

A close-up photograph of a heavily rusted metal structure, likely a steel beam or plate, showing significant corrosion and discoloration. The rust is a mix of reddish-brown and dark grey/black tones. The structure is composed of several interconnected parts, with visible welds and bolts.

Chubb Construction Risk Engineering

Silica in Construction Resource Guide

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Silica in Construction

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Overview

According to OSHA, about two million construction workers are exposed to respirable crystalline silica in over 600,000 workplaces. OSHA estimates that more than 840,000 of these workers are exposed to silica levels that exceed the new permissible exposure limit (PEL).¹

Around 2.3 million workers are exposed to crystalline silica on the job. The hazard exists when specific activities create respirable crystalline silica dust that is released into the air.²

It is important that materials and tasks/activities that contain or have the potential of generating respirable crystalline silica are identified and evaluated in your efforts to protect workers from the hazards associated with respirable silica. This Resource Guide is intended to provide insight into respirable crystalline silica, its affects as well as an overview of the new silica standard and how it applies to you.

What is Silica?

Crystalline silica is a commonly found mineral that is used in construction materials such as sand, concrete, stone/rock and mortar. Crystalline silica is also used to make products such as glass, bricks and concrete.² Crystalline Silica is most commonly found in quartz and can be found in many types of rock.

In the construction industry, respirable silica can be found in many common materials and generated from routine work activities such as:

- Working with brick, block, concrete and rock
 - Grinding, crushing, saw cutting, drilling, mixing mortar/grout and industrial sand.
- Mechanical Equipment Use
 - Sweeping machines, concrete breakers, hoe rams, shears, drilling rigs and grout machines
- Use of hand and power tools
 - Drills, circular saws, mechanical saws, jack hammers/hell dogs, brooms and blow pipes
- Demolition activities
 - Building structures, interior renovations, bridges and utility vaults
- Miscellaneous activities from working around other contractors creating silica dust on multiemployer worksites.

How Silica Affects You

Small particles, typically at least 100 times smaller than ordinary sand found on beaches or playgrounds - are generated by high-energy operations like cutting, sawing, grinding, drilling and crushing stone, rock, concrete, brick, block and mortar; or when using industrial sand. Activities such as abrasive blasting with sand; sawing brick or concrete; sanding or drilling into concrete walls; grinding mortar; manufacturing brick, concrete blocks, or ceramic products; and cutting or crushing stone generates respirable dust.

Inhalation of “respirable” crystalline silica particles may cause multiple diseases including silicosis, an incurable lung disease that can lead to disability and death. Respirable crystalline silica also may cause lung cancer, chronic obstructive pulmonary disease (COPD), and kidney disease.²

The New Silica in Construction Standard 29 CFR 1926.1153

In order to fully understand the standard's requirements, the intent of each section of the standard, as well as the analytical data and research behind the rulemaking, it is recommended that a copy of the Federal Register is obtained and reviewed as you work through your process of determining how or if the new standard affects your company as well as during program implementation.

This standard is written as to place required responsibilities on the employer, ensuring that all aspects including but not limited to:

- determination of potential exposures
- work place practice controls
- implementation of a written exposure control plan,
- medical examinations,
- employee notifications and training are completed.

The language of this standard is very specific in outlining the employer's role and responsibilities and should be reviewed in-depth so you have a full-understanding of what is required and your options under the standard.

Compliance Dates

The new silica standard for construction was codified and became effective on June 23rd, 2016 with requirements of the new standard to become in-force on June 23rd, 2017. However, OSHA extended the enforcement of the standard for three months to allow for additional outreach to affected parties and to provide additional time to train compliance officers. The standard went into enforcement on September 23rd, 2017.³

The Old vs. New

The previous permissible exposure limits (PELs) for silica were considered outdated, inconsistent and did not adequately protect worker health. The previous PEL was based on studies from the 1960s and earlier that, according to OSHA, did not reflect more recent scientific evidence showing that low-level exposures to silica can cause serious health effects, including lung cancer.

The new PEL limits worker exposures to 50 micrograms of respirable crystalline silica per cubic meter of air ($\mu\text{g}/\text{m}^3$), averaged over an eight-hour day. The new Action Level is 25 micrograms of respirable crystalline silica per cubic meter of air ($\mu\text{g}/\text{m}^3$), averaged over an eight-hour day.

Per OSHA, they established the new PEL of 50 $\mu\text{g}/\text{m}^3$ because the agency determined that occupational exposure to respirable crystalline silica at the previous PELs resulted in a significant risk of developing or dying from silicosis and dying from lung cancer, other lung diseases, or kidney disease, and that compliance with a 50 $\mu\text{g}/\text{m}^3$ PEL would substantially reduce that risk.

OSHA also finds significant risk remaining

at the new PEL, but considers a PEL of 50 $\mu\text{g}/\text{m}^3$ to be the lowest level that can reasonably be achieved through use of engineering controls and work practices in most affected operations.²

This new standard applies to all occupational exposures to respirable silica except where employee exposure remains below the Action level of 25 micrograms of respirable crystalline silica per cubic meter of air ($\mu\text{g}/\text{m}^3$), averaged over an eight-hour day under any foreseeable conditions.

Written Exposure Control Plan

In order to evaluate your respirable silica exposure and determine engineering controls, work practices, and respiratory protection that is required for your specific operations, the new standard provides two options; Use Table 1 and/or complete an Exposure Assessment. These are discussed in the following sections of this guide.

Regardless of which option you choose, (Table 1 or Exposure assessments) you are also required to establish and implement a Written Exposure Control Plan for all tasks that expose your employees to respirable Crystalline Silica. Exposed workers include all workers considered performing the task and can include helpers.

The Written Exposure Control Plan requires at a minimum:

- A description of all tasks involving exposure to respirable silica
- A description of the engineering controls, work practices and respiratory protection used for each task
- A description of housekeeping measures

- A description of procedures to restrict access to work areas which includes those created by other contractors or owners

This plan should be reviewed annually and evaluated for effectiveness, updated as necessary and made readily available to covered employees to review and copy.

A Competent Person must be designated to monitor and implement the plan. The Competent Person is responsible for completing frequent and regular inspections of the work areas, materials and equipment.

The definition of a Competent Person designated to oversee the implementation of the Written Exposure Control Plan is: An individual capable of identifying existing and foreseeable Crystalline Silica hazards in the work place and who has the authority to take prompt corrective measures to eliminate them.

This Competent Person must have the knowledge and ability necessary to fulfill the responsibilities.

Specified Exposure and Control Methods

In the new Silica standard, OSHA has written options for a company to choose when determining their worker’s exposure to respirable silica and providing appropriate work place controls and respiratory protection.

Table 1 (Specified Exposure Control Methods)

To assist contractors in their efforts when confronting their respirable silica exposures, OSHA has developed a Table (Table 1) consisting of 18 common tasks

in the construction industry known to generate respirable silica dust. This table is designed to provide the employer with the specific task, workplace controls and required respiratory protection based on task duration and whether the task is being completed indoors or out.

The use of Table 1 by an employer will preclude the employer from having to spend time and money completing exposure assessments to determine potential exposures to respirable silica as well as determining the appropriate work place controls and respiratory protection.

If the employer chooses to use Table 1 and implements the work place controls **fully and properly** as well as requiring the use of the noted respiratory protection, they should be considered in compliance in providing the necessary protection to their workers.

Table 1 Excerpts - The full version of Table 1 can be found in 29CFR 1926.1153

TABLE 1: SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA			
Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
(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. – When used indoors or in an enclosed area.	None APF 10	None 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

It is important to understand that OSHA included the phrase “fully and properly” when discussing the implementation of the Table 1 workplace controls and respiratory protection. If using Table 1, the employer is responsible to ensure that the workplace controls are implemented as written without alteration. In addition, to ensure you are implementing fully and properly, a number of considerations must be taken into account including but not limited to:

- Tools and equipment are utilized according to the manufacturer’s instructions
- Filters (if equipped) are the proper type, clean, and serviceable
- Dust collectors are equipped with appropriate filter and have a filter cleaning mechanism or similar device
- Required minimum air flows are maintained
- Hoses and connections are free from leakage (Dust exiting the system)
- Water systems (if required) are “Continuous”

When working indoors or enclosed areas, a means of exhaust should be provided to minimize visible dust and if using a wet method to control dust, water should be provided at sufficient flow rates.

If you as an employer determine that an alternative workplace control provides better protection than what is noted in Table 1 for a specific task, it can be utilized, however by choosing not to fully and properly implement what is specifically identified in Table 1, you will no longer be considered in compliance with Table 1 and you as the employer will now have to utilize one of the Alternative Exposure Control Methods and are subject to the PEL.

TABLE 1: SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA			
Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
(x) Jackhammers and handheld powered chipping tools	Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact.		
	– 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

There are also requirements when working in an enclosed cab or booth. These requirements are meant to prevent the worker inside the cab or booth from being exposed to respirable silica and include:

- Cab or booth is under Positive Pressure
- Door seals and mechanism work properly
- Air intake with 95% efficient filter
- Gaskets and seals are working properly

OSHA expects most employers will choose to follow Table 1, however there will be many tasks not specified in the

table which will cause the employer to have to utilize one of the Alternative Exposure Control Methods.

Alternative Exposure and Control Methods

If Table 1 is not utilized or implemented “fully and properly”, you as the employer must now choose which Alternative Exposure Control Method will be utilized:

- Performance Option
- Scheduled Monitoring Option

Alternative exposure control methods include assessment of employee exposures to respirable crystalline silica and limiting exposure to the PEL by using feasible engineering and work practice control methods, and respiratory protection when necessary.

Performance Option

The performance option gives employers flexibility to determine the 8-hour TWA exposure for each employee based on any combination of air monitoring data or objective data that can accurately characterize employee exposures to respirable crystalline silica.

Air monitoring data are any results of air monitoring (analyzed according to the procedures and requirements in Appendix A of the standard) that the employer has done to meet the requirements of the standard.

Objective data is information that demonstrates employee exposure to respirable crystalline silica associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions that closely resemble or could result in higher exposures than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

Examples of objective data are information such as:

- Air monitoring data from industry-wide surveys
- Calculations based on the composition of a substance
- Area sampling results and exposure mapping profile approaches
- Historic air monitoring data.

Employers choosing the performance option must:

- Conduct the exposure assessment before work begins
- Reassess exposures whenever a change in production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or higher exposures at or above the action level, or when the employer has any reason to believe that new or additional exposures at or above the action level have occurred
- Be able to demonstrate that employee exposures have been accurately characterized
- Make sure that the exposure assessment reflects the exposures of employees on each shift, for each job classification, in each work area.

Examples of Using Objective Data to Conduct Exposure Assessments under the Performance Option

1. Industry-wide surveys of typical tasks or operations, which include well-documented procedures for measuring exposures and methods for controlling dust, could be used by employers to characterize employee exposures where employees perform tasks consistent with those described in the survey.
2. Employers can use direct-reading instruments to measure real-time levels of respirable dust in the air. If the employer has information on the percentage of respirable crystalline silica in that dust (for example, from the analysis of a bulk sample or information from a safety data sheet), he or she can then calculate the level of respirable crystalline silica in air.
3. Historical data, which are monitoring results collected at any time before the effective date of the standard, could be

used to assess employee exposures if the employer can show that the data were collected during work operations and conditions that are consistent with the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

Scheduled Monitoring Option:

The scheduled monitoring option outlines when and how often exposure monitoring must be performed to measure employee exposures. Employers must make sure that:

- Results represent employee's Time Weighted Average (TWA) exposure to respirable crystalline silica over an eight-hour workday
- Samples are collected from the employee's breathing zone
- Samples are collected outside respirators so that they represent the exposure that would occur without the use of the respirator.

Initial monitoring is conducted as soon as work begins:

- Must correctly characterize each employee's exposure to respirable crystalline silica
 - Monitoring includes, at a minimum one full-shift sample taken for:
 - Each job function
 - In each job classification
 - In each work area
 - On each shift.

Characterizing each employee's exposure may involve monitoring all exposed employees or a smaller number of employees whose exposures can then represent those of other employees.

Representative sampling involves monitoring the employee or employees reasonably expected to have the highest exposure to respirable crystalline silica (for example, the employee closest to an exposure source). This exposure is then assigned to the other employees in the group who perform the same tasks on the same shift and in the same work area. Representative monitoring is allowed when several employees perform the same job on the same shift and under the same conditions.

Frequency of Scheduled Monitoring depends on the results of initial monitoring and, thereafter, any required further monitoring, as follows:

- If initial monitoring indicates employee exposures are below the action level, no further monitoring is required.
- If the most recent exposure monitoring reveals employee exposures at or above the action level but at or below the PEL, the employer must repeat monitoring within six months of the most recent monitoring.
- If the most recent exposure monitoring reveals employee exposures above the PEL, the employer must repeat monitoring within three months of the most recent monitoring.

Monitoring may be stopped when two non-initial monitoring results taken consecutively, at least 7 days apart but within 6 months of each other, are below the action level. This applies for employees represented by those results as long as no changes occur that could reasonably be expected to result in new or additional exposures at or above the action level.

Employee Notification of Assessment Results

Within 5 working days after completing an exposure assessment, the employer shall notify each affected employee in writing of the results of that assessment or post the results in an appropriate location accessible to all affected employees.

Whenever an exposure assessment indicates that employee exposure is above the PEL, the employer shall describe in the written notification the corrective action being taken to reduce the employee exposure to or below the PEL.

Reassessment of Exposures:

- Required whenever a change in production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures to respirable crystalline silica at or above the action level
- Required when the employer has any reason to believe that new or additional exposures at or above the action level have occurred⁴.

Engineering and Work Practice Controls

In the case of the new standard, you as the employer must use engineering and work practice controls to reduce and maintain your employee's exposure to respirable crystalline silica to or below the established PEL unless you can demonstrate that these controls are not feasible.

However, wherever feasible engineering and work practice controls are not sufficient in reducing your employee's exposures to or below the PEL, you must

still use them to reduce the exposure to the lowest feasible level and then supplement with respiratory protection.

Respiratory Protection

Where respiratory protection is required by Table 1 or as determined through Alternative Exposure Control Methods, it must comply with the requirements of this new standard as well as 29 CFR 1910.134.

A respiratory protection program shall be implemented in accordance with 29 CFR 1910.134 which includes but not limited to:

- Medical evaluation
- Fit testing
- Determination of proper respiratory protection
- Training

Housekeeping

Housekeeping requirements for this standard relates to the generation of respirable silica and provides direction regarding dry sweeping, dry brushing and using compressed air.

Dry sweeping or brushing are not to be used to maintain housekeeping as it will generate respirable silica dust unless other means such as wet sweeping, using a HEPA vacuuming system or other methods are not feasible. Floor sweeping compounds may be used, but should be used with caution as they can themselves contain silica or create an increased silica exposure if not used properly.

Similarly, compressed air is not to be utilized to clean surfaces or clothing unless an air filtration system is used in conjunction that "effectively captures the dust cloud" created by the compressed

air or there is no other feasible alternative method.

It is up to the employer to prove infeasibility.

Medical Surveillance

As the employer, if you determine you have employees who are required to utilize respiratory protection 30 days or more per year to protect against respirable silica exposure, medical surveillance per the silica standard is required for each affected employee. As it relates to this standard, this requirement is for employees who wear a respirator for protection against respirable silica; not for protection of other exposures.

The medical surveillance is provided to each affected employees at no cost and is to be provided at a reasonable time and place.

You as the employer are required to ensure that all medical examinations and procedures are performed by a Physician or other Licensed Health Care Professional (PLHCP).

An initial baseline examination is made available to the affected employees within 30 days after his/her initial assignment, unless the employee has received a medical examination within the past 3 years that meets the requirements of the standard for this type of exam.

The initial exam requirements include but may not be limited to:

- Medical and work history with emphasis on past, present and anticipated exposure to respirable crystalline silica, dust and other agents affecting the respiratory system; any history of respiratory dysfunction

including signs and symptoms of respiratory disease; history of tuberculosis, and smoking status and history.

- A physical exam with focus on the respiratory system
- A chest X-ray
- Pulmonary function test
- Testing for latent Tuberculosis infection
- Any other tests deemed appropriate by the PLHCP

Periodic examinations shall also be made available at least every three years. Periodic examinations may be required more frequently if recommended by the PLHCP. The exam includes the procedures noted in the Initial exam with the exception of the tuberculosis testing.

The Medical Surveillance section of this standard places a number of requirements on the employer to ensure affected employees are not only provided the opportunity for examinations but also to ensure they have been fully informed of the results and any additional information such as limitations and follow up examinations.

The employer is required to ensure the following:

- PLHCP's are provided a copy of the standard as well as the employee's current, former and anticipated duties and exposures to respirable crystalline silica.
- PLHCP's explain examination result to the employee and provide the employee with a written medical report within 30 days of the examination performed.
- PLHCP's provide both the employer and employee a written medical opinion within 30 days of each medical examination performed.
- If the PLHCP's opinion indicates the employee should be examined by a specialist, the employer is

responsible to make available a medical examination by a specialist within 30 days after receiving the written medical opinion. The specialist is to be provided the same information that the employer was obligated to provide to the PLHCP.

- The specialist must also explain and provide the exam results and provide the written medical report to the employee within 30 days of the examination
- The employer must also obtain a copy of the specialist's medical opinion within that same 30 period.

Employee Communication (Hazardous Communication)

As part of your Hazardous Communication requirements, respirable crystalline silica must be included in your program. This includes ensuring each employee has access to labels on containers of crystalline silica, safety data sheets and employees are properly trained.

At a minimum, the employer must ensure the training covers cancer, lung effects, immune system effects and kidney failure.

Employee Information and Training

Employees must be able to demonstrate knowledge and understanding of at least the following areas:

- Health hazards associated with exposure to respirable crystalline silica
- Specific workplace tasks that could result in exposure to respirable crystalline silica
- Specific measures you the employer have implemented to protect employees from exposure to respirable crystalline silica to include; engineering controls, work practices and respirators to be used

- Contents of this section of the standard
- Identity of the Competent Person
- Purpose and description of the medical surveillance program

A copy of this section of the standard must be made readily available, without cost, to each covered employee.

Record Keeping

The employer is required to make and maintain an accurate record of:

- All Air monitoring exposure assessments used to assess exposures to respirable crystalline silica
- An accurate record of Objective data that was relied upon and
- For each employee covered by the medical surveillance program

Tools and Equipment

A number of tool and equipment manufacturers have engineered, designed and produced products and tool/equipment attachments that are intended to assist you in controlling the respirable silica dust exposures on your project sites.

These range from small hand held power tools to large pieces of equipment that may be fitted with continuous watering systems, and vacuum shrouds, as well as tools such as hollow core bit drills, and HEPA vacuums or vacuums with an automatic filter cleaning mechanism.

Roadmap for Meeting the Requirements of the Respirable Crystalline Silica Standard

1. Determine if the silica standard applies to your employees.

Could employees be exposed to respirable crystalline silica at or above 25 µg/m³ as an 8-hour TWA under any foreseeable conditions, including the failure of engineering controls, while performing construction activities?

No: No further action is required under the silica standard.

Yes: Choose to comply with the standard using either the:

- Specified exposure control methods in Table 1, or
- The alternative methods of compliance

2. Determine what additional requirements you must meet under the standard, based on the compliance method you are following.

Requirement	Must the Employer Follow this Requirement?	
	If Fully and Properly Implementing Table 1	If Following Alternative Exposure Controls
PEL	No	Yes
Exposure Assessment	No	Yes, when exposures are reasonably expected to be above the action level.
Methods of Compliance	No	Yes
Respiratory Protection	Yes, if respirator use is required by Table 1	Yes, if respirator use is required to reduce exposures to the PEL
Housekeeping	Yes	Yes
Written Exposure Control Plan	Yes	Yes
Medical surveillance	Yes, for employees who must wear a respirator under the silica standard for 30 or more days a year.	
Communication of Hazards	Yes	Yes
Recordkeeping	Yes, for any employees who are getting medical examinations	Yes, for exposure assessments and for any employees who are getting medical examinations

4Small Entity Compliance Guide for the Respirable Crystalline Silica Standard

It is important that you research what is available in the marketplace so you can make informed decisions regarding work practices and engineering controls in your efforts to control respirable crystalline silica dust exposure. In many cases, your local tool and equipment

vendor can provide demonstrations as well as employee training for the purchases you make.

References/Acknowledgements

- For additional information regarding these and other exposures, speak to your ESIS Risk Engineer about access to the Chubb Construction Risk Engineering Portal
- ESIS' American Industrial Hygiene Association (AIHA) accredited Environmental Health Laboratory (EHL); HSE@esis.com, call 866 357-3797 or visit www.esis.com
- Occupational Safety and Health Administration; 29CFR 1926.1153, Respirable Crystalline Silica
- 1 OSHA Fact Sheet; OSHA's Crystalline Silica Rule: Construction
- 2 Frequently Asked Questions: Respirable Crystalline Silica Rule
- 3 OSHA Memorandum dated April 06, 2017 - Delay of Enforcement of the Crystalline Silica Standard for Construction under 29 CFR 1926.1153
- 4 Small Entity Compliance Guide for the Respirable Crystalline Silica standard - OSHA 3902-10 2016
- Federal Register / Vol. 81, No. 58 / Friday, March 25, 2016 / Rules and Regulations



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