

OSHA's Crystalline Silica Construction Regulation—Roofing Operations

29 CFR §1926.1153



Today's agenda:

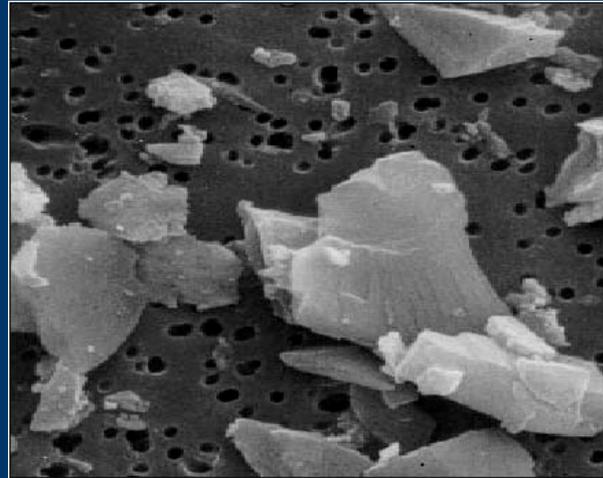
Communication of silica hazards to workers

OSHA Hazard Communication Standard (HCS), 29 CFR §1910.1200

- Employee information and training
 - Health hazards
 - Tasks with respirable crystalline silica (RCS) exposure
 - Control methods used
 - Regulatory provisions
 - Company competent person for job-site compliance
 - Details of the medical surveillance program for silica exposure
- Labels used on products containing silica
- Safety data sheets (SDSs) for products containing silica

What is crystalline silica?

- Silica refers to the chemical compound silicon dioxide (SiO_2).
- SiO_2 is one of the most common elements on Earth; it is the main component of sand.
- Quartz is commonly named when referring to pure silica or crystalline silica in SDSs.



How does a hazard from crystalline silica occur?

- Hazard occurs when material containing silica (quartz, sand) is cut or ground usually with powered equipment such as grinders or saws with diamond or abrasive blades
- Fine particles of RCS dust result
- “Respirable” means breathable: The fine silica particles (about 10 microns or less in size) are tiny enough to be inhaled and settle deep in the lungs



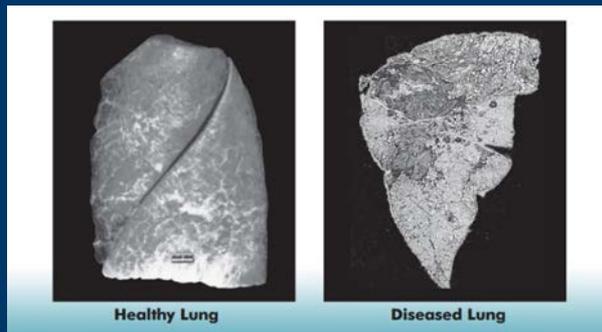
Potential health effects from breathing RCS

- **Silicosis:** the oldest known and most common occupational lung disease marked by the formation of lumps and fibrous scar tissue in the lungs
- **Lung cancer:** the leading cause of cancer deaths in the U.S.
- **Pulmonary tuberculosis:** a contagious bacterial infection of the lungs
- **Other diseases:** More studies are needed on the cause and effect of RCS on other diseases or illnesses, but some research indicates a higher incidence of other cancers among workers exposed to RCS, as well as a higher incidence of chronic obstructive pulmonary disease, kidney disease, immune system effects and enlargement of the right ventricle of the heart.

Silicosis—more details



- A permanent lung disease that makes breathing difficult
- Caused by inhaling RCS
- Causes the lungs to harden from silica that cannot be purged from the body
- No cure
- Sometimes takes 10 to 20 years to present symptoms depending on the exposure; acute silicosis symptoms are more immediate.



Silica regulations



- Notice of proposed rulemaking issued in 2013; rules targeted to general industry (manufacturing) and construction
- Contains a more protective permissible exposure limit (PEL)
- Final rule in construction effective Sept. 23, 2017



Twelve construction trades most affected

- Abrasive blasters
- Drywall finishers
- Heavy equipment operators
- Hole drillers using hand-held drills
- Jackhammer and impact drillers
- Masonry cutters using portable saws
- Masonry cutters using stationary saws
- Millers using portable or mobile machines
- Rock and concrete drillers
- Rock-crushing machine operators and tenders
- Tuckpointers and grinders
- Underground construction workers

Scope of rule

- Applies to all occupational exposures in construction to crystalline silica EXCEPT where worker exposure will remain below the action level of 25 micrograms per cubic meter of air as an eight-hour time-weighted average (TWA) under any foreseeable conditions



Permissible Exposure Limit (PEL)

- PEL is defined as the maximum amount or concentration of a chemical or physical agent a worker may be exposed to under OSHA regulations.
- A standard protocol to protect workers from harmful substances requires the use of engineering controls to limit exposure, if feasible, and additional use of personal protective equipment (PPE) to keep exposure below limits.



New rule PEL

- PEL is the same for all forms of RCS—quartz, cristobalite and tridymite—and is determined by a sampling device meeting a scientific standard set out in ISO 7708:1995.
- PEL is set at **50 micrograms** per cubic meter of air as an eight-hour TWA; a microgram is one-thousandth of a milligram or one-millionth of a gram.

What is a TWA?

Calculating an average is easy: It's the sum of the values divided by the number of values.

For example: Test scores of 80, 76, 84 and 72 result in an average score of 78:

$$80 + 76 + 84 + 72 = 312$$

$$312 \div 4 = 78$$

What is a TWA?

Calculating a TWA is a little harder.

Assume you have the following values for the accompanying time frames in an eight-hour day:

70 for 3 hours

78 for 2 hours

80 for 1 hour

84 for 2 hours

What is the TWA of the values for the eight-hour period?

Calculating TWA

Under 29 CFR 1910.1000(d)(1)(i), OSHA sets out the calculation for TWA as:

$$(C_1 \times T_1 + C_2 \times T_2 + C_3 \times T_3, \text{ etc.}) \div 8$$

C is the concentration sampled for a period, and T is the time in hours.

So for our example:

$$[(70 \times 3) 210 + (78 \times 2) 156 + (80 \times 1) 80 + (84 \times 2) 168 = 614] \quad 614 \div 8 = \underline{76.75} \text{ as an eight-hour TWA}$$

Controlling exposures is more complicated under the new rule— Specified Exposure Control Methods: Table 1

- Lists 18 construction tasks
- Contractor must fully and properly implement engineering controls, work practices and respiratory protection listed for the task in Table 1 UNLESS contractor assesses the worker exposure to silica and limits it as the rule sets out

So use of Table 1 ...

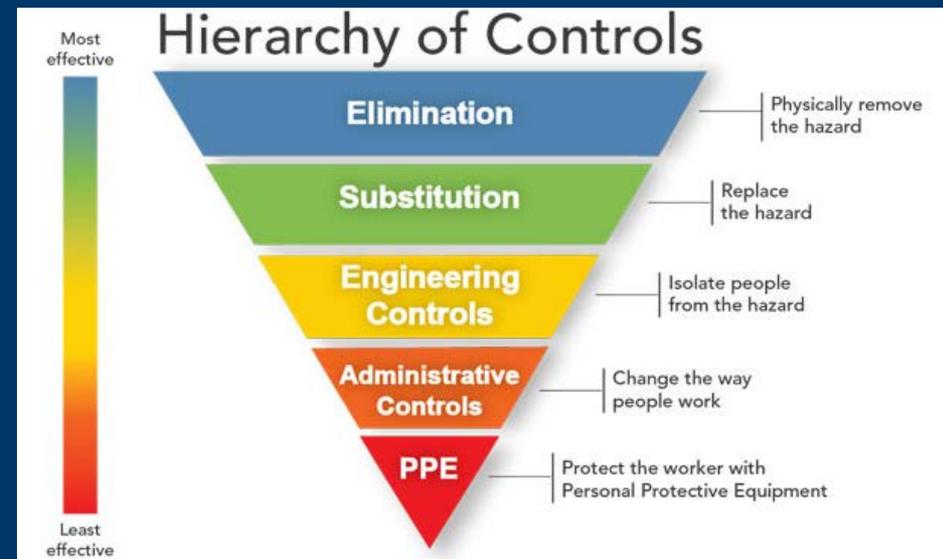
- Eliminates the need for costly exposure monitoring, but you must follow the engineering controls, work practices and PPE recommendations for the **specific task** listed in Table 1
- Avoids a determination by the contractor of the hierarchy of controls to be applied to the performance of the task, according to OSHA

More on Table 1

- Use of Table 1 triggers medical surveillance requirements on the **30th work day** performing a task where respirator use is a listed requirement.

OSHA sets out a hierarchy of controls for silica

- The idea behind the hierarchy of controls is first to apply methods of controlling exposures that would be most effective and then follow up with less-effective measures if exposures are not eliminated or reduced sufficiently. The graph on the right from the Centers for Disease Control and Prevention illustrates the concept that is behind Table 1 and other control provisions of the rule.



What is the hierarchy of controls in silica exposure?

1. Engineering and work practice controls (unless contractor shows NOT feasible)
 - a. Substitution
 - b. Isolation
 - c. Ventilation
 - d. Dust suppression
2. Respiratory protection



Table 1 examples

Operation: **Hand-held grinder**

Engineering control: Shroud and dust-collection system

Respirator required:

If four hours or less per day—APF 10 respirator

If more than four hours per day—APF 25 respirator

Table 1 examples

Operation: **Hand-held power saw (any blade diameter)**

Engineering control: Water delivery system to blade (water must be applied at flow rate that minimizes release of visible dust)

Respirator required:

If four hours or less per day—none

If more than four hours per day—APF 10 respirator

**If tasks are not listed in Table 1
or the OSHA-mandated controls are not
fully implemented ...**

... contractor has to make sure no worker is
exposed to respirable silica in an amount
exceeding the PEL.

Exposure assessment

A contractor is required to **assess** the exposure of any worker who is exposed, or may reasonably be expected to be exposed, to crystalline silica at or above the **action level** of 25 micrograms per cubic meter of air (half the PEL). This can be accomplished by:

(1) The **performance option**, defined as any combination of air monitoring (personal breathing zone [PBZ] sampling) or use of objective data.



(2) The scheduled monitoring option

- If below action level, monitoring can be discontinued
- If at or above action level but at or below PEL, periodic monitoring must be done every six months; if above PEL, monitoring must be done at least every three months
- PBZ by shift, job classification and work area; if these factors overlap, representative sampling may be done
- Reassess in the case of new processes, practices or controls

Objective data

Objective data is defined by OSHA as information, such as air-monitoring data from industry-wide surveys or calculations, that demonstrates worker exposure to RCS associated with a particular product or material or a specific process, task or activity.

Such data must reflect workplace conditions resembling current operations or with a higher exposure potential than current processes, materials, control methods, work practices and environmental conditions.

Written exposure control plan

Required elements of mandatory plan must describe:

- Tasks that involve exposure to RCS
- Engineering controls, work practices and PPE used to limit exposure
- Housekeeping measures used to limit exposure
- Procedures used to restrict access (when needed) to limit worker exposure
- Competent persons in the company for RCS

We will review our company's written plan after this presentation.

Company's competent person

- The company's competent person will be responsible for implementing the written exposure control plan for silica.
- The competent person will make frequent and regular inspections of the job sites, materials and equipment to ensure compliance with the plan.
- The competent person will be identified in the written plan.

According to OSHA:

A competent person is someone who:

- Can identify existing and foreseeable respirable crystalline silica hazards;
- Is authorized to promptly eliminate or minimize silica hazards; and
- Has the knowledge and ability to implement the written exposure control plan.

Medical surveillance

Medical surveillance is needed for workers required by the new rule to wear a respirator for 30 or more days per year.

The following **medical exams** should be conducted by a physician or other licensed health care professional:

- History and physical
- Chest X-rays
- Pulmonary function test
- Latent TB test

An exam within 30 days after the worker's initial assignment must be done for medical and work history, pulmonary function, and other related issues.

Notification

- Contractors must **notify** employees of the results of an exposure assessment within five days after results are complete.
- If there is exposure above the PEL, a description of the contractor's corrective action must be included



Housekeeping

- Wet sweeping or HEPA vacuuming of RCS dust is preferred to dry sweeping or brushing unless infeasible.
- Compressed air may not be used to clean clothing or surfaces if it could contribute to worker exposure.

Safety Data Sheets (SDSs)

- Under the GHS format of SDSs, Section 3 should contain the components of a product as in these examples.

Section 3 - Composition / Information on Ingredients				
Name	CAS Number	Weight %	ACGIH Exposure Limit*	OSHA PEL
Fiberglass	65997-17-3	3-7	1 fiber/cc	1 fiber/cc
Limestone	471-34-1	0-40	10 mg/m ³	15 mg/m ³ (total) 5 mg/m ³ (respirable fraction)
Asphalt	64742-93-4	20-50	0.5 mg/m ³ (fume)	NA
Mineral Granules	NA	0-35	10 mg/m ³	15 mg/m ³ (total) 5 mg/m ³ (respirable fraction)
Sand	NA	0-5	10 mg/m ³	15 mg/m ³ (total) 5 mg/m ³ (respirable fraction)

COMPOSITION / INFORMATION ON INGREDIENTS

Ingredients	CAS #	Ingredient %
Asphalt	8052-42-2	30 - 40
Limestone	1317-65-3	30 - 40
Fiberglass Mat		
Fiberglass	65997-17-3	0 - 5
Urea Formaldehyde Binder	9011-05-6	0 - 0.003
SBS	9003-55-6	2 - 8
Distillates (Petroleum), Hydrotreated Heavy Naphthenic	64742-52-5	1 - 4
Sand	14808-60-7	1 - 7

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components

Continuous filament glass fiber 15 - 45 %
Mineral filler 40 - 70 %
Cured acrylic polymer 5 - 25%

Chemical Name	CAS No.	Weight-%	Trade Secret
Continuous filament glass fiber, non-respirable	65997-17-3	15 - 45	*
Ground Calcium Carbonate containing traces of quartz	1317-65-3	20 - 35	*
Aluminum hydrous silicate: Kaolin Clay	1332-58-7	20 - 35	*
Mica (Al, Si)	12001-26-2	0 - 1	*
Sodium Polyacrylate	9003-04-7	0 - 0.3	*
Lauryl sulfate, sodium salt	73296-89-6	0 - 0.01	*

SDSs

- SDSs may list quartz, sand or silica. Sometimes, none will be listed in Section 3 as the regulation requires, but you may find language elsewhere as the example here indicates. The callout below is found in the “Composition Notes” below the list of ingredients. This highlights the importance of both the contractor and workers being familiar with the contents of all SDSs.

Composition comments

All concentrations are in percent by weight unless ingredient is a gas.

The gypsum used to manufacture these panels contains respirable crystalline silica varying by source and over time, as determined by testing the gypsum bulk samples. Good work practices which minimize the extent of dust generation should be followed, and actual employee exposure on a given jobsite must be determined by workplace industrial hygiene testing.

Product labeling under OSHA HCS

- New products that have silica, quartz or sand listed as a component or ingredient in SDS Section 3, “Composition/information on ingredients,” should also have pictograms conveying a hazard, such as:



Section 3 - Composition/Information on Ingredients

3.1 Substances

- Material does not meet the criteria of a substance in accordance with Regulation (EC) No 1272/2008.

3.2 Mixtures

Composition					
Chemical Name	Identifiers	%	LD50/LC50	Classifications According to Regulation/Directive	Comments
Asphalt	CAS:8052-42-4 EINECS:232-490-9	40% TO 85%	Ingestion/Oral-Rat LD50 >5000 mg/kg Inhalation-Rat LC50 >94.4 mg/m ³	EU DSD/DPD: Self Classified: Carc. 3; R40 EU CLP: Self Classified: Carc. 2, H351 OSHA HCS 2012: Carc. 2	Bound in an asphalt matrix
Limestone	CAS:1317-65-3 EC Number:215-279-6	0% TO 35%	NDA	EU DSD/DPD: Self Classified: Xn R48/20 EU CLP: Self Classified: STOT RE 1 (Lungs), H372 OSHA HCS 2012: STOT RE 1 (Lungs)	NDA
Hydrotreated heavy naphthenic distillates (petroleum) (Highly Refined)	CAS:64742-52-5 EC Number:285-155-0	0% TO 10%	NDA	EU DSD/DPD: Annex I: Carc.Cat.2; R45 EU CLP: Annex VI: Carc. 1B, H350 OSHA HCS 2012: Skin Irrit. 2	NDA
Quartz	CAS:14808-60-7 EC Number:238-878-4	< 10%	NDA	EU DSD/DPD: Self Classified: Carc 1; R45 EU CLP: Self Classified: Carc. 1A, H350 OSHA HCS 2012: Carc. 1A	Only nominal amounts released

Pictogram explanation

Exclamation Mark



- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity (harmful)
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer (Non-Mandatory)

Health Hazard



- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity



Assessing Your Understanding



1. The health concern with silica arises when material containing sand, quartz or silica is cut, ground or abraded, resulting in_____.

- A. Particles that burn your skin
- B. Smoke that irritates your eyes
- C. A poisonous gas
- D. Respirable particles that damage your lungs



2. RCS describes particles of ____ microns
in size or smaller.

- A. 50
- B. 25
- C. 10
- D. 3



3. The PEL under the new OSHA construction silica rule is _____.

- A. 50 micrograms per cubic meter of air as an eight-hour TWA
- B. 25 micrograms per cubic meter of air as an eight-hour TWA
- C. 250 million particles per cubic feet of air
- D. 100 million particles per cubic feet of air



4. A contractor who fully implements the engineering controls, work practices and PPE for a task listed in Table 1 is NOT required to perform a worker exposure assessment.

- A. True
- B. False



5. If a task is NOT listed in Table 1, a contractor must ensure no worker is exposed to RCS in excess of _____.

- A. The action level
- B. The PEL
- C. The percentage of silica in the material
- D. The APF of the respirator



6. Objective data must reflect workplace conditions resembling current operations OR with a higher exposure potential than current processes, materials, control methods, work practices and environmental conditions.

- A. True
- B. False

7. The competent person for RCS

- A. Can identify RCS hazards in the workplace
- B. Is authorized to eliminate or minimize those hazards
- C. Has knowledge and ability to implement the exposure control plan
- D. All of the above



8. Whether a product contains silica, quartz or sand can be found in what part of an SDS?

- A. Section 1
- B. Section 2
- C. Section 3
- D. Section 11

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