

Respirable Crystalline Silica Air Monitoring

Field Case Studies

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Introduction

- QBENA
- North American Insurance Company
- Top 25 \$ Premium Written
- Insurance book: Manufacturers, contractors, truckers, service, main street, quarries, sawmills
- Global Risk Solutions
- Industrial hygienist and lead consultant and 75% home office 2018
- Field IH work, self, other consultants, vendor independent consultants
- Respirable crystalline silica monitoring requests a hot topic this past 18 months from manufacturing and construction accounts, will present some of them here today.

Agenda and Presentation Objectives

1. Variety of Accounts: Manufacturing, Construction, Processors
2. Preparation: Ensuring accuracy
3. Field Air Monitoring Challenges
4. RSC dust controls
- 5. *Observations, Analysis and Correlating RSC Air Monitoring results with Exposures for Protection of Employee Safety and Health***

Accounts Overview

Porcelain Insulator Manufacturer

Pre-stress concrete architectural products and installation

Floor renovation grinding and resurfacing

Outdoor stone products fire pit manufacturer

Midwest Silos Construction

Masonry Contractors

Cement products manufacturer

Landscapers

Backyard DIY 😊

So, What is Respirable Silica?

- **ACGIH Respirable particulate matter**
- Those materials that are hazardous when deposited in the gas-exchange region.
- Analysis of available data indicate that the flow rate of 1.7 liters per minute allows the 10 mm nylon cyclone to approximate the particulate matter concentration which would be measured by an ideal respirable particulate sampler
- Collection efficiencies using this method

Particle diameter	Fraction collected %
0	100
1	97
2	91
3	74
4	50

Ensuring Accuracy

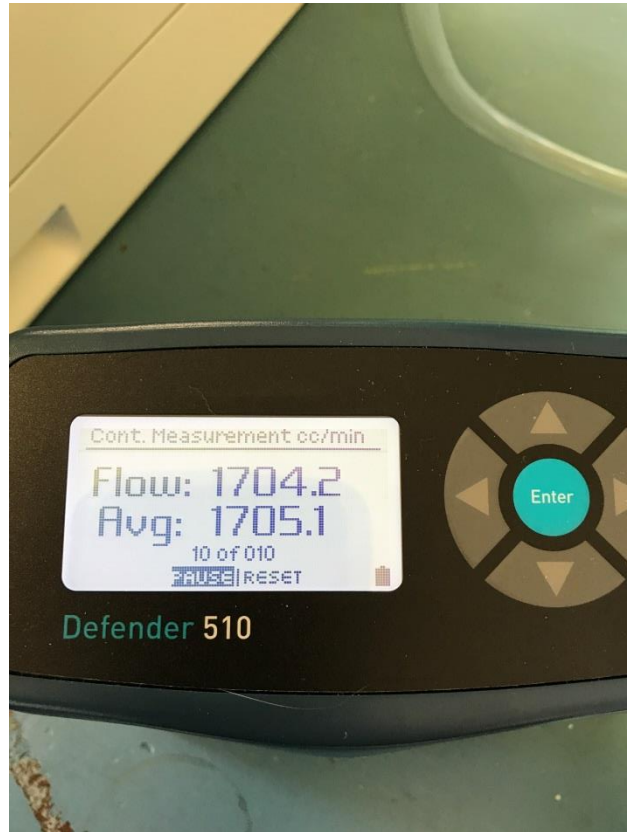
Respirable particulate sampling

- ✓ Median cut point 4 micrometers 50% collected per ACGIH
- ✓ Filter PVC, Pre-weighed, 5 um pore size, 2-piece
- ✓ Nearly an eight-hour sample
- ✓ Dorr-Oliver 10 mm cyclone

Pump Calibration

- ✓ Dry Cal Calibrator with annual factory calibration
- ✓ 10 before average of 10 per **NIOSH Occupational Exposure Sampling Strategy**
- ✓ Post survey 10 and average of same
- ✓ 95% accuracy

Pump Calibration



Footnote

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Ensuring Accuracy

Laboratory Analysis

- ✓ Request all forms of silica: **Quartz**, Cristobalite and Tridymite
- ✓ Respirable particulates
- ✓ OSHA requires minimum volume for 25% of PEL
- ✓ Interferences report these: **Common interferences are bauxite, mica, potash, feldspar, graphite, and zircon**

Laboratory Sampling Specifications

Analyte	Media	Sampling Rate	Sampling volume	Reporting Limit	Method Technique
Silica-Crystalline Profile	PVC, Pre-weighed 37 mm, 5 um, 2pc		816-1200	5 ug	NIOSH 7500 XRD

Special Notes from the laboratory

* Sampling rate is dependent on cyclone used - SKC Aluminum Cyclone - 2.5 LPM, Nylon Dorr-Oliver Cyclone - 1.7 LPM. Pre-weighed PVC filters are specified so that overall filter

- ✓ **Key: OSHA requirement Sample enough volume to where the results, if found to be less than the limit of detection is less than 25% of the PEL or $< 12.5 \text{ ug/m}^3$.**
- **E.g. With a limit of detection of 5 ug, full shift 8-hour sample @ 1.7 liters per minute, = 6.12 ug/m^3**
- **Danger of not enough sample time are results reported less than an amount that is greater than the action level. It is difficult to conclude anything.**

Business Type

- Exposures and Controls
- Results
- Findings Conclusions and Recommendations

DIY and Silica Dust



Landscaping Contractor

- The saw was fitted with a non-HEPA construction vacuum intended to extract dust during its operation. The vacuum was connected to a steel square tube that the saw blade ran into in an attempt to capture as much dust as feasible.



Landscape Contractor

Sample ID	Air Monitoring Time Minutes	Contaminant	Total (mg or µg)	Concentration Found (Mg/m ³ or µg/m ³)
BC110217-01	365	Respirable Crystalline Silica	250 µg	395.8 µg/m ³
BC110217-02	365	Respirable Crystalline Silica	320 µg	502.5 µg/m ³

It is recommended to implement the specified exposure control method listed in OSHA 1926.1153 for stationary masonry saws OR implement an alternative exposure control method and to follow the additional requirements of the OSHA standard for alternative controls.

IH AIR MONITORING PRINCIPLES THAT PROTECT EMPLOYEES!

- IDENTIFY UNCONTROLLED EXPOSURES
- IMPROVE CONDITIONS IRREGARDLESS OF RESULTS
- IDENTIFY BEST PRACTICES
- IF Control methods can be improved Conclude That There IS GOING TO BE an OVER-EXPOSURE
- PRIOR TO RESULTS
- BETTER POSITIONED TO MAKE RECOMMENDATIONS IF RESULTS ARE HIGH
- USE MOST CONSERVATIVE STANDARD
 - **TYPICALLY ACGIH**
- NOT OSHA COMPLIANCE BUT GENERALLY MORE STRINGENT

Interpreting Results

- **Action Level**
- When survey results fall below the Action Level, there is a **statistical basis for concluding that day-to-day variability does not result in a significant number of days where the exposure would exceed the standard.**
- Survey results between the Action Level and the standard indicate a potential for a significant incidence of overexposure. Thus, exposures above the Action Level prompt action to control exposures for which limited quantitative data is available.
- In order to account for variability in exposures which occurs from day to day, an **advisory Action Level** is used when single survey results are evaluated. The Action Level is 50% of the standard.
- **NIOSH Report “Exposure Measurement Action Level and Occupational Environmental Variability”**



Industrial ceramics insulator products

- Manufacturer of industrial insulators
 - › 8/9 samples acceptable to PEL
 - › 5/9 samples acceptable to TLV
 - › 4/9 samples above OSHA action level
 - › Issues and Remedies
 - › **Unregulated air hose for blowing off dust: HEPA Vacuum**
 - › **Blanked off ventilation system on horizontal lathes: Redesign ventilation system.**
 - › **Silo safety procedures circumvented: Repair remote control device to negate silo entry**
 - › **Observed maintenance mechanic covered in dust??**
 - › **Importance of continually checking on your “patients”**

Knowing the Reasons and exposures for the Results



- › Mystery Man: 1 sample > PEL We could never find him.
- › Knew he was in the silo but unable to substantiate the balance of the day exposures
- › Reason for the REMOTE silo control device

Pump Failure!!! Two worst words in a field survey



- Regular Checks on Participants
- Ensuring that pumps are adequately charged
- Redundancies
 - › Note time of pump start and stop
 - › If failure, can cross reference minutes recorded with start time
 - › Take extra pumps to survey

Pre stressed concrete products installation





Pre-stressed concrete products and installation

- **Employees:**
 - › Pressure washer outdoors water propelled shot materials
 - › Air supplied respirator
 - › Monitoring outside the hood: Compare to APF of respirator
- **Concrete pouring via crane, batch-type hopper and gravity feed system**
- **Trim and finishing**
- **Batch mixing in booth**
- **“Construction guys” Mieczyslaw 😊**

- **Range of Results for both plant and construction site**
- **Respirable Silica < 0.013- < 0.015 mg/m³**
- **Respirable Dust 0.13 - 0.37 mg/m³**

Pre-stressed concrete....

- Controls: **Wet Processes**, **enclosed cabs**, **enclosed booths**, full suit air supplied respirator for pressure washer
- Minimal dust generation at the construction site.
 - Dry day, windy.
- Industry study ACI?
- Included the foreman in the study as per Industry study

Department Store in Carmel Indiana

1. Graveyard shift 12 midnight to 8 am
2. Great Denny's ½ mile away
3. 100 employees +- inventory, re-stocking, construction workers
4. Two employees in the study: Machine Operator and Foreman
 - Conclusions from report: Difficult to exactly quantify the source of over exposures.
 - › Potential sources of respirable dust include that generated during grinding operations where a floor grinder is removing concrete floor material--**Controlled**
 - › The _____ brand joint filler material contains silica per the container label, and joint sanding is then performed with a walk behind floor sander that does not have ventilation controls.
 - › In between floor processes, employees hand swept the floor creating dust plumes.
 - › Not following concrete grinder dust collection PM procedures
 - **Review SDS information**

Results and Recommendations

2017-03-01 Control Considerations For Dust Control During Concrete Floor Sanding and Grinding

- Use of wet technologies during concrete floor grinding operations
- Use of alternative materials to _____ brand grout that contains silica and then is subsequently sanded
- Use of HEPA filtered vacuum cleaners in lieu of hand sweeping
- More strict adherence to floor grinder dust collection cleaning to prevent overloading
- Use of sanders with ventilation controls

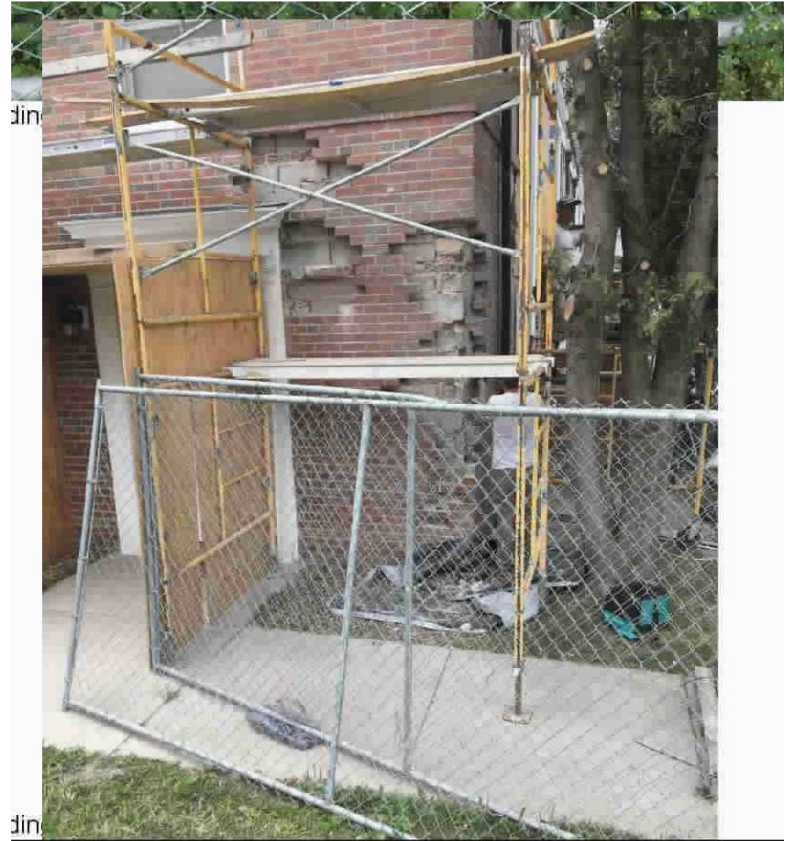
Employee Location	Sample ID	Air Monitoring Time Minutes	Contaminant	Concentration Found (respirable fraction) Ug/m3
Laborer Grinder/Sander Operator	1739-0750	319	Respirable crystalline Silica	150.0
Supervisor	1739-0781	295	Respirable Crystalline Silica	< 0.20

Masonry Contractor Madison, Wisconsin

Assessing employees' exposure to RSC during Masonry brick and mortar renovation work

Three employees

- Hand cutting and chiseling
- Angle cutter
- Water infused hand saw
- 2 > TLV
- 1 > PEL
- **Water Infused hand saw acceptable**





Employee And Location	Sample ID	Air Monitoring Time (Minutes)	Contaminant	Concentration mg/m3
Jose, Assembly	Z1234566	380	Quartz	0.027
			Crystobalite	< 0.0055
			Trydymite	< 0.0022
			RCS	0.027
			Respirable PNOS	0.31

Point of Discussion

- Where Sample Time is < 8 hours
- Quantifying non sampling time
- “0” assumption may be flawed
- Consultant used TWA approach using “0” for the non-sampled time
- Report submitted based on sampling time being representative of “full shift”
 - › Measurements were made for the purpose of **estimating** workplace exposure and not to determine compliance or non-compliance with legal standards. Air monitoring was conducted for a portion of employees work shifts and is believed to be representative of work shift exposures.
 - › More conservative approach
 - › Would have to quantify “other” time to do true TWA

Exposure and Future Controls

Problems:

1. Manual cutting of Hardie Board
2. Scraping of Hardie Board Edges
3. Cutting Hardie Board on Panel Saw

Engineering Action To Be Taken:

1. All Hardie Board will be cut on the water jet to eliminate the need for all of the above.









Footnote

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Air Monitoring Results: 40 Holes Drilled

Employee and Operations	Sample ID	Time Monitored	Contaminants	Concentration Ug/m3	
Roy, Grain Facility	092617	291	Respirable crystalline silica (All forms)	16.2	
			Respirable Dust PNOS	< 101.0	

Knowing What is Normal and Events to Upset Normal

Cement Bagging Operations

- Super-sacks and 50# sacks
- Gravity feed filling system
- Blending room top of the gravity fee
- **Blending room employee results: 82 ug/m³**

- **Visual cloud of dust in the blending room**
- **Increased level of dust in the air**
- **Caused by the blower method of forcing product from the truck trailers to the storage bins.**

Other Surveys and Observations

- Marble Counter top fabrications
 - › 100% wet processes for cutting and polishing
 - › Mostly Man Made Quartz=90%
 - › All results < LOD

Thank You Any Questions

