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Float Coal Dust Explosion Hazards

Objective

To increase awareness of float coal dust explosion hazards in the mining industry.

Background

In underground coal mining, dust is produced at the face, at conveyors, at transfer points, and by the normal movement of workers and machines. The coarse coal dust particles settle rapidly. However, the fine coal particles remain airborne much longer, and the ventilating air can move this fine dust relatively long distances into the returns before settling. This fine dust is called float coal dust. It generally consists of particles of coal that pass a 200-mesh sieve (particles smaller than 75 μm).

Generalized rock dusting is currently the primary means of defense against coal dust explosions in U.S. mines. 30 CFR 75, Subpart E (Combustible Materials and Rock Dusting), requires the use of rock dust in bituminous coal mines (30 CFR 75.402). The regulations state that rock dust shall be distributed upon the top, floor, and sides of all underground areas of a coal mine in such quantities that the incombustible content of the combined coal dust, rock dust, and other dust shall be not less than 65%, and the incombustible content in the return air courses (where the dust is expected to be finer) shall be no less than 80% (30 CFR 75.403). These incombustible concentrations assume that the coal and rock dust are not layered, but are intimately mixed. Float coal dust is a serious explosion hazard if it accumulates on top of the rock dust and is not mixed thoroughly with the rock dust. An example of this is shown in Figure 1.

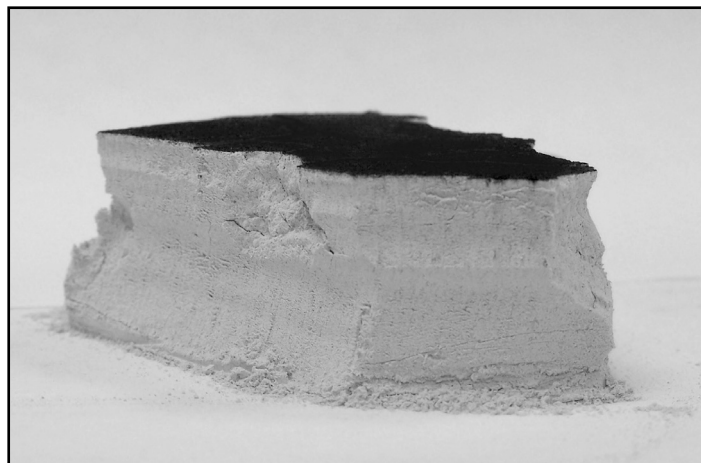


Figure 1.—Cross-section of a very thin (0.01-inch) explosible float coal dust layer deposited on top of a 3/4-inch (20-mm) thick layer of rock dust.

Approach and Results

The explosion hazards of float coal dust have been studied over many decades in the Experimental Mine at Bruceton, PA. The position of coal dust along the perimeter of an entry is a more important factor affecting explosion propagation than is often recognized. The dust on the ribs, roof, and other elevated surfaces (overhead dust) can be dispersed much more readily by an explosion than dust on the floor. If the overhead dust is mainly coal dust, the explosion hazard is intensified. If the overhead dust is primarily rock dust, the explosion hazard is reduced. Depending on the quantity, the overhead rock dust can compensate somewhat for a deficiency of rock dust on the floor. However, thick layers of rock dust on the floor cannot compensate for float coal dust on overhead surfaces.

For some of the Experimental Mine explosion tests, trays of color-coded dust layers were substituted for the floor layer in strategic locations throughout the test zone. The results showed that, for a typical float coal dust explosion, only the top 3/32 to 5/32 inches (2 to 4 mm) of the floor dust layer is stripped off or entrained in the air. It was also found that a minimum 5/1,000-inch (0.12-mm) thick layer (about the thickness of a sheet of paper) of pulverized float coal dust deposited on top of a 3/8-inch-thick uniform concentration of 80% rock dust and 20% float coal dust would propagate an explosion. The thicker the float coal floor layer, the more violent the explosion.

Recommendations

Research has shown that when the overhead dust is primarily rock dust, the explosion hazard is reduced. Depending on quantity, the overhead rock dust can compensate for a deficiency of rock dust on the floor. However, since rock dust on the floor cannot compensate for the float coal dust on surfaces above the floor, special attention toward increasing the rock dust content on these elevated surfaces is recommended.

Float coal dust deposits can be neutralized by new applications of rock dust (such as trickle rock dusting or bulk rock dusting), by mixing the float coal dust with the underlying rock dust, by general cleanup, and/or by washing down the rib and roof surface.

For More Information

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