

# Silica Management

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## University of Tennessee Safety Guide GS-150

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### Purpose

The purpose of this guidance document is to outline the hazards associated with silica dust and outline the steps to take to ensure employees who work around silica are not exposed to hazardous levels of silica dust.

### Scope and Applicability

This shall apply to all students, staff, faculty and students on the University of Tennessee Knoxville campus who are expected to be exposed to silica dust.

Crystalline silica is a basic component of soil, sand, granite and many other minerals. Quartz is the most common form of crystalline silica. All materials containing silica can result in the presence of respirable silica particles when chipping, cutting, drilling or grinding takes place. Silica exposure occurs through inhalation of silica containing particles and occurs through many construction and general industry methods. The most severe exposures generally occur during abrasive blasting with sand to remove paint and rust from bridges, tanks, concrete structures and other surfaces. Other activities that may result in severe silica exposure include jack hammering, rock/well drilling, concrete mixing, concrete drilling, brick and concrete cutting/sawing, tuck pointing and tunneling operations. Exposure to excessive silica dust over long periods of time can result in silicosis.

### Abbreviations and Definitions

#### Abbreviations

**EHS:** Environmental Health and Safety EPA – Environmental Protection Agency

**OSHA:** Occupational Safety and Health Administration

#### Definitions

**Authorized person:** An employee who has received proper training and exposure monitoring to safely work with silica containing materials.

**Action Limit:** A concentration of airborne respirable crystalline silica 25 µg/m<sup>3</sup>, calculated as an 8-hour, time weighted average.

**Crystalline silica:** Naturally occurring component in earth soils, sand, granite and many other minerals resulting in many building materials containing silica.

**Exposure Assessment:** The initial determination to find if any employee may be exposed to silica at or above the permissible exposure level. Until the assessment is completed, employees shall take all precautions necessary to maintain exposures below the PEL.

**HEPA (High Efficiency Particulate Air):** A filtering system capable of trapping and retaining at least 99.97% of all particles of 0.3 micron in diameter and larger.

**Permissible Exposure Limit: (PEL):** the OSHA limit for silica dust exposure. It is set at 50µg/m<sup>3</sup>, averaged over an 8-hour workday, as a time weighted average.

**Silica containing material:** Any material, which has the potential to contain silica at levels, which may pose a hazard to employees when the material is manipulated to create airborne particles

**Silicosis:** A lung disease caused by inhalation of silica dust. Silica dust can cause fluid buildup and scar tissue in the lungs that cuts down the ability for the lungs to fully function. The disease is not curable, but can be prevented through the use of protective systems.

## Roles and Responsibilities

### Environmental Health & Safety

- Environmental Health & Safety (EHS) provides program oversight and consultation to UTK work groups regarding potential risks, exposure prevention and training relating to silica dust exposures.
- Conduct building/material assessments for silica containing materials and perform employee silica hazard assessments/monitoring upon request.

### UTK Departments

- Each department with responsibilities for maintaining buildings or working in buildings with potential exposure to silica should:
- Ensure the applicable components of the Silica Dust Safety Program are available to all affected employees.
- Provide applicable training to employees expected to work in, or with, building materials where there is a potential risk for silica exposure.

### Supervisors

- UTK employees who supervise personnel with responsibilities to work in areas where there is a risk of exposure to silica dust, must ensure employees are properly trained on the applicable contents of the Silica Dust Safety Program and are provided appropriate personal protective equipment (PPE) when conducting such work.

### Authorized Person:

- Employees working in areas where there is an identified risk of silica dust exposure must be properly trained on all applicable elements of the UTK Silica Dust Safety Program; and be provided and utilize the appropriate PPE for the task being performed.

## Procedures

### Material Assessment

Any time there is a potential for silica containing materials to be involved in a project, sources of silica must be assessed prior to disturbing. EHS or an authorized contractor can perform building material assessments to determine silica content in materials.

Crystalline silica occurs naturally in the earth's crust and is a basic component of sand, concrete, brick, asphalt, granite, some blasting grit and wall spackling materials. Employees can be exposed to silica when conducting activities such as:

- Abrasive blasting
- Jack hammering
- Concrete crushing
- Hoe ramming
- Rock drilling
- Mixing of concrete or grout
- Concrete drilling
- Sawing concrete or bricks
- Chipping or scarifying concrete
- Rock crushing
- Moving or dumping piles of concrete, rock or sand
- Demolition of concrete or brick
- Using coatings containing silica
- Removing coatings containing silica

If airborne silica is expected to be generated during the project, EHS shall be contacted to conduct exposure monitoring and ensure all safety precautions are followed to minimize exposure to airborne silica dust.

### Exposure Monitoring

#### *Initial Exposure Monitoring:*

- UTK employees expected to come in contact/work with silica containing materials where there is a risk of exposure through inhalation of dust should develop an exposure monitoring program.
- Initial exposure monitoring should be conducted by EHS to quantitatively evaluate the exposure to airborne silica.
- Exposure monitoring should be conducted on any employee exposed to airborne silica dust as levels may vary based on job duty within a project. For example, the employee performing concrete cutting vs an employee providing supervision during the work.

#### *Periodic Exposure Monitoring:*

- Whenever silica exposure levels are greater than, or equal to the Action Limit (25 µg/m<sup>3</sup>), periodic exposure monitoring is required. It is the responsibility of the affected department to work with EHS and develop a periodic exposure monitoring schedule.
- The frequency of exposure monitoring should be as follows:
- Measured Concentration: Monitoring Frequency: Permissible Exposure Level – 50 µg/m<sup>3</sup>  
Annual

- Exposure monitoring is not required by every employee at risk of airborne silica exposure. Enough sampling must be done to enable the employee's exposure level to be reasonably represented.

***Termination of Exposure Monitoring:***

- Periodic exposure monitoring may be discontinued if results from two consecutive sampling periods taken at least 7 days apart show that employee exposure is below the Action Level.

***Sampling methods***

- Personal exposure monitoring will be conducted using an approved NIOSH or OSHA methods.
- Monitoring records shall include the following.
  - The date, number, duration, location and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable.
  - A description of the sampling and analytical methods used.
  - The type of respiratory protective devices, if any.
  - Name and job classification of the employee monitored.
  - Any environmental variables that could affect the measurement of the employee exposure.

***Reporting of exposure monitoring results***

- EHS will notify the department/supervisor of exposure monitoring results within as soon as the final laboratory analysis is completed. The department/supervisor must provide this information to the affected employee(s) within 5 working days.
- If levels are measured during the exposure monitoring exceeding the Action Level, the EHS report will include steps and controls to reduce exposure to below the Action Level.
- Follow up exposure monitoring may be necessary if engineering or administrative controls are put in place to reduce hazardous exposures.

**Exposure Control*****Pre-project planning***

- Prior to projects taking place affecting UTK buildings/facilities, EHS reviews planning documents to account for potential exposures to hazardous materials, including silica.
- EHS can conduct building material assessments to make determinations if there are any silica containing materials, which may be impacted by the project.
- During the planning process, any silica containing materials are addressed and methods for exposure control are provided prior to work beginning.
- If silica containing materials are to be disturbed during the project, the appropriate exposure control methods will be recommended by EHS.

***Administrative/Engineering Controls***

- Where silica exposures at or above the Permissible Exposure Limit have been documented, or are expected, the appropriate engineering or administrative controls will be implemented, where feasible. Follow-up exposure monitoring may be necessary when administrative or engineering exposure controls are utilized.
- Typical controls may involve:
  - Substituting non-silica containing materials for use while abrasive blasting
  - Alternative methods such as pre ordering grout already mixed instead of on- site mixing in bulk
  - Local exhaust ventilation

- General ventilation
- Vacuum methods with HEPA filters
- Distance
- Dust control products
- Containment
- Use of water to keep dust down
- General work practices such as good housekeeping, worker rotation, development of specific SOPs to minimize exposure

### **Personal Protective Equipment (PPE)**

- In addition to administrative/engineering controls, employees may be required to wear specific PPE during the disturbance of silica containing materials and/or when airborne silica is present. The level of protection will depend on the task being conducted and the tools being utilized to complete the task.
- Recommended PPE will typically include:
  - Respiratory Protection
  - Disposable or reusable work clothing to keep from spreading the dust or bringing the dust home
  - Leather gloves
  - Safety glasses or goggles
  - Face shield
  - Boot covers or rubber boots
- The following table provides recommended respiratory protection levels based on the measured or anticipated exposure levels:

<b>Respirator</b>	<b>Protection Factor</b>	<b>Typical Silica Activity</b>
N95	Less than 50 $\mu\text{g}/\text{m}^3$	<ul style="list-style-type: none"> <li>• Used on voluntary basis to control low exposures</li> </ul>
Half-face with HEPA filters (N-100)	50– 500 $\mu\text{g}/\text{m}^3$	<ul style="list-style-type: none"> <li>• Housekeeping (wet method)</li> <li>• Saw cutting (wet method)</li> <li>• Drilling concrete (wet method)</li> <li>• Power tools with dust collection</li> <li>• Equipment operating with open cab</li> </ul>
Full-face with HEPA filters	500 – 5,000 $\mu\text{g}/\text{m}^3$	<ul style="list-style-type: none"> <li>• Chipping concrete</li> <li>• Jack Hammering</li> <li>• Power tools without dust collection</li> <li>• Mixing grout in bulk</li> <li>• Vacuum abrasive blasting</li> </ul>
SCBA or Supplied Air	Above 5,000 $\mu\text{g}/\text{m}^3$	<ul style="list-style-type: none"> <li>• - Abrasive blasting</li> </ul>

### **Housekeeping & Hygiene Facilities**

- In areas where silica containing dust may be present, all surfaces must be maintained free from accumulations of dust to minimize potential silica exposure. Dust and other silica containing debris must be removed from the work area as soon as possible.

- Acceptable method of silica dust removal includes the use of HEPA vacuum or wet methods such as wet mopping.
- Unacceptable methods of silica dust removal include dry sweeping, vacuum cleaners, shop vacuums, and compressed air.
- Follow all recommended procedures and utilize recommended PPE during silica containing debris cleanup activities.
- Where silica containing materials are used, impacted, or being removed; the following requirements must be met.
  - PPE should be removed upon work completion and disposed of after each use.
  - Employees must wash hands and are recommended to shower prior to leaving work.
  - Ensure contaminated PPE, including footwear is not worn outside the work areas.

### Medical Surveillance

- Employees exposed to silica levels above the OSHA Action Level of 25  $\mu\text{g}/\text{m}^3$  to the Permissible Exposure Limit (50  $\mu\text{g}/\text{m}^3$ ) and above for 30 or more days per year, or any employee working with silica who develops signs/symptoms of excessive exposure, should be enrolled in the Medical Surveillance Program. Medical surveillance is also required for individuals who use a respirator for 30 days per year or more to control exposure to silica.
- All medical surveillance will be performed by UT Occupational Health and results must be provided the affected employee and their supervisor within 15 days of the assessment.
- The medical surveillance program consists of baseline examination and chest X-ray.
- Employees enrolled in the medical surveillance program should be examined annually to track any changes as a result to exposure to silica dust.

### Training and Recordkeeping

- Hazard Communication training is required by all UTK employees and should be conducted initially upon hiring. Additional information can be found at [ehs.utk.edu](http://ehs.utk.edu)
- Silica Awareness Training is available in person or at [ehs.utk.edu](http://ehs.utk.edu). And must be offered to affected employees prior to working with silica and annually thereafter. Silica awareness training should include the following:
  - Information about the potential health effects and symptoms of exposure to respirable silica
  - Safety data sheets for silica, quartz, and applicable products containing silica
  - The purpose and set up of regulated areas to mark the boundaries of work areas containing silica dust
  - The use of engineering controls, work practices, good housekeeping and PPE to control exposure to silica
  - Use and care of PPE
  - Expected exposures to silica dust
  - Exposure monitoring process
  - Medical surveillance process
- Respiratory protection training, medical clearance, and quantitative fit testing is required under the Respiratory Protection Program. Contact EHS for additional information regarding enrollment in the program.
- The supervisor is required to maintain all training, medical surveillance, and exposure monitoring results.

## Signage

- In areas where exposure to silica dust may exceed the PEL the following type of signage must be in place to warn employee of hazards.



## Disposal of Silica:

Individuals wishing to dispose of silica dust or debris should contact EHS regarding proper management.

## Recordkeeping

The following records shall be kept as part of this program

- Training for silica awareness (keep on IRIS, or in dept.)
- Sampling results, including bulk sampling, air sampling and any biological monitoring (kept by EHS)
- Inspection and testing results (kept by EHS)
- Complaint results (kept by EHS)
- Safety Data Sheets (kept by EHS)
- Medical evaluation for lead exposure (kept by Employee Health)

Records falling under this section shall be kept for at least three years. Records from b, c, d, e and f, above shall be kept indefinitely.

## References

OSHA 29 CFR 1910.1053 (General Industry)

OSHA 29 CFR 1926.1153 (Construction)

## Appendices

None

## Disclaimer

The information provided in these guidelines is designed for educational use only and is not a substitute for specific training or experience.

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