Mining Magazine

IPCC- So where's the grade control?

The addition of in-pit crushing and separation techniques is helping to take IPCC to the next level. Carly Leonida investigates with the help of feed-analysis expert Scantech

A Scantech Geoscan in an iron ore application

Processing > Comminution

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Carly Leonida

IPCC by its very nature means putting ore and waste onto a conveyor sooner to remove mined material from an open-pit operation. After blasting, the material is picked up by a loader or shovel and is usually fed to a crusher or sizer before being conveyed out of the pit. This provides a great opportunity to measure feed quality in real time on the belt to ensure that it has been correctly allocated as ore, low-grade material or waste.

Scantech's Geoscan-M elemental analyser uses transmissive (PGNAA) multi-elemental, non-contact, continuous analysis of the flow (i.e. full conveyed flow analysis, not just partial surface measurement), with results reported every two to five minutes. Data from a belt weightometer and moisture monitor enables a tonnage-weighted average dry weight percent for each element to be reported.

Any material that is incorrectly allocated can be diverted to the correct destination at the end of the conveyor. Changes in feed quality from one ore zone to the next can also be detected, particularly if mining near an orebody boundary or different geometallurgical domain.

Depending on the flow rates on in-pit conveyors, the measured increment could be a smaller tonnage than that moved by a haul truck, providing a unique bulk-sorting opportunity and improved grade discrimination.

Low-grade material can be stockpiled and fed through a particle sorter to upgrade it to above the cut-off grade before it is sent to the process plant, and ore can be blended so that the plant receives a consistent feed quality; this alone would improve metal recovery.

Process optimisation

Process plants may use mainly dry processes depending on the commodity and ore grade. Iron ore, for example, can occur in orebodies with zones of higher and lower quality. The higher-quality zones could be used as direct shipping ore (DSO), which requires only screening and stockpiling before export, while lower-grade ore may require beneficiation.

Geoscan on-belt elemental analysers are currently being used for diverting DSO-quality ore to bypass beneficiation while lower-quality material continues to the plant for upgrading. At one site, a Geoscan on an overland conveyor diverting DSO-quality material has saved a company over US$7million a year in unnecessary beneficiation costs, indicating a payback of just a few weeks.

Over 30 Geoscans are used in the South African iron-ore sector by AngloAmerican (Kumba Iron Ore) and Assmang in such applications. They are also used in the manganese industry there. The analysers provide real-time grade data that is not only used for process plant control but also for ore reconciliation, elemental balances and stockpile management.

Other Geoscan users include Rio Tinto Iron Ore and Fortescue Metals Group in their Western Australia operations. These applications set an appropriate precedent for the use of the technology in IPCC.

A number of Geoscan analysers are planned for an iron-ore IPCC project in development. Geoscans would be used for real-time grade measurement on the conveyors from the in-pit crusher to help detect major quality changes and

correctly allocate the conveyed material to high-grade, low-grade and waste stockpiles.

Geoscans would also be used for monitoring the product quality after blending to ensure that the required composition is to target and to measure the product quality loaded onto each train. While not used to certify the quality of the shipments, the analysers would provide a high level of confidence that quality is within the expected target range by the time the train is fully loaded. Corrective actions could then be taken to adjust the product quality by modifying the blend if required.

For flotation circuits, in-pit grade measurement is beneficial as it alerts process operators to feed-quality variability well before it enters the grinding and subsequent slurry circuits. This provides opportunities to proactively manage grinding through measurement of material hardness and grindability indicators such as silica content, and the mill feed rate can be adjusted accordingly to optimise grinding performance.

Careful monitoring of changes in material composition can also enable timely changes in reagent dosing regimens to maximise metal recovery and minimise concentrate contamination through higher than expected deleterious components such as pyrite, arsenic or talc in the plant feed.
Instead of making these changes in response to slurry-analyser results, they can now be pre-empted and the lag time associated with implementing the changes (from a few minutes up to an hour) no longer reduces the efficiency of the flotation process.

Geoscan in action

MMG's Sepon copper-gold mine in Laos uses the Geoscan analysis of its mill feed to optimise plant performance. The copper measurement is used to control the ore blend every half hour from stockpiles being fed into the crusher. This ensures the leach circuit capacity is optimised.

The iron and sulphur measurements help control the pyritic content in the feed blend, and the calcium and magnesium measurements indicate the presence of acid-consuming carbonates in the ore feed, which is used to control and maintain the correct pH in the circuit. Initial payback was estimated at two months based on the copper blending control alone.

Glencore also uses a Geoscan for zinc-lead ore quality measurement at its Mt Isa operations to help control its heavy medium plant operations.

Enter IPCS

Grade telemetry in the pit to improve grade control was a feature of a keynote address to the Canadian Mineral Processors conference in Ottawa in January 2015, delivered by Joe Pease, CEO of CRC ORE.

CRC ORE promotes the adoption of in-pit crushing and separation (IPCS) to exploit the natural heterogenity of orebodies. Pease said that each handling step should be regarded as an opportunity to separate low-grade material before it is mixed through the ore stream.

The earlier removal of waste will reduce consumption of energy, water, grinding media and reagents. It will also free up plant capacity for more valuable ore, effectively increasing plant feed grade and site productivity.

The enabling step for this productivity increase is real-time sensing at ore handling or transfer points – even on two-minute increments – and either implemented alone or in conjunction with other processes such as particle sorting.