Evaluation of Engineering Controls to Reduce Worker Exposure to Respirable Crystalline Silica

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Outline of Presentation

- Misting Controls for Brick Cutting
  - Research conducted by Bryan Beamer
- Vacuum Controls for Brick Cutting
  - Research conducted by William Heitbrink

Misting Controls for Brick Cutting – Why?

- Cons associated with Vacuum Controls
  - Changing of bags
  - Relatively high cost
- Cons associated with Flooding Controls
  - Can be very messy
  - Need for lots of water on site
  - Perceived to discolor brick
- Misting has been used very successfully in the mining industry

Misting Controls for Brick Cutting – Methods

- Experiment done in lab to reduce variation & increase data accuracy
- Objectives:
  - Compare effectiveness of misting to flooding to reduce respirable dust levels
- Factors tested: 5 water levels
  - Two 2 gallon per hour nozzles (4.8 gallons per hour)
  - Two 4 gallon per hour nozzles (8.6 gallons per hour)
  - Two 8 gallon per hour nozzles (17.3 gallons per hour)
  - Flooding (48 gallons per hour)
  - No Control

Misting Controls for Brick Cutting – Methods (cont.)

- Five replicates completed
  - Order of tests within each replicate was completely random
  - All 15 cuts for each replicate were made on the same brick
  - Each test consisted of a six-minute background sample, followed by a six-minute brick cutting sample
  - Each test consisted of three cuts
  - Used EDCO MS-14 Brick cutting saw to cut General Shale red patio brick

Misting Controls for Brick Cutting – Methods (cont.)

Test Chamber

Air flow
Misting Controls for Brick Cutting – Testing Chamber

Misting Controls for Brick Cutting – Testing Chamber

Misting Controls for Brick Cutting – Nozzle Placement

Misting Controls for Brick Cutting – Nozzle Placement

Respirable Fraction of Particulate Under 10 Microns
Misting Controls for Brick Cutting – Conclusions

- Linearity of data suggests that two 16-gph nozzles delivering mist at about 32 gallons per hour would be about as effective as flooding (+/- 10%)
- If true, is misting at 32 gph more practical in the field than flooding at 48 gph?
- Are the manufacturers interested?
- Fine-tuned analysis of nozzle placement for optimized respirable dust control

Vacuum Controls for Brick Cutting – Research by William Heitbrink

EXHAUST CHANNEL

EXHAUST FLOW RATE AFFECTS DUST EMISSIONS FROM BRICK SAW

Q1 IS THE FLOW THROUGH THE EXHAUST CHANNEL (CFM)
Q2 IS THE FLOW THROUGH THE TOOL GUARD (CFM)
Vacuum Controls for Brick Saw - Recommendations

- Pressure loss through bottom channel was >30 inches of water
- Exhaust take-offs for this tool need to be redesigned for transport velocities of 4500 fpm.
- During testing we used two vacuum cleaners during some tests
- Exhaust volume needs to be greater than 200 cfm.

Engineering Controls for Brick Saws – Conclusions

- Flooding Techniques - Pros
  - Seems to be an effective technique to reduce Respirable Crystalline Silica levels for workers engaged in brick-cutting
- Flooding Techniques - Cons
  - Water can be messy
  - Difficult to use in freezing conditions
  - May discolor brick

- Misting Techniques - Pros
  - Research suggests that it might be as effective as flooding with high enough flow rates
- Misting Techniques - Cons
  - Can have many of the same disadvantages as using flooding techniques
  - Unless flow rates can be drastically lowered and still be effective, can use almost as much water as flooding

- Vacuum/Shroud Techniques - Pros
  - Research suggests that it can be an effective technique
  - Not as messy as water
- Vacuum/Shroud Techniques - Cons
  - High initial investment – up to $3K per vacuum
  - Time to change out bags

Questions?

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