

Silica Exposure Control Plan Managing: Silica Exposure for Construction Industry

Clemson University

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Preface

University employees have a right to a safe workplace. Federal and state law requires employers to provide their employees with working conditions that are free of known hazards.

Employers may not retaliate against employees for exercising their rights under the law. Employees have the right to raise a health and safety concern or report an injury to regulatory agencies; for more information visit the Clemson Ethics/Safety Hotline at [Ethics/Safety Hotline \(clemson.edu\)](https://www.clemson.edu/ethics-safety-hotline).

It is the policy of Clemson University (CU) to maintain a safe and healthy work environment. Department Heads, Managers, and Supervisors are responsible for the application and enforcement of CU health and safety policies and procedures.

Introduction

Crystalline silica (silicon dioxide, SiO₂) is a common mineral found in many naturally occurring and man-made materials. There are three forms of silica: quartz (the most common) cristobalite, and tridymite. Silica is found in the earth's crust, and is a component of soil, sand, stone, rock, concrete, brick, block, mortar, and plaster. Additionally, it can also be found in materials like paints, plasters, joint compound, drywall, ceiling tiles, ceramic tiles, and grout.

Respirable crystalline silica is made of very small particles, typically 100 times smaller than ordinary sand found at beaches. At this size, the particles can enter your lungs and cause disease. Respirable-sized particles are generated during job tasks such as sawing, cutting, grinding, drilling, excavating, and/or crushing silica-containing materials, or when abrasive blasting with silica-containing materials or on substrates that contain silica.

There are known health effects from exposure to respirable crystalline silica - it is not just an inert dust. Most common is *silicosis*, an incurable disease where silica has caused scarring in the lungs, making them less flexible and less able to absorb oxygen. *Silicosis* can be Acute (marked by high intense exposures over a brief period of time), Accelerated (which can develop after exposure from 5-10 years), or Chronic (from long term exposure to lower levels).

Silica can also cause chronic obstructive pulmonary disease (COPD), including chronic bronchitis, emphysema, and chronic airway obstruction. It can make you more susceptible to tuberculosis. And there are non-respiratory diseases associated with silica exposure, including kidney disease and autoimmune disorders such as scleroderma, lupus, and rheumatoid arthritis.

Definitions

Action level means a concentration of airborne respirable crystalline silica of 25 µg/m³, calculated as an 8-hour TWA.

Competent person means 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 must have the knowledge and ability necessary to fulfill the responsibilities set forth in paragraph (g) of this section.

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

High-efficiency particulate air [HEPA] filter means a filter that is at least 99.97 percent efficient in removing mono-dispersed particles of 0.3 micrometers in diameter.

Permissible exposure limit (PEL). The employer shall ensure that no employee is exposed to an airborne concentration of respirable crystalline silica in excess of 50 $\mu\text{g}/\text{m}^3$, calculated as an 8-hour TWA.

Regulated area means 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.

OSHA Requirements

Clemson is required to establish and implement a written Silica Exposure Control Plan (SECP) that contains at least the following elements:

- (A) A description of the tasks in the workplace that involve exposure to respirable crystalline silica.
- (B) A description of the engineering controls, work practices, and respiratory protection used to limit employee exposure to respirable crystalline silica for each task; and
- (C) A description of the housekeeping measures used to limit employee exposure to respirable crystalline silica.

Clemson will review and evaluate the effectiveness of the written exposure control plan at least annually and update it as necessary, will make the written exposure control plan readily available for examination and copying, upon request, to employees, their designated representatives, and OSHA representatives.

Program Goals

Clemson's main goal of the Silica Exposure Control Plan for Construction Industry is to *not generate any silica containing dusts above the Permissible Exposure Limit*. and minimize exposures wherever possible This written exposure plan addresses OSHA's Respirable Crystalline Silica Standard for Construction Standard (29 CFR 1926.1153). This will ensure that no one is exposed above acceptable, safe levels including the worker performing the task, or faculty, staff, or students passing by the work area. This approach will also reduce CU compliance requirements to a limited number of tasks and activities.

Whenever possible, silica hazards will be eliminated from the workplace by engineering, work practice, or administrative controls. If those controls do not provide enough protection, CU will use PPE.

This document outlines the hazards associated with silica dust and the steps to take to ensure Faculty, Staff, and Students who work around silica are not exposed to levels of silica dust above the applicable exposure limits.

Program Application

This program applies to all Faculty, Staff, and Students, whose construction activities could generate silica containing dusts and are working in or on Clemson owned and/or operated properties.

Sources of Silica Exposure

Crystalline silica occurs naturally and is a basic component of sand, concrete, brick, asphalt, granite, some blasting abrasives, and some wall spackling materials. Employees and students can be exposed to silica from activities such as, but not limited to the following:

- Abrasive blasting
- Jack hammering
- Concrete crushing
- Rock breaking (e.g., using hoe rams)
- 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
- Dry sweeping of such debris

Other “non-construction” activities like carving stone, foundry/metal casting, porcelain enameling, or pottery can have significant levels of silica exposure.

Controlling Exposures

Where Clemson University employee or student exposure to respirable crystalline silica is above the PEL, Clemson University will implement the hierarchy of controls to reduce and maintain exposure to respirable crystalline silica at or below the PEL. Exposure will first be reduced through engineering controls and then through administrative controls. When all feasible engineering and administrative controls that can be implemented prove insufficient to reduce employee exposure to or below the PEL, Clemson University will implement those controls to reduce employee exposure to the lowest feasible level and shall supplement them with the use of respiratory protection.

In addition to protecting employees working with silica containing materials, building occupants, staff, students, and the public must be protected from the generation of silica dust. Visible dust must be contained to the worksite to prevent potential exposure to others that may be passing by the work area.

Outdoors, engineering controls such as wet cutting, HEPA vacuum, and/or control of work zones through the use of barricades should be implemented to protect others that may be in the vicinity.

Indoors, additional measures may be necessary to protect building occupants. Building occupants should be notified of projects by Project Manager (PM) or Building Security Coordinator (BSC). Scheduling project outside of normal working hours when area is less occupied is recommended when feasible. Barrier tape or plastic sheeting must be used to separate the worksite from the rest of the building. Signs must be posted by University Facilities or the contractor at the entrance to the worksite to prevent access by other employees.

If engineering controls and work practice controls are not sufficient to eliminate visible dust or are not feasible, exhaust ventilation must be utilized in the space to reduce exposures and prevent migration of dust outside the workspace.

Should visible airborne silica dust be generated at the worksite, or if airborne silica exposures are above the PEL, the area must be considered a regulated area and respiratory protection will be mandated for anyone entering the space.

Abrasive blasting with silica containing materials will not be conducted. Alternate blasting methods (dry ice, walnut shells, etc.) shall be used.

Specified Control Methods

For each University employee working with materials containing crystalline silica, Clemson will implement engineering controls, work practices, and respiratory protection as specified. Table 1 of OSHA's Respirable Crystalline Silica Standard for Construction lists various common job activities with predetermined combinations of engineering controls, administrative controls, and personal protective equipment. Table 1 can be found in Appendix A of this document and at the following link.

[https://www.osha.gov/laws-regs/interlinking/standards/1926.1153\(c\)\(1\)](https://www.osha.gov/laws-regs/interlinking/standards/1926.1153(c)(1))

For each employee engaged in a task identified on Table 1, Clemson University shall fully and properly implement the engineering controls, work practices, and respiratory protection specified for the task on Table 1.

When implementing the control measures specified in Table 1, the responsible supervisor shall ensure the controls are sufficient to minimize the release of visible dust when using wet methods and the accumulation of visible dust when using exhaust methods indoors or in enclosed areas.

Sampling and Assessment

For tasks not listed on Table 1 or where the controls associated with a task listed on Table 1 are

insufficient to minimize the exposure to respirable crystalline silica or are not fully implemented, contact OES (oeshelp@clermson.edu) to conduct an assessment to evaluate potential exposure.

Any Clemson University employee exposed or who can reasonably be expected to be exposed to respirable crystalline silica at or above the Action Level will have their exposure assessed. OES will utilize a combination of exposure monitoring and, where present and applicable, objective data to determine the 8-hour TWA exposure for each employee. To be applicable, 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.

OES can conduct exposure monitoring to determine exposure level and recommend additional safety precautions that can minimize exposure to airborne respirable crystalline silica. Personal exposure monitoring will be conducted using approved NIOSH or OSHA methods. Monitoring will assess the exposure for each employee on each shift, for each job classification, in each work area. In place of performing exposure monitoring for each employee individually, a representative fraction of employees, comprising those with the highest expected exposure performing each job activity, may be assessed instead.

OES will notify the department/supervisor of the exposure monitoring results within one day after the laboratory analysis is received and reviewed. The department/supervisor must provide this information to the affected employee(s) within 5 workdays.

Monitoring will be repeated at a frequency dependent on the results of exposure monitoring.

Results	Initial	Frequency of Monitoring
X > PEL	N/A	Repeat every 3 months
AL < X < PEL	N/A	Repeat every 6 months
X < AL	No	Discontinue after 2 consecutive results below the AL taken at least 7 days apart
X < AL	Yes	Discontinue Monitoring

If sampling reveals exposures exceed the PEL, steps will be taken immediately to reduce the exposure to below the PEL.

Employee exposure will be reassessed whenever there is reason to expect an employee exposure above the action level has occurred or when there is reason to believe a change in the production, process, control equipment, personnel, or work practices would cause a new or additional exposure at or above the action level.

Enforcement

Failure to comply with the CU Exposure Control Plan, especially such work that exposes Faculty, Staff, Students, Visitors, may result in the work being stopped by OES until controls can be implemented; this includes contractor/sub-contractor activities.

Procedure

- 1) OES becomes aware of an issue.
- 2) OES evaluates the situation.
 - a. If no exposures (i.e., no visible dust), and proper signage, barriers and exposure controls are in place then OES takes no action.
 - b. If there are exposures (i.e., visible dust), or if there is lack of signage, barriers or exposure controls, and the work is being performed by CU employees:
 - i. OES directs the individual(s) to stop until corrections can be made and contacts the Supervisor to advise him/her of the situation.
 - ii. Once corrections are made, work may resume.
 - c. If there are exposures (i.e., visible dust) and the work is being performed by Contractors (or sub-contractors):
 - i. If no one is exposed except contractor/sub-contractor employees, OES contacts the CU Project Manager and advises him/her of the situation.
 - ii. If people are being exposed, OES requests the individual(s) to stop until corrections can be made and contacts the CU Project Manager to advise him/her of the situation.
 - iii. Once corrections are made, work may resume.

Housekeeping

Dry sweeping or dry brushing where such activity could contribute to employee exposure to respirable crystalline silica is specifically prohibited by OSHA. Use Wet Sweeping or HEPA- Filtered Vacuuming instead.

Compressed air cannot be used to clean clothing or surfaces where such activity could contribute to employee exposure to respirable crystalline silica.

If you are exposed to respirable crystalline silica and engaged in a task using equipment and machines not identified in the list above, contact OES for an exposure assessment to determine the engineering controls, work practices, and respiratory protection requirements to perform job activities safely.

Responsibilities

Occupational and Environmental Safety (OES)

- Provide information on silica management for General Industry.
- Conduct or arrange for Silica Awareness training for General Industry.
- Provide expertise and guidance to departments to maintain compliance with regulatory requirements and university policy.

- Recommend appropriate response actions to control or eliminate potential hazards.
- Audit projects, as necessary.
- Communicate with regulatory agencies, as needed, as well as with the University community at large.
- Develop and maintain the Silica in General Industry Exposure Control Plan and review annually.
- Conduct screenings for employee exposure determinations.
- Coordinate with affected departments to conduct employee exposure assessments.
- Develop and maintains the Respirator Program, as well as conducts respirator training and fit testing
- Maintain records as required.

Supervisors for Affected Department

- Identify a competent person(s) for respirable crystalline silica.
- Schedule Silica Awareness training for employees, as necessary.
- Notify OES in cases of uncontrolled releases of visible dust in occupied buildings.
- Provide engineering and work practice controls as identified in Table 1, or alternative controls, as needed.
- Request employee exposure assessments, when necessary, scheduled with OES.
- Schedule medical surveillance for affected employees, initially and then every 3 years unless sooner as identified by the OSHA Standard.
- Arrange for medical evaluation for respirator use, in accordance with CU Respirator Program; and
- Schedule employees for respirator training and fit testing annually.

Competent Persons

- Frequently and regularly inspect job sites, materials, and equipment.
- Identify existing and foreseeable respirable crystalline silica hazards and take prompt action.
- Be familiar with the Silica in Construction Exposure Control Plan.
- Be available to employees for questions about or problems with dust controls; and Notify OES when problems arise, there is a change in engineering controls and work practices, or in situations of uncontrolled releases of visible dust.
- Have the authority to promptly eliminate or minimize silica hazards.
- Have the knowledge and ability to implement the written exposure control plan.

A list of competent persons at Clemson University can be found at the link [here](#).

Affected Employees

- Comply with Federal and State regulations and University policies as advised by OES.
- Attend Silica Awareness training.
- Attend Respiratory Protection Training and Fit Testing, as necessary.
- Utilize the proper engineering controls and work practices.
- Wear respirators and other PPE when necessary; and
- Conduct work activities in a manner that prevents uncontrolled disturbance of silica- containing materials and the generation of visible dust.

Departments Using Trade Contractors

- Ensure Contractor is aware of OSHA's Silica in Construction standard.
- Ensure Contractor has their own Silica Exposure Control Plan.
- Coordinate with Project Managers, OES, and Building Security Coordinators to schedule the work and ensure proper controls are in place. This would include communication to occupants, signage, containment, and waste management.
- If suitable air quality cannot be achieved, schedule work outside of normal working hours.

Training

OSHA requires that the employer ensure that each employee potentially exposed to silica dust can demonstrate knowledge and understanding of:

- (A) The health hazards associated with exposure to respirable crystalline silica.
- (B) Specific tasks in the workplace that could result in exposure to respirable crystalline silica.
- (C) Specific measures the employer has implemented to protect employees from exposure to respirable crystalline silica, including engineering controls, work practices, and respirators to be used.
- (D) The contents of the OSHA Respirable Crystalline Silica standard.
- (E) The purpose and a description of the medical surveillance program.

Silica Awareness Training that meets OSHA's requirements in the Construction Industry Standard will be provided by or arranged by OES for all affected employees that may work with or around silica. This training will consist of either classroom, online, or a combination of training types. Fact sheets on the CU Silica Exposure Control Plan for OSHA's Respirable Silica Exposure in Construction Standard will be made available and OSHA fact sheets for specific job tasks.

Re-training will occur when there is sufficient cause to think a more frequent training is needed or if the CU Exposure Control Plan requirements change.

The standard does not require specific training for a competent person. CU will determine what training is necessary to provide the knowledge and ability for the competent person(s) to implement the written exposure control plan.

Respirators

Any employee needing a respirator is required by OSHA to be enrolled in a Respiratory Protection Program. The CU Silica Exposure plan tries to eliminate employee exposure to silica through engineering and administrative controls first but, when these steps prove insufficient, respiratory protection will be provided to protect employees and students. If an activity has exposures that cannot feasibly be brought below the PEL by engineering or administrative controls, the employees will participate in the CU Respiratory Protection Program.

Supervisors/employees who suspect they need a respirator should contact OES at (OEShelp@clemsun.edu) for assistance.

Medical Surveillance

OSHA requires employees who will be required by the silica standard to wear a respirator for 30 or more days per year must receive initial and periodic medical surveillance. Those employees will be enrolled in the University's Respiratory Protection Program and Clemson's Medical Surveillance Program.

Recordkeeping

Clemson will keep the records associated with this program for at least 30 years past the date of last employment for any employee with exposures Action Level greater than ($25 \mu\text{g}/\text{m}^3$).

- Training records will be maintained by OES inf SciShield, the IT Management System and in some instances the appropriate departmental (UFac, HFac, AFac, CCIT, etc.).
- SDS documents will be kept by the appropriate departmental personnel (UFac, HFac, AFac, CCIT, etc.).
- Sampling records will be maintained by OES.
- Inspection results will be maintained by OES.
- Records of complaints will be maintained by OES.
- Medical surveillance records will be kept by the Occupational Health Nurse.

OES Contacts:

For additional information regarding Hazard Communication or assistance with the selection of PPE, please contact:

Anne Kogut Industrial Hygiene Manager – akogut@clemsun.edu (864)656-2507

See Appendix A for Table 1

Appendix A

Table 1 of OSHA’s Respirable Crystalline Silica Standard for Construction Industry

Equipment/task	Engineering and work practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤ 4 hours/shift	>4 hours/shift
(i) Stationary masonry saws	Use saw equipped with integrated water delivery system that continuously feeds water to the blade Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions	None	None
(ii) Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions:		
	-When used outdoors	None	APF 10
	-When used indoors or in an enclosed area	APF 10	APF 10
(iii) Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less)	For tasks performed outdoors only: Use saw equipped with commercially available dust collection system Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions Dust collector must provide the air flow	None	None

	recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency		
(iv) Walk-behind saws	Use saw equipped with integrated water delivery system that continuously feeds water to the blade Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions:		
	-When used outdoors	None	None
	-When used indoors or in an enclosed area	APF 10	APF 10
(v) Drivable saws	For tasks performed outdoors only:		
	Use saw equipped with integrated water delivery system that continuously feeds water to the blade Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions	None	None
(vi) Rig-mounted core saws or drills	Use tool equipped with integrated water delivery system that supplies water to cutting surface Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions	None	None
(vii) Handheld and stand-mounted drills (including	Use drill equipped with commercially available shroud or cowling with dust collection system	None	None

<p>impact and rotary hammer drills)</p>	<p>Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism Use a HEPA-filtered vacuum when cleaning holes</p>		
<p>(viii) Dowel drilling rigs for concrete</p>	<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>APF 10</p>	<p>APF 10</p>
	<p>Use a HEPA-filtered vacuum when cleaning holes</p>		
<p>(ix) Vehicle-mounted drilling rigs for rock and concrete</p>	<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>None</p>	<p>None</p>
	<p>OR</p>		
	<p>Operate from within an enclosed cab and use water for dust suppression on drill bit</p>	<p>None</p>	<p>None</p>
<p>(x) Jackhammers and handheld powered chipping tools</p>	<p>Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact:</p>		

	-When used outdoors	None	APF 10
	-When used indoors or in an enclosed area	APF 10	APF 10
	OR		
	Use tool equipped with commercially available shroud and dust collection system		
	Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions		
	Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism:		
	-When used outdoors	None	APF 10
	-When used indoors or in an enclosed area	APF 10	APF 10
(xi) Handheld grinders for mortar removal (<i>i.e.</i> , tuckpointing)	Use grinder equipped with commercially available shroud and dust collection system	APF 10	APF 25
	Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions		
	Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or		

	greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism		
(xii) Handheld grinders for uses other than mortar removal	For tasks performed outdoors only: Use grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface	None	None
	Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions		
	OR		
	Use grinder equipped with commercially available shroud and dust collection system		
	Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions		
	Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism:		
	-When used outdoors		
	-When used indoors or in an enclosed area	None	APF 10
(xiii) Walk-behind milling machines and floor grinders	Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface	None	None

	Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions		
	OR		
	Use machine equipped with dust collection system recommended by the manufacturer	None	None
	Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions		
	Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism		
	When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes		
(xiv) Small drivable milling machines (less than half-lane)	Use a machine equipped with supplemental water sprays designed to suppress dust. Water must be combined with a surfactant	None	None
	Operate and maintain machine to minimize dust emissions		
(xv) Large drivable milling machines (half-lane and larger)	For cuts of any depth on asphalt only: Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust	None	None

	Operate and maintain machine to minimize dust emissions		
	For cuts of four inches in depth or less on any substrate:		
	Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust	None	None
	Operate and maintain machine to minimize dust emissions		
	OR		
	Use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactant	None	None
	Operate and maintain machine to minimize dust emissions		
(xvi) Crushing machines	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)	None	None
	Operate and maintain machine in accordance with manufacturer's instructions to minimize dust emissions		

	Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station		
(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	Operate equipment from within an enclosed cab	None	None
	When employees outside of the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions	None	None
(xviii) Heavy equipment and utility vehicles for tasks such as grading and excavating but not including: Demolishing, abrading, or fracturing silica-containing materials	Apply water and/or dust suppressants as necessary to minimize dust emissions	None	None
	OR		
	When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab	None	None