

Remote monitoring and diagnostics to improve process performance at AngloAmerican Platinum

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The Stone Three Digital remote monitoring and diagnostic (RM&D) service aims to deliver actionable advisories to clients to improve their process productivity, based on data mining activities performed on process historian data and augmented by process expert interpretation. The objective is to provide the client with quantifiable benefits by empowering their personnel and operations through RM&D services and technologies. The RM&D service is provided by Stone Three Digital's experienced professional services team which comprises of specialist process engineers with postgraduate data analytics training who work in close collaboration with site. Core to the service is the link between Stone Three Digital data analyses skills, process knowledge, and site interaction. The RM&D technology includes the use of a RM&D platform and advanced data analytics tools.

The RM&D service has provided tangible benefits to three of AngloAmerican Platinum's operations through, for example, automated flotation health notifications, oscillation detection and root cause analysis, control performance monitoring for prioritized instrumentation maintenance recommendations, and more.

Automated flotation health notifications are implemented at two concentrators. Process data (e.g. milling variables; flotation cell agitator variables; froth appearance, velocity and height variables) are ingested by a real-time data analytics workflow which classifies the froth of different cells into one of six categories (normal, below lip, sliming, overly stable, high or collapsed). When a cell has been in an abnormal froth state for an unacceptably long period of time, an automated notification is generated and sent to appropriate plant engineers, with the required context in order that appropriate remedial action can be taken. Further work is being done to incorporate such notifications in automated advanced process control. Based on historical analysis of notifications generated in 2019 on one of the concentrators, a potential recovery improvement of 0.8% could be enabled by these automated flotation health notifications.

Automated or on-demand oscillation diagnosis analytics are implemented at three concentrators. Undesirable, persistent oscillations in multiple flotation circuit variables can arise, propagate and increase in magnitude due to material recycle as well as regulatory control (feedforward and feedback). Once oscillations have propagated to most variables in a flotation circuit, it is difficult to determine and eliminate the root cause. Such unwanted oscillations can have a negative impact on mass pull, recovery and grade. The oscillation diagnosis analytic automatically detects which process variables show undesirable oscillatory behaviour of similar frequency, ranks these process variables according to closest to the root cause, and highlights the specific start and end times of the oscillatory behaviour. Subject matter experts in the RM&D team can then investigate these results to determine a root cause and appropriate remedial actions. Based on historical analysis of an incident that was picked up by this analytic,

remedial actions (i.e. changing controller limits and recommending pump sizing changes) could be suggested. Such oscillation diagnosis with appropriate remedial action may reduce unwanted variation by 85% in terms of standard deviation of concentrate pump flow rate.

Automated control performance monitoring descriptive analytics are implemented at three concentrators. Control performance for a specific process section (e.g. flotation) is assessed in terms of a specific control performance metric per control loop (e.g. percentage control error), summarised by the percentage of time that control loops have spent in a different control performance states (e.g. a good state is defined as smaller than 5% control error, while a bad state is defined as 5% or greater control error), and accompanied by the top worst performing loops of the current period. This information is used by process service engineers in the RM&D team to diagnosis abnormal control issues and determine appropriate remedial action (e.g. instrumentation maintenance prioritization, controller retuning, set point adjustment). An example of the impact of such control performance monitoring at one concentrator is an improvement of bad to good states month-to-month from 9 to 17 out of 30 control loops.