stages, etc)	Y☐ N☐

Respirators (Refer to ECP for respirator requirements)		
Required: Y☐ N☐	Available: Y☐ N☐	Fit-tested: Y☐ N☐

PPE required for scope of work (other than respirator)

☐ Coveralls ☐ Gloves ☐ Rubber boots ☐ Eye protection ☐ Reflective vest ☐ Hearing protection

Documents to be attached to control plan (☑ if present)

☐ Exposure control program ☐ Respiratory protection program ☐ Training records ☐ SWP (tools and equipment)

SILICA DUST EXPOSURE CONTROL PLAN

Project management signature	Position:	Date:
Contractor supervisor signature	Position:	Date:

Task/risk management matrix (relating to silica dust) use table 1 for codes, separate with a comma (,)

#	Date/Duration		Task	Controls		PPE	Supplies/ Equipment
				Engineering	Administrative		

Notes (For task/risk management matrix above. Use # to indicate which task the note relates to.)

SITE INSPECTION CHECKLIST (complete pre-work & periodically during project)

Engineering controls		Problem noted (DETAIL)	Problem corrected (DETAIL)
Available at site	Y☐ N☐		
Operating correctly	Y☐ N☐		
Used appropriately	Y☐ N☐		
Effective in dust control	Y☐ N☐		
Administrative controls			
Available at site	Y☐ N☐		
Used appropriately	Y☐ N☐		
In place before work start	Y☐ N☐		
Effective	Y☐ N☐		
Cleanup			
Vacuum used properly	Y☐ N☐		
Large pieces picked up	Y☐ N☐		
Vacuum capacity maintained	Y☐ N☐		
Pre-filters in place	Y☐ N☐		
Vacuum attachments used	Y☐ N☐		
Collection bags in place	Y☐ N☐		
Waste properly disposed of	Y☐ N☐		

TABLE 1 (Codes for task/risk management matrix)

Engineering controls		Administrative controls		PPE		Supplies/Equipment	
1	Exhaust fan	1	Signage	1	Respirator	1	Hand grinder
2	LEV	2	After hours work	2	Gloves	2	Ceiling grinder
3	Wetting	3	Scheduling	3	Coveralls	3	Floor grinder
4	Partial enclosure			4	Hearing protection	4	Disposal bags
5	Full enclosure			5	Eye protection	5	HEPA filter (vacuum)
6	Shroud			6	Reflective vest	6	HEPA filter (respirator)
7	Barriers			7	Rubber boots (CSA)	7	Shovel
				8	Fall arrest	8	Lifeline

Site-specific silica exposure control plan

Location: _____ **Date:** _____

Work description:

Primary silica control options (check those options used and explain use if needed)

♦ Substitution controls (using procedures or products that do not create silica; must review MSDSs)

Other means of demo: _____

Different products: _____

Other substitutions: _____

♦ Engineering controls (when using ventilation, draw air out and don't expose others to exhaust dusts)

Vacuuming: _____

Wetting: _____

Ventilation: _____

Isolation: _____

Other means: _____

♦ Administration controls (reducing exposure by work schedules, timing, or planning options)

Control points: _____

Work schedule: _____

Other means: _____

Secondary silica control options (check those options used and explain use if needed)

♦ Personal protective equipment

Half-mask respirators: _____ Cartridge type: _____ Fit tests confirmed: _____

Full-face respirators: _____ Cartridge type: _____ Fit tests confirmed: _____

Supplied air units: _____

Coveralls required: _____

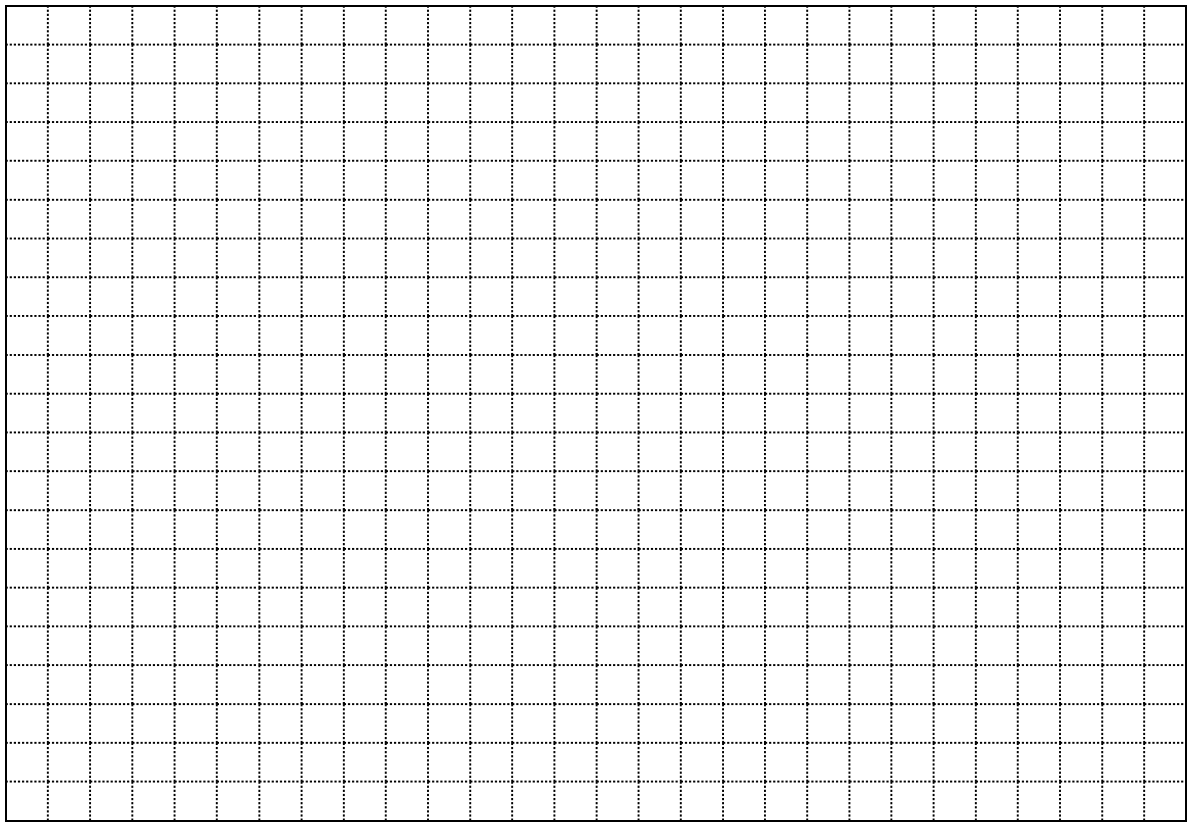
♦ Hygiene and decontamination options (reducing exposures after work has stopped or during breaks)

Water or washing facilities on site: _____

Vacuuming clothing/self: _____

Safe work procedures and other details: _____

Ventilation plan (sketch)



⇦ Show direction of airflow including makeup air locations and discharge air outlets

Area or location in building of ventilation plan (e.g., floor #, wing)

Date plan was reviewed by workers and posted for workers to see

Types of neg. air fans & no.'s *

* Indicate on plan by number the location of the negative air fans

Ventilation safety checklist

- ☐ Makeup air free of possible contaminants
- ☐ Exhaust fan operation has failure warning
- ☐ Dilution fans not stirring up dust
- ☐ Wetting of materials used to keep dust down
- ☐ Workers not placed between contaminants created and exhaust inlet ports
- ☐ Discharge air not affecting others
- ☐ All workers equipped with approved respirators

Note: Attach additional sheets if needed or other documents if required due to hazards or work conditions.

Print supervisor's name

Supervisor's signature