Silica: Workplace Exposures, Health Effects and the New OSHA Final Rule

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Webinar Logistics

Session Format

- All participants are muted
- 45-minute presentation
- 15-minute Q&A session
  - Use the question/chat feature on your sidebar to submit questions
  - We'll respond to as many questions as we can in the Q&A session so we can end on time!
- Web/Phone Conference Issues or Concerns
  - If you are having difficulty seeing/hearing the presentation, please submit your questions using the chat feature
- **Presentation materials will be available after the session**

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About the Presenters

Michelle McIntyre, MPH, CIH, CSP

- Certified Industrial Hygienist (CIH) and Certified Safety Professional (CSP)
- Experience in a variety of construction service areas, including development and implementation of corporate Health and Safety Programs
- Conducted qualitative and quantitative assessments with recommendations for risk reduction and increasing efficiencies in many different industries including healthcare, laboratories, office settings, warehouses, and industrial operations
- Experience helps her to communicate with design teams, engineers, management, and employees to promote health and safety at all management levels
- Developed and conducted health and safety training and presentations for numerous clients as well as regional conferences

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About the Presenters

Michael Peterson, CIH, CSP

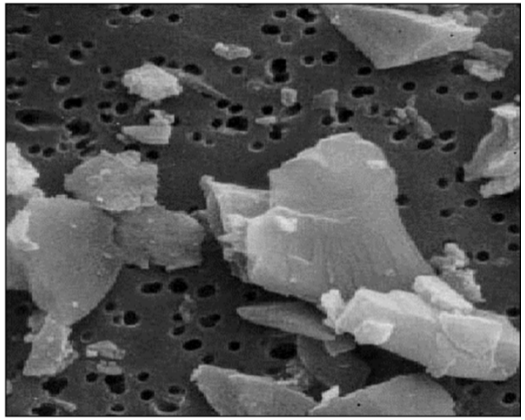
- Certified Industrial Hygienist (CIH) and Certified Safety Professional (CSP)
- 10 years of experience consulting in industrial hygiene and environmental, health, and safety
- Has a wide range of experience managing projects such as; classical industrial hygiene and safety projects (e.g., chemical exposure assessments, ventilation evaluations, noise evaluations, etc.) as well as emerging building science issues (e.g., indoor air quality evaluations, microbial evaluations, and microbial remediation oversight), and environmental permitting

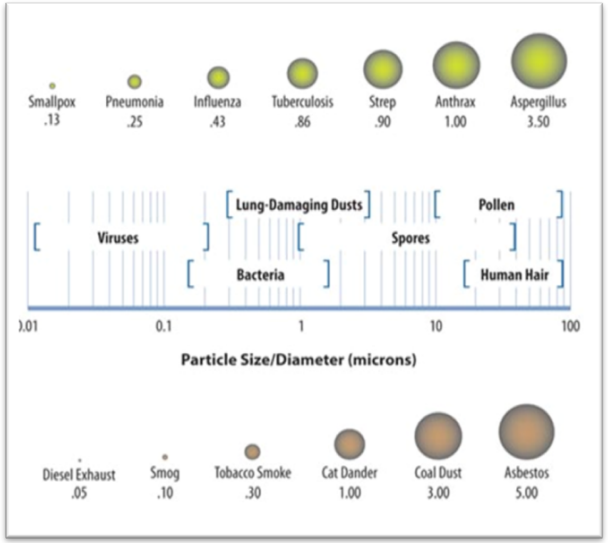
What We Will Cover

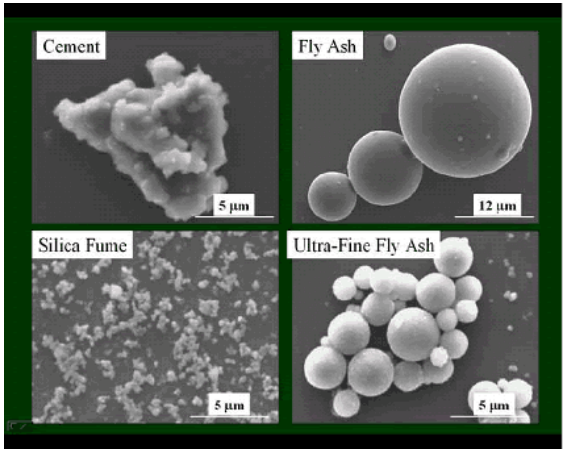
- What is Crystalline Silica?
- Silica Regulations/New OSHA Rule
- Sources of Silica/Health Effects
- Real World Examples
- Exposure Limits/Controls
- Questions?

Silica Basics

Take a Closer Look





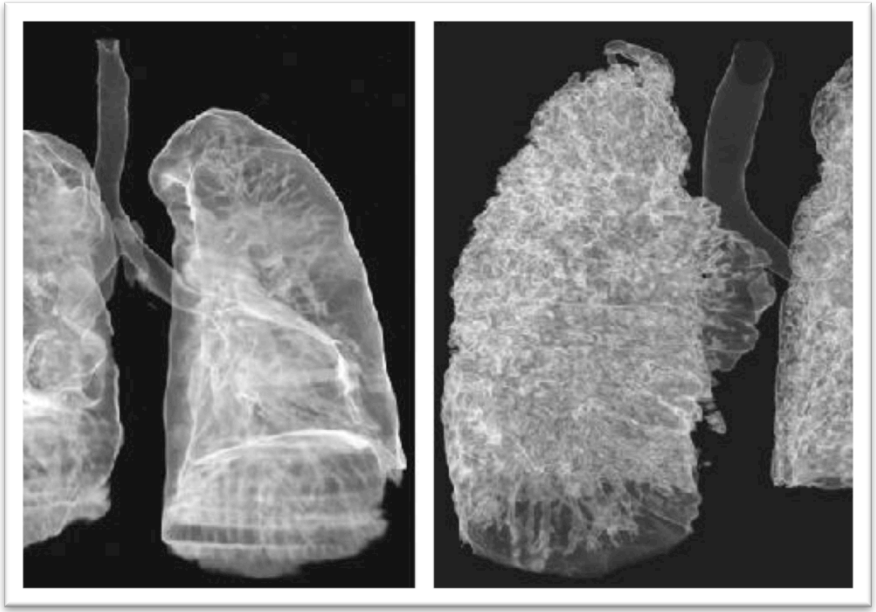


Carcinogenicity

- OSHA - Human lung carcinogen
- ACGIH - A2 (suspected)
- IARC - 1 (confirmed in humans)
- NIOSH - Potential (human)
- NTP - Known

Health Effects of Silica Exposure

- Silicosis-Fibrotic nodules/scarring around the particle
    - Chronic (>10-20 yrs)
    - Accelerated (5-10 yrs)
    - Acute (weeks to 4-5 years)
- Lung Cancer (confounding factors)
- COPD
    - Bronchitis, Emphysema
- Kidney, Immune System Diseases
- Tuberculosis



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Symptomology of Silicosis

Initial Onset

Shortness of breath

Severe cough

Weakness

Other Medical Complications

Fever

Weight loss

Night sweats

Chest pains

Respiratory failure

Some Products Manufactured with Silica

Construction

- Asphalt, Concrete, Mortar, Gunnite, Shotcrete, Pre-cast panels, Pre-formed water/sewer pipes
- Stones, Marbles, Granites, Rock, Terrazzo
- Stucco, Plaster, Porcelain, Gesso
- Drywall, Greenboard, Joint Compound
- Bricks, Tiles, Cement Roof Tile

Parts, Pieces, Electronics

- Silica Wafer, Terminal Screens, Androids, etc.
- Pool Filter Media, Thermocouples, Casting Molds
- Glasses, Mugs, Plates, Pyrex
- Aluminum, Multiplex Metals
- Cosmetics and Homeopathic Remedies

Safety Data Sheets

- Review product SDS for silica:
  - Crystalline Silica
  - SiO_2
  - Silica dust
  - Silicon Dioxide
  - Silica
  - Quartz
  - Sand

Silica Becomes Airborne

- Sandblasting
- Rock drilling
- Foundry work
- Stone cutting
- Drilling
- Quarrying
- Jack hammering
- Concrete manufacturing
- Demolition
- Asphalt paving/manufacturing
- During hydraulic fracking

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Affected Industries (list not all inclusive)

- Construction
- Glass manufacturing
- Pottery products
- Structural clay products
- Concrete products
- Foundries
- Dental labs
- Paintings and coatings
- Jewelry production
- Refractory products
- Ready-mix concrete
- Cut stone and stone products
- Abrasive blasting in maritime, construction and general industry
- Refractory furnace installation and repair
- Railroad transportation
- Oil and gas operations

High Hazard Risk Areas-Construction

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High Hazard Risk Areas

Sanitation




Water & Power

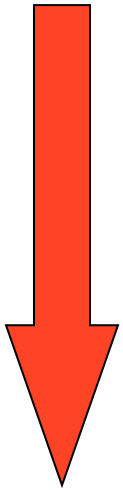


Exposure Limits

Permissible Exposure Limit *(PEL)*	
OSHA	**NEW PEL** 50 µg/m³ (or 0.05 mg/m³) averaged over an 8-hour day **ACTION LEVEL TRIGGER -** 25 µg/m³ **PREVIOUS PEL** ~100 µg/m³ General Industry ~250 µg/m³ Construction

Reduction of Exposure

Most Desirable



Least Desirable

- Material substitution
- Isolate employees/Enclose source
- Modify the process
- Local ventilation/Dust-collecting systems
- Wet Methods
- Administrative controls
- Personal protective equipment

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Regulations on Silica Prior to New Rule

- General Safety and Health Provisions Standard (1926.20) addresses the employee's general right to a safe workplace
- Gases, Vapors, Fumes, Dusts and Mists Standard (1926.55a) lists the airborne levels of substances that would make a workplace hazardous
- The Ventilation Standard (1926.57) for specific requirements about removing silica dust from a worker's breathing zone
- For worker training requirements about silica hazards, the Hazard Communication Standard 1926.59/1910.1200
- If respirators are required on-the-job, then employers must comply with the OSHA Respiratory Protection Standard 1926.103/1910.134

History of the OSHA Regulation

1994	OSHA lists silica as a priority for rulemaking
2003	OSHA Published draft rule
2009-2010	Peer review of health effects & risk assessment-Completed peer review
2011	Notice of proposed rule making (NPRM)
2011	Hearings delayed; executive order review extended
9/2013	Proposed Rule published in Federal Register
3/2014	OSHA begins public hearings on proposed rule
6/2014	OSHA Extends deadline for public comments to 8.18.14
3/2016	OSHA passes Final Rule

Final Rule-Important Dates

- On March 24, 2016, OSHA finalized two new silica standards:
  - General industry and maritime (1910.1053)
  - Construction (1926.1153)
- Both standards became effective June 23, 2016
- Compliance Dates:
  - June 23, 2017 – Construction except laboratory evaluation of exposure samples
    - June 23, 2018 – Construction-laboratory evaluation of exposure samples
  - June 23, 2018 – General Industry and Maritime except certain medical examinations
    - June 23, 2020 – General Industry – certain medical examinations
  - June 23, 2018 – Hydraulic Fracturing-except engineering controls
    - June 23, 2021 – Hydraulic Fracturing-engineering controls

General Industry, Maritime and Hydraulic Fracking 1910.1053

Employers will have to:

- Measure the amount of silica that workers are exposed to that may be at or above the action level of 25 $\mu g/m^3$ averaged over an 8-hr day.
- Protect workers exposed above the PEL of 50 $\mu g/m^3$
- Limit access to high exposure areas by establishing regulated areas, posting signs and limiting access
- Implement controls and work practices that reduce worker exposure
- Restrict housekeeping practices that expose workers to silica unless unfeasible
- Provide training with regards to hazard communication and work practices to reduce exposure
- Provide respiratory protection when controls are not sufficient to limit exposure and comply with existing OSHA requirements of the respiratory protection standard
- Provide written exposure control plans
- Offer medical examinations to workers who wear a respirator for more than 30 days/yr. and periodic exams
- Strict recordkeeping

Construction 1926.1153

Employers are required to limit worker exposures to respirable silica:

- Use a control method described in Table 1 of the standard or measure workers' exposure to silica and independently decide which dust controls work best to limit exposures below the PEL
  - Provide respiratory protection when controls are not sufficient to limit exposure and comply with existing OSHA requirements of the respiratory protection standard
- Establish and implement a written exposure control plan
- Designate a competent person
- Restrict housekeeping practices that expose workers to silica
- Offer medical examinations to workers who wear a respirator for more than 30 days/yr
- Provide training with regards to hazard communication and work practices to reduce exposure
- Strict recordkeeping

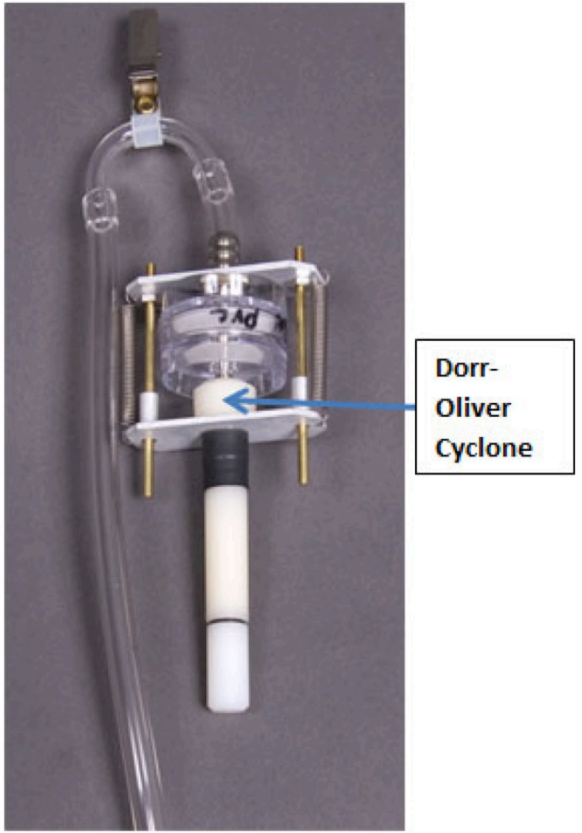
Alternative Exposure Controls

Construction-for tasks not listed in Table 1 or when the employer does not fully and properly implement the engineering controls, work practices, and respiratory protection as outlined in Table 1

- Determine the PEL
  - **Exposure Assessment** - The employer shall assess the exposure of each employee who is or may reasonably be expected to be exposed to respirable crystalline silica above the action level
    - Performance Option-The employer shall assess the 8-hr TWA for each employee using any combination of air monitoring data or objective data sufficient to characterize exposure
    - Scheduled Monitoring
      - Initial monitoring (each shift, each job classification, each work area)
      - If initial monitoring <action level, discontinue monitoring
      - If initial monitoring > action level and < PEL, repeat monitoring within 6 months
      - If most recent exposure monitoring is >PEL, repeat within 3 months
      - If most recent exposure monitoring is below action level, repeat within 6 months until 2 consecutive measurements taken more than 7 days apart are below the action level
  - Reassessment required when a change in production, process, control equipment, personnel, or work practices may change exposure

Sample Analysis and Notification

- Samples are to be collected according to methods defined in Appendix A
- Within 5 days of completing the exposure assessment, employees shall be notified of their results in writing or posted in appropriate location assessable to all employees
- Employees may have a designated representative observe the monitoring



Methods of Compliance

- Provide proper engineering and work practice controls
  - The employer shall use engineering and work practice controls to reduce and maintain employee exposure at or below the PEL unless the employer can demonstrate this is not feasible
- Provide respiratory protection
  - Where specified in Table 1
  - For tasks not outlined in Table 1 or where needed based on exposure assessment
- Housekeeping
  - No dry sweeping or dry brushing
  - No compressed air to clean clothing or surfaces unless ventilated or alternative system is not available

Written Plans

- Respiratory Protection Program (if determined to be required)
  - Prepare and institute a respiratory protection program in accordance with 1910.134
- Written Exposure Control Plan
  - Description of tasks with exposure to crystalline silica
  - Description of engineering controls, work practices, and respiratory protection for each task
  - Housekeeping measures used to limit exposures
  - Description of procedures to restrict access to work areas
  - Designate a competent person to implement the plan (Construction)
  - Shall be reviewed at least annually
  - Readily available to each employee, their representatives, or OSHA

Medical Surveillance

- The employer shall make medical surveillance available at no cost to the employee who will be required to wear a respirator for 30 days or more each year
  - Initial Examination
    - Medical and work history
    - Physical examination
    - Chest X-ray
    - Pulmonary Function Test
    - Testing for latent TB infection
    - Any other tests requested by physician
  - Periodic Examinations
    - All tests listed above (except for TB) at least every 3 years or as required by the physician

Employee Training

- Hazard Communication
  - Respirable crystalline silica shall be added to comply with 1910.1200
  - Signs (General Industry)
  - Employees shall have access to safety data sheets and labels on containers
  - Train on the hazards: cancer, lung effects, immune system effects, kidney effects
- Employee Information
  - The employer shall ensure each employee can demonstrate knowledge and understanding of the following:
    - Health hazards associated with crystalline silica
    - Specific tasks in the workplace that could result in exposure to crystalline silica
    - Specific measures the employer has taken to protect the workers
    - The contents of 1926.1153 and 1910.1053
    - The identity of the competent person in charge of the standard (Construction)
    - Purpose and description of the medical surveillance program

Recordkeeping

- Air monitoring data
- Objective data
- Medical surveillance

Real World Examples

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What Happens in Construction at AL

- Company already following Table 1 (Section vii) but still ≥ AL
- The Silica Standard 1926.1153 applies at ≥ AL
- Respiratory protection is not required per Table 1 Section vii or in situations at < PEL
- Repeat sampling is required within 6 months or if practices change
- Written exposure control plan now required
- Designate a competent person
- Employee Training
- Recordkeeping

Employee Name	Airborne Contaminant	Sampling Results (ug/m^3)
#1	**Respirable Dust**	**350**
	Respirable Crystalline Silica: Quartz	**25**
	Respirable Crystalline Silica: Cristobalite	ND, <0.015
	Respirable Crystalline Silica: Tridymite	ND, <0.021
#2	**Respirable Dust**	**310**
	Respirable Crystalline Silica: Quartz	**21**
	Respirable Crystalline Silica: Cristobalite	ND, <0.014
	Respirable Crystalline Silica: Tridymite	ND, <0.020

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What Happens in Construction at PEL

- Company already following Table 1 (Section vii) but still ≥ PEL
- The Silica Standard 1926.1153 applies at ≥ AL
- **Respiratory protection is not required per Table 1 Section vii but is in situations at ≥ PEL**
- **Repeat sampling is required within 3 months or if practices change**
- **Additional engineering controls required unless proven not feasible**
- Written exposure control plan required
- **Medical surveillance if Employees wear respirators > 30 days per year**
- Designate a competent person
- Employee Training
- Recordkeeping

Employee Name	Airborne Contaminant	Sampling Results (ug/m^3)
#1	**Respirable Dust**	**850**
	Respirable Crystalline Silica: Quartz	**55**
	Respirable Crystalline Silica: Cristobalite	ND, <0.015
	Respirable Crystalline Silica: Tridymite	ND, <0.021
#2	**Respirable Dust**	**1,310**
	Respirable Crystalline Silica: Quartz	**88**
	Respirable Crystalline Silica: Cristobalite	ND, <0.014
	Respirable Crystalline Silica: Tridymite	ND, <0.020

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Real World Example

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What Happens in Manufacturing at AL

- Initial assessment reveals employees are ≥ AL but< PEL
- The Silica Standard 1910.1053 applies at ≥ AL
- Respiratory protection is not required until ≥ PEL
- Repeat sampling is required within 6 months or if practices change and repeated until 2 consecutive events are < AL
- Written exposure control plan now required
- Medical surveillance if employees are ≥ AL > 30 days per year
- Communication of respirable silica hazards
- Employee Training
- Recordkeeping

Employee Name	Airborne Contaminant	Sampling Results (ug/m^3)
#1	**Respirable Dust**	**450**
	Respirable Crystalline Silica: Quartz	**35**
	Respirable Crystalline Silica: Cristobalite	ND, <0.015
	Respirable Crystalline Silica: Tridymite	ND, <0.021
#2	**Respirable Dust**	**710**
	Respirable Crystalline Silica: Quartz	**42**
	Respirable Crystalline Silica: Cristobalite	ND, <0.014
	Respirable Crystalline Silica: Tridymite	ND, <0.020

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What Happens in Manufacturing at PEL

- Initial assessment reveals employees are > new PEL
- The Silica Standard 1910.1053 applies at ≥ AL
- **Implement engineering controls to lowest possible level**
- **Respiratory protection is required at ≥ PEL**
- **Repeat sampling is required within 3 months or if practices change and repeated until 2 consecutive events are < AL**
- **Establish regulated areas**
- Written exposure control plan now required
- Medical surveillance if employees are ≥ AL > 30 days per year
- Communication of respirable silica hazards
- Employee Training
- Recordkeeping

Employee Name	Airborne Contaminant	Sampling Results (ug/m^3)
#1	**Respirable Dust**	**850**
	Respirable Crystalline Silica: Quartz	**55**
	Respirable Crystalline Silica: Cristobalite	ND, <0.015
	Respirable Crystalline Silica: Tridymite	ND, <0.021
#2	**Respirable Dust**	**1,310**
	Respirable Crystalline Silica: Quartz	**88**
	Respirable Crystalline Silica: Cristobalite	ND, <0.014
	Respirable Crystalline Silica: Tridymite	ND, <0.020

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Questions?

BSI EHS Services and Solutions

GENERAL SERVICES

- Construction EHS
- Industrial Hygiene
- Training
- Ergonomics
- Healthcare EHS
- Responsible Supply Chain
- Sustainability
- LEED
- Management Systems

CONTACT

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Resources

Controlling Silica Exposures in Construction: http://www.osha.gov/Publications/3362silica-exposures.pdf

Crystalline Silica

http://www.osha.gov/dsg/topics/silicacrystalline/index.html

https://www.osha.gov/OshDoc/data_General_Facts/crystalline-factsheet.pdf

Department of Labor Regulations: http://www.dol.gov/regulations/

Executive Order 12866:http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201104&RIN=1218-AB70

NIOSH: http://www.cdc.gov/niosh/topics/silica/

NIOSH Hazard Review: Health Effects of Occupational Exposure to Respirable Crystalline Silica April 2002 http://www.cdc.gov/niosh/docs/2002-129/pdfs/2002-129.pdf

USGS. Crystalline silica primer: http://minerals.usgs.gov/minerals/pubs/commodity/silica/780292.pdf

National Emphasis Program – Crystalline Silica: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=3790

Office of Management and Budget: http://www.whitehouse.gov/

OSHA Standard Interpretations

http://www.osha.gov/doc/interpretations.html

https://www.osha.gov/silica/factsheets/OSHA_FS-3683_Silica_Overview.html

Silica eTool—Special Emphasis Program: http://www.osha.gov/dsg/etools/silica/spec_emph_prog/spec_emph_prog.html

EHS Daily Advisor: The Rules Have Changed: How are OSHA's Two Silica Rules Different? BLR —Business & Legal Resources

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