



# Crystalline Silica Program

Initiator: David Mori

Revised by: T. Stark

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## 1. Program Description

The purpose of the Crystalline Silica Program is to protect the UC Riverside campus community from health hazards associated with exposures to respirable dust that contains crystalline silica and ensure campus compliance with applicable health and safety regulations.

This program further ensures a safe workplace based on the following written procedures for crystalline silica. These procedures shall be reviewed and updated as needed to comply with revised Cal/OSHA regulations, revised industry standards, and as work practices demand.

## 2. Scope

The UC Riverside Crystalline Program, through the requirements described in this document, establishes procedures and responsibilities for UC Riverside students, faculty, staff and volunteers while engaged in University related activities. This document applies to all campus exposures to respirable crystalline silica (RCS), except where objective data demonstrates that exposure to RCS will remain below 25 micrograms per cubic meter of air (25µg/m) as an 8-hour time-weighted average (TWA) under any foreseeable conditions.

### 2.1 Background

Silica is the compound formed from the elements silicon (Si) and oxygen (O) and has the molecular form of SiO<sub>2</sub>. Silica makes up over 12% of the earth's crust making it the second most common mineral on earth, which exists naturally in both crystalline and non-crystalline (amorphous) forms. The three main forms of silica are alpha quartz, cristobalite, and tridymite. The most abundant and most hazardous to human health is alpha quartz (α-quartz), and is commonly referred to as crystalline silica. Examples of materials that contain crystalline silica include beach sand, sandstone, shale, and granite are all silica materials and concrete, and mortar also contain crystalline silica. Crystalline silica also used in the manufacturing of products such as glass, pottery, ceramics, bricks, and artificial stone.

### 2.2 Health Hazards Associated with Silica Exposure

Drilling, crushing, cutting, chipping, breaking, sawing, sanding, or polishing materials containing crystalline silica can generate hazardous quantities of RCS particulates. These particles, which are mostly 10 microns in size and smaller, are too small to see, but can penetrate to the deepest part of the

human lung when inhaled. Workers who inhale these very small crystalline silica particles are at increased risk of developing serious silica-related diseases, including:

- Silicosis, an incurable lung disease that can lead to disability and death;
- Lung cancer;
- Chronic obstructive pulmonary disease (COPD); and
- Kidney and auto-immune disease.

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

- Chronic Silicosis: Develops after 10 or more years of exposure to crystalline silica and relatively low concentrations.
- Accelerated Silicosis: Develops 5 to 10 years after initial exposure to crystalline silica at high concentrations.
- Acute Silicosis: Develops within weeks, or 4 to 5 years, after exposure to very high concentrations of crystalline silica.

Initially, workers with silicosis may have no symptoms; however, as the disease progresses, workers may experience:

- Shortness of Breath
- Severe Cough
- Weakness

### **2.3 Potential Exposures to Crystalline Silica at UC Riverside**

Activities which may result in exposure to respirable crystalline silica include, but are not limited to:

- Construction activities:
  - Sandblasting
  - Jack hammering
  - Rock drilling, cutting, chipping or polishing
  - Brick or tile cutting and sawing
  - Concrete drilling, sawing, grinding and polishing
  - Tunneling
  - Demolition
  - Asphalt milling
  - Tuckpointing
- Stone countertop fabrication
- Diatomaceous earth processing

- Pottery production
- Foundry operations

## **2.4 Applicable Regulations**

Cal/OSHA has two regulations specifically related to crystalline silica. Title 8 CCR §1532.3 for Construction and Title 8 CCR §5204 for General Industry. While the activities listed above are primarily related to construction, employers in general industry whose employees are using these same types of equipment and performing these same types of tasks may also use the exposure control methods found in Table 1 (See Appendix A) of the construction standard as an alternative to exposure monitoring. By complying with these alternative exposure control methods, employers are exempted from the regulation's other exposure monitoring, engineering, and work practice control requirements. The general industry standard primarily addresses workers that can be exposed to respirable crystalline silica during activities such as the manufacture of glass, pottery, ceramic, brick, concrete, asphalt roofing, jewelry, artificial stone, dental, porcelain, or structural clay products; or during the use of industrial sand in operations such as foundry work.

The Permissible Exposure Limit (PEL) for respirable crystalline silica is 50 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) of air, calculated as an 8-hour Time Weighted Average (TWA). This is the maximum concentration of respirable crystalline silica in air to which an employee may be exposed.

The action level for respirable crystalline silica is  $25 \mu\text{g}/\text{m}^3$ , calculated as an 8-hour TWA. This is the concentration of respirable crystalline silica in air at or above which employers must assess employee exposures, as prescribed in Cal/OSHA regulations 1532.3 and 5204, and conduct medical surveillance, as prescribed in section 5204.

Note that section 5204 does not apply in the following situations:

- The employer demonstrates (through methods specified in section 5204) that exposures will remain below the "action level" under any foreseeable conditions; or
- The employer complies with section 1532.3 (as specified in section 5204, for tasks not performed regularly).

The Crystalline Silica Program establishes procedures to follow for compliance with Cal/OSHA silica regulations.

### 3. Definitions

**Action Level** - a concentration of airborne respirable crystalline silica at or above 25  $\mu\text{g}/\text{m}^3$ , calculated as an 8-hour TWA.

**Chief** - Chief of the Division of Occupational Safety and Health, or designee.

**Director** - Director of the National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health and Human Services, or designee.

**Employee Exposure** - exposure to airborne respirable crystalline silica that would occur if the employee were not using a respirator.

**High-efficiency Particulate Air (HEPA) Filter** - a filter that is at least 99.97 percent efficient in removing mono-dispersed particles of 0.3 micrometers in diameter.

**Objective Data** - information, such as air monitoring data from industry-wide surveys or calculations based on the composition of a substance, demonstrating employee exposure to respirable crystalline silica associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions closely resembling or with a higher exposure potential than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

**Office of Environmental Health and Safety (EH&S)** - ensures that UC Riverside complies with applicable health, safety and environmental laws, regulations and requirements; and, that activities are conducted in a manner that protects students, faculty, staff, visitors, the public, property, and the environment. UC Riverside is committed to excellence in health, safety and environmental performance.

**Permissible Exposure Limit** - a concentration of airborne respirable crystalline silica at or above 50  $\mu\text{g}/\text{m}^3$ , calculated as an 8-hour TWA.

**Physician or Other Licensed Health Care Professional (PLHCP)** - an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the particular health care services required by subsection (i).

**Regulated Area** - an area, demarcated by the employer, where an employee's exposure to airborne concentrations of respirable crystalline silica exceeds, or can reasonably be expected to exceed, the PEL.

**Respirable Crystalline Silica (RCS)** - means quartz, cristobalite, and/or tridymite contained in airborne particles that are determined to be respirable by a sampling device designed to meet the characteristics for respirable particle size-selective samplers specified in the International Organization for Standardization (ISO) 7708:1995: Air Quality - Particle Size Fraction Definitions for Health-Related Sampling.

**Specialist** - an American Board Certified Specialist in Pulmonary Disease or an American Board Certified Specialist in Occupational Medicine.

#### 4. Responsibilities

##### 4.1 Directors, Department Heads and Chairpersons

Directors and Department Chairs are responsible for:

- Providing the necessary resources to ensure the health and safety of their employees;
- Identifying individuals as supervisors and ensuring they are trained on their health and safety responsibilities;
- Ensuring departmental compliance with campus health and safety policies and procedures;
- Ensuring workplace hazards that their employees are exposed to are identified and controlled.

##### 4.2 Managers, Supervisors, and Principal Investigators

Supervisors are responsible for:

- Ensuring their units understand and comply with the requirements of this document;

- Developing and implementing local procedures to comply with the requirement of this document as needed;
- Being aware of silica exposure risks and risk factors;
- Reducing the risk of silica exposure by taking special precautions when necessary;
- Ensuring an up-to-date Inventory of Tasks Performed with Materials Containing Crystalline Silica form (Appendix A) has been submitted to the Office of Environmental Health and Safety (EH&S) for their unit, if applicable.
- Ensuring that all workers (under the supervisor's direction and control) have received the necessary education and training. As appropriate, each supervisor must ensure that workers are available to "demonstrate competency" for identified tasks.
- Ensuring that all the tools, equipment, PPE and materials (including water) necessary to implement the exposure control plan (ECP) is available (and in proper working order) prior to allowing work activities to commence.
- Ensuring that workers adhere to the project/task specific ECP, including PPE and personal hygiene (i.e. including be clean shaven where the respirator seals to the user's face) requirements.

#### **4.3 Employees, Students and Volunteers:**

Employees, Students and Volunteers are responsible for:

- Understanding and complying with campus health and safety policies and procedures;
- Notifying their supervisor or EH&S about any hazardous conditions observed on the worksite including potential exposures to crystalline silica;
- Using the assigned protective equipment in an effective and safe manner;
- Working in accordance with the project/task specific Exposure Control Plan.

#### **4.4 Competent Person:**

OSHA defines competent person as an individual who is capable of identifying existing and foreseeable respirable crystalline silica hazards in the workplace and who has authorization to take prompt corrective measures to eliminate or minimize them. The competent person responsibilities include, but are not limited to the following:

- Perform frequent and regular inspections of job sites

- Understand the work materials, equipment, and processes
- Assist with hazard assessments, monitoring, and designing controls

#### **4.5 Qualified Person:**

- Has a recognized degree, certificate, or professional standing in an occupational health, safety, environmental, or engineering field (e.g., CIH, CSP, PE);
- Has extensive knowledge, training, and experience in hazards and control of silica hazards on the construction site through formal training and/or extensive, firsthand experience in anticipation, recognition, evaluation, and control of worker silica exposure; and
- Can make quantitative assessments of worker exposure and recommend detailed control measures.

#### **4.6 Environmental Health & Safety (EH&S)**

- Annually reviews and evaluates the program.
- Reviews Silica Training to ensure that all applicable employees (e.g., Managers, Supervisors, and Workers) receive the necessary education and training related to this Program, as well as project/task specific procedures to work safely with silica and training records are maintained.
- Coordinates medical surveillance.
- Conducts quantitative and qualitative assessments of employee exposure to respirable crystalline silica.
- Provides notification to affected employees, the results of exposure assessment from personal air monitoring within 5 days of receipt of lab analysis.
- Makes engineering, administrative and personal protective equipment recommendations based on expert knowledge and sampling results.
- Recommends and/or requires corrective measures to eliminate or reduce the employee exposure to respirable crystalline silica.
- Remains current on updates to Federal and Cal/OSHA silica regulations, any other changes enacted, and new information as it becomes available.
- Serves as competent person as required.
- Conducts periodic site inspections and identifies respirable crystalline silica hazards.
- Shall ensure that University policies are enforced and safe work practices are used;
- Shall ensure appropriate training is provided for workers upon request by departments and training records are maintained; and



- Shall provide technical support to departments and employees when questions or concerns arise with regards to safety.

## 5. Program Components

When a task will be performed that is listed in Appendix A: Table 1 - Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica, the employee will fully and properly implement the control methods that are listed according to the task and duration of time. If the task and duration requires the use of respiratory protection, the employee completing the task must follow the EH&S [procedures for obtaining a respirator](#), have been medically cleared, and fit tested for the type of respirator that is required.

It should be noted that Cal/OSHA does not consider respirators as protective, or as practical, as engineering controls. For respirators to function properly, they must be selected for each employee, individually fitted, periodically refitted, and regularly maintained, which includes replacing filters and other parts as necessary. If proper procedures are not followed, employees may be exposed to silica dust. Respiratory protection should only be used in cases where engineering and work practice controls are not able to adequately eliminate or control crystalline silica dust.

If the task to be completed is NOT listed in Appendix A, or where the department is not able to fully and properly implement the engineering controls, work practices, and respiratory protection, the department is required to contact EH&S, before the task is to be performed.

For tasks not listed in Appendix A, EH&S will complete an assessment to assess any hazards to the employee that may include but are not limited to the following:

- An evaluation a job task for identification of hazards that the employee may be exposed to during the course of completing the task.
- If required, EH&S will conduct personal air monitoring in accordance with Appendix B: Flow Chart for Occupational Exposure Monitoring.
- All results of personal air sampling will be made available to the employee within five business days of receipt of lab analysis results.
- All results will be held on file by EH&S for the course of the employee's time with UC Riverside, and 30 years beyond their separation from the University.

- As a result of air sampling and monitoring, EH&S will make recommendations and/or requirements for the task sampled.
- Recommendations for employee occupational exposures will follow the protection hierarchy. The established hierarchy order is Engineering Controls, Administrative Controls, and Personal Protective Equipment (PPE).
  - a. Engineering controls for mitigation of silica dust include the use of water or a vacuum system to limit dust exposure.
  - b. Administrative or work practice controls include the use of task rotations or task time limits to reduce the employee's time working with or around silica dust. Additional training given to the employees about the hazard and control methods is also considered a work practice control.
  - c. PPE is used when engineering and administrative controls are not feasible or do not lower the exposure to an acceptable level.

### **5.1 Housekeeping**

Follow appropriate housekeeping procedures to minimize exposures to crystalline silica dust:

- Use only approved wet methods (i.e., using water to keep dust down) and HEPA vacuuming to keep dust under control.
- Not allowing the use of compressed air, dry brushing, or dry sweeping to clean clothing or surfaces unless wet methods and vacuuming are not feasible.

### **5.3 Medical Surveillance**

EH&S will notify employee who will be required to be enrolled in medical surveillance.

UC Riverside will provide medical surveillance examinations to employees who will be exposed above the action level for 30 or more days a year. Medical surveillance is intended to identify cases of silica-related disease; identify health conditions that may place an employee at increased risk from exposure to respirable crystalline silica; and determine an employee's ability to use respiratory protection.

Medical surveillance is provided at no cost to the employee.

All medical testing related to medical surveillance will be conducted by an Occupational Health Clinic, employee's physician, or other licensed health

care professional (PLHCP) recognized by UC Riverside, at a reasonable time and place for the employee.

- The provider will be required to supply the employee with a written **report** that includes detailed medical findings, any work restrictions, and recommendations concerning any further evaluation or treatment test results within 30 days of the examination.
- The provider will be required to supply EH&S with a written medical **opinion** that only describes limitations on respirator use within 30 days of the examination. Any recommended limitations on the employee's exposure to respirable crystalline silica, or any referral to a specialist, are only provided to EH&S if the employee provides his or her written consent.

Medical surveillance testing may include:

- Comprehensive history of medical and work history, with an emphasis on the past, present, and anticipated exposure to respirable crystalline silica, dust, and other agents that affect the respiratory system; any history of respiratory system dysfunctions, including signs and symptoms of respiratory disease.
- Physical Examination with a special emphasis on the respiratory system.
  - a. Initial and every three years
- Tuberculosis testing
  - a. Initial testing
  - b. Additional testing if a positive or undetermined results are indicated
- Pulmonary Function Testing
  - a. Initial and every three years
- Chest X-Ray
  - a. Initial and every three years
  - b. Based upon initial exam results, the employee maybe referred to a specialist for further examination.

The University must offer medical surveillance examinations every three years to employees who continue to be exposed above the action level.

## 6. Reporting Requirements

Constant awareness of and respect for equipment, co-workers, and facilities and compliance with all applicable UC Riverside safety rules is mandatory.

Supervisors shall issue warnings and implement disciplinary actions up to and including termination for failure to follow the guidelines of this program.

Employees shall report any safety concerns to their supervisor or EH&S.

## **7. Training Requirements and Competency Assessment**

EH&S shall coordinate the training program for the Campus which shall include *online/classroom instruction and operational training* for specific operations performed on campus.

The training will address the following requirements:

- Health hazards associated with exposure to respirable crystalline silica dust.
- Specific tasks in the workplace that could result in exposure to respirable crystalline silica.
- Control measures such as engineering controls, work practice controls, or the use of personal protective equipment that are used to protect employees from exposure to respirable crystalline silica.
- The function of the competent person responsible for inspections of job sites, materials, and equipment.
- The purpose and description of the medical surveillance program for employees working with respirable crystalline silica.

### **7.1 Employees**

Employees identified to have a risk of exposure to respirable crystalline silica will be required to complete silica training. Training may be completed through an online or classroom course.

Employees must be trained at the time they are assigned to a position involving possible exposure to respirable crystalline silica. Additional training must be provided as often as necessary to ensure that employees know and understand respirable crystalline silica hazards and the protections available in their workplace.

## 7.2 Supervisors

Supervisors who assign or direct this type of work shall be trained to recognize the hazards associated with the work being done. The training shall include, but not be limited, to the following topics as applicable:

- Definitions
- How respirable crystalline silica affects the body
- Preventing exposures to crystalline silica
- Proper use and maintenance of silica dust-preventing equipment
- Implementation and supervision of written silica exposure control plans
- Understanding OSHA's final rule on silica
- Any other pertinent requirements of the Cal/OSHA rules.

### Retraining Requirements:

Retraining shall be required when observations of work practices indicate that an employee lacks the skill or understanding needed for safe work. The employee shall be retrained so that the requisite proficiency is regained. Retraining shall be done in at least the following situations:

- When the department asks an employee to perform a task that is new to that employee;
- When the department introduces new equipment, processes, and protections; and
- When the employee is working in a manner that suggests the employee has not retained the requisite understanding or skills related to prevention of crystalline silica exposures.
- Every 3 years to ensure employees receive the most current information.

## 8. Information and External References

Occupational Health and Safety Administration (OSHA) Silica:

<https://www.osha.gov/dsg/topics/silicacrystalline/>

NIOSH Workplace Safety and Health Topics - Silica

<https://www.cdc.gov/niosh/topics/silica/default.html>

Cal/OSHA §1532.3. Occupational Exposures to Respirable Crystalline Silica (and [Appendix A](#)) for Construction

[https://www.dir.ca.gov/title8/1532\\_3.html](https://www.dir.ca.gov/title8/1532_3.html)

Cal/OSHA §5155. Airborne Contaminants (and [Appendix](#) and [Table AC-1](#))  
<https://www.dir.ca.gov/title8/5155.html>

Cal/OSHA §5204. Occupational Exposures to Respirable Crystalline Silica  
(and [Appendix A](#)) for General Industry  
<https://www.dir.ca.gov/title8/5204.html>

## 9. Appendices

### Appendix A

Table 1 - Specified Exposure Control Methods When Working With Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
<b>(i) Stationary masonry saws</b>	<p>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p>	None	None
<b>(ii) Handheld power saws (any blade diameter)</b>	<p>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p> <p>– When used outdoors.</p> <p>– When used indoors or in an enclosed area.</p>	<p>None</p> <p>APF 10</p>	<p>APF 10</p> <p>APF 10</p>
<b>(iii) Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less)</b>	<p>For tasks performed outdoors only:</p> <p>Use saw equipped with commercially available dust collection system.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p> <p>Dust collector must provide the airflow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency.</p>	None	None

Equipment/Task	Engineering and Work Practice Control	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
<b>(iv) Walk-behind saws</b>	<p>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p> <ul style="list-style-type: none"> <li>- When used outdoors.</li> <li>- When used indoors or in an enclosed area.</li> </ul>	<p>None</p> <p>APF 10</p>	<p>None</p> <p>APF 10</p>
<b>(v) Drivable saws</b>	<p>For tasks performed outdoors only:</p> <p>Use saw equipped with integrated water delivery system that continuously feeds water to the blade.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p>	<p>None</p>	<p>None</p>
<b>(vi) Rig-mounted core saws or drills</b>	<p>Use tool equipped with integrated water delivery system that supplies water to cutting surface.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p>	<p>None</p>	<p>None</p>
<b>(vii) Handheld and stand-mounted drills (including impact and rotary hammer drills)</b>	<p>Use drill equipped with commercially available shroud or cowling with dust collection system.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p> <p>Dust collector must provide the airflow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism.</p> <p>Use a HEPA-filtered vacuum when cleaning holes.</p>	<p>None</p>	<p>None</p>



Equipment/Task	Engineering and Work Practice Control	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
<b>(viii) Dowel drilling rigs for concrete</b>	<p>For tasks performed outdoors only:</p> <p>Use shroud around drill bit with a dust collection system. Dust collector must have a filter with 99% or greater efficiency and a filter-cleaning mechanism.</p> <p>Use a HEPA-filtered vacuum when cleaning holes.</p>	APF 10	APF 10
<b>(ix) Vehicle-mounted drilling rigs for rock and concrete</b>	<p>Use dust collection system with close capture hood or shroud around drill bit with a low-flow water spray to wet the dust at the discharge point from the dust collector.</p> <p>OR</p> <p>Operate from within an enclosed cab and use water for dust suppression on drill bit.</p>	None	None
	<p>Operate from within an enclosed cab and use water for dust suppression on drill bit.</p>	None	None
<b>(x) Jackhammers and handheld powered chipping tools</b>	<p>Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact.</p> <p>– When used outdoors.</p> <p>– When used indoors or in an enclosed area.</p> <p>OR</p> <p>Use tool equipped with commercially available shroud and dust collection system.</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p> <p>Dust collector must provide the airflow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism.</p> <p>– When used outdoors.</p> <p>– When used indoors or in an enclosed area</p>	None	APF10
		APF10	APF10
		None	APF 10
		APF 10	APF 10



Equipment/Task	Engineering and Work Practice Control	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
	<p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.</p> <p>OR</p> <p>Use machine equipped with dust collection system recommended by the manufacturer</p> <p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions</p> <p>Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99% or greater efficiency and filter-cleaning mechanism</p> <p>When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes</p>	None	None
<b>(xiv) Small drivable milling machines (less than half-lane)</b>	<p>Use a machine equipped with supplemental water sprays designed to suppress dust. Water must be combined with a surfactant.</p> <p>Operate and maintain machine to minimize dust emissions</p>	None	None
<b>(xv) Large drivable milling machines (half-lane and larger)</b>	<p>For cuts of any depth on asphalt only:</p> <p>Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust.</p> <p>Operate and maintain machine to minimize dust emissions.</p> <p>For cuts of four inches in depth or less on any substrate:</p> <p>Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust.</p>	None	None
		None	None

Equipment/Task	Engineering and Work Practice Control	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
	<p>Operate and maintain machine to minimize dust emissions.</p> <p>OR</p> <p>Use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactant.</p> <p>Operate and maintain machine to minimize dust emissions.</p>	None	None
<b>(xvi) Crushing machines</b>	<p>Use equipment designed to deliver water spray or mist for dust suppression at crusher and other points where dust is generated (e.g., hoppers, conveyers, sieves/sizing or vibrating components, and discharge points).</p> <p>Operate and maintain machine in accordance with manufacturer's instructions to minimize dust emissions.</p> <p>Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station.</p>	None	None
<b>(xvii) Heavy equipment and utility vehicles used to abrade or fracture silica containing materials (e.g., hoe-ramming, rock ripping) or used during demolition activities involving silica-containing materials</b>	<p>Operate equipment from within an enclosed cab.</p> <p>When employees outside of the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions.</p>	None	None
<b>(xviii) Heavy equipment and utility vehicles for tasks such as grading and excavating but not including: demolishing,</b>	<p>Apply water and/or dust suppressants as necessary to minimize dust emissions.</p> <p>OR</p> <p>When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab.</p>	None	None

Equipment/Task	Engineering and Work Practice Control	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
abrading, or fracturing silica containing materials			

## Appendix B

APPENDIX B: FLOW CHART FOR OCCUPATIONAL EXPOSURE MONITORING

