

Hazardous Materials: Crystalline Silica Safe Handling Guideline

Department: Industrial Hygiene and Information Management

Program: Hazardous Materials

Owner: Program Manager

Authority: ES&H Manual, Chapter 40, Hazardous Materials¹

Chemical Name/Class

Crystalline silica

Synonyms

Silica, silicon dioxide

Reactivity and Physical Concerns

Silica, or silicon dioxide, is a naturally occurring mineral and its physical structure may exist in either crystal or amorphous forms. It is the crystal form of silica that poses the greatest health hazard to workers. The crystal form of silica is also called crystalline silica, and exists in several forms: quartz, cristobalite, tripoli, and tridymite. Quartz is the most common form of crystalline silica found in nature and in industrial use. Because crystalline silica is a major component of sand, granite, and other rock materials, it is common in the work environment. Occupational exposure to silica occurs in abrasive sand blasting, foundry work, stonecutting, rock drilling, quarry work, tunneling, and other construction related jobs.

Inhalation of silica can lead to silicosis, a debilitating lung disease. Silicosis creates inflammation and scar tissue formation in the lungs, reducing the body's ability to extract oxygen from the lungs. As the disease progresses, pulmonary and cardiac impairment may occur to the point where oxygen must be supplied continuously to sustain life. Once silicosis has developed there is no cure for the disease; however, silicosis is preventable if one can reduce silica dust exposure.

Exposure Hazards

Likely Exposures at SLAC

Gravel and sand used in cement mixing often contains large amounts of crystalline silica. During construction activities, fine crystalline silica dust could be generated and become air borne, posing a hazard to workers and people in the vicinity.

At SLAC, silica dust exposure to employees mainly comes from construction-related activities such as

- Concrete structure drilling
- Abrasive polishing using silica sand
- Cement mixing
- Silica sand blasting
- Dry sweeping and other activities that generate a visible cloud of dust

Routes of Exposure

The primary route of exposure that is of concern is through inhalation.

1 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 40, "Hazardous Materials", http://www-group.slac.stanford.edu/esh/hazardous_substances/haz_materials/policies.htm

Chronic Exposure

Chronic overexposure to silica dust results in the formation of fibrotic nodules and scarring around the trapped silica particles. This condition of the lung is called silicosis. If the nodules grow too large, breathing becomes difficult and death may result.

First Aid

As exposure to silica is a chronic exposure concern, there are no first aid requirements. Exposure of dust to the eyes can cause irritation, and the eyes can be flushed with water to clear them.

Exposure Limits

- Refer to the OSHA Table Z-3, "Mineral Dusts", 29 CFR 1910.1000, Table Z-3

Exposure Controls

Engineering Controls

Industrial hygiene assessments should be conducted to include silica dust monitoring, hazard analysis and providing the results to exposed workers and their supervisors. Results of these assessments should include

- Recommendation of engineering and administrative controls to reduce silica dust exposure
- Recommendation of appropriate and suitable respirators and other PPE for the job
- Offering hands-on practical training and quantitative fit tests for respirator use.
- If feasible, recommending non-silica material for abrasive blasting operations.

Engineering controls may include: attaching a dust control system to power tools; using a wet spray method if feasible to suppress dust during sand blasting, jack hammering or other construction activities; and when feasible, using a local exhaust ventilation system to remove dust from the work area.

Administrative Controls

Silica hazards and controls should be identified in pre-work hazard analysis forms prior to performing construction related activities. This applies to any work project that involves the job activities listed in the sections above. If the work includes airborne silica particles, contact the ES&H industrial hygienist at Ext. 4105 for assistance in minimizing exposure.

Silica exposure may also be minimized by reducing exposure time.

Warning signs will be posted if an area is designated by ES&H as a high silica dust area.

Personal Protective Equipment

Eye: safety glasses or safety goggles

Respiratory: half or full-face air-purifying respirators with the appropriate filters must be used if concentrations are at or above the PEL

Disposal

NA

Medical Monitoring (if applicable)

- Baseline pulmonary function exams should be performed on all employees during their voluntary initial employment physical examination.
- Annual pulmonary function exams shall be performed on any employees whose silica dust exposure exceeds the OSHA PEL as identified by an industrial hygienist. These records must be maintained for 40 years.

Emergency Response

NA

Standards/Regulations

- OSHA: PEL: 29 CFR 1926. 55 and 29 CFR 1910.1000, Table Z-1; Respiratory Protection: 29 CFR 1910.134

Other References

- OSHA, "Silica, Crystalline: Hazard Recognition", <http://www.osha.gov/SLTC/silicacrystalline/recognition.html>
- NIOSH, "Silica", <http://www.cdc.gov/niosh/topics/silica/default.html>
- NIOSH, *Health Effects of Occupational Exposure to Respirable Crystalline Silica* (NIOSH 2002-129), <http://www.cdc.gov/niosh/docs/2002-129/02-129a.html>
- NLM, "TOXNET: Toxicology Data Network", <http://toxnet.nlm.nih.gov/>