ALGONQUIN COLLEGE | Risk Management

Silica Control Program

OCCUPATIONAL HEALTH & SAFETY

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GLOSSARY

Agate: Cryptocrystalline form of silica. Composed of extremely fine (submicroscopic) crystals of silica.

Amorphous: Solid material that is composed of randomly orientated atoms, ions, or molecules that do not form defined patterns or lattice structures (non-crystalline).

Chalcedony: Cryptocrystalline silica. Composed of extremely fine (submicroscopic) silica crystals.

Citation: Under Section 17 of the Occupational Safety and Health Act, OSHA is authorized to give citations to employees. Citations describe the item or items within the workplace that do not comply with OSHA regulations, date when the items must be corrected, and any associated fine or penalty. Employer and employee rights and responsibilities are also included in the citation.

Chert: Cryptocrystalline silica. Composed of extremely fine (submicroscopic) silica crystals.

Colloidal Silica: Extremely fine amorphous silica particles dispersed in water. Colloids do not settle out of suspension over time. Colloidal silica is used commercially as binders and stiffeners and as polishing agents.

Cristobalite: The form of crystalline silica that is stable at the highest temperature. It occurs naturally in volcanic rock.

Crystalline: Solid material composed of regularly repeating atoms, ions, or molecules that form defined patterns or lattice structures.

Diatomaceous Earth: See Diatomite.

Diatomite: A rock, high in amorphous silica content, formed from the structures of tiny fresh- and salt-water organisms called diatoms. Diatomite has several commercial uses.

Fumed Silica: An amorphous form of silica formed by the combustion of silicom tetrachloride in hydrogen-oxygen furnaces.

Fused Quartz: The material formed by the rapid melting of quartz crystals. A meteor strike or a lightning bolt striking sand can form fused quartz. The term quartz glass is often erroneously used to mean fused quartz, but quartz

glass is a misnomer because quartz is crystalline and glass is noncrystalline.

Fused Silica: The material formed by heating cristobalite to the melting point (1710° C) and cooling it rapidly.

Jasper: Cryptocrystalline silica. Composed of extremely fine (submicroscopic) silica crystals.

Joint Health and Safety Committee: includes a joint health and safety committee established under section 9 of the Act, a committee of like nature and the workers or their representatives who participate in an arrangement, program or system conforming to subsection 9 (4) of the Act.

Opal: An amorphous form of silica.

PPE: Personal protective equipment used to prevent worker exposure to silica. This includes respirators, hoods, gloves, goggles, etc.

Permissible Exposure Limit (PEL): This is the airborne concentration of silica above which employees can not be exposed.

Precipitated Silica: Amorphous silica that is precipitated from either a vapor or solution.

Quartz: The most common type of crystalline silica. Some publications will use quartz and crystalline silica interchangeably, but the term crystalline silica actually encompasses several forms: quartz, cristobalite, tridymite, and several rarer forms. Also the term sand is used interchangeably.

Radiolarian Earth: Soil, high in amorphous silica content, composed predominantly from the remains of radiolaria. Radiolarian earth that has been consolidated (hardened) into rock is called radiolarite.

Radiolarite: A rock, high in amorphous silica content, formed from the shells of tiny fresh- and salt-water organisms called radiolaria.

Respirable: means that size fraction of the airborne particulate deposited in the gas-exchange region of the respiratory tract and collected during air sampling with a particle size-selective device that,

(a) meets the American Conference of Governmental Industrial Hygienists (ACGIH) particle size-selective criteria, and

(b) has the cut point of 4 microns at 50 per cent collective efficiency

Silica: The common name for silicon dioxide. A compound formed from silicon and oxygen. Silica is a polymorph, that is, it exists in more than one state. The states of silica are crystalline and noncrystalline (also called amorphous). Crystalline silica can take several forms: quartz (most common), cristobalite, tridymite, and four rare forms.

Silica Brick: Brick composed of silica that is used as a lining in furnaces.

Silica Gel: Amorphous silica, prepared in formation with water. Removal of the liquid creates xerogels and further treatment with alcohol creates aerogels. Silica gels are used as drying agents and to alter viscosity of liquids.

Silica Flour: Finely ground quartz, typically 98% of the particles are below 55 microns in diameter.

Silica Sand: A common term in industry. It generally is used to mean a sand that has a very high percentage of silica, usually in the form of quartz. Silica sand is used as a source of pure silicon and as a raw material for glass and other products. Also called quartz sand.

Silicate: A common name for compounds that are composed of atoms of slicon, oxygen, one or more metals and possibly hydrogen. Many natural minerals are silicates.

Tridymite: A form of crystalline silica. It is found in nature in volcanic rocks and stony meteorites. It is also found in fired silica bricks.

Tripoli: (rottenstone) Soft decomposed rock that may contain crystalline (quartz) or amorphous forms of silica.

PURPOSE

The purpose of the Silica Control Program is to educate college staff and raise awareness of the hazards posed by silica. This program provides measures and procedures that must be taken to mitigate the risk of exposure to silica.

Scope

This program applies to all Algonquin College employees you may come into contact with silica in the workplace.

Silica is considered a designated substance. Occupational exposure to crystalline silica dust constitutes a serious health hazard. Although it is now well established that respiratory diseases associated with exposure to silica dust are preventable, they continue to occur and to cause disability or death. The following program addresses the following:

- engineering controls, work practices and hygiene practices and facilities to control the exposure of a worker to silica;
- methods and procedures to monitor the concentrations of airborne silica in the workplace and the exposure of a worker thereto;
- personal records of the exposure of a worker to silica at the workplace, including the time-weighted average exposure of the worker and of the concentrations of silica and the times in which such concentrations were taken to be representative of the exposure of the worker and used in calculating the average exposure to be maintained by the employer;
- medical examinations and clinical tests of a worker;
- records of medical examinations and clinical tests of a worker to be maintained by a physician who has examined the worker or under whose direction the examination and tests have been performed; and
- a training program for supervisors and workers on the health effects of silica and the measures and procedures required under the silica control program.

Roles and Responsibilities

Employer

- Take every reasonable precaution to ensure there is no to minimal exposure of silica to the worker and students.
- Implement the requirements of the Silica Control Program.
- Provide all necessary PPE to workers and students.
- Provide reasonable training to the worker to work safely with silica
- Ensure engineering controls are in place to help eliminate exposure to silica.

- Conduct an assessment to identify the type(s) and to measure the airborne concentrations
- Implement a medical surveillance for workers who work with silica as per O.Reg 490/09.

Manager/Supervisor

- Take every reasonable precaution to ensure there is no to minimal exposure of silica to the worker and students.
- Implement the requirements of the Silica Control Program.
- Ensure that the SDS for any product containing silica is provided to workers/ students prior to using the product, and that measures, as prescribed, are followed.
- Provide all necessary PPE to workers and students.
- Provide reasonable training to the worker to work safely with silica
- Ensure employees are following all measures and procedures set out in the Silica Control Program.

Physical Resources

- Inform staff and contractors of the presence of silica throughout the College prior to commencing work or maintenance activities
- Work with contractors to ensure that a designated substances assessment is conducted before any new construction is undertaken
- Ensure that the SDS for any product containing silica is provided to workers prior to using the product, and measures, as prescribed, are followed.
- Ensure that workers are comply with the Silica Control Program
- Provide Physical Resources staff with any necessary PPE, as required, to enter areas containing silica
- Ensure Physical Resources staff are properly trained to identify silica and the hazards associated with it
- Develop safe operating procedures specific to the tasks performed, for working with or in proximity to silica

Occupational Health and Safety

- Coordinating the development and review of the Silica Control Program
- Develop and deliver silica awareness training to College employees
- Maintain copies of training records for silica awareness training;
- Consult on silica related issues and investigate incidents;
- Assess any uncontrolled disturbance of/ to exposure of silica and to determine if further hygiene monitoring is necessary;
- Notify the JOHSC of silica-related incidents and hygiene testing.
- Provide the JOHSC with copies of any hygiene reports related to silica monitoring;
- Report to the Ministry of Labour, if a worker is accidentally exposure to silica, and ensure they undergo medical surveillance

Employees

- Follow all of the requirements set out in the Silica Control Program
- Wear all necessary PPE, including respiratory protection.
- Participate in all training provided by the College.
- Report an accidental release or exposure immediately to their manager/ supervisor
- Report any hazards immediately to manager/ supervisor.

SILICA

Silica refers to the chemical compound silicon dioxide (SiO_2), which occurs in a crystalline or non-crystalline (amorphous) form. Crystalline silica may be found in more than one form (polymorphism). Silica is a mineral compound made up of one silicon atom and two oxygen atoms. Oxygen is the most abundant element in the earth's crust. Silicon is the second most abundant. Due to such abundance, the formation of the compound silica in nature is very common. There are other compounds that contain silicon whose names are quite similar, such as silicate and silicone. Do not mistake these for silica. They are not the same thing. If the individual silica molecules are lined up in order and create a repeatable pattern then the silica is in crystal form. We call it "crystalline" silica. There can be more than one repeatable pattern in silica. The various crystal patterns are given their own name. There are quartz, cristobalite, tridymite, and other rare forms of crystalline silica. Quartz is so common that the term *quartz* is often used to refer to crystalline silica. And *sand* is often used to refer to quartz.

Occupational Exposure Limits for Airborne Crystalline Silica

Adopted from the Ministry of Labour's Occupational Exposure Limits for Ontario Workplaces:

Type of Silica	Time Weighted Average- 8-hour OEL
Quartz/ Tripoli	0.1 mg/m^3
Cristobalite/ Tridymite	0.05 mg/m^3
Silica fumes	2 mg/m^3
Silica fused	0.1 mg/m^3

HEALTH HAZARDS

Silicosis

Silicosis is a disease where scar tissue forms in the lungs and reduces the ability to extract oxygen from the air. Silicosis most commonly occurs as a diffuse nodular pulmonary fibrosis. This lung disease (which is sometimes asymptomatic) is caused by the inhalation and deposition of respirable crystalline silica particles (i.e., particles <10 μm in diameter). Symptoms of Silicosis include:

- shortness of breath while exercising
- fever
- occasional bluish skin at ear lobes or lips
- fatigue
- loss of appetite

According to a report from the U.S. Surgeon General, cigarette smoking has no significant causal role in the etiology of silicosis. Probably the most important factor in the development of silicosis is the "dose" of respirable silica-containing dust in the workplace setting that is, the product of the concentration of dust containing respirable silica in workplace air and the percentage of respirable silica in the total dust. Other important factors are:

1. the particle size,
2. the crystalline or non-crystalline nature of the silica,
3. the duration of the dust exposure, and
4. the varying time period from first exposure to diagnosis (from several months to more than 30 years)

A worker may develop one of three types of silicosis, depending on the airborne concentration of respirable crystalline silica:

1. chronic silicosis, which usually occurs after 10 or more years of exposure at relatively low concentrations;
2. accelerated silicosis, which develops 5 to 10 years after the first exposure; or
3. acute silicosis, which develops after exposure to high concentrations of respirable crystalline silica and results in symptoms within a period ranging from a few weeks to 5 years after the initial exposure.

Epidemiologic studies of gold miners in South Africa, granite quarry workers in Hong Kong, metal miners in Colorado, and coal miners in Scotland have shown that chronic silicosis may develop or progress even after occupational exposure to silica has been discontinued. Therefore, removing a worker from exposure after diagnosis, does not guarantee that silicosis or silica-related disease will stop progressing or that an impaired workers condition will stabilize.

TB and Other Infections

As silicosis progresses, it may be complicated by severe mycobacterial or fungal infections. The most common of these infections, TB, occurs when the macrophages are overwhelmed by silica dust and are unable to kill the infectious organism *Mycobacterium tuberculosis*. About half of the mycobacterial infections that occur in workers with exposure to silica are caused by *M. tuberculosis*, and the other half are caused by the nontuberculous mycobacteria (NTM) *Mycobacterium kansasii* and *Mycobacterium avium-intracellulare*. Infections in workers with silicosis may also be caused by *Nocardia asteroides* and *Cryptococcus*. It is recommended that tuberculin tests be administered to persons with silicosis and to those without silicosis who have at least 25 years of occupational exposure to crystalline silica.

Chronic Obstructive Lung Disease

Destruction of alveolar walls in silica dust exposed subjects can lead to emphysema which is the main cause of chronic obstructive lung disease. Emphysema develops primarily in subjects who smoke, but silica dust exposure potentiates the damage done by smoking. Nonsmokers rarely develop emphysema due to the effect of silica dust only. Thus, smoking cessation is the most important preventive measure for chronic obstructive lung disease in silica dust exposed workers. Small airways disease specific to mineral dust, referred to as ‘mineral dust airway disease’ (MDAD) has also been described and results from fibrosis in the walls of small airways. Patients with MDAD are reported to have impairment of lung function.

Other Health Effects

In 1997, crystalline silica in the form of quartz or cristobalite was categorized as a human carcinogen by the International Agency for Research on Cancer (IARC). Lung cancer is the only cancer shown to be associated with silica dust exposure. Crystalline silica has been linked with cases of autoimmune diseases such as scleroderma, systemic lupus erythematosus (lupus), rheumatoid arthritis etc. Chronic renal disease, possibly due to immunological abnormalities, has also been linked with silica dust exposure.

LEGISLATION

Occupational Health and Safety Act (OHSA)

The OH&S ACT sets out, in very general terms, the duties of employers and others to protect workers from health and safety hazards on the job. These duties include, but are not limited to:

- taking all reasonable precautions to protect the health and safety of workers [clause 25(2)(h)],
- ensuring that equipment, materials and protective equipment are maintained in good condition [clause 25(1)(b)],
- providing information, instruction and supervision to protect worker health and safety [clause 25(2)(a)], and
- acquainting a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent [clause 25(2)(d)].

Ontario Regulation 490/09: Designated Substances

In addition, section 30 of the OHSA deals with the presence of designated substances on construction projects. Since silica is a designated substance and is regulated by O.Reg 490/09, and compliance with the OHSA and regulations will require some action to be taken where there is a silica hazard on a construction project.

Section 30 of the OHSA requires the owner of a project to determine if silica is present on a project and, if it is, to so inform all potential contractors as part of the bidding process. In a similar way, contractors who receive this information are to pass it onto other contractors and subcontractors who are bidding for work on the project. If the owner or any contractor fails to comply with this requirement, they will be liable for any loss or damages that result from a contractor subsequently discovering that silica is present.

Workplace Hazardous Materials Information System (WHMIS) Regulation, R.R.O. 1990, Reg. 860, and WHMIS 2015 made to the Hazardous Product Act

The WHMIS Regulation applies to all workplaces covered by the OHSA. Any employer or constructor who uses WHMIS controlled products is required to comply with the WHMIS 2015 Regulation regarding the requirements for classification, labels, safety data sheets, and worker education and training. The Ministry of Labour is responsible for the administration and enforcement of both federal and provincial WHMIS 2015 legislation.

Under WHMIS 2015, silica is classified as Carcinogenicity Category 1A and specific target organ toxicity- repeat exposure, category 1A.

Regulation for Construction Projects, O. Reg. 213/91

The Regulation for Construction Projects, O. Reg. 213/91, applies to all construction projects. Although silica is not mentioned specifically, the following sections of the regulation would apply to situations where there is the potential for workers to be exposed to silica:

Section 14	(5) A competent person shall perform tests and observations necessary for the detection of hazardous conditions on a project.
Section 21	(1) A worker shall wear such protective clothing and use such personal protective equipment or devices as are necessary to protect the worker against the hazards to which the worker may be exposed. (2) A workers employer shall require the worker to comply with subsection (1). (3) A worker required to wear personal protective clothing or use personal protective equipment or devices shall be adequately instructed and trained in the care and use of the clothing, equipment or device before wearing or using it.
Section 30	Workers who handle or use substances likely to endanger their health shall be provided with washing facilities with clean water, soap and individual towels.
Section 46	(1) A project shall be adequately ventilated by natural or mechanical means, (a) if a worker may be injured by inhaling a noxious dust or fume; (2) If it is not practicable to provide natural or mechanical ventilation in the circumstances described in clause (1)(a), respiratory protective equipment suitable for the hazard shall be provided and be used by the workers.
Section 59	If the dissemination of dust is a hazard to a worker, the dust shall be adequately controlled or each worker who may be exposed to the hazard shall be provided with adequate personal protective equipment.

POTENTIAL EXPOSURE

If you can answer YES to any of these, then it is likely that Silica is used at your work and that it is airborne		
Industry Do you work in any of these?	**Occupations** Are you one of these?	**Materials** Are any of these involved?
• Abrasive blasting • Asphalt pavement manufacturing • Blast furnaces • Cement manufacturing • Ceramics, clay, and pottery • Concrete mixing • Concrete tunneling • Construction (mainly cement, concrete work) • Demolition • Electronics industry • Foundry industry: grinding, molding, shakeout, core room (High Risk) • Hand molding, casting, and forming • Jack hammer operations • Manufacturing abrasives, paints, soaps, and glass • Mining • Repair or replacement of linings of rotary kilns and cupola furnaces • Rolling and finishing mills • Sandblasting (High Risk) • Setting, laying, and repairing railroad track • Steelwork • Stone, brick, and concrete block cutting, blasting, chipping, grinding, and sawing • Tunneling operations	• Brickmason/stonemason • Construction laborer • Crane and tower operator • Crushing and grinding machine operator • Furnace, kiln, non-food oven operator • Grinding, abrading, buffing, and polishing machine operator • Hand molder/shaper (not jeweler) • Heavy-equipment mechanic • Janitor or cleaner • Machinist • Metals/plastics machine operator • Molding and casting machine operator • Mining machine operator • Miscellaneous material moving equipment operator • Millwright • Operating engineer • Painter who sandblasts (High Risk) • Production supervisor • Rock driller (High Risk) • Roof bolter (High Risk) • Sandblaster (High Risk) • Steelworker • Welder/cutter	• Abrasives • Coal Dust • Concrete • Dirt • Filter Aids • Graphite, natural • Mica • Mineral Products • Paints • Pavement • Perlite • Plant Materials • Plastic Fillers • Polishing Compounds • Portland Cement • Sands • Silicates • Slag • Soapstone • Soil

Control of Exposure

The following solutions are listed in order of preference. (Depending on the work site a higher choice may actually be less effective.):

- Use a silica substitute
- Use engineering controls
- Improve work practices
- Use personal protective equipment

Note that all of these options may serve as a permanent solution if necessary. Yet the ones toward the bottom serve well as temporary controls and the ones toward the top serve best as permanent controls.

<table>
<tr><td colspan="3"><u>Silica Substitutes</u>

The definite way to eliminate the silica hazard is to eliminate the silica!</td></tr>
<tr><td colspan="3">This is especially important for sandblasters, where the abrasive blasting is often done outside and in different locations, making it impossible to install an engineering control. The most severe silica exposures occur in abrasive blasting.

Eliminating the silica means using a different, safer material in place of the silica-containing substance. It is true that in some cases it is not possible to use a substitute in place of silica, but for many operations, such as abrasive blasting, there are many possible substitutes, including those below.</td></tr>
<tr><td>Alumaglass™
Aluminum Oxide
Aluminum Shot
Ambient Polycarbonate
Armex™
Apricot Pits
Corn Cobs
Cryogenic Polycarbonate
Emery</td><td>Garnet
Glass Beads
Melamine Plastic
Novaculite
PC+™
Polycarbonate
Silicon Carbide
Stainless Cast Shot
Stainless Cut Wire</td><td>Starblast XL™
Steel Grit
Steel Shot
Urea Plastic
Visigrit™
Walnut Shells
Wheat Grain
White Aluminum Oxide
Zircon</td></tr>
<tr><td colspan="2">Advantages</td><td>Disadvantages</td></tr>
<tr><td colspan="2">• Complete elimination of any health hazard related to silica.
• Eliminates the need to implement or maintain engineering controls.
• These substances are not as dense as silica products which make them easier to transport.
• They can be moved from job site to job site</td><td>• May be slightly more expensive than silica products*.
• These substances are generally not as hard as silica products which may mean more is needed to do the job</td></tr>
<tr><td colspan="3">*Using a substitute can still be cheaper in the long run when you add the cost of</td></tr>
</table>

engineering controls or protective equipment needed to combat the silica hazard.

Engineering Controls

Keep silica out of the air

If silica products must be used, engineering controls MUST be used wherever possible. This type of control involves a mechanical process to eliminate exposure to silica dust. Some of these controls may be very simple, as can be seen in the examples below:

- Install a water hose to wet down the dust at the point of generation
- Install local exhaust ventilation
- During rock drilling, flow water through the drill stem
- Install dust collection systems onto machines or equipment that generates dust
- Use concrete/masonry saws that provide water to the blade

Advantages	Disadvantages
• If working properly will eliminate the potential hazard. • Must be installed only once. • Requires little training of workers. • Places no physical burden on workers	• Can be expensive to implement. • Requires routine maintenance

There are specific controls recommended for certain types of operations, such as abrasive blasting and foundry work.

Once installed, engineering controls must be properly operated and maintained

Work Practices

What employees can do to reduce silica intake

If workers know about silica and understand the severity of its health hazard, they will be more likely to do the following:

- Know which work operations can lead to silica exposure
- Participate in any air monitoring or training programs offered by the employer
- If possible, change into disposable or washable work clothes at the worksite; shower (where available) and change into clean clothing before leaving the worksite.
- Do not eat, drink, use tobacco, products, or apply cosmetics in areas where there is dust containing
- Wash your hands and face before eating, drinking, smoking, or applying cosmetics outside of the exposure area.
- If using respirators, do not alter the respirator in any way.
- Use type CE positive pressure abrasive blasting respirators for sandblasting
- For other operations where respirators may be required, use a respirator approved for protection against crystalline silica-containing dust.

crystalline silica.	• If using tight-fitting respirators do not grow beards or mustaches
Advantages	**Disadvantages**
• They can reduce the chance for exposure. • They may be cheaper in the short run.	• They require training of all new employees. • They require employees to use the practices appropriately. • They require monitoring of employees at workers.

<u>Personal Protective Equipment</u> **A good option as a temporary control. The last choice as a permanent control.**	
Personal protective equipment against silica includes respirators and masks. Respirators should be used only when the dust controls cannot keep dust levels below the NIOSH Recommended Exposure Level. There are many types of respirators, from air-purifying to air-supplying and from a nose and mouth covering to a full body respirator. You can receive guidance on selecting a respirator from:	
NIOSH Table recommended respiratory protection for workers exposed to respirable crystalline silica (Refer to Respiratory Protection Section)	
Advantages	**Disadvantages**
• They can reduce the chance for exposure. • They may be cheaper in the short run. • Useful as a temporary control while the long term solution is being implemented.	• They require training of all new employees. • They require employees to use the equipment appropriately. • They require setting up a formal PPE program to validate their proper use.

CLASSIFICATION OF WORK

A key feature of this guideline is the classification of work. It is the classification of the work that determines the appropriate respirators, measures and procedures that should be followed to protect the worker from silica exposure. In this guideline, silica-containing construction operations are classified into three groups, Type 1, Type 2, and Type 3 operations, and can be thought of as being of low, medium and high risk. From Type 1 to Type 3 operations, the corresponding respirator, and measures and procedures become increasingly stringent. The classification of typical silica-containing construction tasks is based on available and published exposure data. Type 1, Type 2, and Type 3 operations, are based on the following airborne concentrations of respirable crystalline silica in the form of cristobalite, tridymite, quartz, and tripoli:

	TYPE 1 OPERATIONS	**TYPE 2 OPERATIONS**	**TYPE 3 OPERATIONS**
Cristobalite and Tridymite	> 0.05 to 0.50 mg/m3	> 0.50 to 2.50 mg/m3	> 2.5 mg/m3
Quartz and Tripoli	> 0.10 to 1.0 mg/m3	> 1.0 to 5.0 mg/m3	> 5.0 mg/m3

The following section lists the typical construction operations that generate silica containing dust:

TYPE 1 OPERATIONS

- The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction.
- Milling of asphalt from concrete highway pavement.
- Charging mixers and hoppers with silica sand (sand consisting of at least 95 percent silica) or silica flour (finely ground sand consisting of at least 95 percent silica).
- Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica.
- Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling.
- Working within 25 meters of an area where compressed air is being used to remove silica-containing dust outdoors.

TYPE 2 OPERATIONS

- Removal of silica containing refractory materials with a jackhammer.
- The drilling of holes in concrete or rock that is part of a tunneling or road construction.
- The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials.
- The use of a power tool to remove silica containing materials.

• Tunneling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation)
• Tuck-point and surface grinding.
• Dry mortar removal with an electric or pneumatic cutting device.
• Dry method dust cleanup from abrasive blasting operations.
• The use of compress air outdoors for removing silica dust.
• Entry into area where abrasive blasting is being carried out for more than 15 minutes.

TYPE 3 OPERATIONS

• Abrasive blasting with an abrasive that contains ≥ 1 per cent silica.
• Abrasive blasting of a material that contains ≥ 1 per cent silica.
Employers, supervisors, and workers should be able to recognize and correctly classify the types of operations carried out in the workplace, in order to select appropriate respirators, and implement appropriate measures and procedures.

RESPIRATORY PROTECTION

Use of Respirators

Do not use respirators as the primary means of preventing or minimizing exposures to airborne contaminants. Instead, use effective source controls such as substitution, automation, enclosed systems, local exhaust ventilation, wet methods, and good work practices. Such measures should be the primary means of protecting workers. However, when source controls cannot keep exposures below the NIOSH REL, controls should be supplemented with the use of respirator.

Respiratory Protection Program

When respirators are used, the employer must establish a comprehensive respiratory protection program, as outlined in the CSA Standard Z94.4-11: Selection, use, and care of respirators, and as required in the OH&S Act. These include:

- periodic environmental monitoring,
- regular training of personnel,
- selection of proper NIOSH-approved respirators,
- an evaluation of the worker's ability to perform the work while wearing a respirator,
- respirator fit testing, and
- Maintenance, inspection, cleaning, and storage of respiratory protection equipment.

The respiratory protection program will be reviewed by OHS on an annual basis.

Type CE Abrasive-Blasting Respirators

Type CE abrasive-blasting respirators are the only respirators suitable for use in abrasive-blasting operations. Currently, four Type CE abrasive-blasting respirators are certified by NIOSH [NIOSH 1996]:

1. A continuous-flow respirator with a loose-fitting hood and an assigned protection factor (APF) of 25

2. A continuous-flow respirator with a tight-fitting face-piece and an APF of 50

3. A positive-pressure respirator with a tight-fitting, half-mask face-piece and an APF of 1,000

4. A pressure-demand or positive-pressure respirator with a tight-fitting full face-piece and an APF of 2,000

NIOSH recommends that workers wear a Type CE, pressure-demand or positive-pressure, abrasive-blasting respirator (APF of 1,000 or 2,000) during abrasive-blasting operations that involve crystalline silica.

Other Respirators

For operations other than abrasive blasting, Table 2 lists the minimum respiratory equipment required to meet the NIOSH REL for crystalline silica under given conditions. Use the most protective respirator that is feasible and consistent with the tasks to be performed.

When accessing the Woodroffe campus basement area, a half-face respirator with a P-100 filter is required, in addition to the other required PPE.

For additional information about respirator selection, consult the NIOSH Respirator Decision Logic. Workers should use only respirators that have been certified by NIOSH.

MEASURES AND PROCEDURES FOR WORKING WITH SILICA

Protective measures and procedures should be implemented when working with silica. Specific measures and procedures will depend on how the work is classified. This section of the guideline outlines the general measures and procedures for all work with lead, followed by specific recommendations for Type 1, Type 2 and Type 3 operations.

General Measures and Procedures for Type 1, Type 2, and Type 3 Operations

The following is a list of general measures and procedures that should be followed for all work with silica:

- Clean-up after each operation is encouraged to prevent dust containing silica from spreading;

- Compressed air or dry sweeping should be avoided when cleaning a work area;
- Compressed air should not be used for removing dust from clothing;
- Workers exposed to silica should be provided with or have access to washing facilities equipped with clean water, soap, and individual towels.
- Silica dust on personal protective clothing and equipment should be removed by damp wiping or HEPA vacuuming;
- Contaminated personal protective clothing and equipment should be handled with care to prevent disturbing the silica dust and the generation of airborne silica dust
- Washing facilities and laundering procedures must be suitable for handling silica contaminated laundry.

Preparation of the Work Area

Warning signs should be posted in sufficient number to warn of the hazard. If it is an indoor operation, signs should be posted at each entrance to the work area. The signs should display the following information in large, clearly visible letters:

1. There is a silica dust hazard.
2. Access to the work area is restricted to authorized persons.
3. Respirators must be worn in the work area.

Sample warning sign for silica work area requiring respirators

Dust Control Measures

The generation of airborne silica-containing dust should be controlled with a mechanical ventilation system, wetting, or the use of a dust collection system. If silica-containing airborne dust is generated, mechanical ventilation with an air flow sufficient to remove airborne contaminants from workers breathing zone should be provided. The air flow of the mechanical ventilation system should be at least 50 cubic feet per minute per square foot of face area (0.25 m3/s per square meter of face area). However, if it is determined that none of these methods are practical, workers may be provided with respirators (see Table 1: Respirator Requirements) to protect them from exposure. The following should be considered before assigning respirators:

- Risk to workers using wetting or a dust collection system.
- Likelihood of damage to equipment if wetting or a dust collection system is used.
- Frequency and duration of the operation.

If compressed air is being used to remove silica-containing dust outdoors, the operator and workers within 25 metres of the work area who may be exposed to the dust must either be removed from the path of the dust cloud or provided with respirators (see Table 1: Respirator Requirements).
Where effective dust control measures are in place and where an employer can demonstrate on a continual basis that the silica exposure levels are below the OEL, respirators may not be required.

Key Questions to be asked to improve dust control include:

- Why do we do it this way?
- Do we really need to use this particular harmful substance? Can we eliminate the use of the substance? Is there a less dusty or toxic alternative?
- If we must use this substance, can we change its form so that it no longer produces as much dust?
- Can our suppliers provide raw materials in a less friable or dusty form?
- What options are available for controlling these releases by engineering methods?
- If dust is produced, can we enclose or automate the process?
- If release is inevitable, can we prevent release into the operator's breathing zone?
- Does the operator need to be close to the process? Can we move the operator away from the source of emission?
- Are control rooms or enclosed equipment cabs utilized to minimize exposures?
- Do other workers need to be in the area?
- Can we segregate the process?
- Are the existing controls working effectively?
- Do we need a dust control committee?
- How effective is our ventilation system?
- How effective is our personal protective equipment (PPE) program, what does it cost, and are we supplying the correct respiratory protection?
- Are proper warning signs and labels utilized?
- Are the Material Safety Data Sheets (MSDS) adequate?
- Is the workforce properly trained, involved and committed to dust control?
- Is the work area kept clean to reduce exposure by re-entrainment of settled dust?
- Is the required air monitoring and medical surveillance conducted?
- Is there proper managerial control over the workforce?

- Are senior management and the organization committed to effective dust control?

Measures and Procedures for Type 1 Operations

A half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency should be provided for workers performing Type 1 operations. Respirators should also be provided when:

- Entering a dry mortar removal area with visible airborne dust for less than 15 minutes for the purposes of inspection and/or sampling purposes.
- Work is being performed within 25 metres of an outdoor area where silica-containing dust is being removed with compressed air.
-

Measures and Procedures for Type 2 Operations

Respirators with a NIOSH APF of 50 (see Table 1: Respirator Requirements) should be provided for workers performing Type 2 operations. In addition, the generation of silica-containing airborne dust should be controlled by thoroughly wetting the area prior to and/or during drilling or cutting operations and during the loading, scraping or moving of rock.
Other workers entering a work area where Type 2 operations are being performed should remain at least 10 metres away. Ropes or barriers should be set up to prevent unauthorized personnel from entering the work area. If this is not possible and there are workers within the 10-metre limit, the Type 2 operation should be enclosed to prevent the escape of airborne silica-containing dust (see Section on Barriers, Partial Enclosures and Full Enclosures).

Measures and Procedures for Type 3 Operations

The operator of the abrasive blasting nozzle should wear a Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting half mask or full face-piece. It is recommended that compressed air that is used to supply supplied air respirators meet the breathing air purity requirements of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm should be provided while abrasive blasting is in progress or the airborne dust from abrasive blasting is visible,

- any worker entering the work area where abrasive blasting is being carried out for less than 15 minutes for inspection and/or sampling purposes should wear a half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency.
- any worker entering a work area where abrasive blasting is being carried out for more than 15 minutes should wear a respirator with a NIOSH APF of 50 (see Table 1: Respirator Requirements).

- workers engaged in cleaning dust from abrasive blasting operations, should wear a respirator with a NIOSH APF of 50 (see Table 1: Respirator Requirements).

Where abrasive blasting is conducted, barriers, partial enclosures and full enclosures should be in place to prevent other workers from being exposed to silica-containing dust and to prevent the spread of dust to other work areas.

Barriers, Partial Enclosures and Full Enclosures

Barriers, partial enclosures, and full enclosures are used to separate the work area from the rest of the project, and in some cases, to prevent silica exposure to other workers not directly involved in the operation. Partial and full enclosures can also prevent or reduce the dispersion of silica into the surrounding work area and environment. Barriers should only be used where full and partial enclosures are not practicable.

Barriers

Ropes or barriers do not prevent the release of contaminated dust or other contaminants into the environment. However, they can be used to restrict access of workers who are not adequately protected with proper PPE, and also prevent the entry of workers not directly involved in the operation. Ropes or barriers should be placed at a distance far enough from the operation that allows the silica-containing dust to settle. If this is not achievable, warning signs should be posted at the distance where the silica-containing dust settles to warn that access is restricted to persons wearing PPE. For example, the removal of mortar and cutting operations, ropes or barriers should be located at least 10 metres away. All workers within the barrier or warning sign zone must be adequately protected.

Partial Enclosures

Partial enclosures allow some level of emission to the atmosphere outside of the enclosure. Partial enclosures may consist of vertical tarps and floor tarps so long as the tarps are overlapped and securely fixed together at the seams. A partial enclosure is not a recommended containment system if significant dust is being generated.

Full Enclosures

Full enclosures are tight enclosures (with tarps that are generally impermeable and fully sealed joints and entryways). Full enclosures allow minimal or no fugitive emissions to reach the outside environment.

For full enclosures, the following requirements should be met:

If, as outlined above, a Type 3 operation should be enclosed, the enclosure should meet the following requirements:

- entry ways in the enclosure should be equipped with air locks, overlapping door tarps or doors
- the enclosure should be supported by a secure structure
- all joints in the enclosure should be fully sealed
- the escape of abrasive and debris from the enclosure should be controlled, at air supply points, by the use of baffles, louvers, flap seals and filters
- general mechanical ventilation should be provided to remove contaminated air from the enclosure and replacement air should be provided to replace the exhausted air
- the air pressure within the enclosure should be negative relative to the outside
- equipment venting such air shall be equipped with filters adequate to control vented air to provincial environmental standards
- the air velocity within the enclosure should provide an average minimum cross-draft or down-draft past each worker during abrasive blasting operations as follows:

  - Cross-draft velocity of 0.5 m/sec (100 ft/min)
  - Down-draft velocity of 0.25 m/sec (50 ft/min)

If the enclosure is located outdoors these additional requirements should be met:

- the enclosure should be made of windproof materials that are impermeable to dust
- the enclosure should be supported by a structure that prevents more than minor movement of the enclosure.

Indoor Operations

If abrasive blasting is being conducted indoors and persons other than those doing the abrasive blasting may be exposed to silica-containing dust, the abrasive blasting area should be separated from the rest of the project by an enclosure that will confine the dust within the abrasive blasting area. When an indoor abrasive blasting operation is completed, dust and waste should be cleaned up and removed by vacuuming with a HEPA-filter-equipped vacuum, wet sweeping or wet shoveling.

Outdoor Operations

If abrasive blasting is being conducted outdoors and persons other than those doing the abrasive blasting may be exposed to silica-containing dust, the work area should be identified by ropes or barriers located at least 25 metres from the abrasive blasting area, to prevent entry by workers not directly involved in the operation.
If it is not possible to locate the ropes or barriers at least 25 metres from the abrasive blasting operation, the employer should ensure that the abrasive blasting area is separated from the rest of the project by an enclosure that will confine the dust within the abrasive blasting area.

TRAINING

Training is an important component in preventing worker exposure to silica. Control methods, measures and procedures can only be as effective as the workers carrying them out. It is therefore essential for training to cover the following:

- WHMIS 2015 training;
- Training that includes a review of Algonquin College's Silica Control Program requirements and departmental safe operating procedures for silica;
- The hazards of silica, including health effects and symptom recognition;
- The recognition of typical operations containing silica;
- Personal hygiene, respirator requirements, and work measures and procedures;
- The use, care, maintenance, cleaning and disposal of personal respiratory protective equipment.

Instruction and training should be provided by a competent person. This could be the employer or someone hired by the employer. A competent person is defined under the OH&S Act as a person who:

- Is qualified because of his/her knowledge, training and experience to organize the work and its performance;
- Is familiar with the provisions of this Act and the regulations that apply to the work; and
- Has knowledge of any potential health and safety hazards in the workplace.

The health and safety representative or the representative of a joint health and safety committee should be advised about when and where the training and instruction is to be carried out.

MEDICAL SURVEILLENCE

Purpose

The objective of a medical surveillance program is to protect the health of workers by:

- ensuring their fitness for exposure to silica
- evaluating their absorption of silica
- enabling remedial action to be taken when necessary
- providing health education.

Program

The medical surveillance program should include the following:

- pre-employment and pre-placement medical examinations
- periodic medical examinations
- clinical tests
- health education
- record keeping.

Medical Examinations

- Workers should have a medical evaluation prior to beginning work, and periodically following the initial examination. Periodically, workers should been examined:
- At least once every 5 years, beginning 10 years after initial exposure, or more frequently if deemed necessary by a physician;
- Or more frequent evaluations may be recommended for heavier exposures or where changes to the tasks require it;
- The frequency of examinations may be reduced for worker exposures < 0.025 mg/m3 exposure history and documented exposure data.
- Exit medical examination required for workers with more than 10 years of exposure, unless the most recent periodic examination was performed within the last 12 months.

History

The initial medical and occupational history should include enquiries about the worker's previous exposure to silica, personal habits (smoking) and history of present or past respiratory disorders (particularly tuberculosis). At the periodic examination, the history shall be updated to include:

- (a) information on the frequency and duration of exposure to silica since the previous examination; and
- (b) the occurrence of signs and symptoms of respiratory disease, e.g., dyspnea, cough, sputum, hemoptysis, wheezing and chest pain.

Physical Examination

Medical surveillance should include a general physical examination, with attention particularly directed to the respiratory system. The frequency of periodic examinations will depend on the intensity and length of exposure to silica and should be decided by the examining physician. It need not be the same for all workers but should not be less than once every two years.

Clinical Tests

X-rays and pulmonary function tests should be taken to assess a worker's fitness for continued exposure to silica. Refer to the Code for Medical Surveillance of Silica Exposed Workers in O. Reg 490/09 for specific requirements, outlined in this program.

To avoid unnecessary x-rays at a pre-placement medical examination, the examining physician should, where practicable, obtain the medical status from another facility if the worker has been previously examined in the past year. Radiographs should be closely examined for early signs of silicosis or other chest disease.

When exposure is discontinued, the frequency of X-rays and the period of surveillance will depend on the intensity and duration of exposure and the findings in previous X-rays. The examining physician shall determine the duration and frequency of follow-up

Pulmonary Function Tests

Pulmonary function tests should be taken in conjunction with the chest X-rays. Calibration of the instruments should meet current standards. Tests should include FEV1, FVC, FEV1/FVC per cent and a mid-flow rate such as FEF 25-75 per cent. All relevant data should be corrected to body temperature and pressure (BTPS).

Action Levels

An assessment of a worker's fitness for work should be based on both the clinical examination and clinical test results. For this reason, no specific action levels are stated for the latter. If silicosis is confirmed, the physician should then determine whether the worker is fit, fit with limitations or unfit for further exposure. A worker should not be removed from silica exposure before consultation with the Workplace Safety Insurance Board (WSIB). To qualify for compensation or rehabilitation further assessment by the WSIB will be necessary.

Table 1: OH&S Act Respirator Requirements

NOTE: Respirators must be fit tested prior to use, as per the Respiratory Protection Program.

Operations	Required Respirator
Type 1 **(> 0.05 to 0.50 mg/m3 of silica in the form of cristobalite and tridymite)** **(> 0.10 to 1.0 mg/m3 of silica in the form of quartz and tripoli)**	**NIOSH APF = 10**
• The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction. • Milling of asphalt from concrete highway pavement. • Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica). • Any other operation at a project that requires the handling of silica containing material in a way that may result in a worker being exposed to airborne silica. • Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. • Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.	Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency.
Type 2 **(> 0.50 to 2.5 mg/m3 of silica in the form of cristobalite and tridymite)** **(> 1.0 to 5.0 mg/m3 of silica in the form of quartz and tripoli)**	**NIOSH APF = 50**
• Removal of silica containing refractory materials with a jackhammer. • The drilling of holes in concrete or rock that is part of a tunneling operation or road construction. • The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. • The use of a power tool to remove silica-containing materials. • The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials. • Tunneling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation). • Tuck pointing and surface grinding. • Dry method dust clean-up from abrasive blasting operations. • Dry mortar removal with an electric or pneumatic cutting device. • The use of compressed air outdoors for removing silica dust. • Entry into area where abrasive blasting is being carried out for more than 15 minutes	Full-face-piece air-purifying respirator with any 100-series particulate filter. Tight-fitting powered air-purifying respirator with any 100-series particulate filter. Full-face-piece supplied-air respirator operated in demand mode. Half-mask or full-face-piece supplied air respirator operated in continuous-flow mode.
Type 3 **(> 2.5 mg/m3 of silica in the form of cristobalite and tridymite)** **(> 5.0 mg/m3 of silica in the form of quartz and tripoli)**	**NIOSH APF ≥ 1000**
• Abrasive blasting with an abrasive that contains ≥ 1 per cent silica • Abrasive blasting of a material that contains ≥ 1 per cent silica	Type CE abrasive-blast supplied air respirator operated in a positive pressure mode with a tight-fitting half-mask face-piece. Type CE abrasive-blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting full-face-piece.

* NIOSH APF = National Institute of Occupational Safety and Health Assigned Protection Factor

Note: It is recommended that compressed air that is used to supply supplied air respirators meet the breathing air purity requirements of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm should be provided.

Table 2: NIOSH REL minimum requirements for respiratory equipment required to meet the for exposure to crystalline silica

Condition	Minimum respiratory protection required to meet the NIOSH REL (0.05 mg/m^3)
<=0.5 mg/m^3 (10 x REL)‡	Any half-mask, air-purifying respirator with a high-efficiency particulate filter (P-100)
<=1.25 mg/m^3 (25 x REL)	Any powered, air-purifying respirator with a high-efficiency particulate filter, or Any supplied-air respirator equipped with a hood or helmet and operated in a continuous-flow mode(for example, type CE abrasive-blasting respirators operated in the continuous-flow mode)
<=2.5 mg/m^3 (50 x REL)	Any air-purifying, full-face-piece respirator with a high-efficiency particulate filter, or any powered, air-purifying respirator with a tight-fitting face-piece and a high-efficiency particulate filter.
<=50 mg/m^3 (1,000 x REL)	Any supplied-air respirator equipped with a half-face and operated in a pressure-demand or other positive-pressure mode (for example, a Type CE abrasive-blasting respirator operated in a positive-pressure mode).
<=100 mg/m^3 (2,000 x REL)	Any supplied-air respirator equipped with a full face-piece and operated in a pressure-demand or other positive-pressure mode (for example, a Type CE abrasive-blasting respirator operated in a positive-pressure mode).
Planned or emergency entry into environments containing unknown or concentrations or concentrations >100 mg/m^3 (2,000 x REL)	Any self-contained breathing apparatus equipped with a full face-piece and operated in a pressure-demand or other positive-pressure mode, Any supplied-air respirator equipped with a full face-piece and operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

RESPIRATOR REQUIREMENTS & OTHER MEASURES AND PROCEDURES FOR TYPE 1, 2, AND 3 SILICA-CONTAINING OPERATIONS

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 1:		
• The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction. • Milling of asphalt from concrete highway pavement. • Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica). • Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica. • Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. • Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.	Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100% efficiency.	• Clean-up after each operation should be done to prevent dust containing silica from spreading • Compressed air or dry sweeping should be avoided when cleaning a work area • Compressed air should not be used for removing dust from clothing • Workers exposed to silica should be provided with or have access to washing facilities equipped with clean water, soap, and individual towels • Silica dust on personal protective clothing and equipment should be removed by damp wiping or HEPA vacuuming • Contaminated personal protective clothing and equipment should be handled with care to prevent disturbing the silica dust and the generation of airborne silica dust • Washing facilities and laundering procedures must be suitable for handling lead contaminated laundry • Warning signs should be posted in sufficient numbers to warn of the silica hazard. There should be a sign, at least, at each entrance to the work area. The signs should display the following information in large, clearly visible letters: ➢ There is a silica dust hazard. ➢ Access to the work area is restricted to authorized persons. ➢ Respirators must be worn in the work area.

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 2:		
• Removal of silica containing refractory materials with a jackhammer. • The drilling of holes in concrete or rock that is part of a tunneling operation or road construction. • The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. • The use of a power tool to remove silica-containing materials. • The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials. • Tunneling (operation of the tunnel boring machine, tunnel drilling, and tunnel mesh installation). • Tuck-pointing and surface grinding. • Dry mortar removal with an electric or pneumatic cutting device. • Dry method dust clean-up from abrasive blasting operations. • The use of compressed air outdoors for removing silica dust. • Entry into area where abrasive blasting is being carried out for more than 15 minutes.	Full-face-piece air-purifying respirator with N-, R-, or P-series filter and 100% efficiency. Tight-fitting powered air-purifying respirator with a high-efficiency filter. Full-face-piece supplied-air respirator operated in demand mode. Half-mask or full-face-piece supplied air respirator operated in continuous-flow mode.	**(In addition to Type 1 measures and procedures.)** • Other workers entering a work area where Type 2 operations are being performed should remain at least 10 metres away. Ropes or barriers should be set up to prevent unauthorized personnel from entering the work area. If this is not possible and there are workers within the 10-metre limit, the Type 2 operation should be enclosed to prevent the escape of airborne silica-containing dust (partial or full enclosures).

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 3:		
• Abrasive blasting with an abrasive that contains ≥ 1 per cent silica • Abrasive blasting of a material that contains ≥ 1 per cent silica	Type CE abrasive-blast supplied air respirator operated in a positive-pressure mode with a tight-fitting half-mask face-piece. Type CE abrasive-blast supplied air respirator operated in a pressure-demand or positive pressure mode with a tight-fitting full face-piece.	**(In addition to Type 1 and Type 2 measures and procedures.)** • While abrasive blasting is in progress or the airborne dust from abrasive blasting is visible, ➢ any worker entering the work area where abrasive blasting is being carried out for less than 15 minutes for inspection and/or sampling purposes should wear a half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100% efficiency. ➢ any worker entering a work area where abrasive blasting is being carried out for more than 15 minutes should wear a respirator with a NIOSH APF of 50 ➢ workers engaged in cleaning dust from abrasive blasting operations, should wear a respirator with a NIOSH APF of 50 • Where abrasive blasting is conducted, barriers, partial enclosures and full enclosures should be in place to prevent other workers from being exposed to silica-containing dust and to prevent the spread of dust to other work areas.

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