Silica Exposure Control Program

Office of Risk Management

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# Contents

PURPOSE .................................................................................................................................. 3  
SCOPE .................................................................................................................................... 3  
WHAT IS SILICA? ..................................................................................................................... 3  
HEALTH EFFECTS .................................................................................................................... 4  
  Reporting.................................................................................................................................. 5  
  Regulatory exposure limits ....................................................................................................... 5  
  Exposure.................................................................................................................................. 5  
ROLES AND RESPONSIBILITIES ............................................................................................... 5  
HAZARD CLASSIFICATION ........................................................................................................ 6  
  General work measures and procedures .................................................................................. 7  
  Measures and procedures for Type 1 operations ..................................................................... 8  
  Measures and procedures for Type 2 operations ..................................................................... 8  
  Measures and procedures for Type 3 operations ..................................................................... 9  
HAZARD CONTROL .................................................................................................................. 9  
MEDICAL SURVEILLANCE ....................................................................................................... 12  
  Clinical tests for silica ............................................................................................................. 13  
    Action levels .......................................................................................................................... 13  
    Return to work ...................................................................................................................... 13  
MONITORING ........................................................................................................................... 13  
DOCUMENTATION ................................................................................................................... 13  
WASTE ...................................................................................................................................... 14  
RESOURCES ............................................................................................................................. 14  
APPENDIX 1 – RESPIRATORS FOR SILICA OPERATIONS ........................................................... 15
PURPOSE
This exposure control program is part of the designated substances program. It assists supervisors in controlling silica operations during internal construction-related activities and in teaching or research environments. Common construction-related work, such as sanding, drilling, chipping, grinding, cutting, sawing, sweeping and blasting of concrete and concrete products, can expose workers to hazardous airborne silica concentrations. Chronic or acute exposure to airborne silica dust can lead to silicosis, an incurable lung disease caused by inhaling dust containing crystalline free silica.

Effective control measures exist to eliminate and minimize exposure. These measures must be implemented to protect the University community.

SCOPE
The control program applies to situations in which, following an operational use assessment (refer to the designated substances program), the health of a worker or student exposed to crystalline free silica could be affected. It should be noted that commercially available products may contain appreciable quantities of crystalline free silica.

This control program may require modification based on the needs of the faculty or service and the work conducted to ensure appropriate, reasonable protection. Any modification must be developed in conjunction with the relevant functional occupational health and safety committee and the health, safety and risk manager.

Supervisors and managers should note that this document only deals with silica. Additional hazards (such as asbestos and other designed substances) must also be considered when planning work. Supervisors and managers should review the relevant programs (e.g., asbestos management program).

WHAT IS SILICA?
Silica is a transparent to grey odourless powder or crystal. It is the second-most common mineral in the earth’s crust and a major component of sand, rock and mineral ores.¹ It is used in the manufacturing of many consumer goods, such as glass, ceramics, abrasives, water treatment products, cosmetics, insecticides, paint and foods, as well as in the drying of glassware and as a preservative for plant samples. Crystalline silica is used in the production of concrete, cement, acoustic ceiling tiles and ceramic tiles used in construction.

Many construction-related activities (including demolition) can generate respirable silica, which can lead to worker exposure and increased risk of developing related illnesses. Examples of such activities include chipping, crushing, drilling, grinding or sweeping of materials containing silica.

On campus, crystalline silica is present in concrete, terrazzo flooring, ceiling tiles, plaster and various other building materials. The grinding, cutting, drilling, sanding or demolition of any of these building materials can generate silica dust, leading to silica exposure. In research, silica is used in organic chemistry and the Water Resources Lab. Routes of exposure for silica include inhalation and

skin or eye contact. In both construction and research applications, it is essential that hazards be identified, anticipated, assessed and controlled to protect worker health and safety.

**Relevant Ontario legislation**
The Ministry of Labour, Training and Skills Development enforces legislative requirements, including those relating to silica. Such requirements are found in the following:

- *Occupational Health and Safety Act*
- *Regulation 213/91 — Construction Projects*
- *Regulation 490/09 — Designated Substances*
- *Regulation 833 — Control of Exposure to Biological or Chemical Agents*

**HEALTH EFFECTS**
The *International Agency for Research on Cancer* (IARC) has concluded that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans and has classified these forms of silica as Group 1 carcinogens. In addition, the *American Conference of Governmental Industrial Hygienists* (ACGIH) considers quartz a suspected human carcinogen with an A2 classification.²

Respirable airborne silica dust particles can remain in the lungs once inhaled and create scarring. When enough scar tissue forms, the alveolar surface loses its elasticity, resulting in a reduced transfer of gas in the lungs, shortness of breath, severe cough and general weakness. These symptoms may begin to appear years following exposure and may worsen with time, leading to further health complications and death.

Silica exposure can lead to three main types of silicosis:

- **Acute silicosis** — following short-term, high-level exposure
- **Chronic silicosis** — following continued exposure (e.g., years of exposure) to moderate to low levels of silica over one’s working life. This is the most commonly observed condition.
- **Accelerated silicosis** — following continued exposure (years of exposure) to moderate to high levels of silica over one’s working life.³⁴

Factors influencing health effects include:

- Type, size and volume of dust inhaled
- Frequency and duration of exposure
- Controls implemented during work involving silica
- Personal factors and habits (e.g., age, personal susceptibility, smoking)

For exposure to occur, particles must be sufficiently small to enter the respiratory tract and bypass natural body defences. Particles of less than 10 microns stay in the respiratory tract and therefore must be controlled.

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³. Canadian Centre for Occupational Health and Safety — *Silicosis*.
⁴. Workplace Safety and Prevention Services — *Silica in the Workplace*. 

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Reporting

You must report any actual or suspected exposure to silica to your supervisor and the University using the Accident, Incident, Occupational Illness or Near Miss Form. While there are no prescribed acute silica exposure clinical tests, reporting exposures will help identify opportunities to improve hazard control in the workplace, which will further protect workers and improve organizational health and safety.

Regulatory exposure limits

The Ontario Ministry of Labour, Training and Skills Development enforces the occupational exposure limits for silica. The time-weighted averages (TWAs), the concentration at which most workers can be repeatedly and safely exposed for eight hours a day, five days a week, without adverse health effects, are listed below. However, because silica is a carcinogen with the potential for chronic, cumulative effects, exposure must be as low as reasonably achievable (ALARA) below the occupational exposure limit.

Time-weighted averages

- Quartz / Tripoli – 0.10 mg/m$^3$
- Cristobalite – 0.05 mg/m$^3$

Exposure

Due to the prevalence of silica in building materials and in teaching and research applications, workers or students can be exposed in various ways, including:

- Conducting construction-related work
  - Hammering, chipping, breaking, construction materials
  - Demolishing building materials
  - Loading or dumping of soil or rock
  - Sweeping of dust debris
- Working with silica in research applications
  - Organic chemistry
  - Filling or emptying flume in the Water Resources Lab
  - Mixing and preparation of concrete structures in the Structures Lab

It should be noted that persons in proximity to uncontrolled activities involving silica may also be exposed.

**ROLES AND RESPONSIBILITIES**

The following roles and responsibilities are in addition to those established by the University under Policy 77 – Occupational Health and Safety and Procedure 14-1 – Internal Responsibility Procedure for Health and Safety Issues:

**University of Ottawa**

- Ensures that the:
  - Exposure control program is maintained and regularly reviewed.
  - Respiratory protection program is maintained and regularly reviewed.
• Ensures that supervisors have the requisite tools, resources and materials to implement this exposure control program.
• Ensures that supervisors know the exposure control program requirements.
• Arranges workplace sampling of airborne concentrations as required.
• Manages the worker medical surveillance program (through the Health and Wellness sector) as required.

**Supervisors and managers (including principal investigators (PIs), lab managers)**

- Implement the:
  - Exposure control program as required.
  - Respiratory protection program as required.
- Ensure that exposure control program requirements are communicated to users and that users are trained on meeting them.
- Implement site- or project-specific control measures in line with available resources and recommendations (including from the health, safety and risk manager, functional occupational health and safety committee, etc.).
- Refer workers to the Health and Wellness sector to participate in the University medical surveillance program, in accordance with Ontario legislation and the designated substances program.
- Maintain program records, including those pertaining to workplace sampling, training and instruction, and personal protective equipment.

**Workers (including students)**

- Be informed of the hazards of silica dust exposure.
- As needed, meet and apply requirements established under the:
  - Designated substance program
  - Exposure control program
  - Respiratory protection program
- Comply with directives from supervisors and managers, including following safe work procedures.
- Report any unsafe acts or conditions to their supervisor or manager.

**HAZARD CLASSIFICATION**

The Ministry of Labour, Training and Skills Development has published guidelines for [Silica on Construction Projects](https://www.ontario.ca/page/ministry-labour-training-and-skills-development-publishes-guidelines-silica-construction-projects), which classifies silica operations by three types. While the guidelines are primarily intended for construction workplaces, there are elements that apply to general maintenance. Silica operation types are discussed in the ministry document and summarized below.

**Type 1 operations (low risk)**

- Drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction
- Milling of asphalt from concrete highway pavement
• Filling mixers and hoppers with silica sand (sand consisting of at least 95% silica) or silica flour (finely ground sand consisting of at least 95% silica)
• Any other operation on a project that requires handling 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 or sampling
• Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors

**Type 2 operations (moderate risk)**
• Removal of silica containing refractory materials with a jackhammer
• Drilling of holes in concrete or rock that is part of tunnelling or road construction
• Use of a power tool to cut, grind or polish concrete, masonry, terrazzo or refractory materials
• Use of a power tool to remove silica-containing materials
• Tunnelling (operation of a 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
• Use of compressed air outdoors for removing silica dust
• Entry into an area where abrasive blasting is being carried out for more than 15 minutes

**Type 3 operations (high risk)**
• Abrasive blasting with an abrasive that contains ≥1% silica
• Abrasive blasting of a material that contains ≥ 1% silica

**General work measures and procedures**
Specific work procedures may be required for each task. The supervisor or manager must develop, document, implement and monitor silica work procedures. These procedures should be documented through a **hazard identification and risk assessment**. Assistance is available from the faculty health, safety and risk manager or the Office of Risk Management.

The following general measures and procedures are discussed in *Silica on Construction Projects* and summarized below. They serve as guidelines. However, this is not an exhaustive list. Additional measures and procedures may be required to reasonably protect a worker or student.

**Measures applicable to all work classifications:**
• Clean-up after each operation to prevent dust containing silica from spreading.
• Avoid compressed air or dry sweeping when cleaning a work area.
• Don’t use compressed air to remove 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.
• Remove silica dust on personal protective clothing and equipment by damp wiping or HEPA vacuuming.
- Handle contaminated personal protective clothing and equipment with care to prevent disturbing the silica dust and generation of airborne silica dust.
- Washing facilities and laundering procedures must be suitable for handling silica contaminated laundry.

**Preparation of the work area**
Post warning signs in sufficient numbers to warn of the hazard. For an indoor operation, post signs at each entrance to the work area. The signs should display the following messages in large, clearly visible letters:
- Presence of a silica dust hazard
- Access to the work area is restricted to authorized persons
- Respirators must be worn in the work area

**Dust control measures**
Control the generation of airborne silica-containing dust with a mechanical ventilation system, wetting or a dust collection system. If silica-containing airborne dust is generated, provide mechanical ventilation with an air flow sufficient to remove airborne contaminants from the workers’ breathing zone. 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 metre of face area). However, if you determine that none of these methods are practical, you can provide workers with respirators to protect them from exposure (See Appendix 1 and the Respiratory Protection Program).

Consider the following 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 you are using compressed air 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 (Appendix 1). Where effective dust control measures are in place and you can demonstrate on a continual basis that the silica exposure levels are below the occupational exposure limit, respirators may not be required.

**Measures and procedures for Type 1 operations**
Provide a half-mask particulate respirator with N-, R- or P-series filter and 95, 99 or 100% efficiency for workers performing Type 1 operations. As well, provide respirators when:
- Entering a dry mortar removal area with visible airborne dust for less than 15 minutes for the purposes of inspection or sampling.
- 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**
Provide respirators with a NIOSH APF of 50 (Appendix 1) for workers performing Type 2 operations. In addition, control the generation of silica-containing airborne dust 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 Silica on Construction Projects, section 6.4.1.

Measures and procedures for Type 3 operations
Anyone operating an 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 facepiece.

Compressed air used to supply the provided air respirators should meet the CSA Standard Z180.1-00 breathing air purity requirements. Where an oil-lubricated compressor is used to supply breathing air, provide a continuous carbon monoxide monitor or alarm.

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.
- Any worker 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.

HAZARD CONTROL
Control silica exposure through a hierarchy of controls, namely, through the elimination or substitution of the hazard, engineered or administrative controls, or personal protective equipment. Concurrent controls (such as combination of engineered controls and personal protective equipment) may be required to provide a reasonable degree of protection to workers.
Elimination
Because of the omnipresent nature of silica in many building materials and research applications, hazard elimination may not be realistic. Nevertheless, where possible, supervisors should first assess if the hazard can be eliminated. For example, instead of sanding or smoothing the surface of a concrete wall, leave it rough and natural, thereby eliminating dust and propagation of particles.

Substitution
When the hazard cannot be eliminated, assess if you can replace silica with a less-hazardous alternative and still accomplish your goal.

Engineering
Dust control options include:
- Performing work using wet methods, where water is used to dampen the material during the work operations and minimize the propagation of airborne dust. Tools may have wet spray attachments or water can be applied directly to the surface. Water mist may also be used to weigh down particles and fumes. It should be noted that water can also introduce other hazards, such as slips or falls, or present added risk of electrocution when working around electrical sources (including equipment). Water will also combine with the dust to create a slurry-like material, which can affect tool performance and lead to other hazards.
- Using local exhaust ventilation to capture dust at the point of generation. Work will typically involve the use of a shroud around the capture point, a hose and vacuum system. Shrouds are also available for hand tools and can be equipped with HEPA filters. Ensure that the capture velocity is appropriate to collect the dust and that you regularly inspect the system to ensure its integrity and functionality.
- Restricting or enclosing the work area (when local exhaust ventilation and/or wet methods are not practical or effective). Physical barriers or sheeting around the work area in conjunction with regular housekeeping practices can help to minimize exposure to a dust hazard.
Barriers and sheeting should be impervious to the dust (consider polyethylene sheeting). Use of negative air units may be required to further minimize the spread of dust particles (including to outdoor environments). If so, additional control measures may be required for workers within the enclosure. Enclosures must be entirely decontaminated prior to dismantling. For example, all interior surfaces (including tools and materials used therein) should be HEPA vacuumed, with items destined for disposal placed in rip-proof polyethylene waste bags and taped closed for transport.

**Administrative controls**

Dust control options include:

- Scheduling dust-generating work for off hours to minimize exposure periods.
- Relocating unprotected personnel to areas where there is no dust hazard.
- Posting signage warning of the dust hazard and delineating the hazard zone.
- Creating a site-specific exposure control plan that takes into account elements of this exposure control program and applies them to the specific project. The plan should cover the dust-generating processes specific to the project and specify safe work procedures, hazard controls and equipment required.
- Establishing a project housekeeping and hygiene program.
- Training programs covering:
  - Hazards and risks associated with silica exposure
  - Signs and symptoms of silica-related exposure
  - Using hazard controls (e.g., wet work methods, local exhaust, personal protective equipment)
  - Reporting exposure
  - Other topics

**Personal protective equipment**

Personal protective equipment for dust can include protective clothing and/or respiratory equipment.

Protective clothing, such as Tyvek overalls with snug-fitting cuffs at the ankles, wrists and neck, minimizes accumulation of dust on personal clothing and prevents transportation of dust around the workplace. Workers should never use compressed air to remove dust from their person. Reusable protective clothing can be used, provided that it is stored and laundered regularly.

Don’t rely on respiratory equipment as a primary means of worker protection. The need for respiratory equipment should be determined following a review of the existing hazard controls, with respiratory equipment a last line of defence in addition to other hazard controls. In many instances, a full-face air-purifying respirator with P-100 cartridges will be the most appropriate type of respiratory protection. For additional information, see Appendix 1.

Use of respiratory protection also requires a framework. For additional information and requirements, see [Selection, Use and Care of Respirators](#).
MEDICAL SURVEILLANCE
Supervisors should identify at-risk workers and refer them to the Health and Wellness office. The medical surveillance program, required under Ontario Regulation 490/09, provides support and a testing framework for at-risk workers who are regularly exposed to silica. Examinations for silica must cover the items prescribed in the code for medical surveillance and be carried out periodically as follows:

- Prior to worker’s placement in the workplace. This must include:
  - Taking an initial medical and occupational history of exposure (including information on relevant personal habits such as smoking) as well as any history of respiratory and musculoskeletal disorders including:
    - Silicosis
    - Chronic obstructive pulmonary disease
    - Tuberculosis and other mycobacterial diseases
    - Lung cancer
    - Connective tissue diseases
  - A physical examination focusing on respiratory and musculoskeletal systems
  - Clinical tests for silica in accordance with the code for medical surveillance

  Additionally, relevant health information contained in the code for medical surveillance must be provided.

- Periodically during periods of exposure: at least once every five years, beginning 10 years after the worker’s first exposure with any employer (or more frequently as required by the examining physician). This must include:
  - Updating the worker’s medical and occupational history since the previous examination.
  - Inquiring for signs and symptoms that may be an early indication of silicosis or malignancy.
  - A physical examination focusing on the respiratory and musculoskeletal systems.
  - Provision of relevant health information contained in the code for medical surveillance.
  - Clinical tests for silica in accordance with the code for medical surveillance.

- When a worker ends employment at the University, provided exposure has been for over 10 years and a medical examination has not been performed within the previous 12 months. Workers whose experience does not meet these criteria are not required to undergo an exit medical examination.
  Examinations must include:
  - Updating the worker’s medical and occupational history since the previous examination.
  - Inquiring for signs and symptoms that may be an early indication of silicosis or malignancy.
  - A physical examination focusing on the respiratory and musculoskeletal systems.
  - Provision of relevant health information contained in the code for medical surveillance.
Clinical tests for silica in accordance with the code for medical surveillance.

There is no formal requirement for the medical surveillance of students. Unpaid students involved in the acquisition, handling, storage, removal or disposal of silica should discuss medical monitoring options with their doctor. The code for medical surveillance outlines the necessary medical examinations for the applicable designated substance. Information on student exposure is not maintained by the University. However, the University extends to students the same protections provided for workers.

Clinical tests for silica

Clinical tests for silica exposure include chest radiographs and pulmonary function tests. If the examining physician determines that signs of silica-induced disease are present, the physician should consider whether the worker should be referred to a respirologist, rheumatologist or other knowledgeable specialist educated and experienced in evaluating work-related lung or connective tissue diseases for further medical assessment. The clinical tests are conducted by medical professionals in a health care setting and results are kept confidential to the extent required by law.

Action levels

There are no specific action levels or exposure criteria prescribed following the clinical tests. Assessment of a worker’s fitness to continue working while exposed to silica is based on the results of the medical examination and the results of the clinical tests. Whether the examining physician determines that the worker is fit for work with limitations or unfit, the physician must take action in accordance with section 29 of Regulation 490/09.

Return to work

The university’s Health and Wellness office manages the return to work in close collaboration with the worker and medical professionals. Any return to work that entails exposure to silica is decided on a case-by-case basis and must include a review of sources of exposure and implementation of protective measures in the workplace to ensure exposure is minimized and within acceptable levels.

MONITORING

The control program must include a means of monitoring airborne silica concentrations. Monitoring must comply with a standard method for workplace air sampling and analysis (or another method recognized in industrial hygiene practice) and with Schedule 1 of Regulation 490/09.

The health, safety and risk manager and the Office of Risk Management assist the faculty, service or department in arranging for the monitoring of airborne concentrations. The faculty, service or department may be responsible for any related fees.

DOCUMENTATION

All documentation relevant to the designated substances program, including the silica exposure assessment and control program, must be regularly reviewed (at least annually) to ensure that the assessment of conditions remains accurate and appropriate for the workplace. Additional components of any review should include:

- Operational use assessments (e.g., hazard assessment)
- A list of at-risk workers
- Records of training and orientation for at-risk workers
• Respiratory protection (type, training, fit test, maintenance, etc.)
• Worksite inspections
• Other topics

The supervisor must ensure that documentation is complete and updated (where necessary). Assistance is available from the faculty health, safety and risk manager or the Office of Risk Management.

WASTE
Hazardous waste must be disposed of in accordance with the applicable legislation and University requirements. Consideration must be given to how the waste will be collected, managed, transported and offered for disposal to ensure the health and safety of those involved with the project as well as those potentially affected. For example, materials should be wetted and collected in waste bins covered with polyethylene sheeting. The exterior surfaces of the waste bin should be wet wiped prior to transportation outside the immediate work area.

For information related to the University’s hazardous waste program, contact your health, safety and risk manager or email the Office of Risk Management.

RESOURCES
• Ministry of Labour, Training and Skills Development – Silica on Construction Projects
• Workplace Safety and Prevention Services – Silica in the Workplace
• Regulation 490/09 — Designated Substances
• Regulation 213/91 — Construction Projects
• WSIB — Silicosis: Facts for Workers in Ontario
• WorkSafe BC — Developing a Silica Exposure Control Plan
• Selection, Use and Care of Respirators
• CSA Z94.4 — Selection, Use and Care of Respirators (available from the Office of Risk Management)
APPENDIX 1 – RESPIRATORS FOR SILICA OPERATIONS
This grid was produced by the Ontario Ministry of Labour, Training and Skills Development. Before selecting and using a respirator, you should conduct a thorough hazard identification and risk assessment process based on the work to be undertaken. For additional information, see the University's guide to the selection, use and care of respirators.

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Operations</th>
<th>Required Respiratory Protection</th>
<th>Other Measures and Procedures</th>
</tr>
</thead>
</table>
| 1            | - The drilling of holes in concrete or rock that is not part of a tunnelling 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 | 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 |
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|              | 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. |                                    | suitable for handling silica 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:  
  o There is a silica dust hazard.  
  o Access to the work area is restricted to authorized persons.  
  o Respirators must be worn in the work area. |
| 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 | Full-facepiece 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-facepiece supplied-air respirator operated in demand 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). |
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<td></td>
<td>or break and remove concrete, masonry, stone, terrazzo or refractory materials.</td>
<td>Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.</td>
<td>(In addition to Type 1 and Type 2 measures and procedures.)</td>
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<td></td>
<td>• Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation).</td>
<td></td>
<td>• While abrasive blasting is in progress or the airborne dust from abrasive blasting is visible,</td>
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<td>• Tuckpointing and surface grinding.</td>
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<td>○ any worker entering the work area where abrasive blasting is</td>
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<td>• Dry mortar removal with an electric or pneumatic cutting device.</td>
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<td>• Dry method dust clean-up from abrasive blasting operations.</td>
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<td></td>
<td>• The use of compressed air outdoors for removing silica dust.</td>
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<td>• Entry into area where abrasive blasting is being carried out for more than 15 minutes.</td>
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<th>Operations</th>
<th>(In addition to Type 1 and Type 2 measures and procedures.)</th>
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<tr>
<td></td>
<td>• Abrasive blasting with an abrasive that contains ≥1 per cent silica</td>
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<td>• Abrasive blasting of a material that contains ≥1 per cent silica</td>
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<td></td>
<td>Type CE abrasive-blast supplied air respirator operated in a positive-pressure mode with a tight-fitting half-mask facepiece.</td>
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<tr>
<th>Type of Work</th>
<th>Operations</th>
<th>Required Respiratory Protection</th>
<th>Other Measures and Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Type CE abrasive-blast supplied air respirator operated in a pressure-demand or positive pressure mode with a tight-fitting full-facepiece.</td>
<td>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.</td>
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<td>○ 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 AF of 50</td>
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<td>○ workers engaged in cleaning dust from abrasive blasting operations, should wear a respirator with a NIOSH AF of 50</td>
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<td>• 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.</td>
</tr>
</tbody>
</table>