Technology News

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Improving the Performance of Longwall Gob Gas Ventholes

Objective

Provide longwall operators with an alternative strategy for placement of gob gas ventholes to improve gas production.

Background

Longwall productivity has been increased by improvements in mining technology as well as by the mining of larger panels. Unfortunately, with these productivity improvements and the mining of deeper, gassier coalbeds, methane gas emissions can become a problem. Increased methane gas emissions are a safety concern and can also reduce productivity when mining is halted to allow gas concentrations to decline to statutory levels.

When ventilation alone is not sufficient to control high levels of gas emissions, methane drainage is often used as a supplementary control measure. Gob gas ventholes are the methane drainage method most often used on U.S. longwalls. The completion configuration and spacing of the holes on a longwall panel have generally been determined by trial-and-error experimentation. Once a completion configuration has been established, changes are rarely made.

The absence of fundamental scientific and engineering principles in the design and placement of gob gas ventholes can cause difficulties for mine operators when gas emissions increase because of a change in mine design or because variable geologic conditions are encountered. In an effort to improve on the trial-and-error method of designing and locating gob gas ventholes, the U.S. Bureau of Mines investigated the performance of such holes and how and why they work.

Monitoring Venthole Production

Long-term gas production was monitored on 61 gob gas ventholes on 5 longwall panels in a mine operating in the Lower Kittanning Coalbed, Cambria County, PA. Analysis of these data and associated drilling, completion, mining, and geologic information revealed that several factors influenced gas production rates and cumulative volume.

Low gas production was caused by drilling and completion practices such as cementing the casing after holes were mined through and failing to isolate water-producing zones from the gob gas-producing zones. Both of these practices resulted in the blocking of mining-induced fractures, which in turn impeded gas flow to the wellbore. On the positive side, gob gas ventholes on the ends of the panels generally produced the most gas, at the highest rates, for the longest time.

The enhanced performance for holes at the ends of the longwall panels is thought to be related to the behavior of the overburden as it subsides into the mine void. The central part of the panel experiences maximum subsidence and is a zone of compression in the overburden (figure 1). Mining-induced fracture permeability in the gob is reduced under these conditions, resulting in generally lower production rates for the gob gas ventholes.

Conversely, the strata overlying the ends and sides of a panel are draped into the maximum subsidence zone with partial support provided by the surrounding pillars of the development entries. Because of this support, overburden strata at the ends and sides of the panel are in tension for some distance into the panel, which results in enhanced mining-induced fracture permeability and, hence, the higher production rates observed for the centerline gob gas ventholes at the ends of the panel.

It appears that the current practice of placing gob gas ventholes along the centerline, where maximum subsidence occurs, is not the optimum for holes in the central area of the panel. Locating gob gas ventholes closer to the panel margin (figure 1), and in particular along the tailgate side where the mine's ventilation system would sweep gas toward the holes, would be a more advantageous practice.

Improving Venthole Production

An experiment to evaluate improving production from gob gas ventholes by placing the holes nearer the panel margin was conducted adjacent to the longwall panels where the gas production analysis had been done. The first five holes on the 216-meter-wide panel were drilled near the centerline, as a control against which seven near-margin gob gas ventholes could be compared. Owing to surface restrictions on drilling locations, the near-margin gob gas ventholes had to be drilled on the downdip headgate side of the panel instead of the more advantageous tailgate side of the panel. The seven near-margin holes were located 16.8 to 59.4 meters from the panel margin.

Over 7 months, the near-margin gob gas ventholes produced on average nearly 80 percent more gas than holes in the traditional centerline location on the panel (figure 2). In addition, three near-margin holes, positioned over the central portion of the panel, produced as much or more gas than did the centerline hole located at the start-up end of the panel. Four (57 percent) of the near-margin holes in the central portion of the panel actually remained in production for 7 months, whereas only two (40 percent) of the centerline holes produced for this length of time. In contrast, on the previous five panels, centerline end holes were predominantly the highest and longest gas producers.

For More Information

More information on near-margin gob gas ventholes is available in USBM Report of Investigations 9500, "Evaluation of Alternative Placement of Longwall Gob Gas Ventholes for Optimum Performance." Other applicable methane drainage techniques are discussed in USBM Information Circular 9395, "Methane Control for Underground Coal Mines." For a copy of these reports or additional information on this technology, contact William P. Diamond, U.S. Bureau of Mines, Pittsburgh Research Center, P.O. Box 18070, Pittsburgh, PA 15236, or telephone (412) 892-6551.

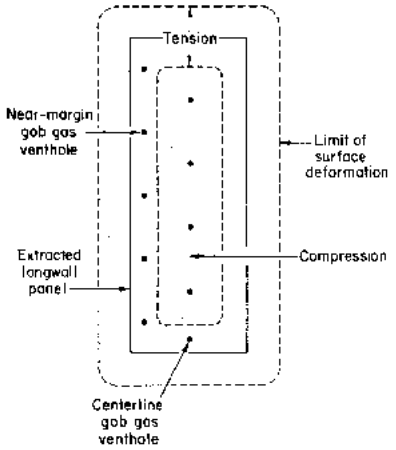

Figure 1.—Relationship of centerline and near-margin gob gas ventholes to zones of tension and compression associated with an extracted longwall panel.

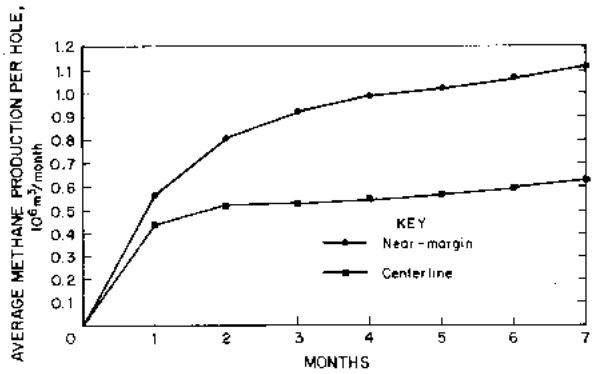

Figure 2.—Comparison of cumulative methane production for centerline and near-margin gob gas ventholes.