Best Practices and Controls for Respirable Crystalline Silica Exposures in Construction and General Industries
OSHA estimates 2.3 million workers are impacted by silica

- 2 million in construction
- 300,000 in general industry
• **Crystalline silica** – silicon dioxide (SiO2) mineral that is naturally occurring. The mineral has ordered structures and symmetry. Examples: sand, quartz. (amorphous silica lacks the symmetry – examples: silica gel)

• **Respirable crystalline silica** – silica that is <10 microns in size, thus able to reach the lower regions of the lungs.
What Industries are Affected?

*Construction Examples*

Ready-Mix Concrete
Cut stone/stone products
Refractory furnace installation and repair
Concrete products
Paintings & Coatings
Asphalt products
Abrasive blasting
<table>
<thead>
<tr>
<th>General Industry Examples</th>
<th>What Industries are Affected</th>
</tr>
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<tbody>
<tr>
<td>Ready-Mix Concrete</td>
<td>Glass Manufacturing</td>
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<tr>
<td>Cut stone/stone products</td>
<td>Pottery products</td>
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<tr>
<td>Abrasive blasting</td>
<td>Foundries</td>
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<tr>
<td>Landscaping</td>
<td>Asphalt products</td>
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<tr>
<td>Concrete products</td>
<td>Railroads</td>
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<tr>
<td>Paintings &amp; Coatings</td>
<td>Dental Labs</td>
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</tbody>
</table>
Health effects

• Pulmonary silicosis - inhaled dust deposits deep in lungs & forms silicotic nodules
• Symptoms of silicosis
  – shortness of breath
  – As the disease progresses, incurable fibrosis develops
• May be associated with lung cancer, tuberculosis, chronic obstructive pulmonary disease (COPD), immunologic disorders, kidney disease, and other cancers.
Health effects

- **Chronic silicosis** — may develop after 10 or more years of exposure to crystalline silica at relatively low concentrations
- **Accelerated silicosis** — may develop 5 to 10 years after initial exposure to crystalline silica at high concentrations
- **Acute silicosis** — may develop within a few weeks, or 4 to 5 years, after exposure to very high concentrations of crystalline silica
Rule published to be in effect June 23, 2016

• Startup dates with specific provisions 1910.1053 (l) for general industry and maritime and 1926.1153(k) for construction.

• Final rule establishes a new permissible exposure limit (PEL) of 50 micrograms of respirable crystalline silica per cubic meter of air (50 μg/m3) as an 8-hour time-weighted average (TWA) in all industries covered by the rule. There is an action level of 25 ug/m3.
Effective Dates

- **Construction Industry** - One year from effective date – June 23, 2017
- **General Industry and Maritime** - Two years from effective date - June 23, 2018
- **Hydraulic Fracturing** - June 23, 2018, two years after the effective date for all provisions except Engineering Controls, which have a compliance date of June 23, 2021
Legal Challenges

Just a few of the key organizations who have filed lawsuits against the standard:

• National Association of Manufacturers (NAM)
• American Foundry Society
• American Road and Transportation Builders Association
• American Subcontractors Association
• Associated General Contractors of America
• Mason Contractors Association of America
Likely cases will be consolidated and presented D.C. Circuit Court of Appeals because that court usually hears challenges to OSHA.

Word out is advising employers to proceed with taking active steps towards compliance.
Differs from prior standard which utilized a calculation to establish the PEL:

$$PEL = 10 \text{ mg/m}^3 \times \% \text{ Silica} + 2$$

New PEL is straight value. No requirement to calculate PEL based on amount of silica in the air sample.
OSHA Silica Rule

**Action Level**: When silica exposures are determined by the employer through OSHA approved methods be $\geq 25 \text{ ug/m}^3$ but less than $50 \text{ ug/m}^3$ for 30 or more days a year

- Employee exposure medical assessment
  - Within 30 days of hire, every 3 years after or as PLHCP advises
  - Comply with 1910.1020 recordkeeping
  - Name, Social Security number, healthcare provider opinion
  - To be in place by June 23, 2020
WRITTEN MEDICAL REPORT FOR EMPLOYEE

EMPLOYEE NAME: ____________________________ DATE OF EXAMINATION: ____________________________

TYPE OF EXAMINATION:
[ ] Initial examination  [ ] Periodic examination  [ ] Specialist examination
[ ] Other: ____________________________

RESULTS OF MEDICAL EXAMINATION:

Physical Examination –  [ ] Normal  [ ] Abnormal (see below)  [ ] Not performed

CHEST X-RAY –  [ ] Normal  [ ] Abnormal (see below)  [ ] Not performed

Breathing Test (Spirometry) –  [ ] Normal  [ ] Abnormal (see below)  [ ] Not performed

Test for Tuberculosis –  [ ] Normal  [ ] Abnormal (see below)  [ ] Not performed

Other: ____________________________  [ ] Normal  [ ] Abnormal (see below)  [ ] Not performed

Results reported as abnormal: ____________________________

[ ] Your health may be at increased risk from exposure to respirable crystalline silica due to the following:

RECOMMENDATIONS:
[ ] No limitations on respirator use
[ ] Recommended limitations on use of respirator: ____________________________
[ ] Recommended limitations on exposure to respirable crystalline silica: ____________________________

Dates for recommended limitations, if applicable: ____________________________ to ____________________________

MM/DD/YYYY     MM/DD/YYYY

[ ] I recommend that you be examined by a Board Certified Specialist in Pulmonary Disease or Occupational Medicine

[ ] Other recommendations*: ____________________________

Your next periodic examination for silica exposure should be in: [ ] 3 years  [ ] Other: ____________________________

Examining Provider: ____________________________ (signature)  Date: ____________________________

Provider Name: ____________________________  Office Address: ____________________________

Office Phone: ____________________________

*These findings may not be related to respirable crystalline silica exposure or may not be work-related, and therefore may not be covered by the employer. These findings may necessitate follow-up and treatment by your personal physician.

Respirable Crystalline Silica standard (§ 1910.1053 or 1026.1153)
WRITTEN MEDICAL OPINION FOR EMPLOYER

EMPLOYER: ____________________________

EMPLOYEE NAME: ________________________

DATE OF EXAMINATION: __________________

TYPE OF EXAMINATION:
[ ] Initial examination  [ ] Periodic examination  [ ] Specialist examination
[ ] Other: ____________________________

USE OF RESPIRATOR:
[ ] No limitations on respirator use
[ ] Recommended limitations on use of respirator: ____________________________

Dates for recommended limitations, if applicable: MM/DD/YYYY to MM/DD/YYYY

The employee has provided written authorization for disclosure of the following to the employer (if applicable):

[ ] This employee should be examined by an American Board Certified Specialist in Pulmonary Disease or Occupational Medicine
[ ] Recommended limitations on exposure to respirable crystalline silica: ____________________________

Dates for exposure limitations noted above: MM/DD/YYYY to MM/DD/YYYY

NEXT PERIODIC EVALUATION: [ ] 3 years  [ ] Other: ____________________________

Examining Provider: ____________________________ Date: ____________________________
Provider Name: ____________________________ Provider’s specialty: ____________________________
Office Address: ____________________________ Office Phone: ____________________________

[ ] I attest that the results have been explained to the employee.

The following is required to be checked by the Physician or other Licensed Health Care Professional (PLHCP):
[ ] I attest that this medical examination has met the requirements of the medical surveillance section of the OSHA Respirable Crystalline Silica standard (§ 1910.1053(h) or 1926.1153(h)).
AUTHORIZATION FOR CRYSSTALLINE SILICA OPINION TO EMPLOYER

This medical examination for exposure to crystalline silica could reveal a medical condition that results in recommendations for (1) limitations on respirator use, (2) limitations on exposure to crystalline silica, or (3) examination by a specialist in pulmonary disease or occupational medicine. Recommended limitations on respirator use will be included in the written opinion to the employer. If you want your employer to know about limitations on crystalline silica exposure or recommendations for a specialist examination, you will need to give authorization for the written opinion to the employer to include one or both of those recommendations.

I hereby authorize the opinion to the employer to contain the following information, if relevant (please check all that apply):

☐ Recommendations for limitations on crystalline silica exposure

☐ Recommendation for a specialist examination

OR

☐ I do not authorize the opinion to the employer to contain anything other than recommended limitations on respirator use.

Please read and initial:

☐ I understand that if I do not authorize my employer to receive the recommendation for specialist examination, the employer will not be responsible for arranging and covering costs of a specialist examination.

Name (printed)

Signature ____________________________ Date ____________________________

Missouri Employers Mutual
OSHA Silica Rule

Action Level: When silica exposures are determined by the employer through OSHA approved methods be $\geq 25$ ug/m$^3$ but less than $50$ ug/m$^3$ for 8 hour TWA

• Establish Written Exposure Control Plan
  – Describe employee tasks
  – Controls
    • Includes work practices such as HEPA vacs, wet methods
    • *respiratory protection
      – Employer must consider and implement feasible engineering controls even when respirators are employed. This evaluation process should be documented and performed regularly.
OSHA Silica Rule

• Establish Written Exposure Control Plan cont...
  – Housekeeping measures
    • Eliminate or significantly reduce compressed air use
    • Eliminate or significantly reduce dry sweeping
  – Review and update at least annually
  – Make available to employees
Respirable silica

- The fine silica particles can stay suspended in air

<table>
<thead>
<tr>
<th>Diameter of Particle in microns</th>
<th>Time to Fall 1 Foot (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 (grain of sand)</td>
<td>0.02</td>
</tr>
<tr>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>2</td>
<td>14.5</td>
</tr>
<tr>
<td>1</td>
<td>54</td>
</tr>
<tr>
<td>0.5</td>
<td>187</td>
</tr>
</tbody>
</table>
OSHA Silica Rule

• Employee training
  • Employer **shall ensure** employee can demonstrate knowledge and understanding of:
    – Health effects of respirable crystalline silica
    – Specific tasks that result in exposure
    – Specific measures the employer has implemented for employee protection
      » Engineering controls
      » Work practices
      » Respirators
OSHA Silica Rule

**Action Level:** When silica exposures are determined by the employer through OSHA approved methods be \(\geq 25\) ug/m\(^3\) but less than \(50\) ug/m\(^3\) for 30 or more days a year

- **Exposure Evaluation Options**
  - Air sampling – if at or above action level, but less than PEL, repeat sampling every six months.
  - Performance Option- combination of air monitoring data or objective data sufficient to accurately characterize employee exposures
Action Level: When silica exposures are determined by the employer through OSHA approved methods be \(\geq 50\) ug/m\(^3\) but less than 50 ug/m\(^3\) for 30 or more days a year

- Employee exposure medical assessment
  - Comply with 1910.1020 recordkeeping
  - Name, Social Security number, healthcare provider opinion
  - To be in place by June 23, 2020
PEL: When silica exposures are determined by the employer through OSHA approved methods be $\geq 50$ ug/m$^3$ but less than 50 ug/m$^3$ for 30 or more days a year

- Employee exposure medical assessment
  - Comply with 1910.1020 recordkeeping
  - Name, Social Security number, healthcare provider opinion
  - To be in place by June 23, 2018
PEL: When silica exposures are determined by the employer through OSHA approved methods be $\geq 50$ ug/m$^3$ for 30 or more days a year

- Employee exposure evaluation - for air sampling, every 3 months for each job, shift and work activity. Representative sampling should consider highest anticipated exposures.
PEL: When silica exposures are determined by the employer through OSHA approved methods be \( \geq 50 \) ug/m\(^3\) for 30 or more days a year

- For General Industry, Regulated Areas must be established and identified.
  - #1 Make facility regulated area. PPE required. Limit traffic, food & water but also must have available non-regulated areas.
  - #2 Limited regulated area(s). This is specific locations.
  - #3 Conditional regulated area(s). This is activity specific.
Reassessment of exposures. The employer shall reassess exposures whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional 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.
Air Sampling Caveat

Also requires:

• Date of Sampling
• Name of employee(s) sampled
• Their Social Security number *
• Job classification and number of employees represented
• PPE worn
• Lab who did analysis
DANGER
RESPIRABLE CRYSTALLINE SILICA
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
WEAR RESPIRATORY PROTECTION IN THIS AREA
AUTHORIZED PERSONNEL ONLY
Construction standard Table 1, specifies silica exposure control methods for tasks such as the use of:

- stationary masonry saws, handheld power saws, walk-behind saws, jackhammers, walk-behind milling machines and floor grinders, crushing machines, and heavy equipment and utility vehicles used to abrade or fracture silica-containing materials, or used during demolition work.
The construction rule requires the designation of a competent person, which the general industry rule does not.

• Individual who is capable of identifying existing and foreseeable hazards
• Has authority to take prompt corrective measures
• Has knowledge and ability necessary to fulfill the responsibilities set forth in the standard.
The construction standard does not apply where exposures will remain low under any foreseeable conditions; for example, when only performing tasks such as mixing mortar; pouring concrete footers, slab foundation and foundation walls; and removing concrete formwork.
The construction rule does not contain the requirement for a “regulated area” nor posting of warning signs but to address restricted areas where PEL is exceeded in exposure control plan.
• If construction employers choose to follow Table 1, they do not need to do air monitoring nor are they subject to the PEL.

• If they do not follow Table 1, they must do air monitoring and are subject to the PEL and action level.
Specific Exposure Control Methods When Working with Silica Materials

- Lists the Equipment / Task:
  - Example - Handheld power saw

- Lists the Engineering & Work Practice Control Methods
  - Example - Use saw with continuous water feed to the blade or
  - Operate and maintain tools in accordance with manufactures’ instructions to control dust emissions.
Specific Exposure Control Methods When Working with Silica Materials - continued

• Lists the Respiratory Protection required with minimum assigned protection factor (APR) for ≤ 4 hours and > 4 hours
  – In this example also considers tool use indoors and outdoors:
    • Outdoors ≤ 4 hours, No respirator required. >4 hours APR 10 respirator
    • Indoors, minimum APR 10 respirator required.
Table 1 Example: Handheld Power Saws

If workers are sawing silica-containing materials, they can use a saw with a built-in system that applies water to the saw blade. The water limits the amount of respirable crystalline silica that gets into the air.

<table>
<thead>
<tr>
<th>Equipment/Task</th>
<th>Engineering and Work Practice Control Methods</th>
<th>Required Respiratory Protection and Minimum Assigned Protection Factor (APF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handheld power saws</td>
<td>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.</td>
<td>None, APF 10</td>
</tr>
</tbody>
</table>

*See regulatory text for construction standard, with complete Table 1 at www.osha.gov/silica/ConstructionRegText.pdf.*
Why use silica sand for molds?

• “Refractoriness” of the sand. It holds up well against high temps and fusing with the poured metal.
• Silica sand is permeable and allows gases to vent.
• Silica sand with binders has good cohesion. Liquid metal diffuses well throughout the sand mold.
• Silica sand packs well into the holding box; filling nooks and corners so that the mold has sharp, clear patterns which helps reduce machining.
• Silica sand has good recycling properties which lowers costs.
Best Practices Tips

• Install a magnehelic gauge to help determine if a dispensing shoot is clogged
• Collect the dry sand “fines” that dispense at first.
Best Practices Tip

• Eliminate compressed air or use within a controlled area to capture dust – like a glove box or table for small parts; booth for larger units
• Eliminate / reduce dry sweeping – use HEPA vacs for cleaning
Avoid using dry saws – use wet saws or saws equipped with local exhaust ventilation, if possible.
Simple work practices like not tossing a pallet over empty sacks that held cement and body position with wind direction can help lower exposures.
Masonry Tips

Auger-fed & tarped mixer verses dump to mixer
## Case Studies

<table>
<thead>
<tr>
<th>Task</th>
<th>Respirable silica air sample results</th>
<th>Task</th>
<th>Respirable silica air sample results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick Layer – dry cutting</td>
<td>0.12 mg/m³</td>
<td>Brick Layer- wet saw</td>
<td>0.019 mg/m³</td>
</tr>
<tr>
<td>Mold line - no local exhaust ventilation</td>
<td>0.57 mg/m³</td>
<td>Mold line – local exhaust with gauge</td>
<td>0.035 mg/m³</td>
</tr>
</tbody>
</table>
Affected Industries should regularly evaluate potential new technologies and techniques to reduce silica exposures. Industry associations are great resources for information!

– Such product replacement or additives for sand
– New types of ventilation controls
– Work practice improvements

Document these evaluations on why these would not feasible if not utilized.
THANK YOU

AND

HAVE A SAFE DAY!

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