A Review of Dust Control Techniques for Longwalls

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Overview
A Review of Dust Control Techniques for Longwalls:

- Quick overview of current longwall dust control techniques and the limitations of these techniques
- Impact of future regulations for dust control in longwall mines
- Better ways to control respirable dust levels in the future
- New technologies for dust control going forward to improve the productivity of longwall mining
Longwall System Dust Controls
Roadway Controls Include:

- Attempt to limit travel on intake roadways during production shifts but this is hard to control due to maintenance requirements

- Continual application of water to roadways with water truck to keep dust levels low

- Dust introduced into the system needs to be as low as possible
Beltway Controls Include:

- Sprays located on belt heads
- Sprays near the booster drive
- Scrapers located on the head and tail
- Any transition area in which dust is liberated needs to be addressed

Stageloader Controls Include:

- Dust scrubbers used at stageloader to capture excess dust
- Sprays located at dust generation areas

- Top and bottom raceway sprays
- Pneumatic atomising sprays in dust hood
- Crusher Sprays – fed from cooling circuits

Draws from both Crusher and Dust Hood
AFC Controls Include:

- Transition area sprays
- Use of water cooled motors on the stageloader and excess water is streamed onto conveyor

Main gate Corner Venturi Sprays

Transmission cooling water used on Crusher water sprays
AFC Controls Include:

- Water sprays to wet coal to suppress liberated coal dust

Sprays in Inspection linepan top decks for lubrication and dust suppression

Cooling water for lubrication and dust suppression exits here
Mine Controls Include:

- High volume face ventilation
  - Keep dust along the face and not in walkway
Shearer Controls Include:
Drum Controls Include:

- Drum-mounted water sprays
  - Bit face flushing sprays – prevention by wetting coal
  - Bit back flushing sprays – frictional ignition & suppression

- Conduct bit maintenance every “x” passes dependent upon cutting conditions but a regular maintenance schedule should be established
Shearer Body Controls Include:

- Splitter arm on head gate side only
  Belting to create barrier
- Ranging arm sprays
- Sloughing plates
- “Shearer-Clearer” sprays
Powered Roof Support Controls Include:

- Automated sprays on canopy and underside
  Optimum sequence can be developed to reduce dust

- Maintenance is key to keeping these sprays effective and operational

- Additional sprays available to reduce dust produced in other areas
  Gob side sprays
  Side shield sprays
  Wash down sprays (toes, links)
Future Regulations Impact
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- If respirable dust level drops from 2.0 mg/m³ to 1.0 mg/m³ using 1,217 MSHA dust samples taken in 2009 at the tailgate side operator and jack setter locations: Average = 1.15 mg/m³
  - 122 samples > 2.0 mg/m³ or 10.0%
  - 195 samples > 1.7 mg/m³ or 16.0%
  - 271 samples > 1.5 mg/m³ or 23.3%
  - 628 samples > 1.0 mg/m³ or 51.6%

- These samples are at the bimonthly sample rate and could worsen if the rule changes to increase the sampling rate
Better Ways / New Technologies
Other Opportunities:

Computational Fluid Dynamics (CFD) –to solve fluid flow scenarios

CFD to design optimized dust reduction systems

Full scale models can be expensive, CFD can be utilized to reduce the dust reduction options to be trialed

CFD results need to be verified with field testing
Respirable Dust Reduction

The placement of shearer and shield operators is the #1 contributor to dust levels. This has a dramatic effect to reduce respirable dust at the operator location.

Automation that can be “trusted” will help these operators stay in the proper location for reduced dust exposure.

In the future remote automation (man-less face) will help remove these operators from these hazardous areas.
Conclusion
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- Dust cannot be eliminated only controlled
- No one particular control that makes a huge difference to the overall dust reduction effort
- Engineering controls work in conjunction to reduce respirable dust exposure at points throughout the system
- Maintaining the current controls is key in keeping dust levels in check
- CFD as a tool to test and improve current dust management
- Remote operation and automation will be the future to meet more stringent regulations
References:

- ASGCO Manufacturing, Inc.. (2012)

- Chekan, G. (2011, November)

- Ren, T. X., & Balusu, R. (2007, June)

- U.S. Department of Labor - MSHA. (2010, October)
Thank You!

Questions & Comments?