The Situation

Sons of Gwalia’s Greenbushes Mine had been recovering tantalum and tin minerals from the upper weathered zone of the Greenbushes pegmatite for the previous 25 years. A new treatment plant was constructed in 1992 in order to treat the deeper unweathered pegmatite ore. Ore production was set to double and the existing rates, the primary crusher was under-utilised. Which meant, that at future rates, the primary crusher would be operating very close to its rated capacity. Therefore, there is benefit in optimising the muckpile fragmentation to improve crusher performance.

Mining Issues

Initially the tantalum ore is blasted and selectively mined by a contractor using conventional hydraulic excavator and trucking methods. A previous increase in powder factor had resulted in anecdotal improvements in the mining and crushing processes. This lead to the consideration of further blast improvements for further incremental gains.

The Crusher Feed Optimisation project described in this Case Study began, after Sons of Gwalia and Orica agreed on the project scope, with the objective of characterising the ore fragmentation achieved under different blasting regimes and linking this to the performance of the downstream comminution processes.

Technical Solutions

Ore was stockpiled at the crusher depending on grade, this resulted in up to nine tantalum stockpiles. A front end loader was used to feed the crusher from the stockpiles, blending on a bucket by bucket basis to maintain grade. Therefore dedicated stockpiles were required to isolate the trial material for campaign crushing and measurement. The stockpiles were built to meet the mine’s grade requirements.

The project sought to measure the effect of changing a single blast variable, on a number of processes in the mining and comminution chain. A large number of other variables influence these processes, and wherever possible these were controlled. Where a major variable could not be controlled, its influence was either diluted by effective sampling or the variable was measured so its influence could be noted in the outcome.

The main measurements undertaken were:

- Ore characterisation
- Blast Loading
- Excavator Productivity
- Muckpile Fragmentation
- Crusher and Mill feed and product size distributions.
- Crusher and Mill Throughput and Energy Consumption
- Recovery

Results

The results showed that Orica could improve the excavator productivity, ROM fragmentation, and crusher and mill throughput through changes to blast design.
Orica also established that:

No detrimental effect was observed in mill discharge size distribution or the primary tantalum plant recovery due to the improved throughput. The extra cost of the new blasting regime could be offset by direct savings in power consumption, primary crusher liner wear, rock-breaking, load and haul costs and improved throughput of the crusher and tantalum plant.

Acknowledgments

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