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SILICA IN THE WORKPLACE

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Silica in the Workplace

What's Inside

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Workplace Safety & Prevention Services™
A Health & Safety Ontario Partner

An amalgamation of
FSA, IAPA and OSSA

About this Guide

Silica, meaning crystalline silica in the respirable form, is a designated substance under the *Occupational Health and Safety Act*, and the subject of a specific Regulation. This Regulation applies in part or in whole to workplaces in which silica is present, produced, processed, used, handled or stored. It establishes as a standard a 40-hour time-weighted average exposure, as well as a targeted standard, and provides for assessment of worker exposure, and for implementing a control program, should certain conditions be met.

The purpose of this guide is to provide general information about silica to employees, members of joint health and safety committees, supervisors, and managers. The guide outlines uses and health effects of silica, and provides guidelines for setting up a program to determine and control workplace exposures.

To make best use of this guide you may wish to find out how much you know already about silica and its hazards. The following questions were prepared to help you. We suggest that you try to answer them before reading further. The answers are found inside.

1. Which forms of silica pose a hazard in the workplace?
2. How can you determine whether a hazardous form of silica is present?
3. Does all dust containing a hazardous form of silica pose the same hazard? Explain.
4. Does the potential for inhaling a hazardous form of silica exist in your job?
5. How do the hazardous forms of silica affect the body?
6. How can a doctor identify a silica-related disease?
7. How can silica exposure in the workplace be controlled?
8. Describe the silica control program that is in effect at your workplace?
9. What is the importance of a medical surveillance program?

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Silica: Its Occurrence, Uses and Health Effects

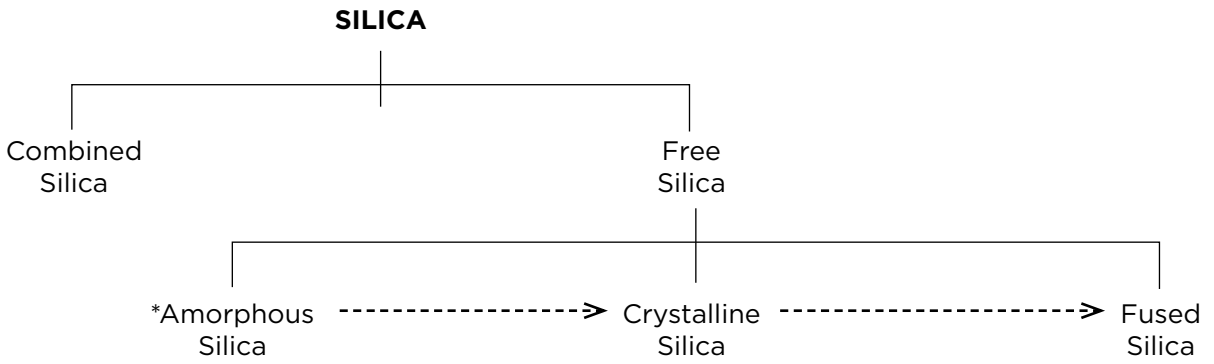
What is Silica?

Silica is the name of a group of minerals that contain silicon and oxygen in a chemical combination and have the general formula SiO_2. Silica may be free, in which case only SiO_2 is present, or combined, in which the SiO_2 is combined chemically to some other atom or molecule. This difference is important to recognize, since the silica problem exists only with free silica. Labels on packages and product analysis sheets must be read carefully for this reason. Free silica may occur as amorphous free silica, of which there are many forms, and crystalline free silica, of which there are five principal forms. Certain materials contain both amorphous and crystalline free silica. Silica-related diseases are associated only with crystalline free silica. The most common examples of crystalline free silica are beach or bank sands. A third form of free silica is fused silica, which is produced by heating either the amorphous or crystalline forms. Heating amorphous silica causes conversion to the crystalline form under appropriate conditions.

The interrelationships between the crystalline and non-crystalline forms of silica are extremely important. Products containing amorphous silica are often heated to high temperatures during use in the workplace. A material initially containing no crystalline silica when installed may contain considerable quantities when removed.

Figure 1 illustrates the interrelationship between the various forms of silica.

Figure 1
Interrelationships between Forms of Silica



- diatomaceous earth
- silica gel
- fused silica
- precipitated silica

- quartz
- cristobolite
- tridymite
- tripoli
- coesite
- flint
- chert
- jasper
- chalcedony

(a mixture of crystalline and amorphous silica)

---------> conversion induced by heating

***NOTE:** Commercially available products may contain appreciable quantities of crystalline free silica. Obtain **written** confirmation of the analysis from the manufacturer or supplier to determine whether or not the Silica Regulation applies.

How Can I Determine Whether Crystalline Silica is Present in my Workplace?

The best source of information about products that are used in the workplace is the material safety data sheet (MSDS). These should be obtained from the manufacturer or supplier for all hazardous products that are used in the workplace. The MSDS must provide information about the form of silica. The process conditions to which products containing amorphous silica are subjected should be studied carefully to determine whether the temperature is sufficiently high to produce the conversion to crystalline forms of silica.

Mineral compositions are extremely important in the extractive industries because crystalline silica often occurs in appreciable quantities in unprocessed rock. This also applies in the mining and handling of rock.

Is all Dust Containing Crystalline Free Silica Potentially Harmful?

The answer to this question is no. The body possesses an efficient filtration system, which tends to capture and remove particles of varying sizes. Large particles are removed primarily in the nose and throat. Intermediate particles are removed from the air in the upper airways. Small particles are removed in the area of the lung in which the exchange of gases occurs. Some particles breathed into the lung remain suspended in air.

Particles, known as the respirable fraction, are the cause of silica-related diseases. These are so small that individually they cannot be seen and are capable of penetrating to the area of the lung in which gas exchange occurs.

Who is Likely to be Exposed?

Crystalline silica, amorphous silica and products containing them are used widely in industry. Exposure may also occur during extraction of materials obtained from the earth's crust. Silica is a component of most rock.

Table 1 presents a summary of the major uses of products likely to cause exposure to respirable crystalline silica. Sources of exposure within the extractive industries are also included.

Table 1
Some Sources of Exposure to Crystalline Free Silica

- hardrock mining
- granite quarrying
- aggregate quarrying
- quarrying of semi-precious stones
- ferrous and nonferrous metal casting
- pottery manufacturing
- porcelain manufacturing
- enamelware manufacturing
- abrasive products manufacturing
- polishing semi-precious stones
- asbestos-cement products manufacturing
- abrasive blasting and grinding
- refractory products manufacturing and utilization
- cement products manufacturing

What are the Effects of Exposure to Respirable Crystalline Silica?

Exposure to silica can cause silicosis which is, in fact, the most significant lung disease caused by breathing mineral dusts. Development of silicosis is influenced by several factors, which include:

- Amount and kind of dust inhaled
- Content of crystalline free silica in the dust
- Form of the silica
- Relative size of the inhaled particles
- Length of exposure
- Individual resistance
- Smoking habits
- Disease status
- Age of worker

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Silicosis is the result of the body's response to the presence of silica dust in the lung. The respirable fraction of the dust, particles generally considered to be smaller than 5µm (millionth of a metre), can penetrate to the innermost reaches of the respiratory tract. These are the alveoli or air sacs where exchange of oxygen and carbon dioxide occurs. Dust particles, which land on these surfaces, are removed by white blood cells known as macrophages. Particles of free crystalline silica cause the macrophages to break open. The result is the formation of a scar like patch on the surface of the alveolus. Formation of large numbers of "scars" following prolonged exposure causes the alveolar surface to become less elastic. This reduces the transfer of gases. This is noticed as shortness of breath following exertion. Symptoms seldom develop in less than five years and in many cases may take more than 20 years to become disabling.

There are three major types of silicosis: acute, chronic and accelerated.

Acute silicosis

Acute silicosis develops from inhaling large amounts of silica dust over a few days or months. Signs of the disease include shortness of breath, fever, cough and weight loss. Generally, people with acute silicosis have stable health, however for some it may lead quickly to death.

Chronic silicosis

Chronic silicosis is the most common type and occurs after many years of contact with low levels of silica dust in the air. There are two forms of chronic silicosis: *simple* or *complicated*.

With *simple silicosis*, small solid or unclear nodules can be detected on a chest x-ray, however, individuals are asymptomatic. Long-term exposure to silica dust may lead to complicated silicosis.

With *complicated silicosis*, also called progressive massive fibrosis (PMF), larger nodules can be detected on a chest x-ray. Some individuals may still be asymptomatic or initial symptoms may include shortness of breath with exercise, wheezing or sputum that causes coughing. Other lung diseases can aggravate the condition and severe complicated silicosis can result in heart disease with lung disease, called cor culmonale.

Accelerated silicosis

Accelerated silicosis is similar to the chronic type, however it forms more quickly. The lung scars can be detected sooner and nodules appear on a chest x-ray five years after the first exposure to silica dust. This type of silicosis occurs from exposure to large amounts of silica dust over a short time period and can progress quickly.

Silica: Assessment and Control

How Can Workplace Exposure to Silica be Assessed?

The presence of crystalline free silica in workplace air can be detected and measured using sophisticated techniques. These are often needed when the potential for dust production exists. Generally, if dust containing crystalline free silica can be seen, an exposure problem is likely to exist. (It should be remembered that respirable dust, which is only a portion of the total dust, **cannot** actually be seen by the unaided eye. If airborne dust **can** be seen, however, **a problem is likely to exist**). The procedures for monitoring, sampling and determining the concentrations of airborne silica in the workplace and a worker's exposure to airborne silica must be in accordance with standard methods for workplace air sampling and analysis.

The assessment should establish a comprehensive picture of the following aspects of the operation:

- Source of exposure
- Cause of exposure
- Number of workers exposed to each source
- Length of exposure per day
- Frequency of exposure
- Concentration of respirable crystalline silica in the air
- Effectiveness of existing control strategies and workplace practices
- Performance capabilities of existing dust controls
- Existing use of personal protective equipment
- Methods and procedures used presently or to be used in future
- Measures and procedures necessary to control exposure

The employer must consult with the joint health and safety committee in causing the assessment to be made. The employer must also provide each member of the committee with a copy of the assessment.

How Can Exposure to Crystalline Free Silica be Controlled?

Silicosis is a preventable occupational disease.

Workplace exposure to crystalline free silica can be controlled by several possible means, which may be included in a control program. The control program is the product of the workplace assessment of exposure. Several possible strategies may be used depending on the effectiveness of existing facilities and practices. Usually a combination of controls is most suitable.

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A control program is necessary where the assessment shows that "a worker is likely to inhale silica and that the health of a worker may be affected." Note that in this context no reference is made to numerical values. The joint health and safety committee must also be consulted on the control program, which should include provisions for the following:

A. ENGINEERING CONTROLS

Engineering controls are most effective in workplaces in which the production of dust is presently uncontrolled. These often produce the most dramatic results when used properly and installed correctly. Engineering controls are selected to control emissions at their source. These may include any or all of the following:

1. Process Selection/Workplace Design

Process selection and layout can significantly affect the production of silica-containing dusts. Attention to the mechanics of silica handling can lead to the selection of processes least likely to generate dust, and of workplace layouts which minimize the spread of dust. These considerations are best addressed during the design stages.

Mechanization often offers the advantage of increased production and improved protection of workers.

2. Equipment Selection

The ideal time to address engineering controls is during the selection of new or replacement equipment. Equipment selected for silica handling or in which silica-containing dust is generated, should enclose the process and contain venting points capable of being connected to local exhaust ventilation. Manufacturers' specifications should be examined to ensure that these capabilities are included. Performance specifications with expected warranty should be proposed by the purchaser and submitted as part of the purchasing requirement.

Ensuring that the specifications are met at the time of start-up is essential to future performance and maintenance.

3. Modification of Existing Equipment or Processes

Control of silica in the workplace can sometimes be achieved by modifying existing processes or equipment.

Less hazardous materials can sometimes be substituted for silica. This change should be examined carefully to ensure that product quality remains high and that other problems are not introduced. Use of silica may possibly be eliminated from the process when alternate technologies become available. Once again, the alternative should be examined to ensure that it meets the need at hand and does not introduce new hazards.

The most common modification of existing processes is isolation. Sources of silica dust can sometimes be isolated from workplace air by enclosing the equipment or by separating it from workers by barriers or walls. Sometimes special booths may be used to isolate the worker from the source of silica dust.

4. Ventilation

Ventilation of the workplace is essential to maintaining acceptable conditions of exposure. Workplace ventilation may be provided in two ways: natural or mechanical ventilation.

Natural ventilation relies on the principle that heated air expands and rises. Natural airflow in a building can be obtained by providing openings at floor level and roof level. This type of ventilation is most effective when the openings are as far apart vertically as possible and the inlet and outlet areas are equal.

Mechanical ventilation is provided by fans. This may be required when natural ventilation is inadequate. Exhaust fans located at roof level may supplement natural ventilation in controlling dust generated by process emissions.

More effective mechanical ventilation is provided by local exhaust systems. The collecting hood should be located as close as possible to the source of emission. The air velocity measured at the opening of the hood, the capture velocity, must be sufficient to collect the dust. Generally the face velocity must be at least 60 m/min (220 ft/min). Local exhaust ventilation is usually required when existing equipment is enclosed. Air containing silica dust should be passed through a dust collector prior to being drawn through the fan. Waste air should be exhausted through a stack to the outdoors. Exhausted air must comply with environmental emission standards.

In all cases in which mechanical exhaust ventilation is installed, make-up air must be provided. Make-up air is required to maintain the air balance within the building. Suction fans will be "starved" if not provided with sufficient make-up air.

B. WORK PRACTICES AND PROCEDURES

The practices and procedures employed in the workplace are critical to the control of contaminants such as crystalline free silica. Installed engineering controls are only as effective as the practices and procedures built around them.

1. Work Procedures

Procedures must ensure the safe handling, use and disposal of materials containing crystalline free silica. In order to ensure consistency when training new employees, all procedures should be documented in writing.

When preparing written procedures, the task should be examined to ensure that the methods to be included will minimize exposure when properly carried out.

Workplace procedures should address normal operating conditions as well as situations arising from accidental release of material into the workplace air.

2. Housekeeping

All areas of the plant should be kept clean and free from settled dust. This is a difficult task in situations in which dusty materials are being handled continually. Settled dust contains material, which given appropriate conditions such as vibration or other mechanical disturbance, can become airborne.

Procedures for removing settled dust must be reviewed carefully to ensure that they do not contribute to the dust problem. In general, the following practices are recommended:

- vacuum cleaning
- wet sweeping (if compatible with other constituents in the dust)
- no dry sweeping
- no air blowing

Vacuum cleaning equipment should be fitted with HEPA (High Efficiency Particulate Air) filters to ensure that respirable particles are not blown into the workplace air through the exhaust of the vacuum system.

Housekeeping procedures should be scheduled for both routine and non-routine occurrences. Spilled material likely to contain crystalline free silica should be collected promptly and the cause investigated. A central vacuum system is ideal for this purpose. Wet sweeping should be undertaken only if water is compatible with other materials likely to be present in the area.

3. Maintenance

Dust control equipment is only as good as the maintenance that it receives. Performance deteriorates as equipment:

- ages
- is damaged
- is improperly serviced
- is altered in a manner not intended in its original design

The continued control of silica emissions over time depends upon maintaining performance standards. The simplest, least expensive means to achieve this objective is a program of regularly scheduled maintenance.

A maintenance program should include documented procedures and the maintaining of performance records. This permits diagnosis of problems occurring in equipment prior to breakdown. Servicing dust control equipment, for example, involves potentially significant exposures since ducts and the dust collector are likely to become covered by fine, easily esuspended particulate materials. This activity may require isolating the affected area from the remainder of the building in order to limit the spread of airborne dust. Use of personal protective equipment is likely to be necessary.

Some examples of activities that are often best carried out during off-shifts include:

- duct cleaning
- replacing filter bags
- fan repair
- altering the layout of the existing ventilation system

C. PERSONAL HYGIENE FACILITIES AND PRACTICES

Particulate materials possibly containing silica adhere to both clothing and exposed skin as a result of daily activities. While inhalation is the only plausible route of exposure to crystalline free silica, dust adhering to clothing can cause exposure due to resuspension.

1. Clothing

Dust-laden clothing is likely to be a source of continuing exposure following motions which cause the dust to become resuspended. Loose dust can be easily removed from clothing or skin by use of a vacuum cleaning system. The use of compressed air to blow dust from skin or clothing must be prohibited. A policy regarding removal of work clothing from the workplace must be considered in light of the potential presence of other toxic materials in the dust.

2. Washing Facilities

Skin contamination by dusts containing crystalline free silica is not considered to pose a serious route of exposure. Washing facilities must be provided and used in consideration of other toxic materials which may be present in dusts which contaminate the skin. Employees should be encouraged to wash their hands and arms before eating, drinking, smoking or leaving the workplace. In some cases, employees may be required to shower before leaving the workplace.

3. Eating Facilities

Consumption of food and beverages and smoking in the working area should be prohibited. The severity of response to exposure to crystalline free silica is affected by smoking. While ingestion is not considered a credible route of exposure, ingestion may be an important consideration in exposure to other toxic agents, which may be present in the dust. Eating, drinking or smoking when one is exposed to toxic materials can provide an important route of exposure.

Specially designated eating and drinking areas, remote from the workplace, should be provided.

D. AIR MONITORING

The control program must include planned air monitoring of worker exposure. Results must be posted in a conspicuous place within the plant and provided to the joint health and safety committee. In addition, records of individual exposure, which include calculated 40-hour time-weighted averages, must be retained. These should be **representative of actual exposure**.

These results provide a profile of actual worker exposure prior to and following establishment of the control program. The air monitoring strategy should be designed to obtain results from all workers who are exposed to silica.

E. MEDICAL SURVEILLANCE AND EXAMINATIONS

The only means available to determine the effects of exposure to crystalline free silica is a medical surveillance program. The objective of a medical surveillance program is to protect the health of workers by:

a) Identifying workers with conditions that may be aggravated by exposure to silica and establishing baseline measures for determining changes in health

b) Evaluating the effect of silica on workers

c) Enabling corrective action to be taken when necessary

d) Providing health education

By law, the medical surveillance program must consist of the following:

a) Pre-employment and pre-placement medical examinations

b) Periodic medical examinations

c) Clinical tests

d) Health education

e) Record keeping

Medical examinations must include the following:

1. History

The initial medical and occupational history must cover previous exposure to silica, personal habits (e.g., smoking) and history of present or past respiratory disorders (particularly tuberculosis). At each periodic examination, the history must be updated to include:

a) History of frequency and duration of exposure to silica since the last examination; and

b) Any signs and symptoms of respiratory disease (e.g., difficulty breathing, cough, sputum, wheezing and chest pain)

2. Physical Examination

The physical examination is directed primarily at the respiratory system. The frequency of the periodic examination will depend on the intensity and length of exposure to silica and must be decided by the examining doctor. It need not be the same for all workers, but it must be done at least once every two years.

3. Clinical Tests

Clinical tests aid in the assessment of a worker's fitness for continued exposure to silica. The main clinical tests are chest X-rays and pulmonary function tests. The requirements for each are specified in the Code for Medical Surveillance of Silica Exposed Workers. Where respiratory equipment is required, the physician should also assess whether the worker is fit to use this equipment.

4. Health Education

At pre-placement and periodic examinations, all workers must be advised of the hazard from silica and smoking, and their examination results must be discussed. If a worker leaves his or her employer, the worker must be advised to inform his or her doctor of previous silica exposure.

5. Record Keeping

Under the provisions of the Silica Regulation, the examining doctor must maintain health records for each worker examined (s.7 of R.R.O. 1990, Reg. 845). The Code for Medical Surveillance of Silica Exposed Workers specifies what information must be recorded and how long those records must be kept on file by the doctor.

F. EDUCATION AND TRAINING

One of the most important and potentially most productive parts of the control program involves education and training. *The ultimate success or failure of the control program rests in providing workers with appropriate information and instruction on the hazards posed by crystalline free silica, measures needed to reduce or control exposures to acceptable levels, and the need for worker co-operation in seeing that the controls are put into action effectively.*

The following topics should be addressed:

- Health hazards of exposure to crystalline free silica
- Hazards involved in use, handling and disposal of silica-containing products
- Elements of the program to control silica exposure

- Legal consequences of failure to comply with the control program
- Use of control equipment
- Use, fit, care and limitations of personal protective equipment
- Housekeeping procedures
- Procedures to minimize dust generation

Training should also address the requirements of the Workplace Hazardous Materials Information System. See **Responsibilities under the WHMIS Regulation** on page 18.

Training should be an on-going process of updating and re-evaluation. This is a necessity to ensure continued success of the control program.

G. PERSONAL PROTECTIVE EQUIPMENT

Some operations involving exposure to crystalline free silica cannot be controlled adequately by any of the preceding strategies. Often the reason is one (or more) of the following:

- An emergency situation
- Lack of control technology
- Equipment breakdown
- Infrequency of operation

These are the only situations in which the use of respiratory protection is permitted to reduce worker exposure. Selection of the appropriate equipment depends on many factors, some of which include:

- Nature of the task
- Duration of exposure
- Frequency of exposure
- Presence of toxic chemical agents other than crystalline free silica for which respiratory protection is also required
- Concentration of respirable crystalline silica:
  - known
  - anticipated
  - unknown

The preceding factors must be considered during the process of selection. Additional requirements are stated in the Code for Respiratory Equipment for Silica contained in the Silica Regulation.

In addition to respiratory protection, workers exposed to crystalline free silica may be required to wear protective outer clothing. The fabrics used are often very tightly woven or sealed by resins.

Use of personal protective equipment carries a cost to the user. Among the factors, which must be recognized, are the following:

- Reduced vision
- Reduced performance due to increased difficulty in breathing
- Reduced manual dexterity
- Increased frequency of accidents
- Possible hyperventilation syndrome
- Increased susceptibility to heat stress

For the preceding reasons the use of personal protective equipment, such as outlined here, should be considered only as the **last** line of defence rather than the first.

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Putting the Control Program into Effect

The control program should be a joint effort of the management and worker representatives of the health and safety committee, starting with proposals by management about options for controls, which are technically and economically feasible, followed by comment and counter-proposals from worker representatives. Eventual consensus of both groups is essential to ensure satisfactory implementation of the program.

The Regulation respecting Silica requires that the control program be communicated to all workers affected. The depth of management commitment must be communicated in order to secure the initial and continued co-operation of employees.

Measuring and Evaluating the Control Program

Like the proverbial chain, the control program is only as effective as its weakest link. There are several possible ways to evaluate compliance with and effectiveness of the program. These should be incorporated into an audit of the workplace and its written and actual procedures. The components of an audit could include:

- Review of air monitoring results
- Evaluation of procedures

Audits should be conducted and assessed by members of the joint health and safety committee and reported to all workers who are affected. It is essential to establish and maintain the spirit of co-operation throughout this process.

Air Monitoring

Air monitoring can provide considerable information about the status of the workplace through interpretation of worker exposure. Careful analysis of this data can provide information about:

- Success (or failure) of the control program
- Areas requiring additional attention
- Potential failure or breakdown of control equipment
- Faulty performance by individuals within a group

The factors, which may affect the interpretation of results, include:

- Differences between the way people work
- Differences in style of a single worker from day to day

- Influence of dust generated by one worker upon the exposure of another
- Differences in workplace conditions

Evaluation of Procedures

Procedures may be examined by directly observing the performance of workers. This examination should compare the level of expected performance with that actually observed. This section of the audit should examine:

- Worker awareness of the hazards posed by silica
- Compliance in use of personal protective equipment
- Adherence to established procedures

These findings must be interpreted as objectively as possible since they are likely to reflect upon individual workers, supervisors and management. The co-operation of all is required to ensure the continuing success of the control program.

Improving the Program and Recognizing Performance

Management should periodically review evaluation and audit results and initiate immediate action to correct deficiencies and make improvements in the control program, as needed. These reviews should also be an opportunity to recognize good performance.

What the Law Says

1. Responsibilities Under *The Occupational Health and Safety Act*

Under the *Occupational Health and Safety Act*, employers, supervisors and workers have legal responsibilities relating to the control of safety and health hazards in the workplace. For example, the employer must inform the worker or his or her supervisor about any safety or health hazard present in the workplace. The supervisor must advise the worker about hazards of which he or she is aware and the worker must report to his supervisor whenever he or she becomes aware of a hazard or a contravention of the *Act* or Regulations. These, and other duties set out in the *Act* apply to silica as they do to any other safety or health hazard present in the workplace. In addition, the *Act* specifies certain general duties, which apply to toxic substances in the workplace once appropriate regulations are in effect. Worker exposures related to the presence, production, processing, use, handling or storage of silica are the subject of the Designated Substances Regulation 490/09 made under the *Occupational Health and Safety Act*.

2. Regulations Made Under *The Occupational Health And Safety Act*

Section 70(2) of the *Occupational Health and Safety Act* empowers the Lieutenant Governor to issue regulations:

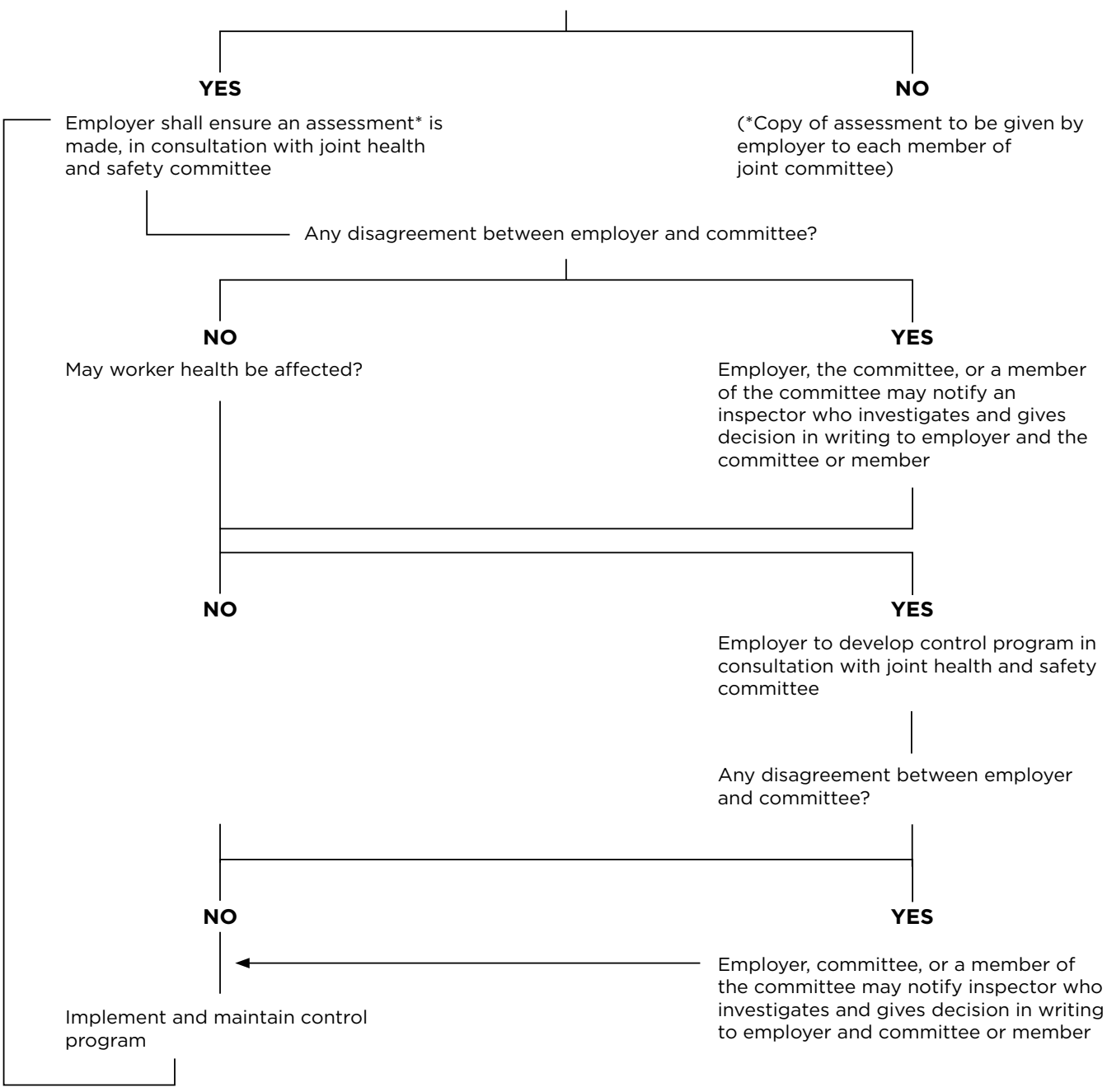
- Prescribing any biological, chemical or physical agent or combination thereof as a designated substance

AND

- Prohibiting, regulating, restricting, limiting or controlling the handling of, exposure to, or the use and disposal of any designated substance

The Regulation respecting Silica prescribes silica as a designated substance and outlines the legal requirements, which must be met for regulating its use in the workplace. Figure 2 is a decision diagram for assessing and controlling silica.

Figure 2
Decision Diagram for Assessing and Controlling Silica



** The employer is legally required to:

- Give each committee member a copy of the silica control program.
- Acquaint affected workers with the provisions of the program.
- Make a copy of the program available in English and the majority language of the workplace.

Note: "Inspector" refers to a Ministry of Labour Inspector.

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Reference should also be made to the following Codes, which have been issued as part of the Silica Regulation:

- Code for Respiratory Equipment for Silica
- Code for Medical Surveillance of Silica Exposed Workers

3. Responsibilities Under Designated Substances Regulation Respecting Silica

The Designated Substances Regulation (with respect to Silica) contains specific precautions, which must be taken in workplaces in which the Regulation is deemed to apply.

Under this Regulation, the employer and the worker bear certain legal responsibilities at a workplace in which silica is present and the worker is likely to inhale it.

For example, the employer is responsible for:

- Carrying out an assessment of possible exposure to silica
- Developing, implementing and maintaining a control program
- Providing training and instruction in the care and use of respirators
- Consulting with the joint health and safety committee on the assessment and the control program

Workers have a responsibility to:

- Work in accordance with the work hygiene practices established under the silica control program
- Use the respiratory equipment provided by the employer
- Undergo medical examinations and clinical tests as required under the code for medical surveillance of silica exposed workers

4. Limits of Exposure Established In The Regulation Respecting Silica

Silica means crystalline silica in a respirable form. 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 Government Industrial Hygienists (ACGIH) particle size-selective criteria; and

b) Has the cut point of 4 microns at 50 per cent collective efficiency.

The time-weighted average exposure of a worker to airborne silica must be reduced to the lowest practical level and in any event must not exceed:

- In the case of cristobalite, 0.05 Mg/m^3
- In the case of quartz and tripoli, 0.10 Mg/m^3

5. Responsibilities Under The WHMIS Regulation (R.R.O. 1990, Reg. 860)

WHMIS or the Workplace Hazardous Materials Information System is a regulated system across Canada designed to ensure that workers know and understand the hazards of materials to which they are exposed at work. The system covers controlled products (products that meet federal criteria for certain classes of materials including toxic materials). The *Occupational Health and Safety Act* and the WHMIS Regulation place duties on employers with respect to these products and these duties apply in workplaces where silica is used. Employers must ensure that:

1. All containers (bags, packages) of silica have supplier or workplace labels affixed to them, as appropriate.

2. Material safety data sheets (MSDSs) are obtained, and copies of un-expired MSDSs made accessible to workers and provided to the joint health and safety committee or health and safety representative. The MSDSs must contain the following information, as applicable:
   - hazardous ingredients
   - preparation information
   - product information
   - physical data
   - fire or explosion hazard
   - reactivity data
   - toxicological properties
   - preventive measures
   - first aid measures

3. Workers who work with or near silica receive training in:
   - the content, purpose and significance of information on labels and msdss
   - procedures for safe use, handling, storage and disposal
   - procedures to be followed when fugitive emissions are present
   - emergency procedures

   The training program and worker familiarity with the program must be reviewed annually. The joint health and safety committee or health and safety representative must be consulted in the development, implementation and review of this training.

Review Questions

Congratulations! You have now completed this guide, "Silica in the Workplace." We hope that it has been both interesting and informative, and that you will keep it for further reference. It contains important information that can have a direct bearing on **you** and **your well being at work**. The following questions were prepared to help focus your attention on the most important points. Please take a few minutes to make sure that you can answer them without difficulty.

1. What is the difference between free and combined silica?
2. Which forms of silica are likely to cause silicosis?
3. Why is respirable dust so important?
4. What are the basic features of silicosis (effects, detection, treatment)?
5. What are the most likely sources of airborne silica in your plant?
6. Are you likely to be exposed? If so, what aspects of your job are affected?
7. How is exposure to airborne silica measured?
8. What control measures are available to regulate exposure to silica?
9. If respirators are used, are they the correct type for this purpose? Is a respirator program in place?
10. What can you do to reduce your exposure to silica and that of your fellow workers?

Need More Information?

For more information on Silica or on the Regulations affecting the use of silica in the workplace, contact us at 1-877-494-WSPS (9777) or visit us at our website at www.wsps.ca

Resources

- Designated Substances Regulation (O.Reg. 490/09)
- MOL Guideline: Silica on Construction Projects
- WSIB Fact Sheet: Silicosis: Facts for Workers in Ontario

Workplace Safety & Prevention Services (WSPS), formed in 2010 through the amalgamation of Farm Safety Association (FSA), Industrial Accident Prevention Association (IAPA) and Ontario Safety Service Alliance (OSSA).

Revised: November 2011

Workplace Safety & Prevention Services

Toll-free: 1-877-494-WSPS (9777)

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