



Hazards of Silica in Construction *etool*

What are the possible exposure sources?

What's the hazard?

How do you control the hazard?

Who needs to be trained and what should you cover?



What are some of the related Cal/OSHA requirements?

What's the hazard?

Each year more than 300 U.S. workers die from silicosis and thousands more are diagnosed with the lung disease. **It is frequently misdiagnosed, so actual numbers may be quite higher.**



Silica is a natural mineral that comes in several Crystalline forms, some more hazardous than others, such as:

- Quartz
- Fused
- Tripoli
- Cristobolite
- Tridymite



Crystalline silica dust is made up of a variety of particle sizes. Particle sizes small enough to reach the deep parts of the lungs are referred to as “respirable”, which are more likely to cause:

- ❌ "Silicosis", which is a scarring of the lung tissues,
- ❌ Lung cancer
- ❌ Chronic obstructive pulmonary (lung) disease (COPD)
- ❌ Decreased lung function
- ❌ Increased risk of getting tuberculosis

It's important people working with silica-containing materials understand:

- ! With lower exposures over longer periods of time it usually takes several years before you know that you have a problem.
- ! Higher exposures can produce health problems much sooner.
- ! At first, there can be no symptoms of disease, and then
 - o Shortness of breath.
 - o Chest pain
 - o Persistent dry coughing
 - o Loss of appetite and weight loss
 - o Extreme fatigue
 - o Fever
 - o Nails with a bluish tint

- ! Short of a lung transplant, silicosis cannot be cured. Doctors can only treat the symptoms to provide some comfort. It's best to minimize exposures now to prevent disability later in life.

The symptoms and other health affects listed above can be caused by other things besides exposure to silica. Make sure and get evaluated by a board certified occupational medicine physician.

Additional Sources of Information

- [NIOSH](#)
- [Washington State](#)
- [OSHA](#)

What are the possible exposure sources?

Crystalline silica can be found in certain types of natural materials, such as:

- Sand
- Soil and rock
- Gravel
- Sandstone
- Slate
- Granite
- Clay

Typical construction materials made from these natural ingredients include:

- ✔ Ceramic and terracotta tiles
- ✔ Concrete and concrete block
- ✔ Manufactured stone
- ✔ Roof tiles
- ✔ Bricks and blocks
- ✔ Grouts and mortar
- ✔ Some joint compounds
- ✔ Abrasive materials

These become some of the sources of exposure associated with a number of the construction trades.

Exposure Levels

Airborne exposure to crystalline silica dust can depend on a number of things, such as:

1. Types of activities

- **Cutting, drilling and coring**
 - Concrete
 - Roof tile
 - Tile backer board
 - Brick and block
 - Granite



- **Grinding, Sanding and Sandblasting**

- Sack and patch
- Tuck point grinding
- Scabbling/scarifying
- Drywall mud sanding
- Hand-held surface grinding



- **Pulverizing**

- Jack and chipping hammers
- Cement truck cleaning
- Concrete recycling
- Road milling
- Backhoes, excavators
- Demolition

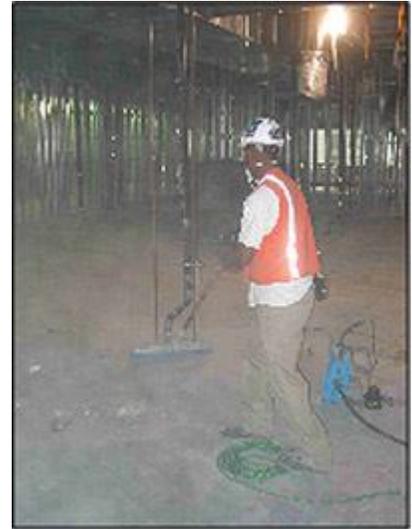


- **Mixing (dry)**

- Cement
- Plaster and grout



- **Cleaning up**
 - Dry sweeping (versus wet)
 - Compressed air (versus vacuum)
 - Hauling



2. Location

- Outside or in a wide open area versus inside or an enclosed area

3. Materials being used

- The percentage of silica present varies a lot. The higher the content, the more likely overexposure will occur

4. Types of equipment used

- Cutting using wet methods versus dry methods
- Types of blades or abrasives used
- Use of local ventilation that prevents or reduces the amount of dust you breathe

5. How long the dust-generating activity goes on in a shift

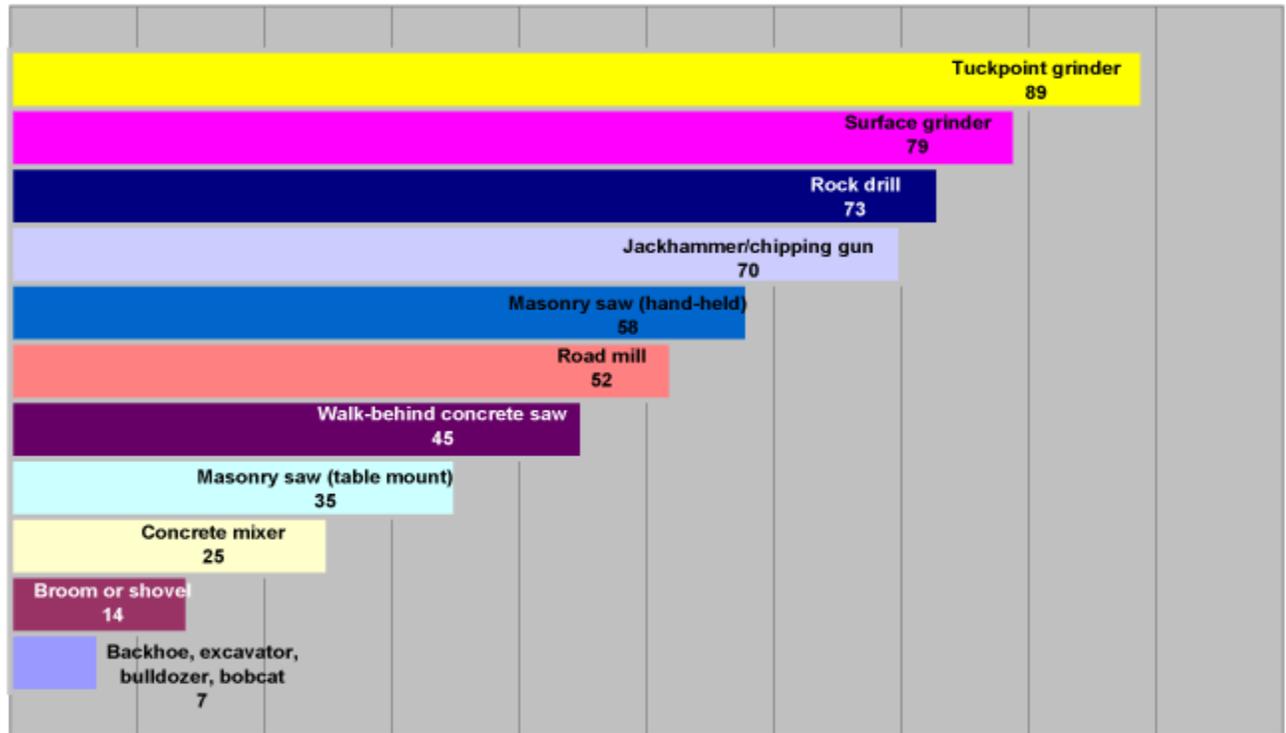
- The longer the duration of exposure, the greater the chance of overexposure

6. Weather conditions

- Presence of moisture
- The lighter the wind the less likely airborne dust generated will move away from the breathing zone and be quickly diluted. On the flip side, wind currents can move the hazard away from one person to another.

Sources of Exposure Information

What are your chances of being overexposed?
(Based on a Summary of University of Washington Studies)



The probability (in %) of being overexposed
(based on the Cal/OSHA PEL of 0.1 mg/m³ of air for respirable quartz silica)

Allowable Exposure Levels

Cal/OSHA has established regulatory permissible exposure levels for silica that varies depending on the form of silica (quartz, fused, tripoli, tridymite and cristobolite) and particle sizes present. These allowable exposure levels are reflective of an employee's average exposure throughout an 8-hour shift. There is a difference between "total" and "respirable" silica dust, in that "respirable" silica dust is more likely to get into the deep parts of the lungs and cause more serious damage.

- Cal/OSHA's Permissible Exposure Levels over an 8-hour average basis
 - Respirable crystalline silica (quartz, fused, tripoli), 0.1 mg/m³ - 0.1 milligrams of Silica in 1 cubic meter of air.
 - Total crystalline silica (quartz), 0.3 mg/m³.
 - Respirable cristobolite and tridymite, 0.05 mg/m³.

NOTE: Special exposure sampling methods are needed to collect the “respirable” fraction of the dust you are exposed to. If not done properly, this type of sampling can easily be inaccurate and give you misleading results.

It’s important to note that there are other exposure guidelines from NIOSH (National Institute of Occupational Safety and Health) and ACGIH (American Conference of Industrial Hygienists). Although not enforceable by Cal/OSHA, you should still take them into consideration.

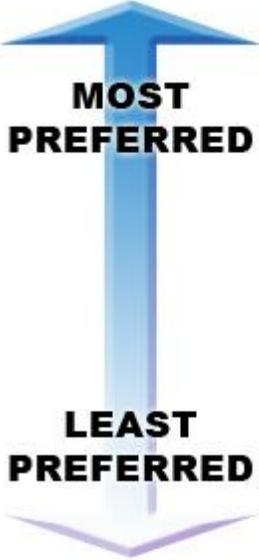
- NIOSH recommends an exposure level of 0.05 mg/m³ on an 8-hour average basis
- ACGIH recommends an exposure level of 0.025 mg/m³ on an 8-hour average basis.
 - ACGIH currently lists crystalline silica as a known human carcinogen.
- Crystalline silica is currently on the California Prop 65 List of substances known to the State of California to cause cancer

Additional Sources of Exposure Information:

- University of Washington: www.depts.washington.edu/silica/dust.html
- NIOSH: www.cdc.gov/niosh/topics/silica/
- eLCOSH: www.cdc.gov/elcosh/docs/hazard/chemical_silica.html
- Health and Safety Executive (UK): www.hse.gov.uk/pubns/cis36.pdf

How do you control the hazard?

Whether it's silica dust or anything else that employees are being overexposed to, you want to control the problem by starting at the top of the following sequence. Reference T8CCR, Section 5141 for details on how Cal/OSHA requires this hierarchy of controls.

 <p>MOST PREFERRED</p> <p>LEAST PREFERRED</p>	<p>Eliminate or reduce the silica content.</p> <p>“Engineer” out the exposure – i.e. use an effective local exhaust or vacuum tool system, wet-cutting and/or isolate the source of dust.</p> <p>Use administrative and work practice controls, such as limiting the amount of time of exposure and working with materials in a way that reduces the generation of airborne dust.</p> <p>Use personal protective equipment, such as a respirator and coveralls that keeps the dust off the clothes you wear home. Respirators may still be required if the above controls don't adequately reduce exposure levels.</p>
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NOTE: “Ventilation”, “Wet Cutting”, “Isolation” and “Work Practice Controls” are automatically mandatory requirements for activities that fall within the scope of Section 1530.1, unless it can be clearly established that employees will not be exposed above Cal/OSHA allowable exposure levels for crystalline silica (quartz, cristobolite, tridymite).

Isolation

- ✔ Enclose the work so all dust is contained within the enclosure and all employees are outside.
- ✔ Establish a perimeter around the source of the airborne dust to keep employees away and prevent exposures.

In both cases, careful attention is needed where employees need to enter the affected area once the process has stopped or the enclosure has been removed. There may be considerable dust contamination that can easily become airborne due to traffic and other activities, such as clean up.

Ventilation

Use a local exhaust or vacuum tool system that removes airborne dust before it gets to the breathing zone of the operator or surrounding employees.

Some important things to watch out for:

- The exhaust system needs to be properly designed in order for it to effectively control exposure. This means an exhaust hood design that allows for effective capture of airborne dust.



- The users need to make sure it is consistently set up according to the manufacturer's specifications, and remains so throughout its use. This includes using the shortest flexible ducting with the least amount of bends.
- The system needs to be maintained to ensure optimal air exhaust. This includes ensuring the dust collectors are serviced as needed. NOTE: Maintenance of the system can result in significant dust exposures, so respiratory protection may be needed.
- User training on the proper use and maintenance of the equipment.

Wet-Cutting

Use a wet-cutting system that minimizes the generation of dry dust.

What to watch out for:

- Systems meeting Nationally Recognised Testing Lab (NRTL) approval requirements for electrical systems in wet conditions, including GFCI-protected electrical sources.
- Set up and maintenance of the equipment according to the manufacturer's instructions. This will include ensuring water flow rates within specifications.
- User training on the proper use and maintenance of the equipment.

Work Practice Controls

✓ DO's

- ✓ Work with materials in a way that minimizes the generation of airborne dust.
- ✓ Wet sweeping where possible using water or a sweeping compound.
- ✓ Use HEPA (high efficiency particulate air) filter vacuums.
- ✓ Wet materials before disturbing, unless that creates significant muscular skeletal strain, slip or other safety hazards.
- ✓ Use a water mist to keep airborne dust down.

✗ DON'Ts

- ✗ Work with materials dry unless you also have a good exhaust system or there is simply no other way to do it safely, in which case a good respirator protection program will be necessary.
- ✗ Use compressed air to clean dust off of surfaces, equipment or yourself.

Respirator Protection

This is your last and least preferred means of protection. If your employees are using one, then make sure that:

1. They are using the right one for the type of material in question. This means
 - The filter will filter out the particle size employees are being exposed to, as well as any other hazardous materials, such as solvents, that may be present. Given the hazards of silica, it's best to use a P100 filtered air purifying respirator, unless an air supplied respirator is called for.
 - The respirator's protection factor is suitable for the exposures being encountered.
2. They are medically approved to wear one.
3. It fits them properly. This means the user needs to
 - Do a positive/negative fit check every time they put a respirator on.
 - Undergo a qualitative or quantitative fit-test at least annually.
4. They've been trained on the respirators' limitations and how to properly use, clean and store it.
 - This includes making sure they do not have facial hair that breaks or interferes with the seal between the respirator and their face.

5. Someone in the organization has been given the responsibility to make sure the program is being implemented correctly.

Other Sources of Information

Cal/OSHA

Respirator Protection: Guidelines on how to make sure you as the employer have an effective respirator protection program that includes:

- Selection of the appropriate type.
- Medical approval.
- Fit-testing.
- Training on how to wear and maintain.

NIOSH

Control Technology for Ready-Mix Truck Drum Cleaning

WISHA

Who needs to be trained and what should you cover?

It's important all people...

- Employees
- Foremen, superintendents, and
- Project managers and those involved in the proposal and planning phases of construction that may involve silica-containing materials.

...Understand

- ✔ What the health hazards are
- ✔ When and where silica-containing materials pose a concern, and
- ✔ How to eliminate, or at least control the exposure hazard.

Employees

Make sure they clearly understand the:

Health Hazards, including

- ! Silicosis
- ! Lung cancer
- ! Chronic obstructive pulmonary (lung) disease (COPD) and decreased lung function.

Exposure Controls, including

- **Methods used by the employer to control employee' exposures to airborne dust, such as**
 - ✔ Wet cutting
 - ✔ Local exhaust ventilation systems
 - ✔ Isolation of the process from the operator and surrounding employees by means of distance, enclosure or other method, as applicable
 - ✔ Work practices
- **Proper use and maintenance of dust reduction systems, including the safe handling and disposal of collected waste materials**

- **The importance of good personal hygiene and housekeeping practices when working with or around dust containing crystalline silica, including:**
 - ❌ Ensuring that hands, arms, face, and any exposed parts of the body are thoroughly washed before eating, or leaving the worksite.
 - ❌ Not smoking tobacco products.
 - ❌ Using appropriate methods to clean employees' own clothes
 - ❌ Making sure that protective clothing worn to prevent employees' own clothes from getting contaminated is safely discarded (before leaving the worksite) in a manner that does not spread contamination.

Foremen, Superintendents and Project Managers

In addition to what employees are trained on, supervision and management needs to also be able to:

- ✅ Identify tasks employees will perform that may result in employee exposure to silica containing dust, and
- ✅ Determine procedures for implementation of the measures used by the employer to reduce the exposure to concrete or masonry dust

NOTE: For activities falling within the scope of Section 1530.1, all of the above must be addressed with employees and supervision on at least an annual basis.

Additional Tools and Information

- [WISHA PowerPoint Presentation](#)
- [WISHA Silica in Construction Training Kit](#)
- [OSHA "Silica Card"](#)
- [Cal/OSHA Silica Hazard Alert](#)

What are some of the related Cal/OSHA requirements?

No matter what material you are working with – even something considered to be a "nuisance dust" - there is a basic Cal/OSHA requirement that employers know if their employees are being overexposed, whether that be by inhalation, skin absorption, or ingestion. Since it is not always easy to know if employees are overexposed, it is safest to assume they are. **That means going ahead and implementing the exposure reduction controls described in the [How do you Control the Hazard?](#) page.**

For activities falling within the scope of section 1530.1, much of what is covered by this eTool is automatically required of employers to implement unless the employer can reliably demonstrate by air sampling data applicable to the specific operation being performed that employees will not be exposed above Cal/OSHA allowable exposure levels for the various crystalline silica. Refer to Section 1530.1 for details.

In particular, take a look at Title 8 of the California Code of Regulations (T8CCR), Sections:

- [1509](#): Injury and Illness Prevention Program (construction)
- [1530](#): General Requirements of Mechanical Ventilation Systems (construction)
- [1530.1](#): Control of Employee Exposures from Dust-Generating Operations Conducted on Concrete and Masonry Materials

Important Note for Section 1530.1: *“This section does not preclude the application of other sections of Title 8 including, but not limited to, Sections 1509, 1530, 3203, 5141, 5143, 5144, 5155, and 5194.”*

Keep this “Note” in mind when you consider the seven (7) exempted construction activities. Even though these specific activities are exempted by 1530.1, excessive exposures to crystalline silica cannot necessarily be ruled out. **You must still evaluate the potential exposures to silica and control as necessary.**

- [3203](#): Injury and Illness Prevention Program (general industry)
- [5141](#): Control of Harmful Exposure to Employees
- [5143](#): General Requirements of Mechanical Ventilation Systems
- [5144](#): Respiratory Protective Equipment
- [5155](#): Airborne Contaminants
- [5194](#): Hazard Communication

Depending on what your employees work with, you may also want to take a look at other things besides silica, such as:

- [1529](#): Asbestos
- [1532](#): Cadmium
- [1532.1](#): Lead
- [1532.2](#): Hexavalent Chrome
- [1535](#): Methylenedianiline
- [1521](#): Excessive Noise Exposure – i.e. Ear Protection

Reference [California Code of Regulations, Title 8](#) for other Cal/OSHA requirements not addressed above.