

Risk Analysis of Ventilation Design Approaches for Mines Operating in Kazakhstan

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ABSTRACT

Underground mine ventilation system design in Kazakhstan is based on standards and regulations approved in early nineties of last century, which were adopted yet from Soviet era normative. Those normative are not up-to-date and utilise standards for outmoded equipment. Problem is that if to follow this normative, ventilation system utilise unreasonably high energy consumption at a time when fans operate none efficiently. The aim of this study is to analyse financial risks associated with use of outdated standards for modeling ventilation systems in Kazakhstan's operational underground mines.

In this case study a zinc-lead mine has been examined in terms of its initial ventilation network design which has been produced in compliant with Kazakhstan's mine ventilation normative. Further ventilation modeling took into account worldwide standards considering the main aspects required for estimation of airflows quantity and quality. Financial analysis has been produced with inclusion of capital and operational expenses for both options: for the initial ventilation system and for the optimised ventilation system based on general worldwide standards. Fit comparison for number of risks occurring at use of outdated standards has been produced in terms of potential impact on ventilation expenses. Comparison analysis of Internal Rate of Return ('IRR') for the initial ventilation and the optimised ventilation has been carried out. Financial model utilise stochastic modeling with various economic variabilities.

As result the optimised ventilation system demonstrates probability distribution with stronger confidence level for receiving higher IRR than the initial ventilation network. Performed risk analysis recommends implementing updated standards for Kazakhstan's mine ventilation network modeling and design which will improve mine safety and save energy costs. Results of this study could help to analyse ventilation efficiency in agreement with underground mine safety regulations and low operational costings.