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Reducing risks due to rockbursts: strategic financial considerations

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ABSTRACT

Gold mines in the Far West Witwatersrand area experience frequent mining induced seismic events due to dynamic stress changes associated with the depth and extent of mining. Some of these seismic events result in rockbursts, of varying magnitudes, in access tunnels. Geological structures, mine design layout and support system design influence the magnitude of a rockburst damage in an underground excavation. Support systems are the last line of defence and are effective in environments where the mining layout is optimised for dynamic stress changes.

The objective of this research is to determine the financial value energy absorbing support systems add to a rockburst prone well designed mine. The research focuses on quantifying indirect consequences of rockburst risk using an Excel model developed as part of this research. The model has three versions, each targeting a specific user. The model is used to evaluate the financial benefits of different support systems in access tunnels prone to seismicity and possible rockbursts. Executive management can use the Executive spreadsheet of the model to facilitate proactive rockburst risk management.

Four case studies were evaluated in detail, and the results indicate production loss is the major source of quantifiable financial loss after a rockburst. The tunnels were supported with variations of rigid support systems, even though energy-absorbing support systems were the most suitable for dynamic loading conditions, and were likely to have contained the rockburst events. This is because energy-absorbing support systems are viewed as an unnecessary expense. However, the “extra” cost of energy absorbing support system, as a strategy to minimise effects of rockbursts, will almost always create better value than the less expensive rigid support. This extra cost can be significantly reduced by increasing the spacing between yielding tendons in an energy absorbing support system. In conclusion, it is strategic for rockburst prone mines to install high quality yielding support systems as they have the potential to create substantial long term value for the mine.