

Clearheart Construction Co., Inc.

Silica

Silica, Crystalline (Respirable Size), National Institute of Health

Silica

Occupational silica exposure is completely preventable through employee training, use of a silica substitute, use of engineering controls, improved work practices, and, lastly, use of personal protective equipment.

Employees who are potentially exposed to an environment containing airborne concentrations of silica will receive training prior to working with silica and receive periodic refresher training after work has started.

Silica training will include:

- a. Exposure monitoring for respirable silica.
 - 1. Full shift personal samples will be taken that are representative of the employees regular, daily exposure to silica. A certified industrial hygienist will use a combination device called a cyclone assembly and a sampling pump to trap tiny respirable silica particles from the air in the work environment.
 - 2. The cyclone assembly and sampling pump will be placed on an employee who will wear the device throughout the work shift for up to 8 hours.
 - 3. Sampling requires just a select few employees who are closest to the silica source may be fitted. The industrial hygienist can help you determine what will be most appropriate.
 - 3. At the end of the sampling period, the hygienist will de-activate the sampling pump and remove the filters to be sent to a certified laboratory for analysis.
 - 4. Employee exposures to concentrations of silica must be kept below the permissible exposure limits found in 1910.1000 Table Z-3, below:

Standard Number: 1910.1000 TABLE Z-3
TABLE Z-3 Mineral Dusts

Substance	mppcf a	mg/m3
Silica:		
Crystalline		
Quartz (Respirable)	250b	10 mg/m3 e
	%SiO ₂ +5	%SiO ₂ +2
Quartz (Total Dust)		30 mg/m3
		%SiO ₂ +2
Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz.		
Tridymite: Use ½ the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth	20	80 mg/m3

Substance	mppcf a	mg/m3
		%SiO2
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc (not containing asbestos)	20c	
Talc (containing asbestos) Use asbestos limit		
Tremolite, asbestiform (see 29 CFR 1910.1001)		
Portland cement . . .	50	
Graphite (Natural)	15	
Coal Dust:		
Respirable fraction less than 5% SiO2		2.4 mg/m3 e
Respirable fraction greater than 5% SiO2		10 mg/m3 e
		%SiO2+2
Inert or Nuisance Dust:d		
Respirable fraction	15	5 mg/m3
Total dust	50	15 mg/m3

Note -- Conversion factors - mppcf X 35.3 = million particles per cubic meter = particles per c.c.

^a Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

^b The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable.

^c Containing less than 1% quartz; if 1% quartz or more, use quartz limit.

^d All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Table Z-1.

^e Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5.0	25
10	0

The measurements under this note refer to the use of an AEC (now NRC) instrument. The respirable fraction of coal dust is determined with an MRE; the figure corresponding to that of 2.4 mg/m3 in the table for coal dust is 4.5 mg/m3.

[58 FR 35340, June 30, 1993; 58 FR 40191, July 27, 1993, as amended at 61 FR 56831, Nov. 4, 1996; 62 FR 1600, Jan. 10, 1997; 62 FR 42018, Aug. 4, 1997]

- b. The health hazards associated with respirable silica are silicosis, lung cancer, pulmonary tuberculosis and other airway diseases.

Silicosis is caused by exposure to respirable crystalline silica dust. Crystalline silica is a basic component of soil, sand, granite, and most other types of rock, and it is used as an abrasive blasting agent. Silicosis is a progressive, disabling, and often fatal lung disease. Cigarette smoking adds to the lung damage caused by silica.

Symptoms of silicosis:

Silicosis (especially the acute form) is characterized by shortness of breath, fever, and cyanosis (bluish skin); it may often be misdiagnosed as pulmonary edema (fluid in the lungs), pneumonia, or tuberculosis. Severe mycobacterial or fungal infections often complicate silicosis and may be fatal in many cases

Three types of silicosis:

1. Chronic silicosis: usually occurs after 10 or more years of exposure to crystalline silica at relatively low concentrations
2. Accelerated silicosis: results from exposure to high concentrations of crystalline silica and develops 5 to 10 years after the initial exposure
3. Acute silicosis: occurs where exposure concentrations are the highest and can cause lung cancer.

c. The exposure limits for respirable silica.

See paragraph a.4., above, 1910.1000 Table Z-3.

Permissible Exposure Limit (PEL) = Crystalline Quartz (respirable): 250 mppcf (millions of particles per cubic feet of air)/(%SiO₂ +5); 10 mg/m³/(%SiO₂ + 2); Quartz (total dust): 30 mg/m³/(%SiO₂ + 2); Cristobalite and Tridymite: Use 1/2 the value calculated from the count or mass formula for quartz

e. Acceptable substitutes for silica.

The many types of abrasive materials have varying degrees of health hazards -- silica sand being probably the most hazardous mineral abrasive used.

Whenever possible, its use should be limited and, if possible, a substitute material used. Other types of abrasives include: synthetic or natural mineral grains; metallic shot or hard grit (made of steel or chilled cast iron); and organic abrasives such as ground corncobs and walnut shells. These and other engineering controls such as containment and ventilation are important for employee safety.

f. Engineering controls.

It is important to note that silica is only hazardous in its airborne form. Engineering controls would include local exhaust ventilation and blasting cabinets.

Establishing a clearly identified exposure area.

g. Work practice controls.

Use of water sprays, wet methods for cutting, chipping, drilling, sawing, grinding, etc..

Eating, drinking, or smoking near crystalline silica dust is prohibited.

Employees will wash hands and face before eating, drinking or smoking away from silica exposure area.

h. Personal protective equipment.

The **only health hazard from silica is respiratory** therefore appropriate half-face or full face respiratory will be used.

1. Up to 0.5 milligrams per cubic meter of air (mg/m^3) of airborne exposures to crystalline silica:

Half-facepiece particulate respirators with N95 or better filters

2. Up to 1.25 milligrams per cubic meter of air (mg/m^3) of airborne exposures to crystalline silica:

Any powered, air-purifying respirator with a high-efficiency particulate filter.

Any supplied-air respirator operated in a continuous-flow mode

3. Up to 2.5 milligrams per cubic meter of air (mg/m^3) of airborne exposures to crystalline silica:

Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.

Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter

4. Up to 2.5 milligrams per cubic meter of air (mg/m^3) of airborne exposures to crystalline silica:

Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

However, when working with respirable silica, there are many physical hazards and appropriate PPE will be worn to address the hazards presented by the work at hand.

1. Eye protection: Goggles; safety glasses with side shields.
2. Head protection: Hard hat.
3. Hand protection: Gloves.
4. Foot protection: Steel toed work boots.
5. Body protection: Tyvek suits/coveralls.

Following are NIOSH recommendations for reducing crystalline silica exposures.

NIOSH Safety Recommendations:

NIOSH recommends the following measures to reduce crystalline silica exposures in the workplace and prevent silicosis and silicosis-related deaths:

1. Prohibit silica sand (or other substances containing more than 1% crystalline silica) as an abrasive blasting material and substitute less hazardous materials.
2. Conduct air monitoring to measure worker exposures.
3. Use containment methods such as blast-cleaning machines and cabinets to control the hazard and protect adjacent workers from exposure.
4. Practice good personal hygiene to avoid unnecessary exposure to silica dust.
 - a. Wash hands and face before eating.
 - b. No eating, drinking or tobacco products in the blasting area.
 - c. Shower before leaving work site.
 - d. Vehicles parked away from contaminated area.
5. Wear washable or disposable protective clothes at the worksite; shower and change into clean clothes before leaving the worksite to prevent contamination of cars, homes, and other work areas.
6. Use respiratory protection when source controls cannot keep silica exposures below the NIOSH REL.
7. Provide periodic medical examinations for all workers who may be exposed to crystalline silica.
8. Post signs to warn workers about the hazard and to inform them about required protective equipment.
9. Provide workers with training that includes information about health effects, work practices, and protective equipment for crystalline silica.
10. Report all cases of silicosis to the state health department.