

Spotlight Topic: Pressure Balancing Techniques Used to Control and Prevent Spontaneous Combustion in Underground Mines.

Alpha Foundation Grant AFC113-12: Control of Spontaneous Combustions Using Pressure Balancing Techniques.

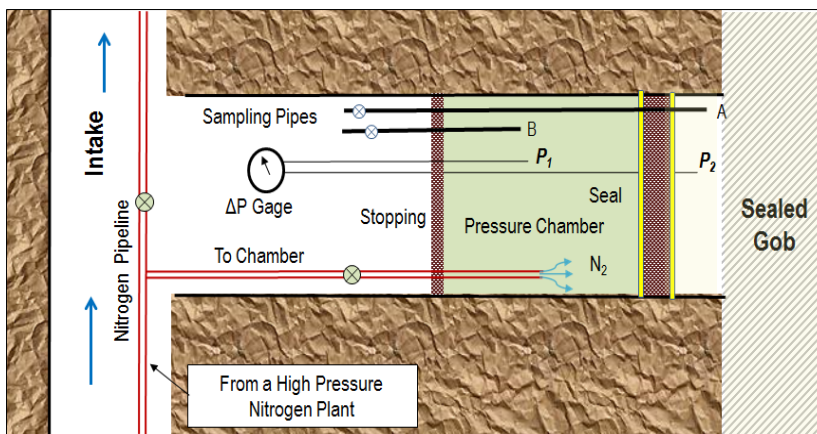
Contact Information: University of Utah, Dr. Felipe Calizaya, felipe.calizaya@utah.edu

The problem of spontaneous combustion (sponcom) has been associated with the coal mining for many years. It is estimated to be the cause of more than 20% of coal mine fires. Some of these fires continue for a long time and result in a heavy toll in terms of injuries and fatalities to mine personnel, expenses incurred in attempting to extinguish the combustion, and loss of production and machinery. In longwall mines, fires usually start in the gob areas that are not easily accessible. Pressure balancing is a ventilation technique that can be used to reduce or eliminate the ingress of oxygen to the mine gob, thus reducing the risk of sponcom fires.

The University of Utah conducted research funded by the Alpha Foundation to evaluate various pressure balancing applications for preventing spontaneous combustion. The main objective of this research was to construct a physical model that can be re-arranged to mimic nearly any type of ventilation system used in underground coal mines. Thus constructed, the model was calibrated against data collected from operating mines. After the model was found to be well correlated to a given configuration, a specific pressure balancing technique was applied to the gob areas to reduce pressure differentials, which in a mine would reduce the risk of sponcom.

There are two types of pressure balancing systems: passive and active. **Passive pressure balancing** is achieved by changing airway and regulator resistances or changing the fan duty. It is used when moderate pressure differences across the gob are expected. **Active pressure balancing** is achieved by

using an external pressure source, usually in the form of inert gas such as nitrogen that is injected to the chambers in a controlled manner. It requires the construction of pressure chambers, monitoring and evaluating of pressure differentials across the stoppings, and pressurizing the chamber when required. Active pressure balancing is used to overcome large pressure differentials.



Several laboratory experiments were conducted using both passive and active pressure balancing techniques. The results of these experiments showed that pressure balancing can be used effectively for control of spontaneous combustion conditions in U.S. coal mines, especially in sub-bituminous coal mines. However, such use will always require a thorough evaluation of the coal characteristics, the geologic properties, and the propensity of coal to spontaneous combustion. Further physical and in-mine modeling studies are recommended to more accurately investigate the effects of a large pressure chamber on the pressure-balancing system.