Silica Dust in Construction: Real Case Studies in Exposure Assessment and Hazard Control

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Webinar Logistics

- All participants are muted
- 50 minute presentation
- 5 minutes Q&A session
  - Use the Questions box 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 a question using the Questions box or
  - Call / text 503.267.1698
- A short evaluation survey will be sent after the session – please help us by providing your feedback!
- All attendees will receive a link to the recorded webinar and presentation slides within a day or two of the webinar

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Agenda

Welcome/Introductions	Holly Wilkalis
Speaker Bios	Holly Wilkalis
Silica Dust Standard Overview	Xavier Alcaraz
Case Studies in Sampling and Exposure Control	Michael Peterson
Short Video	Xavier Alcaraz
Questions	Holly Wilkalis - Facilitator
Additional Resources	Holly Wilkalis

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About the Presenters

Xavier Alcaraz, CIH, CSP

- Certified Industrial Hygienist (CIH) and Certified Safety Professional (CSP)
- 20 years of experience consulting in industrial hygiene and environmental, health, and safety
- Has performed and managed hundreds of industrial hygiene and safety assessments including many for the construction industry
- Supports a multitude of other industries including municipal agencies, electronics, semiconductor, government, traditional manufacturing, life sciences, insurance, schools, etc.
- Based in Northern California

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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
- Based in Portland, OR

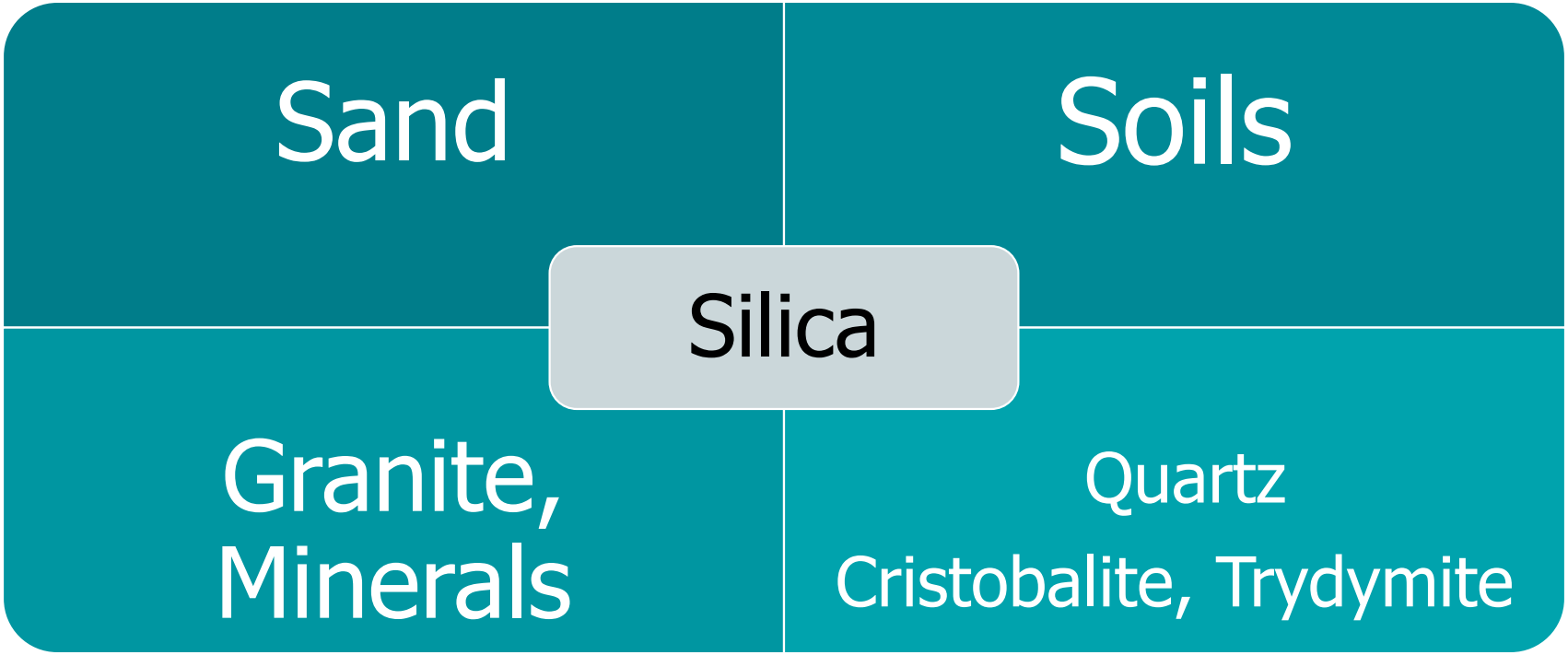
Crystalline Silica Dust Overview

Silica Dust Exposure in Construction

Common Construction Activities Causing Silica to Becomes Airborne

- Concrete (block) grinding/cutting/chipping
- Concrete coring/drilling
- Sandblasting
- Rock drilling
- Cement board cutting
- Stone cutting
- Jack hammering
- Demolition
- Asphalt paving/manufacturing
- Tunneling

Silica Basics



Safety Data Sheets

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

QUIKRETE®
CEMENT & CONCRETE PRODUCTS™

GHS SAFETY DATA SHEET

C1: Portland Cement Based Concrete Products

SAFETY DATA SHEET
(Complies with OSHA 29 CFR 1910.1200)

SECTION I: PRODUCT IDENTIFICATION

The QUIKRETE® Companies
One Securities Centre
3490 Piedmont Road, Suite 1300
Atlanta, GA 30305

Emergency Telephone Number
(770) 216-9580
Information Telephone Number
(770) 216-9580

SDS C1
Revision: Jan-16

QUIKRETE® Product Name	Item #(s)
Fence Post Mix	1005
Fiber-Reinforced Concrete Mix	1006
Crack Resistant Concrete Mix	1006-80
Pro-Finish Crack Resistant Concrete Mix	1006-68
QUIKRETE 5000 Concrete Mix	1007
QUIKRETE 6000 Concrete Mix	1007
Pro-Finish QUIKRETE 5000	1007-85
Lightweight Concrete Mix	1008
Basic Concrete Mix	1015
Maximum Yield Concrete Mix	1100-80
Concrete Mix	1101-10, -20, -40, -60, -80, -90
Green Concrete Mix	1101-63, -73
B-Crete	1101-81
Red-E-Crete Concrete mix	1101-91, -87; 1141-62, -63, -92, -93
Countertop Mix	1106-80
All-Star Concrete Mix	1121
Rip Rap	1129
Rip Rap Scrim	1134-80
Handicrete Concrete Mix	1141-59, -60, -80
RiteMix Concrete	1171-60
Fiber Reinforced Deck Mix	1251-80, -81
All-Star Crack Resistant Concrete Mix	1470-03
All-Star 5000 Concrete Mix	1470-01
Form & Pour Mortar	808100-65
FlowCrete 5000 (Mix 801)	8080026/NR80026

Product Use: Portland cement-based, aggregated products for general construction

SECTION II - HAZARD IDENTIFICATION

Hazard-determining components of labeling: Silica, Portland cement
2.1 Classification of the substance or mixture
Carcinogen – Category 1A
Skin Corrosion – Category 1B
Skin Sensitization – Category 1B
Specific Target Organ Toxicity Repeat Exposure – Category 1
Specific Target Organ Toxicity: Single Exposure – Category 3

2.2a Signal word DANGER!

2.2b Hazard Statements
May cause cancer through chronic inhalation
Causes severe skin burns and serious eye damage
May cause an allergic skin reaction
Causes damage to lungs through prolonged or repeated inhalation
May cause respiratory irritation

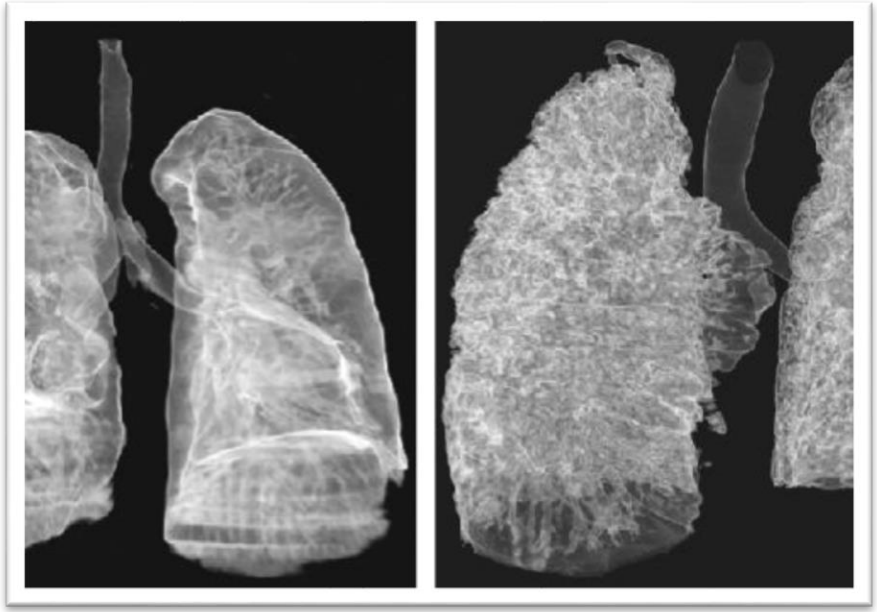
2.2c Pictograms

SECTION III - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components	CAS No.	% by Weight
Sand, Silica, Quartz	14808-60-7	60-100*
Portland Cement	65997 15 1	10-30*
Fly Ash	68131-74-8	5-10*

Long-Term Health Effects of Silica Exposure

- Silicosis - scarring around the particle
  - Acute (weeks to 4-5 years)
  - Accelerated (5-10 yrs)
  - Chronic (>10-20 yrs)
- Shortness of breath, cough, weakness
- COPD
  - Bronchitis, Emphysema
- Kidney, Immune System Diseases
- Tuberculosis
- Lung Cancer



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OSHA Construction Standard for Crystalline Silica

History of OSHA Regulations for Silica

1971	Initial OSHA PELs enacted
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
2013	Proposed Rule published in Federal Register
2014	OSHA begins public hearings on proposed rule
3/2016	OSHA publishes Final Rule (enforcement date of June 23, 2017)
4/2017	OSHA delays enforcement of Construction Standard to September 23, 2017

State OSHA Programs

OSHA® Occupational Safety and Health Administration

Alaska	Arizona	Virginia
Connecticut	California	Vermont
Hawaii	Iowa	Washington
Kentucky	Maryland	Wyoming
Michigan	Minnesota	
Nevada	New Jersey	
New Mexico	New York	
North Carolina	Oregon	
South Carolina	Tennessee	
Utah	Vermont	

Construction Standard Requirements 29 CFR 1926.1153

Employers are required to limit worker exposures to respirable silica through:

- Designating a competent person
- Using prescriptive exposure control methods and respiratory protection (where applicable) or by measuring workers' exposure to silica and independently selecting exposure controls
- Establishing and implementing a written exposure control plan
- Restricting housekeeping practices that expose workers to silica
- Offering medical examinations to workers who wear a respirator for more than 30 days/yr
- Providing training with regards to hazard communication and work practices to reduce exposure
- Strict recordkeeping

1926.1153 Table 1 – Specified Exposure Control Methods

- List of 18 tasks with equipment descriptions
  - Use of handheld power saws
  - Use of walk-behind saws
  - Use of jackhammers and powered chipping tools
  - Use of masonry saws
- Defines specific engineering controls needed for each task
  - Power saw: "Use saw equipped with integrated water delivery system that continually feeds water to blade"
- Prescribes respiratory protection requirement based on duration of task
  - Less than or greater than 4 hrs.
  - Examples of tasks requiring respiratory protection under certain conditions: use of power saws, jackhammers, concrete drill rigs

Excerpts from 29 CFR 1926.1153 - Table 1

TABLE 1: SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA

Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
(x) Jackhammers and handheld powered chipping tools	Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact. – When used outdoors. – When used indoors or in an enclosed area. OR Use tool equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None APF 10	APF 10 APF 10

TABLE 1: SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA

Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
(iv) Walk-behind 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. – When used outdoors. – When used indoors or in an enclosed area.	None APF 10	None APF 10

Alternative To Following Table 1

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:

- **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
    1. "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
    2. "Scheduled Monitoring"
        - Initial monitoring (each shift, each job classification, each work area)
        - If initial monitoring <action level, no additional monitoring needed
        - 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

Federal OSHA Exposure Limits for Crystalline Silica

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

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

Worker milling granite floor indoors with milling machine and dust collection system
Photo credit: OSHA

Jackhammering with water-spray control to reduce dust
Photo credit: NIOSH

Cutting fiber cement board using circular saw with HEPA Vac
Photo credit: NIOSH

Worker drilling into concrete with a rotary hammer equipped with shroud and dust collection system. Note the shroud around drill bit, silver and black hose, and dust collector are attached conveniently to the drill
Photo credit: DeWalt & OSHA

Walk-behind saw with water delivery system
Photo credit: OSHA

In Summary: Roadmap to Compliance

1. Determine if the silica standard applies to your employees.

Could employees be exposed to respirable crystalline silica at or above 25 µg/m^3 as an 8-hour TWA under any foreseeable conditions, including the failure of engineering controls, while performing construction activities?

No: No further action is required under the silica standard.
Yes: Choose to comply with the standard using either the:

- Specified exposure control methods in Table 1, or
- The alternative methods of compliance

Source: OSHA publication "Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction"

In Summary: Roadmap to Compliance - continued

2. Determine what additional requirements you must meet under the standard, based on the compliance method you are following.

Requirement	Must the Employer Follow this Requirement?	
	If Fully and Properly Implementing Table 1	If Following Alternative Exposure Controls
PEL	No	Yes
Exposure Assessment	No	Yes, when exposures are reasonably expected to be above the action level.
Methods of Compliance	No	Yes
Respiratory Protection	Yes, if respirator use is required by Table 1	Yes, if respirator use is required to reduce exposures to the PEL
Housekeeping	Yes	Yes
Written Exposure Control Plan	Yes	Yes
Medical surveillance	Yes, for employees who must wear a respirator under the silica standard for 30 or more days a year.	
Communication of Hazards	Yes	Yes
Recordkeeping	Yes, for any employees who are getting medical examinations	Yes, for exposure assessments and for any employees who are getting medical examinations

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Important Compliance Dates

- Compliance Dates for Final Construction Rule 29 CFR 1926.1153
  - September 23, 2017 – Comply with all requirements of the standard except laboratory evaluation of exposure samples
  - June 23, 2018 - Comply with the methods for air sample analysis

Pop Quiz

Based on the worker's activities, what would his employer be required to do?

A. Nothing. Worker is wearing a respirator and hearing protection

B. Consult Table 1 of the standard for walk-behind grinding/milling machines to verify control methods

C. Contact the equipment manufacturer to request options for dust suppression engineering controls and upgrade the employee to a half-mask respirator with goggles or a full-face respirator

Photo credit: NIOSH

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Case Studies in Sampling and Exposure Control

Real World Example 1

TABLE 1: SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA

Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /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. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. 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. Use a HEPA-filtered vacuum when cleaning holes.	None	None

Sampling Results

Employee	Airborne Contaminant	Sampling Results (ug/m^3)
#1	Respirable Dust	350
	Respirable Crystalline Silica	**25**
#2	Respirable Dust	310
	Respirable Crystalline Silica	21

What Happens 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

What Happens 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

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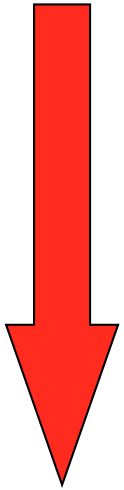
Hierarchy of Hazard Controls

Most Effective



Least Effective

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

Beyond Just the Standard

1. Why was the employee at the AL when they followed Table 1?
2. What could have been done to prevent it?

Real World Example 2

TABLE 1: SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA

Equipment / Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours /shift	> 4 hours /shift
(vi) Rig-mounted core saws or drills	Use tool equipped with integrated water delivery system that supplies water to cutting surface. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None

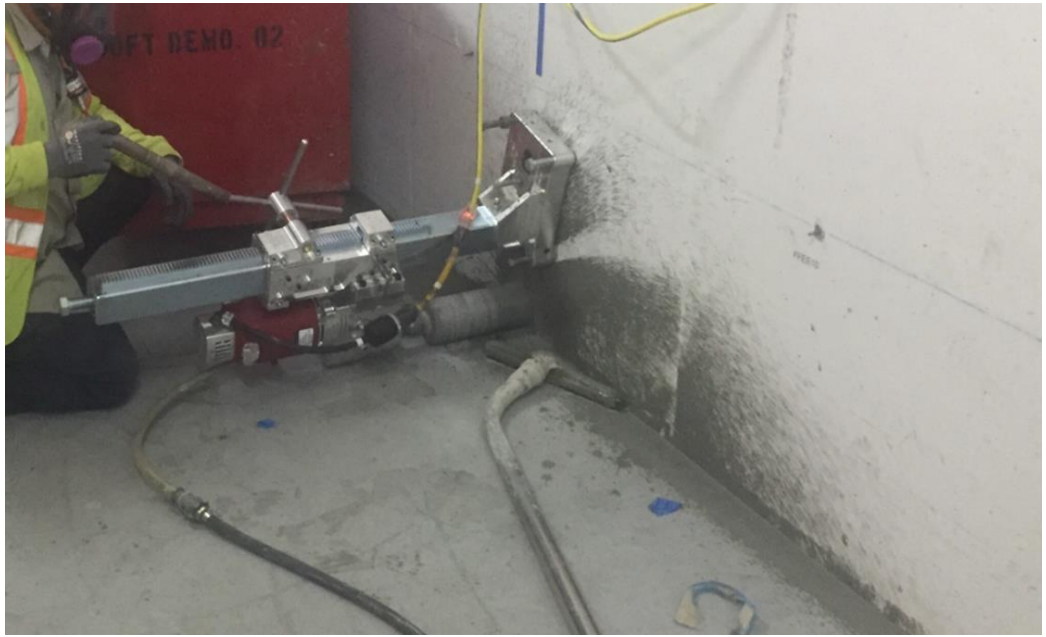
Quiz

What would you guess is the sampling result?

A. ND, <25 ug/m^3

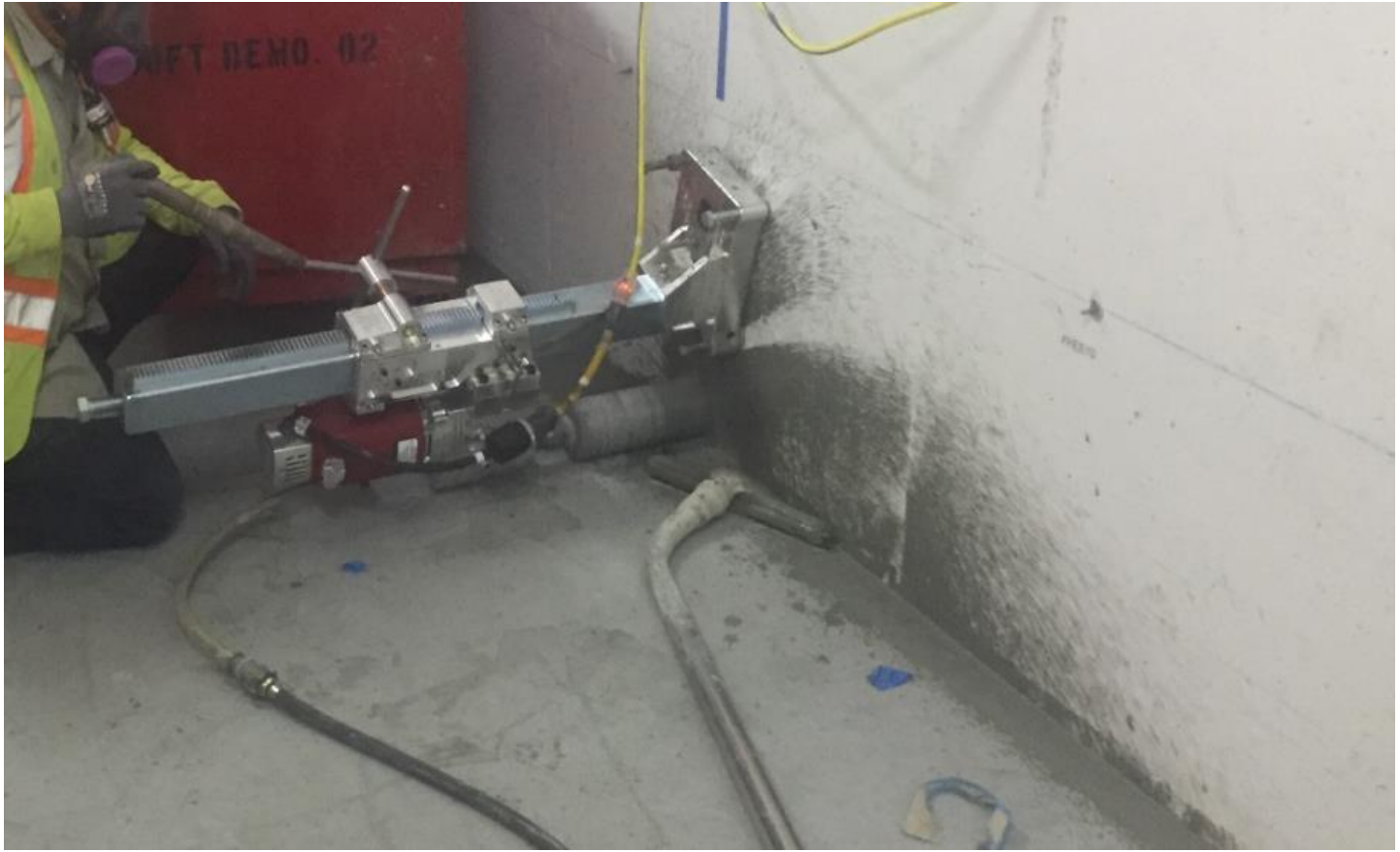
B. Between 25 and 50 ug/m^3

C. >50 ug/m^3



Sampling Results

Employee/ Area	Airborne Contaminant	Sampling Results (ug/m^3)
Employee # 1	Respirable Dust	2,700
	Respirable Crystalline Silica	**150**
Area – 5’ From Saw	Respirable Dust	920
	Respirable Crystalline Silica	**27**
Area – 25’ From Saw	Respirable Dust	880
	Respirable Crystalline Silica	**28**
Area – 50’ From Saw	Respirable Dust	700
	Respirable Crystalline Silica	**25**



Handheld Grinder – 21 ug/m^3

Hammer Drill with Vacuum – ND, <15 ug/m^3

Wire Saw Cutting – 260 ug/m^3

Remote Chipping – 850 ug/m^3

In Closing…..

Short Video

- https://www.youtube.com/watch?v=HAByIIzQSuU
  - Source: OSHA silica dust standard web page https://www.osha.gov/silica/index.html

Thank You!

Questions?

Resources for Crystalline Silica Dust Compliance

OSHA

- Controlling Silica Exposures in Construction: http://www.osha.gov/Publications/3362silica-exposures.pdf
- http://www.osha.gov/dsg/topics/silicacrystalline/index.html
- https://www.osha.gov/silica/index.html
- Silica eTool—Special Emphasis Program: http://www.osha.gov/dsg/etools/silica/spec_emph_prog/spec_emph_prog.html

NIOSH

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

Accredited Laboratories

- Galson Labs: www.sgsgalson.com
- ALS Labs: www.alsglobal.com

BSI EHS Services and Solutions

General Services

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

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