Innovations in Underground Mining Ventilation

Ventilation on Demand

Ventilation on Demand (VOD) is a significant advancement in underground mining ventilation systems. VOD systems employ a series of sensors distributed throughout the mine that send real-time information regarding air quality, vehicle use, and personnel to a central computer with specialized software. This technology system, combined with adjustable fan and louver controls, creates a highly adaptable ventilation system capable of substantial energy savings while maintaining air quality standards. VOD systems have successfully been implemented at mines in Ontario and throughout Canada resulting in reduced environmental footprints and substantial energy cost savings.

Resources:

- Ventilation on Demand Project Presentation – CEMI, 2010
- Air Supply on Demand – Krystyna Lagowski, 2013
- Nickel rim South Mine's Ventilation on Demand System Presentation – Glencore
- Goldcorp Éléonore: Building the Connected Mine Video – Cisco, 2015

Air Quality Stations for Deep Mining

The introduction of digital sensors capable of surface calibration allows for a safer underground mining environment. The air quality stations are capable of being swapped rather than undergoing time consuming recalibrations underground. This allows for less downtime and increased productivity while ensuring safety. The air quality stations form an important component of innovative ventilation systems for underground mining.

Resources:

- Mines embrace air quality monitoring solution – Norm Tollinsky, 2013
- Ventilation: Maestro solution keeps miners safe using IoT sensors – Canadian Mining Journal, 2016

Thermal Management

Underground mining operations rely on ventilation systems to ensure adequate heating and cooling throughout varying seasonal conditions. Through a natural heat exchange, heat or cold is captured and stored underground for use at a later point to meet ventilation needs. Heat exchanges can eliminate or reduce the need for mechanical refrigeration resulting in significant cost savings. Vale's Creighton mine utilizes an ice cavern system and is an example of heat exchange ventilation in Ontario.

Resources:

- Vale Inco's Creighton mine: Digging deeper by the day – ViewpointMining
- Heat Transfer Analysis of Large Scale Seasonal Thermal Energy Storage for Underground Mine Ventilation - Seyed Ali Ghoreishi-Madiseh, et al., 2015
- Improved Thermal Mass Utilization Decreasing Applied Ventilation System Energy Intensity – UDMN, 2016

Hydraulic Compressed Air Cooling

Hydraulic compressed air was historically used for large scale compressed air in mines throughout the world. An innovation currently in the demonstration phase has modernized the technology to provide cooling for deep mines in addition to compressed air. The innovative technology has the potential to provide low cost compressed air and cooling to deep mines. Currently, a demonstration project is underway within a mine shaft in Sudbury.

Resources:

- Introduction to the HAC Demonstrator Project Presentation – Dean Millar, 2015
- Hydraulic Air Compressor Demonstrator Project Video – Dean Millar, 2017

Electric Mining Vehicles

Electric mining vehicles are an important mining innovation with substantial implications for ventilation. With advances in battery technology moving at a rapid rate, electric mining vehicles are increasingly regarded as cost-effective and environmentally preferable alternatives to underground diesel vehicles. Electric vehicles reduce emissions and heat in the underground mining environment thus reducing ventilation requirements. Several mines in Ontario have piloted the use of electric vehicles or have plans to deploy electric vehicle fleets in the future.

Resources:

- How Batteries are Lowering the Costs of Underground Mining - Michael Allan McCrae, 2016
- The Electric Underground Mine – Ian Ewing, 2016
- Canada's Goldcorp to Make Borden an All-Electric Mine - Cecilia Jamasmie, 2016
- Why Electric Mining Vehicles are Starting to Take Off - Teemu Ronkainen, 2016