

Project Title: Control of Spontaneous Combustion Using Pressure Balancing Techniques

Organization: University of Utah Mining Engineering Department

Partnerships: (None)

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Focus Area: Safety

SYNOPSIS

Problem Statement and Justification: In the U.S., by law, worked out areas in coal mines must be either ventilated by a bleeder system or isolated by explosion-proof seals to exclude leakage flow. Experience has shown that seals are not airtight structures as such they allow some leakage of air into the gob. In fact, seals “breathe in and breathe out” with changes in barometric pressure. In some mines the gob is kept under negative pressure. Under these circumstances, an increase in barometric pressure may cause an influx of fresh air into the gob. This quantity may be sufficient to start the self-heating of coal and spontaneous combustion, with the possibility of a catastrophic underground fire.

Pressure differentials in the gob atmosphere can be controlled in several ways. One of the most straightforward is to use a positive pressure balancing system. By maintaining the gob at a pressure slightly higher than the barometric pressure, the ingress of oxygen to the gob can be reduced or eliminated, greatly reducing the risk of fires from spontaneous combustion.

Impact of the Research: Spontaneous combustion (sponcom) is a safety hazard frequently found in underground coal mines. If not detected in time, it can lead to mine fires and explosions. Low-rank coals, like those found in the western U.S., can self-heat and combust at temperatures as low as 95°F. Sponcom fires account for approximately 15% of the total number of fires recorded in the U.S. since 1990, and have claimed the lives of many miners. Two such events have occurred as recently as 2003, one in the U.S. and one in Australia. Pressure balancing is one proven way to control self-heating and the consequent fires in coal mines. An exhaustive laboratory analysis of pressure balancing techniques will lead to a thorough understanding of the method, so that technical guidelines for its implementation can be issued to the industry.

Objectives and Research Approach: The research will be accomplished in the following steps. First, ventilation surveys in two operating mines will be conducted at U.S. mines, one in the east and one in the west. These surveys will provide baseline data for laboratory work. Second, a lab model of a mine gob will be constructed. Third, the model will be fitted with an automatic pressure balancing system. Fourth, tests and experiments will be conducted with the model, and parameters for optimization of the pressure balance in the model will be determined. Finally, guidelines for the design and implementation of pressure balancing systems in operating mines will be prepared, reviewed, and disseminated to the professional and industrial communities. It is anticipated that this work will provide a basis for future research related to spontaneous combustion, mine fire detection, and mine fire control.