

## Respirable Crystalline Silica

Its Not Just Dust!

## What is silica?



One of the most common minerals on Earth



Photos courtesy PDPhoto.org

## Silica is found in rock, soil, and sand



Photo courtesy PDPhoto.org



Photo: CPWR



Photo: CPWR

## Concern: 3 forms of crystalline silica

**Quartz**—common, found in sand, gravel, clay, granite, sandstone and other rock



Quartz

Photo: CPWR

**Cristobalite and Tridymite**—less common, but more toxic to workers

## These materials may contain silica

- Asphalt
- Brick
- Cement
- Concrete
- Concrete block
- Drywall
- Fiber cement products (siding, cladding panels)
- Grout
- Mortar
- Paints
- Plaster
- Refractory Mortar/Castables
- Refractory units
- Rock
- Roof tile (concrete)
- Sand
- Soil (fill dirt, top soil, soil w/fly ash added)
- Stone (granite, limestone, quartzite, sandstone, shale, slate, cultured, etc.)
- Stucco/EIFS
- Terrazzo
- Tile (clay and ceramic)

## How can you find out if it contains silica?



← Product label

Safety Data Sheet →

Published data—online

Analyze a sample of the material



Section 1: Product Identification

Product Name: Big Touch 5000 Plus Concrete Mix  
Product Type: Dry-Packed Cement-Based Products

Section 2: Hazard identification

The most immediate and likely hazard is burns from dust in the eye. When the product is inhaled, it can cause irritation to the respiratory tract. When the product is swallowed, it can cause irritation to the mouth and throat.

Product Name: Big Touch 5000 Plus Concrete Mix  
Product Type: Dry-Packed Cement-Based Products

Applicable hazard statement based on crystalline silica content:

Danger: Causes serious eye damage (Category 1)  
H319: Causes serious eye damage.

Applicable hazard statement based on crystalline silica content:

Danger: May cause cancer from inhaling dust (Category 1)  
H350: May cause cancer from inhaling dust.  
H351: May cause cancer from repeated exposure through prolonged or repeated exposure to inhaled dust.

29CFR1910.1200, Appendix A, H350: Categories 1 and 2

Applicable hazard statement based on crystalline silica content:

Danger: Causes serious eye damage (Category 1)  
H319: Causes serious eye damage.

29CFR1910.1200, Appendix A, H319: Categories 1 and 2

Hazardous substance via dermal/skin irritation - Category 1 and skin irritation - Category 2

Applicable Precautionary Statement:

Section 3: Precautionary statements for handling and storage:

P202: Do not handle until all safety precautions have been read and understood.

P281: Wash thoroughly after handling.

P291: Do not eat, drink or smoke when using this product.

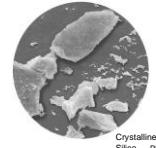
P292: Wear eye protection.

## Silica Hazards

Why is silica a hazard?



“Respirable” silica is small enough to penetrate body's natural defenses and get deep into your lungs

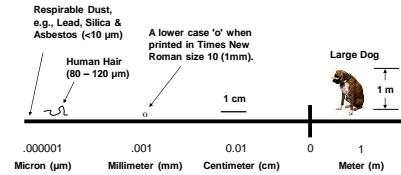


Crystalline Silica  
Photo source: CDC

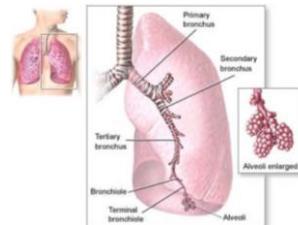
It's 100 times smaller than ordinary beach sand



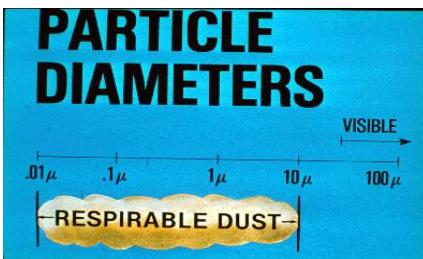
## How Small is Small?



## Silicosis



The respirable silica dust enters the lungs and causes the formation of scar tissues, thus reducing the lungs' ability to take in oxygen.



## What can it do to you?

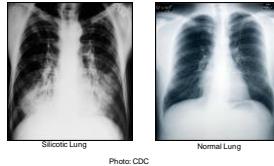
- Silicosis
- Lung cancer
- Chronic obstructive pulmonary disease (COPD)
- Immune system effects
- Kidney effects

Are these effects Chronic or Acute?



## Silicosis Facts

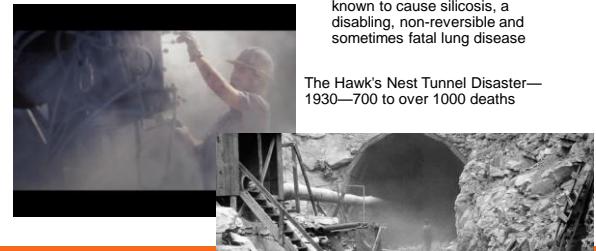
- ✓ Permanent
- ✓ Irreversible
- ✓ No cure
- ✓ Worsens after exposure ends
- ✓ Deadly



Preventing exposure is your best defense



## Stop Silicosis - 1938



- Inhalation of respirable crystalline silica particles has long been known to cause silicosis, a disabling, non-reversible and sometimes fatal lung disease

The Hawk's Nest Tunnel Disaster—1930—700 to over 1000 deaths



## Putting it all together Silica is hazardous because:



## When will I find dust?

- **Manufacturing:** Foundries, Abrasive blasting, Paint, Glass, Concrete, Brick making, Plumbing fixtures, Refractory, Mixing (dry), Grout and Caulking
- **Construction:** highway, masonry, concrete, rock drilling, cleaning up
- **Construction tasks:** masonry saws, grinders, drills, jackhammers and handheld powered chipping tools; vehicle-mounted drilling rigs; milling; operating crushing machines; and heavy equipment for demolition.



## OSHA Respirable Crystalline Silica (RCS) Rule

- Two standards:
  - One for general industry and maritime
  - One for construction
- Similar to other OSHA Substance Specific Health Standards



## OSHA Respirable Crystalline Silica Permissible Exposure Levels (PELs)

**Action Level** = 25 micrograms per cubic meter of air  
(25  $\mu\text{g}/\text{m}^3$ ) calculated as 8-hour TWA

**PEL** = 50 micrograms per cubic meter of air  
(50  $\mu\text{g}/\text{m}^3$ ) averaged over an 8-hour day

What does that mean?

## Industry Standard, 29 CFR, 1910.1053

- DEFINITIONS – PARAGRAPH (B) OF THE STANDARD
- PERMISSIBLE EXPOSURE LIMIT (PEL) – PARAGRAPH (C)
- EXPOSURE ASSESSMENT – PARAGRAPH (D)
- REGULATED AREAS – PARAGRAPH (E) >PEL
- METHODS OF COMPLIANCE – PARAGRAPH (F)
  - Engineering and Work Practice Controls >PEL
  - Written Exposure Control Plan All covered employers
- RESPIRATORY PROTECTION – PARAGRAPH (G) >PEL
- HOUSEKEEPING – PARAGRAPH (H) All covered employers, avoid certain practices
- MEDICAL SURVEILLANCE – PARAGRAPH (I) >PEL >30 days/year through 6/22/2020 then AL
- COMMUNICATION OF HAZARDS – PARAGRAPH (J) All covered employers
- RECORDKEEPING – PARAGRAPH (K)

- (a) Scope
- (b) Definitions
- (c) Specified exposure control methods (Table 1 OR
- (d) Alternative exposure control methods
  - (1) PEL
  - (2) Exposure Assessment
  - (3) Methods of Compliance
- (e) Respiratory protection, Required by Table 1 or >PEL for Alternative
- (f) Housekeeping, All covered employers avoid certain practices
- (g) Written exposure control plan, All covered employers
- (h) Medical surveillance, Wear a respirator  $\geq 30$  days/year
- (i) Communication of silica hazards, All covered employers
- (j) Recordkeeping
- (k) Dates

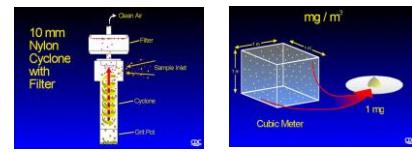
## Exposure Assessment

### Silica Sampling Personal Breathing Zone

- Crystalline silica: respirable fraction is of concern due to the health effects
- Sample for respirable particulate



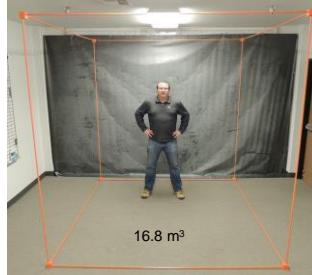
### Silica Sampling



OSHA PEL:  $50 \mu\text{g}/\text{m}^3 = 0.05 \text{ mg}/\text{m}^3$



Respirable silica dust equivalent to <0.1% of a sweetener packet over the course of an 8 hour workday would exceed the OSHA PEL of  $50 \mu\text{g}/\text{m}^3$ .



### RCS Standard– Scope

- All occupational exposures to respirable crystalline silica are covered, unless employee exposure will remain below  $25 \mu\text{g}/\text{m}^3$  as an 8-hr TWA under any foreseeable conditions.
- The phrase "any foreseeable conditions" refers to situations that can reasonably be anticipated, for example, failure of engineering controls
- Therefore, employers who maintain exposures below  $25 \mu\text{g}/\text{m}^3$  with engineering controls are covered.



## Silica Exposure Determination

- Objective Data
  - Plumbers, carpenters, and electricians who have to drill a hole are exempted—<15 minutes
  - Construction tasks exempted also includes pouring concrete or removing forms
- Performance Option
- Scheduled Monitoring Option—IH Monitoring
- Utilize Table 1, (Construction Only)
  - Fully and properly implemented
  - Do not have to assess employees' silica exposure levels or keep employee exposures at or below the permissible exposure limit (PEL)



## RCS Exposure Assessment

- Initial assessment
  - Not required if objective data of exposure <AL of 25  $\mu\text{g}/\text{m}^3$
- Scheduled Monitoring option—Periodic IH monitoring
  - < AL Discontinue
  - $\geq \text{AL} \leq \text{PEL}$  – every six months
  - $> \text{PEL}$  – every 3 months
- Performance option – assess exposure for each employee sufficient to characterize exposures
- Reassess



## Performance Option

- Exposures assessed using any combination of air monitoring data or objective data sufficient to accurately characterize employee exposure to respirable crystalline silica
- Be able to demonstrate that employee exposures have been accurately characterized
- Reassess exposures whenever a change may reasonably be expected to result in new or higher exposures at or above the action level



## Objective Data

- Includes air monitoring data from industry-wide surveys or calculations based on the composition of a substance
- Demonstrates employee exposure associated with a particular product or material or a specific process, task, or activity
- Must reflect workplace conditions closely resembling or with a higher exposure potential than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations



## Employee Notification of Assessment Results

- Within 15 working days after completing an exposure assessment;
  - Employer **shall** individually notify each affected employee in writing of the results.
  - Employer can post results in appropriate location accessible to all affected employees.
  - If exposures exceed the PEL, the employer **shall** describe in writing the corrective action being taken to reduce exposures.
- Observation of monitoring
  - Affected employees or their designated reps have the option to observe the air monitoring.
  - Observers must comply with the PPE requirements of the area.



## Roadmap for meeting the Construction Requirements of the Respirable Crystalline Silica Standard

- Determine if the silica standard applies to your employees
  - Not required if objective data of exposure <AL of 25  $\mu\text{g}/\text{m}^3$
  - Required if employees could be exposed to RCS at or above 25  $\mu\text{g}/\text{m}^3$  as an 8-hour TWA under any foreseeable conditions, including the failure of engineering controls
- Choose to comply with the standard using either the:
  - Specified exposure control methods in Table 1, or
  - The alternative methods of compliance
    - (similar to General Industry)
      - » Schedule Monitoring Option
      - » Performance Option

## Specified Exposure Control Methods (Table 1)

### Construction

- For each employee engaged in a task identified on Table 1, **the employer shall fully and properly implement the engineering controls, work practices, and respiratory protection specified for the task on Table 1**
- Table 1 tells you exactly the Equipment/Task, Engineering and Work Practice Controls, and Respiratory Protection
- If you don't do it exactly you must use schedule monitoring or performance options

## Construction – Specified Exposure Control Methods

- Table 1 in the construction standard matches 18 tasks with effective dust control methods and, in some cases, respirator requirements.
- Employers that fully and properly implement controls on Table 1 do not have to:
  - Comply with the PEL
  - Conduct exposure assessments for employees engaged in those tasks

## Tasks from Table 1

○ Handheld Power Saws	○ Handheld Grinders for Mortar Removal (Tuckpointing)
○ Handheld Grinders	○ Rig-Mounted Core Saws/Drills
○ Jackhammers	○ Dowel Drilling & Vehicle Rigs
○ Handheld Powered Chipping Tools	○ Walk-Behind Milling Machines and Floor Grinders
○ Handheld and Stand-Mounted Drills	○ Drivable Milling Machines
○ Stationary Masonry Saws	○ Crushing Machines
○ Walk-Behind Saws	○ Heavy Equipment (cab operated)
○ Drivable Saws	

Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum APF	
		≤ 4 hr/shift	> 4 hr/shift
Stationary masonry 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.	None	None

Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum APF	
		≤ 4 hr/shift	> 4 hr/shift
Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade.  Operate and maintain tool in accordance with manufacturers' instruction to minimize dust  - When used outdoors - When used indoors or in an enclosed area	None APF 10	APF 10

Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum APF	
		≤ 4 hr/shift	> 4 hr/shift
(vii) Handheld and stand-mounted drills (including impact and rotary hammer drills)	Use drill equipped with commercially available shroud or cowling with dust collection system. <input type="checkbox"/> Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. <input type="checkbox"/> 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. <input type="checkbox"/> Use a HEPA-filtered vacuum when clearing holes.	None	None



Ohio | Bureau of Workers' Compensation

### Fully and Properly Implementing Controls Specified on Table 1

- Presence of controls is not sufficient.
- Employers are required to ensure that:
  - Controls are present and maintained
  - Employees understand the proper use of those controls and use them accordingly

### Employees Engaged in Table 1 Tasks

- Employees are “engaged in the task” when operating the listed equipment, assisting with the task, or have some responsibility for the completion of the task
- Employees are not “engaged in the task” if they are only in the vicinity of a task

### Alternative Exposure Control Methods 1926.1153 (d)

Utilized for tasks not in Table 1—Compile a List!  
or  
Where the employer does not fully implement the engineering, work practice or respiratory protection described in Table 1

Employers can choose between two options for assessing exposures:

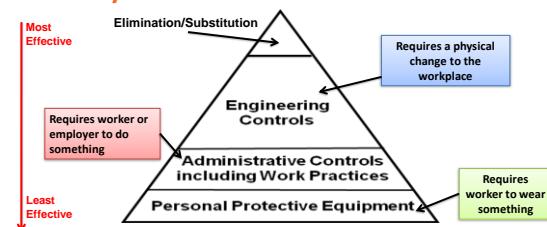
- The performance option; or
- The scheduled monitoring option.

(Similar to requirements of General Industry)

## Controlling Hazards

How does your employer protect you?

### Hierarchy of Controls



## Engineering controls

- Wet methods
  - Cutting
  - Chipping
  - Sawing
  - Milling
  - Grinding



Photo: OSHA

Must be used per manufacturer's requirements!!!

## Engineering Controls

- Local exhaust ventilation (LEV)
  - Vacuum
  - Dust collection system

- Substitution
- Isolation



Photo: OSHA

## Engineering Controls

Cutting block without engineering controls



Cutting block using water to control the dust

## Engineering Controls (cont.)

Grinding without engineering controls



Grinding using a vacuum dust collector



## Engineering Controls (cont.)

Jackhammer use without engineering controls



Jackhammer use with water spray to control dust





**Administrative controls**

- Move employees out of hazardous area
- Hold a job briefing
- Use awareness barricades
- Don't eat, drink, smoke, or apply cosmetics while near silica dust—wash hands/face



**DANGER**  
SILICA DUST HAZARD  
EXPOSURE TO CRYSTALLINE SILICA  
DUST CAN CAUSE LUNG CANCER  
OR SILICOSIS  
AVOID BREATHING DUST

Photo source: CDC

**Respiratory Protection**

- Use of respiratory protection must comply with 29 CFR 1910.134 Respiratory Protection Standard.
- Respiratory Protection is required:**
  - Table I requirements
  - Where exposures exceed the PEL during periods necessary to install or implement feasible engineering and work practice controls.
  - Where exposures exceed the PEL during tasks, such as certain maintenance and repair tasks, for which engineering and work practice controls are not feasible.
  - During tasks for which an employer has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposures to or below the PEL.
  - During periods when the employee is in a regulated area.



APF	10	25	50	1000	Additional PPE
If you are referring to OSHA 29 CFR 1910.1000 Table I Find your APF	Disposable Respirators and Half Face Reusable Respirators 8200 820V 85M 921*	PAPRs and M-307 Respiratory Half-Hat 6000 M-307 GVP PAPR TR-300	Full Face Reusable Respirators (With quantitative fit test) 6000 FF FF-400 GVP PAPR 7600S	PAPRs and M-407 helmet TR-600 M-407 702R UV 3900400 1600797	V/Haz P95-1001
MUC*	0.5 mg/m <sup>3</sup>	1.25 mg/m <sup>3</sup>	2.5 mg/m <sup>3</sup>	5.0 mg/m <sup>3</sup>	Additional PPE

\*Maximum Use Concentration

**What else is required by the Silica Standard?**

- Written exposure control plan
- Housekeeping practices
- Medical exams
- Training
- Record retention

**OSHA's Respirable Crystalline Silica Standard for Construction**

Workers who are exposed to respirable crystalline silica dust are at increased risk of developing serious silica-related diseases. OSHA's standard requires employers to take steps to protect workers from exposure to respirable crystalline silica.

## Respirable Silica Exposure Control Plan

- Establish and implement a **written exposure control plan** that identifies tasks that involve exposure and methods used to protect workers, including procedures to restrict access to work areas where high exposures may occur;



## Written Exposure Plan

Written Plan must contain the following:

- Description of tasks in workplace that involve exposure to silica
- Description of engineering controls, work practices, & respiratory protection used to limit employee exposure to silica for each task
- Description of housekeeping measures used to limit employee exposure to silica
- Description for procedures limiting access to restricted areas

## Written Exposure Plan

- Annual Review of Plan; or as deemed necessary
- Available to Employees or their designated representatives
- Designated person to inspect the job site, materials & equipment to make updates to the plan

## Regulated Area / Industry Access Control Plan / Construction

### Regulated Area (Mfg.)

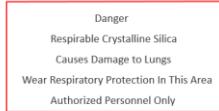
- Exposure > PEL
- Demarcation
- Limit access
- Respirators provided
- Work clothing provided if gross contamination potential

### Written Access Control Plan (Construction)

- Competent person ID presence/location
- Procedures to notify and mark
- Inform other contractors
- Provisions to limit access
- Procedures to provide respirators
- PPE
- Annual review & update
- Available

## Signs

The employer **shall** post signs at all entrances to regulated areas that bear the following legend:



## Who is the Competent Person (only construction)?

- Must be designated by the employer
- Can change job to job or day to day
- Make sure you know who it is at your job site
- Responsibilities include:
  - Regular and frequent inspections of the job site;
  - Identify existing and foreseeable respirable crystalline silica hazards;
  - Authorized to promptly eliminate or minimize silica hazards; and
  - Has the knowledge and ability to implement the written exposure control plan

## Now – I should NOT see dust, but...

- If engineering controls are in place and dust is present...
- If the tool isn't working properly...



Photo source: elcosh

## Notify the Competent person.

## Housekeeping



Photo source: elcosh

- If it contributes to silica exposure
  - e.g. – creates/suspends silica dust
- NO dry sweeping or brushing
- NO use of compressed air for cleaning surfaces or clothing
- So, what do we do now?
  - Wet sweeping and HEPA-filtered vacuums
  - Compressed air with vacuum system
  - Procedure during filter change/vacuum clean out may be needed

## Medical Surveillance

- Construction: If you wear a respirator 30 or more days/year for silica exposure
- Industry: >PEL >30 days/year through 6/22/2020 then ≥AL
- Exam includes:
  - Medical/work history
  - Physical exam
  - Chest x-ray
  - Pulmonary function test
  - Tuberculosis test
- Physician provides written reports



Photo: wikimedia

## Medical Surveillance – cont.

- Initial Exam- within 30 days of assignment or last 3 years if the exams were the same requirements.
- Periodic Exams – every 3 years, or more frequent if recommended by PLHCP.
- Information provided to the PLHCP
  - Copy of the standard
  - Description of employee's former, current, anticipated duties related to silica exposures.
  - Description of personal protective equipment to be used, including when and how long it is used.
  - Information from records of employment-related medical exams previously provided to employee if possible (within the control of the employer).
- PLHCP's written medical reports
  - Employer gets full detail of health results
  - Employer gets a fit for work result

## Employee Information & Training

- The employer **shall** ensure that each employee covered by this section can demonstrate knowledge and understanding of at least the following:
  - Health hazards associated with silica exposure.
  - Specific tasks in the workplace that could result in silica exposure.
  - Specific measures the employer has implemented to protect employees from silica exposures.
    - Engineering Control
    - Work Practices
    - Respiratory Protection Used
  - The contents of this section of the silica standard.
  - The purpose and a description of the medical surveillance program required.
  - The employer **shall** make a copy of this section readily available without cost to each employee covered.

## Recordkeeping

- Training
- Air monitoring data
- Objective Data
- Medical Surveillance
  - 1910.1020





## Effective Dates

- Manufacturing
  - June 23, 2018 Program Requirements
  - June 23, 2020 – Medical Surveillance Requirements
  - June 23, 2021 – Hydraulic Fracturing engineering controls
- Construction
  - ~~June 23, 2017~~ Program and Medical Requirements
    - September 28, 2017 (4/6/17 announcement)
  - June 23, 2018 Laboratory Analysis Compliance



## Guidance and Outreach

- Silica Rulemaking
  - Webpage: [www.osha.gov/silica](http://www.osha.gov/silica)
  - Fact sheets
  - FAQs
  - Video
- Appendix B – Medical Surveillance Guidelines
- Small Entity Compliance Guide
  - Industry
  - Construction



[www.silica-safe.org](http://www.silica-safe.org)



(1) About

Regulations & Requirements

What's New

(2) Know the Hazard

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