NIOSH

HAZARD CONTROLS

HC 27

New Shroud Design Controls Silica Dust from Surface Mine and Construction Blast Hole Drills

HAZARD

Exposure to airborne respirable crystalline silica dust can lead to silicosis, a debilitating lung disease. On surface coal mining and construction sites, blast hole drills are notorious sources of airborne respirable dust that may contain significant amounts of silica. The drill operator and drill helper usually receive the greatest silica exposure compared with other occupations. As a result, many drilling operations have been, and still are, on more stringent dust standards. Drilling through various rock formations naturally presents a strong potential for silica dust generation for several reasons. First, drilling is a pulverizing process that generates large amounts of very small dust particles. Second, the bailing air used to flush cuttings from the hole leaves the hole at a very high velocity and can be difficult to contain. Third, many fixed shrouds used to enclose the area beneath the drill deck have a significant amount of leakage due to 1) gaps between the shroud and ground created by raising/leveling the drill, 2) gaps in the corner seams, and 3) torn deck shrouds.

CONTROLS

A dry dust collection system is typically connected to the drill deck to collect dust as the bailing airflow transports the cuttings (and significant amounts of airborne respirable dust) out of the drill hole. Deck shrouds are installed in an attempt to enclose the volume around the drill steel and prevent dust escaping. However, most deck shrouds are rectangular and constructed of four separate pieces of rubber belting attached to the deck. Because of this design, there is usually a significant amount of dust escaping from the open seams as well as the open area between the shroud and the ground. This dust can be a significant source of silica exposure to drill operators as well as other personnel downwind of the drill.

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■ Circular Deck Shroud

The drill deck shroud described below is unique in that it is circular and slightly conical in design, without any open seams (see Figure 1). Steel banding is used to attach the shroud to the bottom of the drill deck and close the one seam. The shroud is capable of being hydraulically raised to nearly flush with the drill deck and lowered to make contact with the ground after raising and leveling the drill. A steel band is attached to the bottom of the shroud to maintain shape as well as to provide weight for lowering. Sheet rubber material, which is thinner than material typically used for deck shrouds, is used for flexibility. Operation is accomplished by guide wires attached to the bottom steel band and a hydraulic cylinder. The cylinder is controlled by a hand valve located near the other drill controls (see Figure 2). The shroud has a small trap door which can be manually raised/lowered so that the cuttings can be shoveled from inside the shroud without losing dust capture efficiency.

An evaluation of the deck shroud on a surface coal mine drill was performed to document the dust capture efficiency. Testing consisted of comparisons with the shroud in fully operable condition and with the shroud partially raised to simulate a leakage condition. Respirable dust concentrations were less than 0.5 mg/m^3 with the shroud lowered and 52 mg/m^3 with the shroud raised. Dust reduction efficiencies greater than 99% were achieved. Typical efficiencies for the common square shroud can approach the 95% level. At 95% efficiency, the dust emission level at this mine during drilling would be 2.5 mg/m^3 and could contribute to a non-compliance status.

The bailing airflow measured approximately 460 cubic feet per minute (cfm) at 50 pounds per square inch (psi) at the bit. The dust collector airflow was measured to be approximately 680 cfm. The minimum collector airflow-to-bailing airflow ratio recommended for most drills with a typical rectangular shroud is 3:1, with higher ratios being desirable. The circular shroud was so effective in confining dust that an airflow ratio of 1.48:1 did not allow dust to escape. The high dust levels measured when the shroud was partially raised were due to an insufficient amount of dust collector airflow and demonstrates the need to maintain contact between the shroud and the ground. However, the low airflow ratio was insufficient to overcome leakage when the shroud was partially raised, resulting in high dust levels.

Figure 1. Dry dust collection system for blast hole drill: circular deck shroud.

Figure 2. Drill operator at the control panel.

For More Information

To obtain more free information about controlling this hazard or for information about other occupational health and safety issues:

— call the Pittsburgh Research Laboratory at (412) 892–6669, or

— call NIOSH* at 1-800-35-NIOSH (1-800-356-4674)

— visit the NIOSH Homepage on the World Wide Web at http://www.cdc.gov/niosh

*NIOSH is the Federal agency responsible for conducting research and making recommendations for preventing work-related illnesses and injuries. All *HAZARD CONTROLS* are based on research studies that show how worker exposures to hazardous agents or activities can be significantly reduced.

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