Site Profile

Carmen de Andacollo is located in Region IV in central Chile at an elevation of 1,000 metres, approximately 350 kilometres north of Santiago and 100 km from La Serena City, near the southern limit of the Atacama Desert. Andacollo is an open cut copper mine that produces copper cathode through leaching operations.

The Situation

Andacollo was experiencing problems with fines materials on their leach pads. The fines materials (<100 # Ty) can reach up to 13% in the stockpile after the tertiary crusher. Fines significantly affect copper recovery in leach pads: ± 1% fines = ± 1.5% Cu recovery (Actual recovery 70%). The mine historically has managed the issue of fines with a special program of ore extraction that supports crusher feeding with a blend of different quality geotechnical material. However in the future development of the mine, the major area of extraction is in supergene materials which are known to produce significant fines.

Andacollo mine needed to process these supergene materials for 2 years before implementing a new plant process utilising flotation.

Andacollo requested Orica to develop a proposal to reduce the fines through a Blast Based Services (BBS) project. The BBS team developed a Fines Control for Supergene Materials program and in conjunction with Andacollo established a joint project team to ensure the project’s success.

Technical Solutions

Orica developed an extensive program of research in Andacollo mine. The general objectives were:

1) To recognize rock mass properties that control fines generation

2) Associate the rock mass properties with % of fines and create a technical tool for prediction of the fines materials

3) Develop new D&B design for fines control minimisation.

Detailed ore characterization of hydrothermal alteration in blastholes was developed in zones of advanced argyle and quartz-sericite/sericite-quartz alterations; analysis was carried out by X-ray diffraction techniques. When the base line was created, the next step was modeling a new design for drilling and blasting. This design needed lower energy explosives (Flexigel™ 60 – Flexigel™ 110) to reduce the crush zone and altered timing design for inter-hole and inter-row, using the i-kon™ Electronic Blasting System.

These products in conjunction with the information from the drilling process enabled blast designs to be
implemented that reduced the percentage of fines produced from blasting in the Andacollo mine.

The Result

Once the bulk explosive was changed to variable energy Flexigel™ and using the i-kon™ electronic blasting system, the % fines (<# 100Ty) in the post blast material in Phase 15 reduced from 11.3% down to 2.6%. A similar effect was measured in the crusher process with values reduced from 3.2% down to 1.8% for the phase 15 (<# 100Ty).

The % of fines <# 100Ty measured in Phase 15 with bulk ANFO showed how the processes of transport, loading and crushing generates the largest amount of fines in the mine-plant operations. When the amount of fines material in blasted muckpile was compared against the fines material after the crusher it was found that the fines material increased 127% for the Phase 12 material and 282% for Phase 15.

Results showed the amount of sericite mineral controls the fines generation in quartz-sericite alteration zones. At the same time the presence of different clay minerals in argyle alteration zones do not apparently have direct control of fines generation. Finally, drill parameters (penetration rate) showed that geotechnical properties of the rock mass are more important in argyle zones than the alteration mineralogy.

It was found that fines were generated in the Copper supergene materials by the use of high density explosive (for this kind of rocks) and that the energy imparted on the rock mass pre-conditions post-blast materials and causes increased fines generation in downstream processes.

The use of lower energy Flexigel explosive has permitted a decrease in fines by 13 wt% and 50 wt% in blasted piles and stockpiles respectively.

This project enabled Andacollo to maintain continuous operations in the lead up to the establishment of new processing infrastructure.

Testimonial

Andacollo acknowledged the efforts of Orica Mining Services Blast Based Services in improving recovery through reducing fines. A joint paper was presented in EXPOMIN in Chile.

Acknowledgements

Orica Mining Services to acknowledge support of Andacollo. In the Fines Control for Supergene Materials project