Technology News

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Ventilation of a 40-Foot, Two-Pass, Extended Cut

Objective

To evaluate the quantity of ventilation air reaching the face of a 40-ft box cut during a 40-ft, two-pass, extended cut and to examine ways to increase this quantity of air.

Background

About one-half of all continuous mining faces in the United States are using extended cutting, i.e., advancing more than 20 ft past the last row of bolts. Most of these extended-cut approvals are for cutting depths of approximately 40 ft. Almost all of the continuous miners on these faces are equipped with machine-mounted dust scrubbers and water spray systems for dust control. Little is known about how much ventilation air reaches the box-cut face during various parts of the cutting sequence. This is of particular concern when a 40-ft, two-pass, extended cut is taken, because at the start of the 40-ft slab cut, the continuous miner is located 40 ft from the point of deepest penetration—the face of the 40-ft box cut. The National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Research Laboratory (PRL), undertook a study to evaluate this situation.

Approach

Testing was conducted in PRL's full-scale methane test gallery, which was configured to simulate a 16.5-ft-wide, 7-ft-high entry and has a full-scale model continuous miner with scrubber and water spray system. The first series of tests was conducted with the continuous miner at three locations in the 40-ft, two-pass, extended-cutting sequence: at the completion of the 40-ft box cut, at the start of the 40-ft slab cut, and 20 ft into the slab cut (figure 1). The curtain setback location was established at 50 ft. At each continuous miner location, the curtain airflow was set at both 4,000 and 10,000 cfm, and the scrubber flow was matched to the curtain flow or the scrubber was turned off. The water sprays were either operated at 120 psi for a total flow of 22 gpm or they were turned off. Methane gas was released at a constant rate through a manifold at the face of the box cut and monitored using three Bacharach methane monitors evenly spaced across the box-cut face, 1 ft from the roof and face. The quantities of fresh air reaching the box-cut face were calculated for each set of operating conditions using the average methane concentrations and methane release flow rates.

A second series of tests demonstrated how advancing the blowing curtain closer to the face of the box cut impacted how much air reached the box-cut face, with the continuous miner at the start of the 40-ft slab cut and 20 ft into the slab cut. The curtain setback was varied at 50, 40, and 28 ft from the 40-ft box-cut face. This places the 40-ft curtain at the last row of bolts, while the 28-ft curtain requires a 12-ft extensible curtain beyond the last row of bolts. Blowing curtain flow rates of 4,000 and 10,000 cfm were tested with matching scrubber flow rates; the water spray system was always operated at 120 psi and 22 gpm.

Results

Figure 2 shows the results of the first series of tests for curtain and scrubber flows of 10,000 cfm. With the continuous miner at the face of the 40-ft box cut and the scrubber and water sprays operating, more than 50% of the curtain air reaches the box-cut face. With the scrubber and water sprays turned off, this is reduced to about 5%. With the continuous miner at the start of the 40-ft slab, only about 5% of the available curtain air reaches the box-cut face regardless of the operation of the scrubber and water sprays. As the miner advances 20 ft into the slab cut, ventilation at the face of the box cut improves, especially with the use of the scrubber and water sprays. Similar results were observed for curtain and scrubber flows of 4,000 cfm.

Figure 3 shows the results of the second series of tests for a 10,000-cfm blowing curtain and matching scrubber flow. With the miner at the start of the 40-ft slab cut, advancing the curtain from a 50-ft to a 40-ft setback results in a greater than 100% increase in the airflow reaching the box-cut face. Advancing from a 50-ft to a 28-ft curtain setback results in a greater than 600% increase in the

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airflow to the box-cut face. With the continuous miner located 20 ft into the slab cut, advancing the curtain from a 50-ft to a 40-ft to a 28-ft setback improves ventilation to the box-cut face, but not as significantly as with the miner at the start of the 40-ft slab cut. Similar results were observed for curtain and scrubber flows of 4,000 cfm.

For More Information

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To receive additional information about mining issues or other occupational safety and health problems, call **1-800-35-NIOSH (1-800-356-4674)**, or visit the NIOSH Home Page on the World Wide Web at http://www.cdc.gov/niosh

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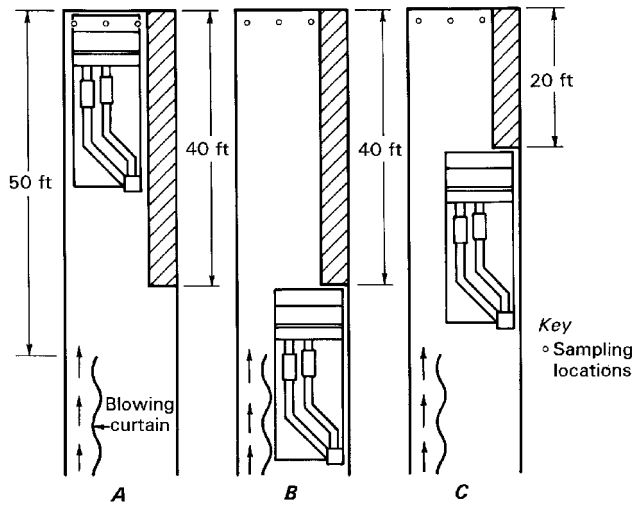

Figure 1.—Continuous miner in the 40-ft, two-pass, extended-cut sequence (A) at the completion of the 40-ft box cut, (B) at the start of the 40-ft slab cut, and (C) 20 ft into the slab cut.

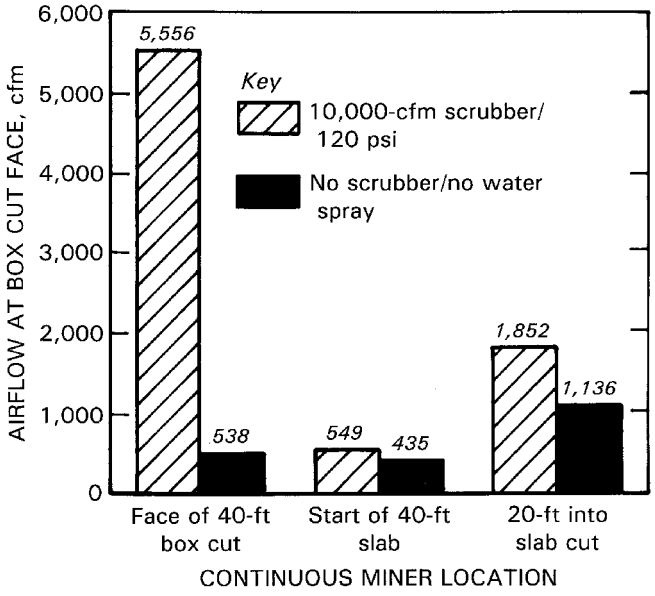

Figure 2.—Airflow to end of box cut for 10,000-cfm curtain with 50-ft setback.

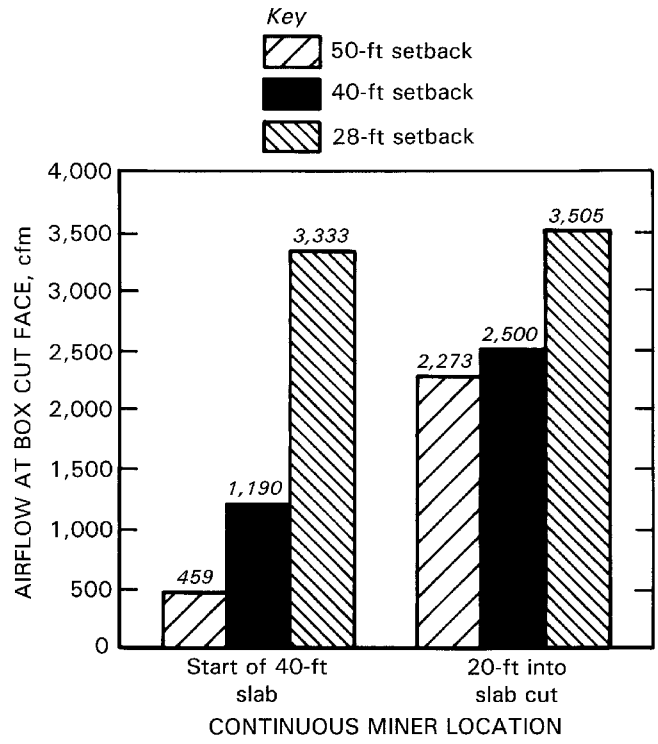

Figure 3.—Brattice setback effect for 10,000-cfm curtain/ scrubber flow and 120-psi water pressure.