Dust Aerosol Control around Continuous Miners

Yoginder P. Chugh
Harrold Gurley
John Pulliam
V. Kollipara
Mining and Mineral Resources Engineering
Southern Illinois University Carbondale

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Continuous miner

- Cutting drum
- Chassis
- Loading pan
CM READY TO MAKE BOX-CUT, SCRUBBER OPERATING

Zone B
Zone C
Zone A
Zone D
Zone E
Sources of dust around a continuous miner

- Dust from loading pan
- Dust from loading
- Dust from cutting coal
- Dust from loading pan
- Dust from cutting coal
- Roll back dust
- Roll back dust
- Roll back dust
- Roll back dust
- Dust from scrubber exhaust
- Dust from scrubber exhaust
- Dust from scrubber exhaust
- Dust from cutter drum
- Dust from cutter drum
- Dust from cutter drum
- Return air
- Intake air
- Continuous miner operator
- Continuous miner chassis
- Haulage unit
- Dust from tail
- Dust from tail
Current cutting drum spray system
Coal dust wettability characteristics affect dust control
Current spray block design

Multiple spray orientations with minimal spacing
Limitations of Current Spray Systems Design

- Spatially, sprays are located to control dust mostly in one vertical plane.
- Randomly oriented sprays resist air movement.
- Different sprays intercept each other to create large water droplets inefficient for dust control.
- High spray pressure tends to blow dust away and reduce possibility of colliding with water.
- Dust aerosol is not contained within the face area to be sucked in within the wet scrubber.
- Residence time for aerosol and water droplets to interact is small.
SIUC spray system – plan view

- Second line of defense misting sprays
- Scrubber discharge point
- Throat sprays
- Pan sprays
- Outer bit ring sprays
- Head sprays
Modified spray system – elevation view

- Second line of defense misting sprays
- Head side sprays
- Loading pan sprays

**Right side elevation**

**Left side elevation**

- Head side sprays
- Second line of defense misting sprays
- Loading pan sprays
- Side chassis sprays
SIUC spray system- isometric view

- Second line of defense sprays
- Cutting boom side sprays
- Loading pan side sprays
Under-boom spray locations – modified miner
PDM data – HO location for unmodified miner

Critical time period – box and slab cuts
PDM data HO location for modified miner

Critical time period – box and slab cuts
Mock up of continuous miner cutting drum
Mock up of continuous miner loading pan and cutting drum

Under-boom side sprays
Mock up of continuous miner cutting drum sprays

Good spray coverage
SIUC Designed Cutting Drum Spray Block
The Applications

- Continuous miners, road headers, tunneling machines, highway concrete and asphalt cutting machines.
- Extend the concepts to longwall shearer.
- Surface mining equipment
- Crushing and grinding plants
- Material transfer points such as conveyors, truck dump points, loading points in non-coal mines.
The Advantages

- Meet regulatory requirements for dust control.
- Reduced total dust and quartz dust concentration.
- Improved visibility.
- Reduced water requirements.
- Overall reduction in dust control.
Current Status of the Innovation

- Provisional patent application filed in July.
- Demonstrated the overall spray system to two mining operating companies.
- Completed the design of spray blocks for top and sides of the cutting drum and chassis.
- Completed the design of third line of defense top and side sprays.
- Worked with a local machine shop to fabricate one spray block.
- Cooperating with a coal company to test performance of the spray block.
- Available for licensing.
That is all folks!!