New Approach Controls Dust at the Collector Dump Point

NIOSH Finds a Simple, Cost-Effective Solution for Reducing Dust for Blasthole Dills

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Dust (including the respirable size fraction) becomes entrained in the atmosphere from the dumping of fine material from the drill dust collector.

Researchers studying dust generation from blasthole drills developed a simple, quick fix that reduced respirable dust concentrations by more than 63% at the dump point. This device, which requires almost no maintenance, is small and inexpensive, and it will help operators maintain compliance to the dust standard. The thought process was that a reduction of respirable dust at any of the multiple sources on the drill, in this case the dust collector dump point, should reduce the total respirable dust generated by the drill.

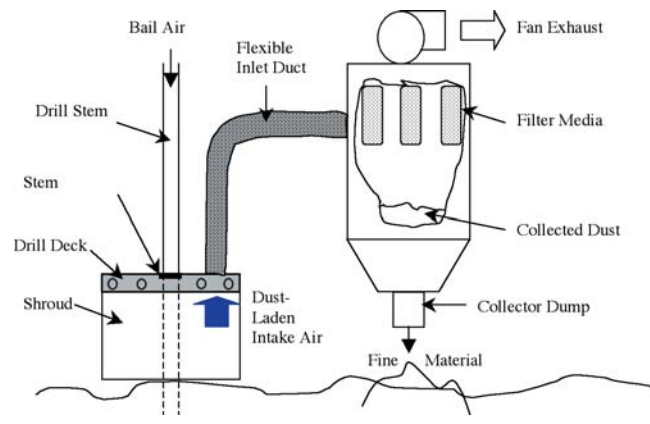
The U.S. Mine Safety & Health Administration (MSHA) has a coal respirable dust standard of 2 milligrams per cubic meter (mg/m^3) for an 8-hour shift. MSHA and mine operators periodically collect personal dust samples to determine compliance with this dust standard.

Drill operators have one of the highest exposure levels to respirable dust. This has been proven through many reviews of the MSHA dust sampling database. Prior to 1987, the highwall driller at surface coal mines had the most severe exposure to respirable silica dust, a trend that continues today based on MSHA's respirable dust sampling database.

A review of the MSHA database for the years 1985 through 1992 shows that 81% of the respirable silica dust samples taken exceeded the permissible exposure limit for the highwall drill operator at surface coal mines. A more recent review of the MSHA database, for the years 1996 through 2000, shows that only 31% of the respirable silica dust samples taken exceeded the respirable silica dust limit for the highwall driller at surface coal mines. This suggests a substantial improvement in preventing the exposure of silica dust to the highwall drill operator. The drill operator, however, still tops the list of job occupations that have the highest exposure to respirable silica dust.

Respirable dust has been shown to be harmful to human health, especially when silica is present in the dust. It causes a disease known as silicosis, which can occur in three levels: chronic silicosis, which occurs after 10 years of exposure; accelerated silicosis, which occurs between 5 and 10 years of exposure; and acute silicosis, which can occur within a few weeks to five years of very high exposure to silica dust. Respirable dust consists of the dust particle size fraction whose median diameter is 4 micrometers (µm).

The drilling machine generates high concentrations of respirable dust from several sources: drill table shroud leakage, dust leakage through the table bushing, dust discharge from the dust collector exhaust due to impaired filters, and dust entrained from the dust collector fines dumped onto the bench. The National Institute for Occupational Safety and Health's (NIOSH) Pittsburgh Research Lab (PRL) has been studying different methods to reduce respirable dust from these sources. During its testing, the institute identified a simple solution that reduces the amount of respirable dust generated at the collector dump point.



Schematic diagram of dust collector. Large arrows represent airflow.

THE PROBLEM: DUST COLLECTOR FINES DUMP

The drill's dust collector dumps fine material onto the bench and generates respirable dust. The device collects dry dust from the space below the drill table that is enclosed by the shroud. This area contains respirable dust from the fine material removed from the drill hole by the bailing air. This respirable dust frequently contains high silica content.

A high-speed fan is used to pull dust-laden air from underneath the drill table into the collector. This air is then routed through filters to remove the dust particles and clean air is discharged through the fan. The removed dust particles are captured on the filters. The collector then uses a high-pressure pulse jet of air to backflush the filters, removing the material off the filters at regular intervals. The backflushing occurs several times per minute. The backflushed material drops from the bottom of the collector onto the ground beside the drill machine.

The dust collector dump point rests anywhere from 24 to 36 inches above the bench. Dumping the fine material from this height causes entrainment of the respirable size fraction of this material into the air. Recently, the average respirable dust concentration measured at the dump location at a surface coal mine in Kentucky varied from approximately 0.53 to 1.34 mg/m^3, in time periods ranging from 2.9 to 5 hours. These concentrations are an average of three dust measurements taken with one personal-data-ram gravimetric and two gravimetric filters all using 10-mm Dorr-Oliver cyclones.

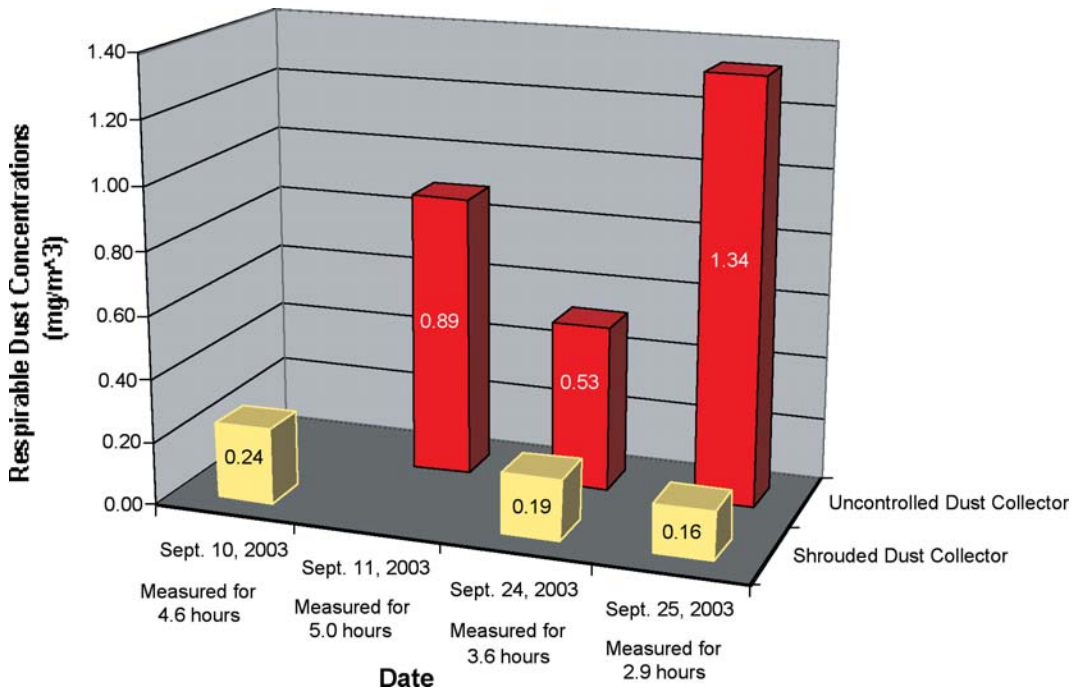
The measurements were taken within a distance of 2 to 3 ft from the dust collector dump point. The prevailing wind directions were used to determine the placement of the sampling equipment with the samplers being placed downwind of the dump point. Once the location was set with respect to the drill, it was kept constant throughout the day of testing. However, the sampling location did move with the drill to maintain the 2 to 3 ft distance from the dump point.

Location of sampling equipment with respect to dust collector dump point.

THE SOLUTION: BRATTICE INSTALLATION

To reduce the respirable dust concentrations at the collector dump point, a piece of brattice cloth was attached to the dust collector dump point using a large hose clamp. This dust shroud is installed over the existing rubber boot attached to the dust collector dump point.

The length of brattice cloth (or similar material) should be sufficient to allow it to extend from the dust collector dump point to the ground. It should be cut so that it is only long enough to just touch the ground when the drill is lowered. When wrapping the cloth around the dust collector dump, the overlap should be placed so that it is on the outside of the dust collector dump (it should be visible as the installer looks directly at the dust collector dump). This overlap allows the cloth to expand as fine material is dumped to the ground, while containing the entrained respirable fraction within its confines.



Comparison of dust concentrations of uncontrolled dust collector dump to shrouded dust collector dump.

Dust collector dump point prior to installation.

Dust collector dump shroud after installation.

Placement of the overlap on the outside also keeps the fine material off the drill tracks, which otherwise could cause re-entrainment of the respirable size fraction of the material when the drill starts in motion.

This simple procedure of creating a dust collector dump shroud is very effective in reducing the respirable dust. Respirable dust concentrations measured after installation of the dust collector shroud ranged from 0.16 to 0.24 mg/m^3. It can be seen that the reduction of respirable dust generated by the dust collector dump point can be reduced by between 63% and 88%. This reduction is highly dependent upon wind direction and wind speed.

Advantages to this method of respirable dust reduction are that the material is inexpensive and requires almost no maintenance. If the shroud becomes damaged, it can easily be replaced in 10-15 minutes requiring little, if any, downtime for the drill.

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