



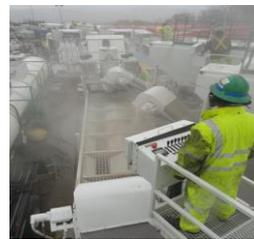
Annual Workplace Safety and Health Conference

SILICA COMPETENT PERSON REVIEW

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SILICA COMPETENT PERSON REVIEW (cont.)



OVERVIEW

- Acronyms
- Crystalline silica: OSHA's new rule deadline; workers and industries affected
- Competency objectives for silica competent person
- What is silica
 - Exposure and health risks
 - Controls to reduce the exposure
 - New permissible exposure limit



... OVERVIEW

- Monitoring
 - Scheduled monitoring
 - Equipment
 - Gravimetric analysis of air samples requirements
- Sampling strategies
- Laboratory results and interpretation



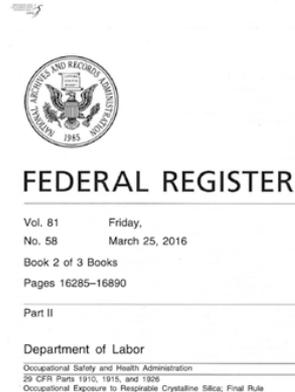
Acronyms

- American Conference of Governmental Industrial Hygienist (ACGHI)
- National Institute for Occupational Safety and Health (NIOSH)
- Permissible Exposure Limits (PELs) 50 µg/M³ as an 8-hr TWA
- Action Level (AL) 25 µg/M³
- Time-Weighted Average (TWA)
- Occupational Safety and Health Administration (OSHA)
- Mine Safety and Health Administration (MSHA)
- American Industrial Hygiene Association (AIHA)
- Micrograms (µg); Cubic Meter (M³)
- Liters per Minute (LPM)
- Lower Detection Level (LDL)
- Limit of Detection (LOD)



Construction 1926.1153 New Rule Compliance Dates

- Employers must comply with all requirements (except methods of sample analysis) by June 23, 2017
- Compliance with methods of sample analysis required by June 23, 2018



General Industry/Maritime 1910.1053 New Rule Compliance Dates

Employers must comply with all requirements of the standard by June 23, 2018 except:

- Employers must comply with the action level trigger for medical surveillance by June 23, 2020. (The PEL is the trigger from June 23, 2018 through June 23, 2020.)
- Hydraulic fracturing operations in the oil and gas industry must implement engineering controls to limit exposures to the new PEL by June 23, 2021.



Close-up view of frac sand (on the right) and a typical sand of similar grain size (on the left). Notice how the frac sand has a very uniform grain size, nicely rounded grain shapes and a uniform composition. It is also a very tough material that can resist compressive forces of up to several tons per square inch. Grains in this image are about 0.50 millimeter in size. Photo © BanksPhotos, iStockphoto.



ASTM E1132 - 13 on Silica

- This practice covers a description of several actions that should be taken to reduce the risk of harmful occupational exposures to humans in environments containing respirable crystalline silica. This practice is intended for, but not limited to, industries regulated by the U.S. Mine Safety and Health Administration (MSHA) and the U.S. Occupational Safety and Health Administration (OSHA). A separate practice, designed for the unique conditions of the construction industry, has been designated Practice [E2625](#).



Important Reasons for the New Rule Workers and Industries Affected

- 2.3 million workers:
 - Construction: 2 million
 - GI/Maritime: 300,000
- 676,000 establishments
 - Construction: 600,000
 - GI/Maritime: 76,000

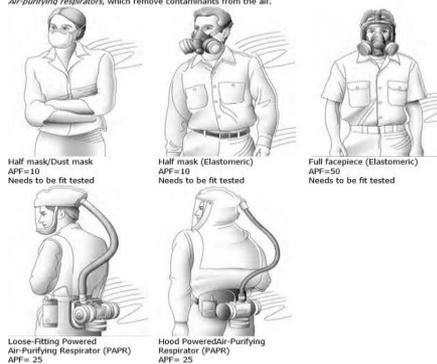


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Most Important Reason for the Rule

- Current PELs do not adequately protect workers ($250 \mu\text{g}/\text{m}^3$; General Industry $100 \mu\text{g}/\text{m}^3$)
- Extensive epidemiologic evidence that lung cancer and silicosis occur at exposure levels below $100 \mu\text{g}/\text{m}^3$

Air-purifying respirators, which remove contaminants from the air.



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Competency Objectives Silica-Competent Person

- **OSHA's** Advisory Committee for construction safety and health recommended that OSHA use a competent-person approach for the proposed silica in construction rule
- *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 and completion of training program; OSHA's new rule [1926.1153](#) (b) definitions.
- 24 hours of classroom training and 4 hours of hands-on is recommended



... Competency Objectives Silica-Competent Person

- **AIHA** describes as a common, minimum body of knowledge needed by a competent person capable of recognizing and evaluating situations where overexposure may be occurring and
- The role of the silica competent person is critical to the effective implementation of a written exposure silica plan
- Silica competent persons demonstrate competency by:
 - Successfully completing a Silica Competent Person Training Program meeting the criteria set forth or by
 - Successfully demonstrating each of the capabilities described in formal training or on-the-job experience.

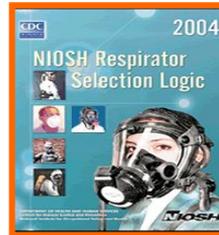


Competency Objectives



Silica dust exposure control plan includes the following parts:

1. Hazard Identification
2. Worksite Air Monitoring
3. Employee Training; Health Hazards and HAZCOM
4. Housekeeping Procedures
5. Engineering Controls
6. Personal Hygiene
7. Personal Protective Equipment; APF=10
- 8. Medical Examinations and Evaluation**
- 9. Record Keeping 29 CFR 1910.1020**
10. Emergency First Aid Procedures for Silica Dust
11. Spill and Disposal Procedures



What is silica?

- Silica is one of the most common naturally occurring elements on the planet. Silica, the mineral compound silicon dioxide (SiO_2), is found in two forms—crystalline or non-crystalline (also referred to as amorphous) and in very small particles at least 100 times smaller than ordinary beach sand.
- There are several forms of crystalline silica, the most common of which are quartz, cristobalite, and tridymite. Crystalline silica is ubiquitous, being in rocks from every geologic era and from every location around the globe.

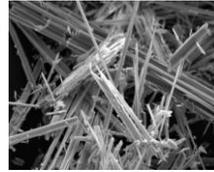


(Quartz)



Cristobalite

Tridymite



Exposure and Health Risks

Exposure to respirable crystalline silica has been linked to:

- Silicosis
- Lung cancer
- Chronic obstructive pulmonary disease, COPD
- Kidney disease
- Immune system compromise
- Tuberculosis; susceptibility to TB
- Scleroderma disease affecting skin, blood vessels, joints, and muscles



Healthy Lung



Silicotic Lung



Industries and Operations with Exposures

- Construction
- Glass manufacturing
- Pottery products
- Structural clay products
- Concrete products
- Foundries
- Dental laboratories
- Paintings and coatings
- Jewelry production
- Refractory products
- Asphalt products
- Landscaping
- Ready-mix concrete
- Cut stone and stone products
- Abrasive blasting in:
 - Maritime work
 - Construction
 - General industry
- Refractory furnace installation and repair
- Railroads
- Hydraulic fracturing for gas and oil



Controls Used to Reduce Silica Exposure

- Use all available engineering controls; avoid using compressed air for cleaning surfaces
- Use wet methods for cutting, chipping, drilling, sawing, grinding
- Substitute non-crystalline silica blasting material
- Use respirators during sandblasting or abrasive blasting
- Do not eat, drink, or smoke near crystalline silica dust
- Move away from exposure area and wash hands and face before eating, drinking, or smoking
- Local exhaust ventilation system
- Respiratory protection at least APF=10



New Permissible Exposure Limit (PEL)

- **PEL = $50 \mu\text{g}/\text{m}^3$ as an 8-hour TWA**
- **Action Level = $25 \mu\text{g}/\text{m}^3$ as an 8-hour TWA**

Major Air Pollutants

Suspended particulate matter (SPM)

- **Properties**
 - Consists of a variety of solid particles and liquid droplets small and light enough to remain suspended in the air.
 - The most harmful forms of SPM are fine particles (PM-10, with an average diameter micrometers) and ultrafine particles (PM-2.5).
- **Sources**
 - Burning coal or diesel
 - Volcanoes
 - Asbestos
 - PCBs, dioxins, pesticides
 - unpaved roads, plowing, burning fields
 - lint, pollen, spores
- **Effects**
 - lung damage,
 - mutagenic, carcinogenic, teratogenic
- **EPA Standard:** $50 \mu\text{g}/\text{m}^3$ (annual mean)
 - SPM is responsible for about 60,000 premature deaths a year in the U.S.

Scheduled Monitoring Option

- *Prescribes a schedule for performing initial and periodic personal monitoring*
- *If monitoring indicates:*
 - *Initial below the AL: no additional monitoring*
 - *Most recent at or above the AL: repeat within 6 months*
 - *Most recent above the PEL: repeat within 3 months*
 - *When two consecutive non-initial results, taken 7 or more days apart, are below the AL, monitoring can be discontinued*
 - *Reassess if circumstances change*



www.osha.gov/dsg/etools/silica/determine_exposure/determine_exposure.html



How to Take an Air Sample and What Do We Need?

- Pre-weighed 5um 37mm PVC cassette
 - Do not use a regular MCE, PVC, PCM, TEM cassette
 - OSHA has a % silica component for the current PEL calculation
- Cyclone (Respirable Silica)
- Cyclone Calibrator-Adapter or Calibration-Jar
- Low Flow Sampling Pump (1-4 LPM)
- Field Rotameter



Methods Listed in Silica Standard For Lab Reference Base in Appendix A

Crystalline Silica Quartz and Cristobalite	
Method number:	ID-142
Version:	3.0
Target concentration: (for quartz and cristobalite)	50 $\mu\text{g}/\text{m}^3$
OSHA PEL:	$\frac{10 \text{ mg}/\text{m}^3}{\% \text{ SiO}_2 + 2}$ for quartz (mass formula) Use $\frac{1}{2}$ the value calculated from the mass formula for quartz for cristobalite.
ACGIH TLV: (respirable fraction) (α -quartz and cristobalite)	0.025 mg/m^3
Procedure:	Samples are collected by drawing workplace air through pre-weighed 5- μm pore size, 37-mm diameter low ash polyvinyl chloride (PVC) filters preceded by 10-mm nylon Dorr-Oliver cyclones. The weight of the respirable dust is determined by gravimetric analysis. The PVC filters are dissolved and the samples are suspended in tetrahydrofuran (THF). The samples are then deposited on silver membranes and analyzed by X-ray diffraction (XRD).
Recommended sampling time and sampling rate:	480 min at 1.7 L/min (816 L)
Reliable quantitation limit:	9.76 $\mu\text{g}/\text{sample}$ (12.0 $\mu\text{g}/\text{m}^3$) quartz 20.6 $\mu\text{g}/\text{sample}$ (25.2 $\mu\text{g}/\text{m}^3$) cristobalite
Standard error of estimate at the target concentration:	8.2% quartz 9.6% cristobalite
Status of method:	Fully validated method.

Method No.	Analysis	LDL (1.7LPM)
OSHA ID-142	XRD, Redposition	12.0 $\mu\text{g}/\text{m}^3$ (qtz)
NIOSH 7500	XRD, Redposition	6.12 $\mu\text{g}/\text{m}^3$ (8 hr)
NIOSH 7602	IR, KBr Pellet	6.12 $\mu\text{g}/\text{m}^3$ (8 hr)
NIOSH 7603	IR, Redposition	12.24 $\mu\text{g}/\text{m}^3$ (8 hr)
MSHA P-2	XRD, Redposition	24.48 $\mu\text{g}/\text{m}^3$ (8 hr)
MSHA P-7	IR, Redposition	24.48 $\mu\text{g}/\text{m}^3$ (8 hr)

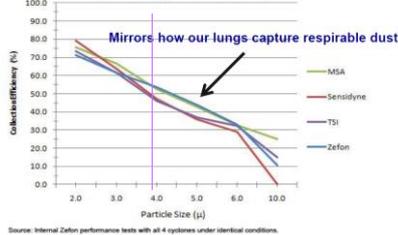
Cyclone Model	Part Number	Flow Rate ACGIH Respirable (50% @ 4 μm)
10 mm Dorr-Oliver	800061	1.7 LPM
BGI-4L, HD style (US version)	811-9924-01	2.2 LPM
Medium flow rate GK 2.69 for 37 mm Cassettes	811-9926-01	4.2 LPM
High flow rate RASCAL Cyclone with Plastic Filter Holder	811-9925-01	8.5 to 9.5 LPM

37 mm cassette version of the GK 2.69 cyclone is recommended over the 25 mm due to the higher backpressure caused by the smaller cassette.



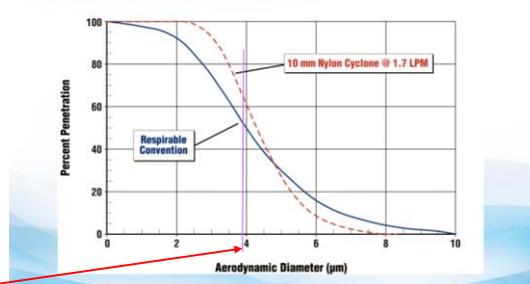
4 μm^3 IS US ACGIH 50 Percent Cut Point

10mm Nylon Cyclone Collection Efficiency
Curve Comparison at 1.7 lpm



Source: Internal Zefon performance tests with all 4 cyclones under identical conditions.

Particle Size Distribution-US ACGIH



4 μm 50% cut point
at a 1.7 L/min flow rate
-Dorr Oliver

Particles below 4 μ WILL ENTER the lungs
Sizes 8 μ to 10 μ are trapped by respiratory protection



Sampling Strategies

- From the lab, get (AHIA authorized or use the OSHA ID-142 or NIOSH 7500 methods) the three piece cassettes, pre-weighed, 5 μ , 37mm PVC filter and chain of custody with tape sealer. At least one blank cassette for every 20 samples is needed. From the same lab, request the report as % quartz, % cristobalite and respirables in mg/m^3 . Take one sample for each OD and run for not less than 8 hours at a constant rate of 1.7 LPM (low rates).
- The personal pump must have a constant flow control and maintain a flow rate not less than 5% of the rate set up; remember, these types of pumps work like the cruise control of a car; most of the asbestos pumps do not have this.
- If the occupation task runs less than 8 hours, this will affect results; and the person will be overexposed.
- MSHA *procedures* ... civil penalties *higher*



Q & A

*Thank you for your time and attention.
Stay safe!*

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