YORK UNIVERSITY SILICA PROGRAM

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# York University Silica Program

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I. Objective

The objective of York University Silica Program is to assist supervisors and employees to meet the requirements of designated substance regulation respecting silica in the workplace. This program will include information on:

- Methods to assess the extent to which workers are exposed to silica
- Hazards associated with silica exposure
- Appropriate controls to eliminate/reduce the worker’s exposure
- Training requirements, and
- Requirements under the *Occupational Health and Safety Act* of Ontario and the relevant regulations.

II. Philosophy

York University employees may be involved in work activities that lead to exposure to crystalline silica. The prolonged inhalation of dust containing free crystalline silica is a health hazard. It is the employer’s duty to acquaint a worker with any hazard to the work and in the handling, storage, use, disposal and transport of the hazardous agent.

III. Definitions

OHS - Occupational Health and Safety

JHSC - Joint Health and Safety Committee

MOL - Ministry of Labour

OEL - Occupational Exposure Limit

OH&S Act - Occupational Health and Safety Act

Supervisor - A person who has charge of a workplace or authority over workers

TWA - Time-Weighted Average Limit” means the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week. O. Reg. 490/09, s. 1.

Worker - A person who performs work or supplies services for monetary compensation

“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 for airborne particulate matter, and
(b) has the cut point of 4 microns at 50 per cent collective efficiency;

“silica” means crystalline silica in a respirable form. O. Reg. 490/09 s. 1;

Silica is prescribed as a designated substance. O. Reg. 490/09 s. 2.

IV. Legislation & Occupational Exposure Limits

Occupational Health and Safety Act (OHSA)

The OHSA 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 are defined in Sections 25, 26 and 27.


The WHMIS Regulation applies to all workplaces covered by the OHSA. Any employer or constructor who uses WHMIS controlled products (including silica) is required to comply with the WHMIS Regulation regarding the requirements for labels, material safety data sheets, and worker education and training.

Designated Substances Regulation—Ontario Reg. 490/09

The Ministry’s designated substances regulation, Regulation 490/09, specifies occupational exposure limits (TWA-Time Weighted Average) for silica, an assessment to determine worker’s exposure and whether a control program is required and the measures required in a control program.

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

Although silica is not mentioned specifically, sections 14, 21, 30, 46, 59 of the regulation would apply to situations where there is the potential for workers to be exposed to silica.

Note: This program does not apply to construction projects. For construction projects involving silica, refer to MOL’s “Guideline—Silica on Construction Project”

Occupational Exposure Limits

The TWA of a worker in every event should not exceed the limits shown on the following Table:

<table>
<thead>
<tr>
<th>Silica, Crystalline</th>
<th>TWA-Time Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Cristobalite and tridymite,</td>
<td>0.05 milligrams silica per cubic metre (mg/m³) of air by volume as an 8-hour daily or 40-hour weekly time weighted average; and</td>
</tr>
</tbody>
</table>
b) Quartz and Tripoli

| 0.10 milligrams silica per cubic metre (mg/m³) of air by volume. |

For the calculation of Occupational exposure level, refer to Appendix 1

V. Roles and Responsibilities

Supervisors and Department Managers

It is the responsibility of all Supervisors and Department Managers to:
1. Identify processes and the type of work that involve the use of silica;
2. Cause an assessment to be made in writing of the exposure or likelihood of exposure in a workplace of a worker to the inhalation of silica (contact DOHS);
3. Implement controls to ensure that the TWAEV of a worker to Silica is reduced to the lowest practical level;
4. Ensure that the personnel involved in the work is trained;
5. Ensure that the appropriate personal protective equipment are provided;
6. Notify DOHS if changes are made to the existing work processes and if there is a need for a re-assessment.

Workers

The workers involved in performing silica work shall:
1. Follow safety work practices during the course of their work
2. Wear personal protective equipment as required
3. Report any related hazards to their supervisor
4. Attend training
5. Consider in participating in the medical surveillance program where required by the control program

Occupational Health and Safety

It is the responsibility of the Occupational Health and Safety to:
1. Develop and provide training to personnel working with silica
2. Provide respirator fit testing, and advice on the safe use of PPE
3. Review the program jointly with Joint Health and Safety Committees
4. Maintain records of assessment exposure of the workers

VI. Assessment

An assessment, in writing, of the exposure or likelihood of exposure of a worker in the workplace where silica is present, used, handled or stored and at where the worker is likely to inhale silica is required. The conclusions of the assessment will indicate whether or not a control program is necessary.

The assessment should include matters such as:
a) the methods and procedures used or to be used in the processing, use, handling or storage of silica;
b) the extent and potential extent of the exposure of a worker to the inhalation of silica (air sampling may be required); and
c) the measures and procedures necessary to control such exposure by means of engineering controls, work practices and hygiene practices and facilities.

O. Reg. 490/09, s. 19 (2) (b).

In causing an assessment to be made, the JHSC(s) should be consulted and a copy of the assessment should be made available to them. Also, when changes are made to the work process that may affect a change to the worker’s exposure, a re-assessment should be conducted to re-evaluate the exposure under the new conditions.

VII. Hazard Controls

The Control Program

In order for silica to be a hazard, silica-containing dust particles that are small enough to be inhaled (i.e., respirable) must get into the air.

Regardless of whether a control program is required, measures and procedures by means of engineering controls, work practices and hygiene practices and facilities to ensure that the TWAEV of a worker is reduced to the lowest practical level should be taken.

If the assessment reveals that a control program is required, a written program must include provisions for:

a) engineering controls, work practices and hygiene practices and facilities to control the exposure of a worker to silica;
b) methods and procedures to monitor the concentrations of airborne silica in the workplace and the exposure of a worker thereto;
c) 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;
d) medical examinations and clinical tests of a worker;
e) 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 the tests have been performed; and
f) a training program for supervisors and workers on the health effects of silica and the measures and procedures required under the silica control program.

A. Engineering Controls

Engineering controls are methods of designing or modifying equipment, ventilation systems, and processes to minimize the amount of a substance that gets into the workplace air. They include:

• substitution
• process control
Substitution:
Substitution can eliminate silica from certain processes by replacing it with a less toxic material. Some examples are:

- silica sand used in abrasive blasting may be replaced by metal shot and grit, alumina, garnet, cereal husks, sawdust, high pressure water, steel sand, silicon carbide or corundum (Note: When choosing non-silica containing abrasives, avoid choosing abrasives that may introduce new health hazards to the workplace. For example, abrasives containing walnut shells may cause allergic reactions in some workers);
- the replacement of sandstone grinding wheels with ones using an abrasive like aluminum oxide; and
- the use of magnesite or aluminum oxide bricks in place of silica bricks in furnaces.

Process Control:
When it is not possible to use a silica substitute, changing how a process is performed can lower silica exposures. For instance:

- wet methods reduce dust and should be used whenever practical, particularly in cutting, grinding, and drilling operations.
- the modification of an abrasive operation to produce a coarser dust that is less hazardous because it settles more readily and is less likely to be trapped in the lungs if inhaled.

Enclosure and/or Isolation:
If a process cannot be modified to reduce exposure, it may have to be isolated or enclosed. Dusty operations can be isolated by carrying them out in areas that are physically separated from non-dusty areas and keeping workers not involved in the operation out of the area. Where isolation is not effective, the process can be completely sealed off from the rest of the workplace with an enclosure. In addition, a warning sign (Appendix 5) indicating the presence of silica dust hazard in the area should be posted in a visible location.

Ventilation:
Ventilation refers to engineering controls that rely on the removal of contaminated air from the workplace and the replacement of exhausted air with filtered air. The most effective use of ventilation to control a silica hazard is the removal of dust at its source (local exhaust ventilation). Often dust-generating tools are equipped with dust collection systems to prevent dust from spreading or becoming airborne. An essential component of these systems are the cleaning devices, such as filters, which will effectively remove the dust.

B. Work Practices and Hygiene Practices

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

Good housekeeping is important wherever silica dust is generated. Containers of silica containing waste should be kept tightly covered to prevent dust from becoming airborne. Surfaces should be kept clean by washing down with water or vacuuming with a vacuum equipped with a high-efficiency particulate air (HEPA) filter. Cleaning with compressed air or dry sweeping should be avoided.

C. Personal Protective Equipment

Personal protective equipment includes **protective clothing and respirators**. The purpose of protective clothing is to prevent the contamination of regular clothing and the transportation of silica-containing materials from the workplace. Clothing that is contaminated with silica dust should not be worn home without cleaning.

Sometimes engineering controls and work practices cannot lower the concentration of silica to non-hazardous levels and workers must wear respirators for protection. If respirators must be used, a respirator program should be implemented. It should include written procedures for the selection, use, care and maintenance of personal respiratory protection equipment. Workers should be instructed and trained on the care and use of personal protective equipment before using it. Some workers may have a medical condition that causes them to have difficulty breathing when wearing a respirator. Such workers should not be assigned to do work that requires a respirator if they have written medical proof of their condition.

**Respirator Selection**

Where respiratory equipment is provided, it shall:

a) be appropriate in the circumstances for the concentration of airborne silica;

b) meet or exceed the requirements set out in the *Code for Respiratory Equipment for Silica* dated June 30, 2000 (Appendix 2) and issued by the Ministry; and

c) be issued in accordance with the requirements of the Code. R.R.O. 1990, O. Reg. 490/09 s. 18.

**Use, Care, and Maintenance of Respirators (refer to Appendix 3)**

The following general use, care, and maintenance procedures should be followed whenever respirators are required:

- respirators should be used and maintained in accordance with the manufacturer’s specifications
- proper seal of respirators should be checked prior to each use
- storage of respirators should be in a convenient, clean and sanitary location
and stored in a manner that does not subject them to damage or distortion
- respirators assigned for the exclusive use of one worker, should be cleaned, disinfect and inspected after each shift
- respirators used by more than one worker, should be cleaned, disinfected and inspected after each use
- any respirator parts that are damaged or that have deteriorated should be replaced before the respirator is used.

For additional information on the use, care, and maintenance of respirators, refer to CSA standard Z94.4-02.

Respirators with a tight-fitting facepiece must be fitted to the worker in such a way that there is an effective seal between the equipment and the worker’s face. Each worker must be fit-tested for each type of respirator to be worn.

**Respirator Fit Testing**

For any respirator fit testing needs, please contact the Occupational Health and Safety at ext. 55491.

**D. Medical Surveillance**

Where a control program is required (when the assessment discloses that a worker is likely to inhale silica and that the health of the worker may be affected), the control program shall include a medical surveillance program. Additional information on the medical surveillance program for silica exposed workers can be found in Appendix 3.

**VIII. 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. Training provided by OHS, will cover the following:

- WHMIS training
- the hazards of silica, including health effects and symptom recognition;
- the typical operations containing silica;
- personal hygiene, respirator requirements, and safe work measures
- the use, care, maintenance, cleaning and disposal of personal respiratory protective equipment.

The training plan (refer to Appendix 4) shall be reviewed at least once very two years in consultation with health and safety representative or joint health and safety committee.

**IX. Program Review**

The Silica Control Program shall be reviewed once every two years in consultation with Joint Health and Safety Committees and Health and Safety Representatives.
X. Records

The results of monitoring the concentrations of airborne silica in the workplace and the exposure of the workers shall be kept by the employer (OHS) for a period of at least five years.

The records of medical examinations and clinical tests of a worker and of the exposures of the worker to airborne silica furnished by the employer shall be kept by the physician who has conducted the examinations and tests (O. Reg. 490/09, s. 30, 31).

XI. Resources


3. Canadian Centre for Occupational Health and Safety (CCOHS): Quartz Silica  
   [http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/quartz_silica/](http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/quartz_silica/)


XII. APPENDICES
Appendix 1: Calculation of Occupational Exposure

The time-weighted average exposure of a worker to airborne silica shall be calculated for a forty-hour week and an eight-hour day as follows:

1. The average concentrations of silica to which a worker is exposed shall be determined from analyses of air samples representative of the exposure of the worker to silica during work operations in accordance with standard methods for workplace air sampling and analysis.

2. The results of the analyses are the concentrations expressed as milligrams silica per cubic metre of air (mg/m³).

3. The concentrations shall be multiplied by the time in hours to which the worker is taken to be exposed to such concentrations.

4. The cumulative daily or weekly exposure shall be calculated using the following formula:

   \[
   C_1T_1 + C_2T_2 + \ldots + C_nT_n = \text{cumulative daily/weekly exposure}
   \]

   where,

   \(C_1\) is the concentration found in an air sample, and
   \(T_1\) is the total time in hours to which the worker is taken to be exposed to concentration \(C_1\) in a work day or work week.

5. The time-weighted average exposure shall be calculated by dividing the cumulative daily exposure by eight and the weekly exposure by 40 respectively.

O.Reg. 490/09 Part I
Appendix 2:

CODE FOR RESPIRATORY EQUIPMENT
FOR SILICA

Ministry of Labour
Occupational Health and Safety Branch
June 30, 2000
TYPE OF NIOSH-APPROVED RESPIRATORY REQUIRED

The respiratory equipment provided by an employer and used by a worker shall meet or exceed the following requirements:

<table>
<thead>
<tr>
<th>Airborne Concentration</th>
<th>Type or Respirator Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Respirable Silica, any crystalline form)</td>
<td></td>
</tr>
<tr>
<td>Less than or equal to 10 x TWA</td>
<td>Half-mask particulate respirator with N-, R-, or P-series filler and 95, 99 or 100% efficiency.</td>
</tr>
<tr>
<td>Less than or equal to 25 x TWA</td>
<td>Powered air purifying respirator equipped with a hood or helmet, and any type of particulate filter; or supplied air respirator equipped with a hood or helmet and operated in a continuous flow mode (see note).</td>
</tr>
</tbody>
</table>

Notes:

1. Respirators with higher protection factor or required for protection from higher airborne silica concentrations must be selected in accordance with the NIOSH assigned protection factors as given in Table 1 of its publication entitled "NIOSH Respirator Decision Logic" dated May 1987; and respirators for escape must be selected in accordance with Table 4 of this NIOSH publication.

2. Respirators need not be worn if the levels of silica are less than the time-weighted average exposure limit. However, if the worker wishes to use a respirator below the time-weighted average exposure limit, the correct type of respirator shall be worn.
GENERAL REQUIREMENTS FOR THE USE OF RESPIRATORS

1. Subject to the above, respiratory protective equipment shall be used in accordance with the procedure specified by the equipment manufacturer.

2. Written standard operating procedures governing the selection and use of respirators shall be established.

3. Written procedures on use and care of respirators shall be reviewed with workers.

4. Workers shall be trained in the proper use of respirators and their limitations.

5. Where a respirator is designed to be tight-fitting against the face, there must be no facial hair along the face-seal area.

6. Where practicable, the respirators shall be assigned to individual workers for their exclusive use.

7. Compressed air used for respirators is to meet the recommendations in Table 1 of the CSA Standard Z180.1-00, Compressed Breathing Air and Systems, The intake of the ambient breathing air system is to be located appropriately in accordance with the CSA recommendations to ensure acceptable breathing air quality.

8. Respirators shall be regularly cleaned, disinfected and inspected. Those issued for the exclusive WIC of one worker shall be cleaned after each day's use, or more often if necessary, while those used by more than one worker shall be thoroughly cleaned and disinfected after each use.

9. Worn or deteriorated parts shall be replaced.

10. Respirators for emergency use, such as self-contained devices, shall be thoroughly inspected at least once a month and after each use.

11. All respirators and replacement parts shall be stored in a convenient, clean and sanitary location.

12. Persons should not be assigned to tasks requiring use of respirators unless they are physically able to perform the work and use the equipment.

13. Workers required to wear respirators who experience breathing difficulty while using; respirators shall be referred to a physician for examination.

14. Records of frequency of use by the worker of respiratory equipment and its type shall be kept.
Appendix 3. Medical Surveillance of Silica-Exposed Workers

Medical Surveillance Program

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
The medical examination should include the following:

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, haemoptysis, 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.

**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).

**Follow up after Medical Examination and Clinical Tests**

Refer to O. Reg. 490/09-Designated Substances Regulation, section 29 (1)-(7) for details

The physician conducting the physical examination or clinical tests or under whose supervision the examination or tests are made shall advise the employer (Employee Well-Being Office), and the worker whether the worker is fit, or because of a condition resulting from exposure to silica is fit with limitations, or unfit for work in exposure to silica without giving or disclosing to the employer the records or results of the examination or tests.

If the worker is fit with limitations or unfit for work in silica exposure, because of a condition resulting from exposure to silica, the physician shall also advise in writing upon a confidential basis the joint health and safety committee and in giving such advise shall indicate his/her opinion as to the interpretation of the results.

In advising that the worker is fit with limitations or unfit, the physician shall be governed by the provisions of the *Code for Medical Surveillance of Silica Exposed Workers* dated October 17, 1983 and issued by the Ministry.
Appendix 4: Silica Training Program

OUTLINE

SILICA TRAINING PROGRAM

Introduction

As required by Ontario Reg. 490/09, s.20 (2) (4) “...the silica control program shall include provisions for a training program for supervisors and workers on the health effects of silica and the measures and procedures required under the silica control program”.

Purpose

To educate and inform workers on the health effects of silica and applying control methods to eliminate/reduce the exposure when working with silica.

Trainer

Silica training is provided by Occupational Health & Safety (OHS) to all workers and their supervisors who work with materials containing silica.

It is the responsibility of the area supervisors to identify all work involving silica and notify DOHS on the training needs.

Training Outline

The silica training incorporates information on legislative requirements on silica work, types of silica and health effects, and control methods.

An outline of the silica training is presented on the following table:
Silica Training  
Time: Approx. 2hrs.

<table>
<thead>
<tr>
<th>Item</th>
<th>Content</th>
<th>Method</th>
<th>Time</th>
</tr>
</thead>
</table>
| Legislation                 | Occupational Health & Safety Act  
Designated Substances Regulation-O. Reg. 490/09)  
-Occupational exposure limits (TWA-Time Weighted Average)  
-The silica control program | Power Point Presentation/Handout                                   | 30 Minutes |
| Types of Silica-Properties  | Silicon Dioxide (SO2)  
- Amorphous  
- Crystalline                                                      | Power Point Presentation/Handout                                   | 10 Minutes |
| Silica-Health Effects       | Review of Material Safety Data Sheets (M.S.D.S.)  
- Eye contact  
- Skin contact  
- Inhalation (silicosis)                                            | Handout                                                             | 20 Minutes |
| Control Methods             | - Engineering controls  
- Administrative controls  
- Work practices  
- Hygiene practices                                                 | Power Point Presentation/Handout                                   | 30 Minutes |
| Personal Protective Equipment (PPE) | Respirator use and Maintenance  
Other PPE: gloves, safety glasses, coveralls etc.                    | Handout/Hands On                                                 | 30 Minutes |
Appendix 5. Warning Sign

CAUTION

There is a silica dust hazard. Silica dust is potentially dangerous to breathe.

Access to the work area is restricted to authorized persons.

Respirators must be worn in the work area.