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Evaluating the viability of pumpable emulsion explosives for use in narrow reef mining operations

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2015-05-12
http://hdl.handle.net/10539/17728

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Abstract

Pumpable emulsion explosives have been available to surface and underground massive mining operations for decades and through their unique properties offer significant advantages through improved safety, reliability and performance. Despite their advantageous properties the benefits of pumpable emulsions have been unavailable to narrow reef mining operations due to the void in technology necessary for their successful implementation within the challenging environment.

The purpose of the following research report is to evaluate the viability of pumpable emulsion explosives for use in South African narrow reef mining operations. By approaching the problem from multiple perspectives, this research report aimed first to propose a theoretical framework and suite of equipment suitable for the implementation of pumpable emulsions within the narrow reef environment. Through the development of this equipment, controlled tests could be undertaken on the proposed narrow reef emulsion formulations and pumpable emulsion technology to obtain the necessary understanding of the performance of the system under controlled conditions. Once an understanding had been obtained for the controlled performance of the system, a field study could be undertaken in order to compare the performance of the new pumpable emulsion system with available explosives within the underground mining industry. Through the results obtained a comparison could be made of the blasting efficiency and feasibility of pumpable emulsions when compared to existing explosives within the narrow reef environment.

Given the vast difference in underground narrow reef and massive mining operations, fundamental changes were necessary with regard to emulsion technology prior to the successful implementation of the narrow reef emulsion system. Following the development of the system, controlled explosives tests allowed for optimisation of the pump technology as well as recommended daily practices. Blast results achieved in field trials with the narrow reef emulsion system allowed for improved blasting efficiency while reducing explosives costs per tonne broken. While blast results and efficiencies improved throughout pumpable emulsion trials, variances in daily blasting practices including the use of stemming, overcharging and varying priming practices influenced the results obtained. Further testing is therefore recommended in order to determine the influence of variables on the results obtained such that a specific increase in blasting efficiency can be determined.