The Australian Mine Ventilation Conference 2017

Paper Number: 30

Application of modelling to improve ventilation and gas management in a single entry longwall panel

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ABSTRACT

Ventilation modelling is used to evaluate ventilation system performance and this paper describes modelling used to assess the potential benefits of changes to a single entry longwall ventilation circuit to improve ventilation and gas management. The longwall panel is extracting a 215 metre face in the 1.5 metre coal seam at a depth of 900 to 1000 metres below surface. The 1.5 metre B seam is located approximately 25 metres below the main 3.0 metre A seam and the gas content of both coal seams is approximately 20 to 25 m^3/t. The B seam is extracted prior to the A seam and the mine relies on fracturing of the overlying strata to induce gas emission from the A seam as a means of reducing the gas content of this seam prior to mining. Longwall operations in the B seam are constrained by limited ventilation and high gas emissions. Due in part to statutory limits on gas concentration and air velocity, the average longwall production rate is approximately 700 tonnes per day.

Gateroads in the B seam are single entry, developed using road headers and supported with steel arches. Additional timber cog support is installed in an attempt to reduce roadway closure due to abutment loading. Due to the slow advance of gateroad development, mine management were reluctant to consider significant mine design changes, such as two heading gateroads, therefore the investigation focused on determining the extent to which ventilation and gas emission impacted on longwall production performance and recommending short term, low-cost actions to improve ventilation and gas management to support increased longwall production.

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Paper Number: 22

Ventilation design rules of thumb – friend or foe?

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ABSTRACT

There are several long-standing rules of thumb that will usually be quoted in a mine ventilation study. They include optimum airway design air velocities and the critical upcast air velocity range that must be avoided to prevent a water blanket forming. Quoting these rules of thumb may lend a veneer of legitimacy to a ventilation design and allow the design engineer to avoid having to study a problem from first principles. But how valid are these long-established shortcuts in today's fast evolving industry? This paper summarises research into the genesis of several commonly quoted rules of thumb. It finds that they were very specific to the local practices and economics at the time when they were developed. It also presents examples where applying these rules of thumb outside of their original context can lead to unexpected and erroneous results.

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Paper Number: 54

What is the impact of using traditional diesel dilution factors for mine ventilation design?

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ABSTRACT

The primary mine ventilation and cooling infrastructure along with their associated capital and operating cost ultimately depends on the amount of airflow allocated to the underground mine workings. This airflow allocation depends on the type and level of hazards that will be encountered plus other operational considerations. The hazards arise from dust, gas emission, heat, fires, explosions and radiation directly impact the airflow estimates. The operational considerations include nuisance dust, visibility and blast fume clearance.

In the majority of mechanized hard rock mines the dominant factor that determines the airflow requirement is either diesel fleet exhaust fumes or heat. The diesel fleet also represents one of the biggest heat loads underground mine and is therefore critical both from a diesel dilution and heat management perspective. Hence the increasing interest in electrification of future mines.

Airflow estimates for mechanized mines in Australia and around the world are traditionally based on diesel dilution criteria. These dilution criteria are legislated in some parts of the mining industry and in other parts of industry a risk based approach is followed. Where a risk based approach is followed the dilution rate is set by the owner. Ventilation practitioners would traditionally default to $0.05m^3/s$ or $0.06m^3/s$ per rated kW in the absence of any specific regulations. There are also various ventilation strategies such as parallel and series ventilation that has a direct bearing on ventilation infrastructure and air quality. A greater emphasis is also placed on series ventilation to maximize available air and concepts such as ventilation-on-demand directing air as required both gaining greater attention to increase air utilization.

In an industry that is severely capital constrained, and with ventilation infrastructure a major cost component, there is increasing pressure on mines to have larger diesel fleets with less air. Designs based on traditional rule-of-thumb dilution criteria are perhaps no longer sufficient motivation for investment decisions. There is a greater need for decisions makers to fundamentally understand the risk implications of different ventilation designs. This paper explores the implications of different diesel design criteria and ventilation strategies on the CAPEX and OPEX of a typical mine that employs a trucking decline. It also discusses qualitatively the occupational and operational risks associated with the different approaches.