Understanding the causes of dilution in narrow vein stopes

S Ricketts[1], S Thomas[2] and R Hassell[3]

1.Geotechnical Engineer, Northern Star Resources, Kalgoorlie WA 6433.
Email: sricketts@nsrltd.com
2.Group Geotechnical Engineer, Northern Star Resources, Subiaco WA 6008.
Email sthomas@nsrltd.com
3.Technical Services Superintendent, Rio Tinto, Argyle WA 6743.
Email: Rhett.Hassell@riotinto.com

ABSTRACT

Northern Star Resources (NSR) operates several operations utilising narrow vein stoping operations in the Kundana area. Stope dilution performance is variable across these operations, with unplanned dilution reducing individual stope economic viability, increasing risk to personnel and machinery operating in and around the stope and delaying the overall stoping sequence. Technical investigations were undertaken to objectively understand the variables which had the largest impact on stope performance and then use the findings to help develop mining strategies to reduce dilution. A stope reconciliation process was developed to compile key stope performance information such as stope design parameters, geotechnical and drill and blast factors. These were compared against the measured dilution. Production targets necessitated a high turnover of stopes in the operations, and hence a requirement for an expeditious process and mine design software with automated tools.

The output of these results, together with numerical variables from geological, geotechnical and drill and blast data were analysed via multivariate regression. The analysis identified the factors with the greatest influence over stope dilution, and a forecast model was consequently created. Confidence was gained in the model when the subsequent stopes performed in line with prediction. Different drill and blast designs were subsequently trialled and found to reduce dilution.

The model was then updated with the new practices, facilitating further regression analysis to identify revised key controlling factors. The subsequent production results however, displayed a poor correlation with the prediction from the revised model. Inconsistencies in drill and blast designs and execution were identified as key factors in the dilution performance. This was an important finding as the correct implementation of the design is critical and this has become a key focus for future stoping. Overall the technique presents an objective process to identify causal factors of stope dilution resulting in improved economic metrics for stope production. The process will be applied to other similar Northern Star operations.