Technology News

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Improved Dust Control for Surface Coal Mine Drills With Rotoclone Collectors

Objective

Improve the dust-control effectiveness of the Rotoclone[1] dry-dust collection systems used on surface coal mine drills.

Approach

Inject small amounts of water into the Rotoclone exhaust to mix the dust and water, reducing the levels of respirable and total dust discharged from the Rotoclone exhaust.

Background

The U.S. Bureau of Mines field tested a method for reducing dust emissions on small drills, such as Davey, used in surface coal mining. These drills typically use a dust collection system called a Rotoclone. The Rotoclone, not a high-efficiency collector of very small dust particles, discharges significant amounts of visible dust. Typically, the Rotoclone discharge goes through a short section of pipe where it is directed vertically so that prevailing winds will disperse the dust away from the drilling operation. However, new Mine Safety and Health Administration regulations on dust emissions require that no visible dust be discharged to the atmosphere. Many operations will find it difficult to meet these new requirements.

How It Works

The Rotoclone discharge port initially must be rotated so that the discharge is horizontal or downward. Approximately 6 meters (20 feet) of either flexible or rigid plastic tubing (although not tested, a shorter length may possibly work as well) with approximately the same diameter as the discharge port is coupled to the port. This duct is mounted at a downward-sloping angle along the side of the drill so that the exit remains approximately 0.3 meter (1 foot) above the ground.

A water tank of approximately 26.4-liter (100-gallon) capacity is mounted at a location and elevation to gravity feed a small amount of water into the Rotoclone discharge port. In practice the drill operator can use a truck fuel-saddle-tank system to supply the required water. It is estimated that 26.4 liters (100 gallons) or less will be sufficient for 8 hours of continuous drilling using the 0.05-liter-per-minute (0.2-gallon-per-minute) flow rate for most Rotoclone systems used on small drills. Because of the low flow rate, the water from the tank can be supplied through 0.6-centimeter (0.25-inch) tubing. A variety of suitable fittings can be mounted in the metal discharge port of the Rotoclone. It is recommended that two valves be used to control the water flow. One valve will be used as a flow regulator and the second valve will be the on-off control.

Test Results

Tests were performed on the same drill bench with and without the use of water to evaluate the effectiveness of

[1]Reference to specific products does not imply endorsement by the U.S. Bureau of Mines.

the water-trickle system in reducing dust emissions from the Rotoclone discharge. With the trickle system, dust sampling conducted approximately 10 feet directly downwind of the Rotoclone discharge showed 90 percent reduction of total airborne dust, 92 percent reduction of respirable dust, and elimination of all visible dust emissions. Analysis of the dust samples showed that the quartz content of the respirable samples decreased from 21 percent without using water to 18 percent with the water-trickle system. Figures 1 and 2 show the effectiveness of the trickle system in eliminating visible emissions from the Rotoclone discharge.

To prevent clogging problems during operation, it is critical to not use too much water. Since the airflow from the Rotoclone varies widely, depending on the revolutions per minute of operation, the amount of water used must be determined individually for each application. One simple guideline is to slowly increase the trickle flow rate until the visible emissions are significantly reduced. It will be found that with time (less than approximately 1 hour), as the duct interior becomes wetted, dust reduction will improve.

Also, the downward slope of the discharge duct is important to allow excess water to drain from the line. Actual extended operation of the system showed that some material agglomeration will occur within the first 0.3 meter (1 foot) of duct length during an 8-hour drilling period. However, this material is easily removed by disconnecting the duct from the Rotoclone exit. If the duct is connected with a standard hose clamp, cleaning can be performed in a few minutes.

For More Information

Additional information can be obtained by contacting the principal investigator for this research, Steven J. Page, at the U.S. Bureau of Mines, Pittsburgh Research Center, P.O. Box 18070, Pittsburgh, PA 15236, or telephone (412) 892-6669. Technology News issues 286, 308, and 338 provide additional information on techniques to control respirable dust emissions from highwall drills.

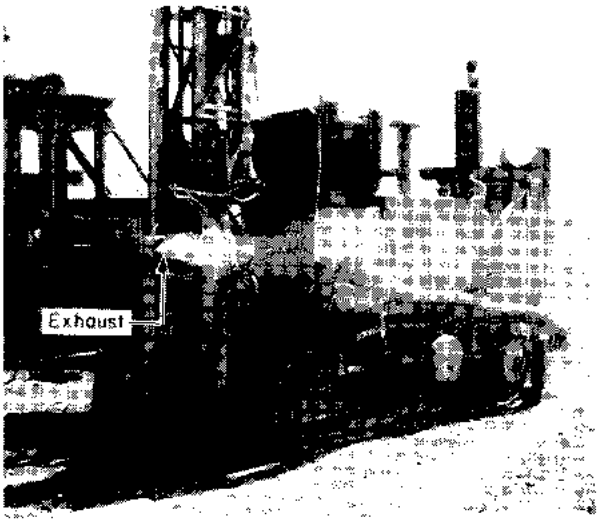

Figure 1.—Visible dust in the exhaust from a coal mine drill.

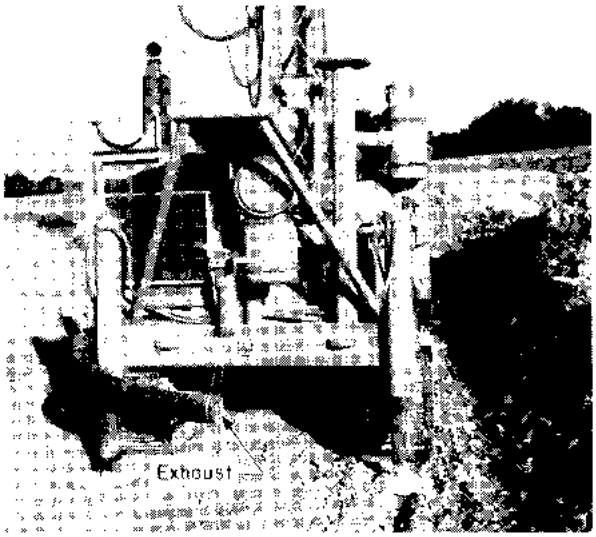

Figure 2.—No visible dust in the exhaust from a drill equipped with the water-trickle system.