

Crystalline Silica – Exposure Assessment and Management

A Presentation to:

**Virginia Transportation Construction Alliance
(VTCA)**

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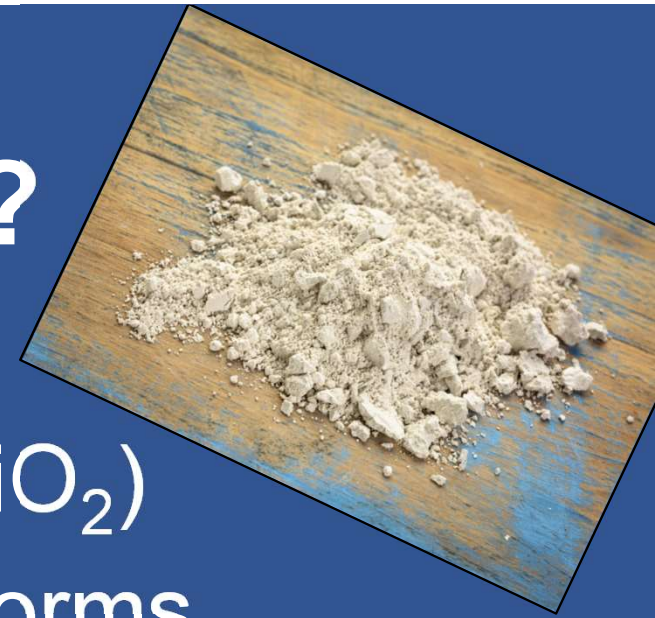
Agenda

- What is Silica? Why does it pose a health hazard?
- Silica Regulations
- Sampling Techniques
- Results and Interpretation
- Control Measures

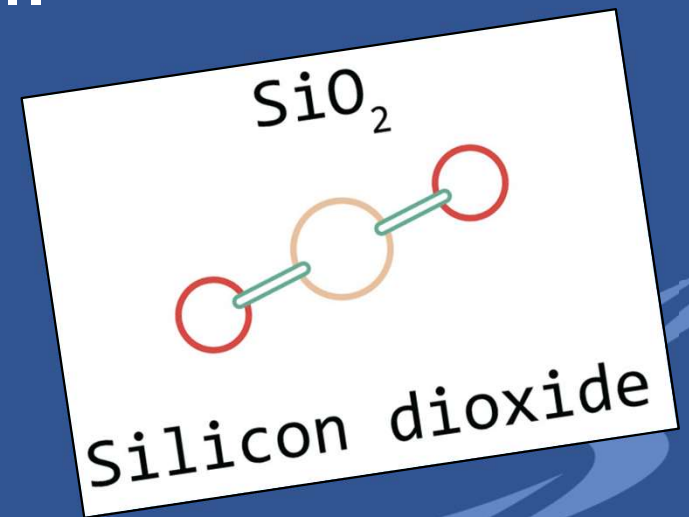




What is silica?



- Oxide of the metal silicon (SiO_2)
- Crystalline and amorphous forms
- Silica is everywhere; quartz is the most common crystalline form found in minerals, sand, rocks, soil.



Size and Structure Matter!

- Crystalline structure – scars the lungs, irreversible
- Smaller the size – deeper into the lungs
- Respirable fraction - broadly defined as particles having a diameter of 10 μm or less; other criteria
- Main concern - RCS



OSHA Regulation

- General Industry/Maritime/Construction
 - Permissible Exposure Limit (PEL), 8-hr Time-Weighted Average (TWA):
0.05 mg/m³
 - Action Level (AL), 8-hr TWA:
0.025 mg/m³
 - Specific Requirements
 - Exposure Monitoring
 - Employee Notification
 - Medical Monitoring
 - Control Measures



MSHA Regulation

- Current PEL = $10/(\text{silica}\%+2)$
~ 0.1 mg/m³
- MSHA Request for Information - 2019
- Proposed Rule on the Agenda - 2020
- Waiting on the Notice of Proposed Rulemaking - 2021
- Probably in 2022?
- Will they follow similar to OSHA? What elements will they take?

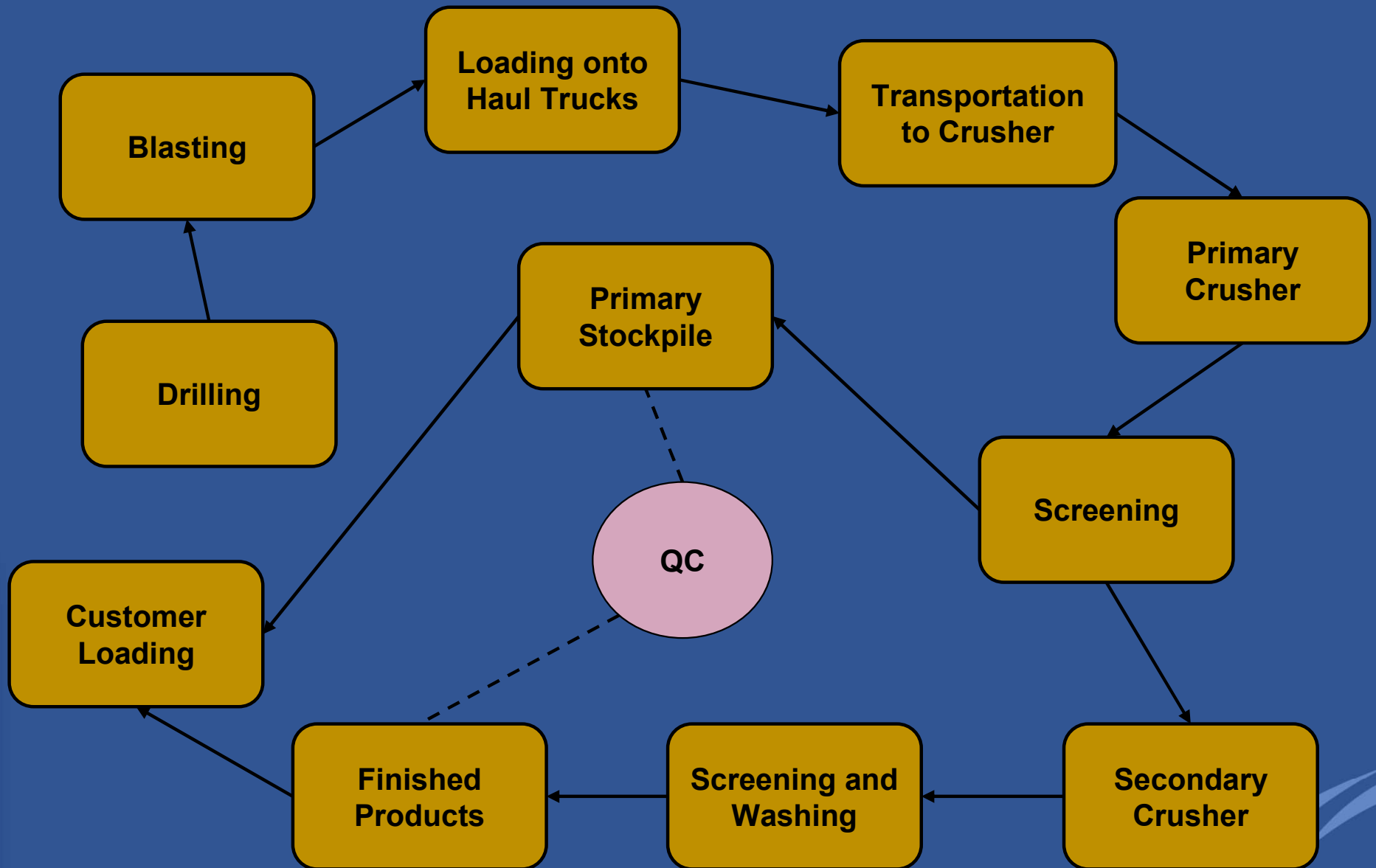


MSHA Regulation, contd.

- Expected decrease in PEL to 0.05 mg/m³
- How will they rule on:
 - Coal vs. Metal/Non-Metal
 - Will respirators be considered as an acceptable control measure?
 - Will they specify other control measures similar to OSHA's Table 1?



Mining Simplified Overview



Factors Affecting Silica Exposure

- Geology - typical silica content
Limestone < Granite, Slate < Sand & Gravel, Sandstone
- Job classes - Exposure and Frequency
 - Plant Operators
 - Heavy Equipment Operators
 - Maintenance Crew
 - Clean Up Activities
- Control Measures In-place



Direct Read Instruments

- Instantaneous Size-Selective Particulates Monitors (PDR, Dusttrak, Sidepak)
 - Measures aerosol concentration - dust, smoke, mists, fumes
 - Need silica concentration in the dust being measured
 - Multiple assumptions
 - Screening



Silica Sampling

- Polyvinyl chloride (PVC) filters
- Cyclone - Respirable Particulates @ Specific Air Flow Rate



Silica Sampling contd.

- Sampling Pump



Analysis and Results

- Gravimetric Analysis – Respirable Particulates (RP), mg
- X-ray Diffraction – RCS, mg
- % Silica - $RCS/RP \times 100, \%$
- Total Air Volume (Flow rate x Sampling Time) - m^3
- Concentrations (RP and RCS) calculated in mg/m^3



MSHA Regulation Reminder

- Current PEL = $10/(\text{silica}\%+2)$
~ 0.1 mg/m³
- Expected decrease in PEL to 0.05 mg/m³



Example Lab Result

Weight Percentages of Crystalline Silica Minerals			Airborne Concentration	
Quartz	Cristobalite	Tridymite	Respirable	Quartz
12.4	< 0.9	< 0.9	0.467	0.058



Lab Result Interpretation

- RP Concentration - 0.467 mg/m^3
- RCS Concentration (Quartz) - 0.058 mg/m^3
- % Silica (quartz) - 12.4
- Cal. PEL - $10/(12.4+2) = 0.694 \text{ mg/m}^3$
- Current MSHA Rule: $\text{RP} < \text{PEL}$ - **does not exceed PEL**
- Proposed MSHA Rule - $\text{RCS} > 0.05$ - **exceeds PEL**



Hierarchy of Controls

- Elimination
- Substitution
- Engineering Controls
- Administrative Controls
- Personal Protective Equipment (PPE)



Regulations: Control Measures

- Implement feasible engineering and administrative control measures
- When such controls are not feasible **OR** in the process of being implemented, appropriate PPE shall be used
- If use of respirator mandated; a site-specific RPP shall be established



Control Measures

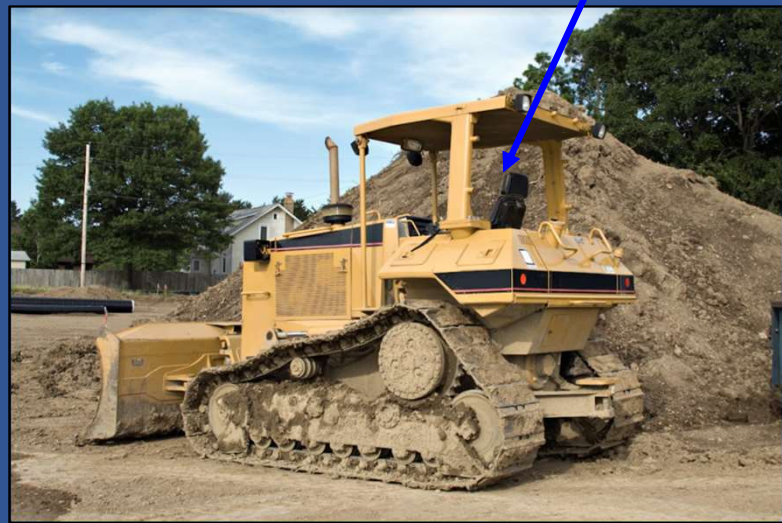
- Water suppression
 - Water sprays in the crusher area, conveyors
 - Water trucks
 - Wet the work areas



Control Measures, contd.

- Enclosed work areas
 - Control Rooms
 - Heavy Equipment Cabs
 - Seals on Doors and Windows
 - Positive Pressure

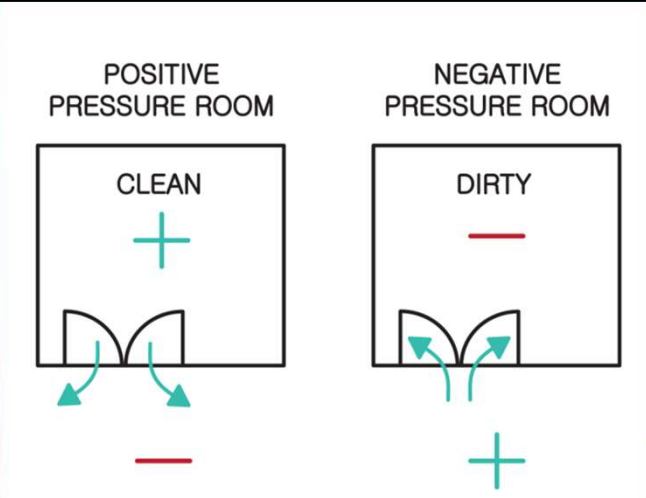
Open cab



Open window



Door seals



Control Measures, contd.

- Scheduling of cleanup work before or after plant operation



Control Measures, contd.

- Regular Maintenance
- Regular and Consistent Follow-up
- Employee Training



Keep air intake away from dust source



A/C or Heater brings air in



The Main Take Aways

- Silica is almost everywhere - significant health risk in its crystalline form
- Smaller the size - more toxic
- Characterize silica exposure
- Understand the results
- Evaluate engineering and administrative controls prior to PPE use



Questions?

Thank you for your interest

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