## Fit-for-Purpose Grade Analysers Assist Leading PGM Producer to Improve Recoveries

State-of-the-art grade analysers are assisting Northam Platinum to significantly improve platinum-group metal (PGM) recoveries at Booysendal North UG2 mine in the Bushveld Complex.

Recent investigations at the operation confirmed that Blue Cube Systems' grade analysers have reduced the response time of the mass-pull controller in adapting to variations in head-grade by providing up-to-date and relevant set-points.

The studies were undertaken by Northam Platinum, Mintek and Blue Cube Systems, a leading South African specialist in real-time in-line instrumentation for minerals processing.

At Booysendal North UG2 mine, the varying head grade is as a result of waste dilution that is caused by the introduction of room-and-pillar mining methods.

Head grade varies by between 2,14g/t to 3,07g/t over 100 days, and is fed to the surface for further processing in the concentrator. Delays in adjusting the mass-pull controller resulted in very high concentrate grades, while sudden declines in the head grade were the cause of a concentrate of below 130g/t, which is lower than the limit required by the receiving smelter.

The mass pull is controlled by adjusting the flow set-point on the concentrate pump. Pump speed controls the concentrate flow rate according to the flow optimiser, and the level in the sump is administered by adjusting the float cells' air and level optimiser set-points.

When the calculated mass pull is low, the concentrate flow set-point is increased, and flow rate is constantly adjusted to ensure the targeted mass pull and recovery.

Blue Cube Systems' optical measurement technologies have been installed in the main process line and are being used to provide the real-time elemental input required by the process controllers to optimally control the grade.

The high success rate of the grade analysers at Booysendal North UG2 can be attributed to a number of factors. This includes their representation of the actual process stream for which measurement is intended and a providing fast measurement response time of less than 30 seconds

The grade dynamics of the measured process stream is accommodated by the frequency at which a new data point is made available by the analyser.

This eliminates temporal aliasing when the frequency of measurement is slower than the grade dynamics of the process that is being studied. Infrequent measurements can compromise control, as well as the response time of the system in grading set-point changes and load disturbances.

Importantly, Blue Cube Systems' grade analysers are precise, providing a consistent reading for the same sample. They also facilitate the optimal conversion of digital data for interpretation by the programmable-logic controller.

The investigation at Booysendal North UG2 has also validated that precision of measurements overrides absolute accuracy in process-control applications, while providing critical insights into the effect of measurement delays.

Optimal control relies on measurement with a minimal time delay, while being precise enough to provide trending data about the current operating point. Accurate measurements are desirable; however, they can be effectively dealt with in a reasonable operating region.

Meanwhile, grade measurements with short time delays provide a distinct advantage, in terms of the control effort that can be applied to the process, while maintaining stability. In theory, 20 times the control effort can be applied to a process with a 15-second measurement time delay versus one with a 30-minute time delay.

The process takes longer to achieve a steady state in instances where long measurement delays are experienced. In practise, measurement time delays in the order of 15 seconds are only possible with optical in-line measurement techniques, with longer measurement times typically being associated with multiplexed elemental analysers. Optimising sample collection intervals have also played a part in the successes achieved thus far.

Optical analysers operate independently of the sample-management process before measurement and, because they are installed inside the process line, they can only be repaired during plant shut downs. Blue Cube's purpose built and field proven build quality, as well as Blue Cube and Booysendal's sound proactive maintenance of the hardware and software has ensured high availability of the grade analysers.

Blue Cube is constantly refining its interface with the slurry stream to minimise any abrasion-related risks and to reduce maintenance intervals.

Blue Cube Systems has witnessed an increase in demand for its solutions to high concentration grades as more mines turn to automation to improve safety, increase efficiencies and reduce costs.

Based on a Technical Paper presented at Flotation 17 Grade analyser success factors: What is good enough for process control?

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