



CONCRETE
ALBERTA

CRYSTALLINE SILICA

Exposure Control Policy,
Program & Procedure



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PART 1: INTRODUCTION

Silica Exposure Prevention & Control

Silica is the second most common mineral on earth, found in the common form as “sand” and “rock”. Silica is the compound formed from the elements silicon (Si) and oxygen (O) and has a molecular form of SiO_2 . The three main forms or ‘polymorphs’ of silica are alpha quartz, cristobalite and tridymite. The polymer most abundant and most hazardous to human health is alpha quartz, and is commonly referred to as crystalline silica.

Health Hazards Associated with Silica Exposure

The health hazards of silica come from breathing in the dust. If crystalline silica becomes airborne through industrial activities, exposures to fine crystalline silica dust (specifically exposure to the size fraction that is considered to be respirable) can lead to 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 the symptoms of the diseases may not appear for many years. As noted in the following Figure, (respirable) silica dust is very small, and is not visible to the human eye.

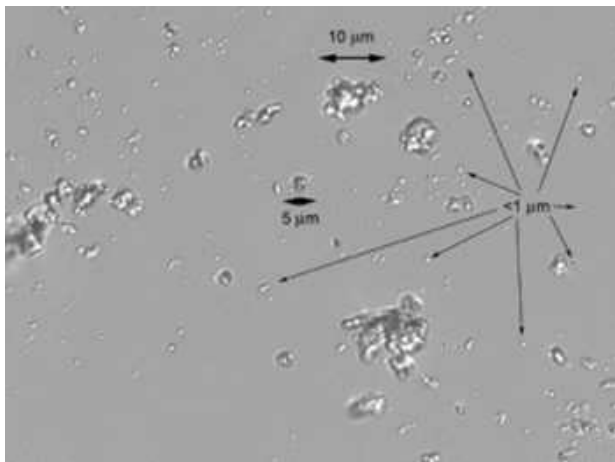


Figure 1: Crystalline silica up close. 1000 times magnification of sand dust. These particles are small enough to be trapped in lung tissue.



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

- Chronic Silicosis: Develops after 10 or more years of exposure to crystalline silica and relatively low concentrations.
- Accelerated Silicosis: Develops 5 to 10 years after initial exposure to crystalline silica at high concentrations.
- Acute Silicosis: Develops within 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, workers may experience:

- Shortness of Breath
- Weakness
- Severe Cough



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.

Silica Exposure

Many activities performed can result in the creation/release of silica dust, thus exposing your employees. These activities include, but are not limited to:

- Slumping concrete
- Washing concrete trucks
- Chipping concrete truck drums
- Chipping concrete truck exterior
- Dust from unpaved roads and storage areas
- Concrete grinding at jobsites and labs
- Re-crushing concrete operations



PART 2: STATEMENT OF PURPOSE

Silica Exposure Prevention & Control

You are committed to providing a safe and healthy workplace to your employees and recognize the right of workers to work in a safe and healthy work environment and ensure that your activities do not adversely affect the health and safety of any other persons.

This commitment includes ensuring every reasonable precaution is taken to protect your employees (and others) from the adverse health effects associated with exposure to silica.



PART 3: RESPONSIBILITIES

Silica Exposure Prevention & Control

Due to the risk posed by respirable silica, it is critical that all personnel involved in activities that could potentially create silica dust take specific actions to ensure that, as much as practicable, a hazard is not created. In recognition of this, the following (Silica related) responsibilities have been established and must be adhered to:

Senior Management Responsibilities

- Regularly evaluating new equipment and technologies that become available, as able/appropriate, purchasing the “best available” equipment/technologies (within your capabilities). Equipment/technologies with (silica) dust suppression and/or capture technologies will generally be given preference over equipment/technologies that lack such.
- Implement a suitable respirable silica exposure monitoring program, or otherwise ensuring representative exposure monitoring results are available. The purpose of the program will ensure that (over time) your company will have quantifiable silica exposure data available for all regularly occurring, as well as reasonably foreseeable, work activities.
- Ensure project and/or task specific Exposure Control Plans (ECPs) are developed, communicated and effectively implemented as appropriate.
- Ensure that all employees (i.e. Managers, Supervisors and Workers) receive the necessary education and training related to this Policy, as well as project/task specific ECPs.
- Maintain applicable records (i.e. exposure sampling, inspections, respirator fit tests, training records, etc.) in accordance with your companies record retention procedures/practices.
- In conjunction with your companies Health & Safety Committee, conduct a review of this Policy, as well as: (1) project/task specific ECP’s, (2) available exposure monitoring data, (3) Industry/Regulatory information, and (4) new/emerging equipment/technologies on a regular (i.e. annual) basis.



Supervisors Responsibilities

- Obtain a copy of the project/task specific ECPs (and/or other similar such information), and ensuring such are made available at each work site.
- Ensure that all the tools, equipment, PPE and materials (including water) necessary to implement the ECP is available (and in good working order) prior to allowing work activities to commence.
- Ensure that all workers (under the supervisor's direction and control) have received the necessary education and training. As appropriate, each supervisor must ensure that workers are available to “demonstrate competency” for identified tasks.
- Ensure that workers adhere to the project/task specific ECP, including PPE and personal hygiene (i.e. including be clean shaven where the respirator seals to the user's face) requirements.
- Coordinate work activities with the Owner/Prime Contractor as required, and/or otherwise implementing the controls necessary to protect others (i.e. erecting of barricades and signage) who could be adversely effected by your companies acts (or omissions).

Employees & Subcontractors Responsibilities

- Know the hazards of silica dust exposure.
- Use the assigned protective equipment in an effective and safe manner.
- Work in accordance with the project/task specific ECP.
- Report (immediately) to their supervisor, any hazards (i.e. unsafe conditions, unsafe acts, improperly operating equipment, etc.).



PART 4: EXPOSURE LIMITS

Silica Exposure Prevention & Control

Exposure Limits/Considerations

The Occupational Health & Safety Regulation (OHSR) lists an occupational exposure limit (OEL) for respirable crystalline silica (including quartz) of 0.025 milligrams per cubic metre (mg/m³). 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 As Low As Reasonably Achievable below the OEL.

Schedule 1 of the Alberta Occupational Health and Safety Code - AR 191/2021 (effective March 31, 2023):

https://kings-printer.alberta.ca/documents/OHS/OHSCode_March_2023.pdf

Schedule 1							OCCUPATIONAL HEALTH AND SAFETY CODE		S1-29	
Substance	CAS number	8-hour occupational exposure limit			15-minute or ceiling (c) occupational exposure limit		Substance interaction 1, 2, 3	Carcinogenicity A1, A2		
		ppm	mg/m ³	f/cc	ppm	mg/m ³				
n-Propyl nitrate	627-13-4	25	107	-	40	172	-			
Propyne (Methyl acetylene)	74-99-7	1000	1640	-	-	-	-			
Pyrethrum	8003-34-7	-	5	-	-	-	-			
Pyridine	110-86-1	1	3.2	-	-	-	-			
Pyrocatechol (Catechol)	120-80-9	5	23	-	-	-	1			
Quartz, Respirable particulate	14808-60-7	-	0.025	-	-	-	-	A2		
Quinone	106-51-4	0.1	0.4	-	-	-	-			
RCF (Refractory Ceramic Fibres)	-	-	-	0.2	-	-	-	A2		
RDX (Cyclonite)	121-82-4	-	0.5	-	-	-	1			
Refractory Ceramic Fibres (RCF)	-	-	-	0.2	-	-	-	A2		
Resorcinol	108-46-3	10	45	-	20	90	3			
Rhodium, as Rh	7440-16-6	-	-	-	-	-	-			
Metal and Insoluble compounds, Soluble compounds	-	-	1	-	-	-	3			
	-	-	0.01	-	-	-	-			
Rock Wool Fibres	-	-	-	1	-	-	-			
Ronnel	299-84-3	-	5	-	-	-	-			
Rotenone (commercial)	83-79-4	-	5	-	-	-	-			
Rubber solvent (Naphtha)	8030-30-6	400	1590	-	-	-	-			
Selenium and compounds, as Se	7782-49-2	-	0.2	-	-	-	3			
Selenium hexafluoride	7783-79-1	0.05	0.4	-	-	-	-			
Sesone (Sodium-2,4-dichlorophenoxyethyl sulphate)	136-78-7	-	10	-	-	-	3			
Silane (Silicon tetrahydride)	7803-62-5	5	6.6	-	-	-	3			
Silica-Crystalline, Respirable particulate										
Cristobalite	14484-46-1	-	0.025	-	-	-	-	A2		
Quartz	14808-60-7	-	0.025	-	-	-	-	A2		
Silicic acid, tetraethyl ester (Ethyl silicate)	78-10-4	10	85	-	-	-	-			
Silicon carbide, nonfibrous	409-21-2	-	10	-	-	-	3			
Total particulate	-	-	3	-	-	-	3			
Respirable particulate	-	-	-	-	-	-	-			
Silicon carbide, fibrous (including whiskers)	409-21-2	-	-	0.1	-	-	-	A2		
Silicon tetrahydride (Silane)	7803-62-5	5	6.6	-	-	-	3			



PART 5: RISK IDENTIFICATION

Silica Exposure Prevention & Control

Risk Identification

Silica is contained on many of the products that you use/encounter. For example, reference your cement provider's Safety Data Sheet (SDS) as cement reveals the potential for up to 0 - 0.2% crystalline silica, as well as silica contained in the aggregate. In addition, silica dust can be readily released through various tasks performed. The SDS for the finished ready-mix product estimates silica content between 0 - 90% by weight.

The health hazards of silica come from breathing in the dust. In addition to identifying the specific activities/areas where personnel could be exposed to silica dust, the "amount" of exposure and "duration" of exposure must also be considered. With consideration to these three factors, activities performed that expose your employees to the dust include, but are not necessarily limited to:

- Loading, unloading and conveying of aggregates at our plant.
- Batching of concrete, including the addition of Portland cement products and water to the aggregate mix.
- Washing concrete trucks of dust and debris following loading.
- Chipping hardened concrete accumulations on the exterior (i.e., collection hopper and chute) as well as the interior of the drum.



PART 6: RISK ASSESSMENT

Silica Exposure Prevention & Control

Risk Assessment

There are a variety of methods to assist with the “assessment” of possible and actual silica exposures. These methods will include, but may not necessarily be limited to:

- Reviewing worker exposure levels obtained through the collection of crystalline silica samples using personal sampling cyclone pump, and consistent with NIOSH 7500 methodology. These were obtained during task specific and 8 hour shift work for both concrete truck drivers and shop workers.
- Reviewing data/reports available in the public domain (i.e. Information available through regulatory agencies (including WCB Alberta) and industry associations (including the Alberta Construction Safety Association).
- Regularly consulting with the Safety Resources/Safety Managers from firms who perform similar work (i.e. through Concrete Alberta’s Safety Committee).



PART 7: RISK CONTROL

Silica Exposure Prevention & Control

Control Methods

When determining measures to reduce or eliminate worker exposure to silica dust, generally select a combination of controls, listed in order of preference:

- Elimination and Substitution
- Engineering
- Administrative
- Personnel Protection Equipment (PPE)

Substitution and Elimination

Whenever possible, substitute products containing silica with products that do not contain (or contain a lower percentage of) crystalline silica. While there have historically been few “substitution” options available, it’s important to recognize the importance of planning work in order to minimize the amount of silica dust generated.

Engineering Controls

Engineering controls are those controls which aim to control or otherwise minimize the release of crystalline silica. Two “common” engineering control options are available in many circumstances. These include the Local Exhaust Ventilation (LEV) and Wet Dust Suppression (WDS) systems.





LEV Systems

Tools/appliance specific LEV systems are available on some tools/appliances. Such LEV systems are generally comprised of a shroud assembly, a hose attachment, and a vacuum system. Dust-laden air is collected within the shroud, drawn into the hose attachment, and conveyed to the vacuum, where it is filtered and discharged.

When/if LEV systems are used, employ the following systems and safe work practices:

- Vacuum attachment systems that capture and control dust at its source whenever possible.
- Dust control systems will be maintained in optimal working condition.
- HEPA or good quality, multi-stage vacuum units (approved for use with silica dust) will be used in accordance with the manufacturer's instructions.

WDS Systems

The majority of water necessary for the concrete mix is added when the materials are being loaded into the concrete truck. This acts to reduce the release silica contained in the Portland cement and aggregate mix into the worker occupied work areas.

- Wet slurry will be cleaned from trucks when concrete loading and unloading is complete, if/when necessary.
- Accumulations of cement dust from batching activities will be washed from the batching platform and run off collected.
- Aggregate materials are wetted during dry weather to control dust.



Administrative Controls

Administrative controls are those that aim to control or otherwise minimize the release of silica through the use of work procedure and work methods, rather than by affecting the actual physical work. Common examples of administrative controls include, but are not limited to:

- Posting of warning signs.
- Rescheduling of work as to avoid the activities of others.
- Relocating unprotected workers away from dusty areas.

When administrative controls are used, employ the following systems and safe work practices:

- As necessary/appropriate, supplemental (to this policy/procedure) project and task specific Exposure Control Plans will be developed.
- Suitable housekeeping, restricted work area, hygiene practices, training and supervision procedures/standards should be determined and implemented at the plant.
- As appropriate, barriers will be erected around known silica dust generating activities, and/or warning signs will be posted.
- As able, work activities will be scheduled to minimize the silica related effect on, and from, others.



Personal Protective Equipment Controls

When used in conjunction with the other (i.e. Engineering and Administrative) controls elsewhere identified, personal protective equipment and clothing can help further reduce our employee's exposure to silica dust.

An air purifying respirator fitted with HEPA cartridges is the most common piece of PPE that would be used to minimize exposure to silica dust. Dependent on the effectiveness of the other (i.e. engineering) control measures employed, either a "full face piece" or "1/2 face piece" respirator would be used by personnel. In the majority of situations, a face respirator will be used. When working confined spaces or in other areas with poor ventilation, an air supplying respirator may be specified. Respirators are "seal dependent", and thus the users must be "fit tested" and clean shaven where the respirator seals to the face. Workers utilizing respirators as outlined in this ECP are required to conduct and document the inspection and fit testing of their personal respirator before use each day.

In addition to respiratory PPE, protective clothing (i.e. disposable/washable coveralls) are used to help prevent the contamination of the worker's personnel clothing.





PART 8: EDUCATION AND TRAINING

Silica Exposure Prevention & Control

Prior to performing activities, or working on project sites where personnel could be exposed to silica dust, ensure that personnel receive suitable education and training. As necessary, personnel will be trained to a level of “demonstrated competency”. While not necessarily an exhaustive list, education and training may include:

- The hazards and risks associated with exposure to silica dust.
- The signs and symptoms of silica related diseases.
- General and specific silica exposure reduction methods/strategies (i.e. as detailed in the general/specific exposure control plans).
- The use of specific pieces of equipment and control systems (i.e. LEV and WDS systems).
- The use and care of respiratory (and other) personal protective equipment.
- How to seek first aid (i.e. for respiratory related concerns, including those that may be caused/associated with silica dust exposure).
- How to report items of the concern (i.e. those related to silica dust).

The education and training detailed will be delivered to employees through a variety of forums, including but not necessarily limited to:

- New Employee Orientations.
- Project/Site Orientations.
- Equipment/task specific training in accordance with training systems, all personnel must be trained to a level of “demonstrated competency” prior to completing tasks, especially those that carry a risk of silica exposure.
- Regularly scheduled crew “Toolbox Meetings”.
- Notifications and bulletins, including those developed in house and those acquired from other reputable sources.



PART 9: SAFE WORK PROCEDURES

Silica Exposure Prevention & Control

Ensure that suitable written procedures for controlling the risk of silica exposure are developed. This document/table summarizes the silica control options available to your concrete plant and should be updated or modified as necessary. This document and any supplemental work procedures/ECPs can be made readily available for review by all affected workers.

Specific Written Instructions

Division/Task		Control Methods	PPE	Comments
Plant Operations	Concrete batching & truck washing by drivers	<p>Safe Job Procedure for batching concrete</p> <ol style="list-style-type: none"> 1. Pull out from plant and park the truck at the wash rack. 2. Set RPM on both the drum and truck to mixing speed. 3. Ascend the wash platform and approach the rear of the truck mixer. Be sure to maintain a distance of 2 meters or more from the charge hopper to reduce exposure to dust and cementitious material particles. 4. Using a spray setting on the water hose, spray down the leftover cementitious/aggregate materials for a minimum of 5 seconds. Spray the Charge Hopper, other areas of the drum and rear of the truck to wash the bulk of any excess mix materials from the surface. 5. Once this is achieved you may approach the charge hopper to visually check the load for slump. 6. Limit visual checks of the Charge Hopper and/or being within the 1 meter approach distance to 5 seconds. This will minimize exposure to airborne concrete mix particles present both in and outside the drum during the mixing/slump up process. 7. Maintain a distance of 2 meters from the charge hopper between visual inspections. <p>SJP of Concrete batching & truck washing by drivers CONTINUED</p> <ol style="list-style-type: none"> 8. A maximum of 4 visual inspections are permitted during the mixing process to achieve the desired slump. 9. Drivers to observe good hygiene practices i.e. frequent hand washing, particularly before smoking or eating. 10. Drivers will ensure windows and doors of cab are closed during loading & batching activities to prevent the accumulation of silica containing dust. 11. Drivers will regularly clean the passenger compartment of their trucks to prevent silica containing dust accumulation. 	Drivers will wear washable coveralls and use gloves & Safety Glasses.	<p>The addition of Portland cement to the aggregate /water mix was observed as causing visible clouds of silica containing dust. A safe job procedure will assist in controlling this exposure.</p> <p>The washing of the concrete batching platform may cause drainage issues. Consider building a water retaining system to prevent the accumulation of water at the base of the platform steps as well as to contain contaminated water.</p>



Specific Written Instructions

Division/Task		Control Methods	PPE	Comments
Plant Operations	Chipping concrete trucks - EXTERIOR	<p>Safe Job Procedure</p> <p>Work to occur in well ventilated area, preferably outdoors</p> <p>Hopper and chute to be wetted prior to and periodically throughout the chipping process to inhibit silica dust being generated.</p> <p>Debris from exterior cleaning will be wetted prior to cleaning/sweeping to inhibit silica dust being generated.</p> <p>Drivers to observe good hygiene practices i.e. frequent hand washing, particularly before smoking or eating.</p> <p>Purging and continuous mechanical ventilation of drum before and during chipping.</p> <p>Debris from drum chipping will be wetted, when practicable, prior to cleaning/sweeping to inhibit silica dust being generated.</p> <p>Drivers to observe good hygiene practices i.e. frequent hand washing, particularly before smoking or eating.</p>	<p>Shop workers will wear a 1/2 mask respirator with P100 cartridges while chipping.</p> <p>Shop workers will wear washable coveralls and use gloves while chipping.</p> <p>Shop workers will wear air supplied respirator while inside drum/chipping.</p> <p>Shop workers will wear washable coveralls and use gloves while chipping.</p>	<p>Daily inspection and fit testing of respirator is necessary to ensure proper protection is provided by the respirator. These inspections should be documented.</p> <p>Ensure qualitative fit testing is completed prior to first use and at least annually thereafter.</p> <p>Additional fit testing is required when there has been a change with either the worker (e.g. weight loss) or conditions (e.g. type or model of respirator changed)</p> <p>Daily inspection and fit testing of respirator is necessary to ensure proper protection is provided by the respirator. These inspections should be documented.</p> <p>Respirator operators are required to receive annual fit testing by a qualified professional.</p>



PART 10: DOCUMENTATION

Silica Exposure Prevention & Control

In accordance with Record/Statistics Procedures detailed in the latest revision of your “Health & Safety Manual”, records associated with Crystalline Silica Program will be maintained in accordance with the following:

Record Type	Location(s)	Retention Requirement
Silica Policy, Program and Procedure	Head Office	Current Revision
Project/Task Specific Silica ECPs	Head Office	3 Years
Exposure Monitoring Results	Head Office	LOP + 10 years
Workplace Inspections	Head Office	3 Years
First Aid Records/Reports of Exposure	Head Office	3 Years
Incident Investigation Reports	Head Office	Of Possible Overexposure - 10 Years
Alberta Health & Safety/Regulator Reports and Correspondence	Head Office	Indefinitely
Respirator Fit Tests	Head Office	LOE + 3years
Equipment Maintenance and Repair Logs	Head Office	LOS
New Employee Orientation Records	Head Office	Indefinitely
Site/Project Orientation Records	Head Office	Indefinitely
Tool Box Talk Records	Head Office	3 Years
Crew Safety Meeting Records	Head Office	3 Years
Job/Task Specific Training Records	Head Office	LOE + 3 Years

*LOP - Length of Project

*LOE - Length of Employment

*LOS - Length of Service



APPENDIX A

Applicable Material Safety Data Sheets

Other Resources

You are mandated by law to have a copy of the most current Safety Data Sheets (SDS) for each controlled substance on your premises.

A Safety Data Sheet for Portland Cement, including Portland Limestone Cement, Ready-Mix Concrete has been created for members to populate with their company specific information.

Download Here: <https://concretealberta.ca/public/download/files/237384>

Visit our Member, Heidelberg Materials, website for additional Safety Data Sheets:

<https://www.heidelbergmaterials.us/resources/safety-data-sheets>