

Continuous Monitoring of Uranium in Mining Water – Case Study at Gold Fields’ South Deep mine in South Africa

Customer: [Gold Fields Limited, Sandton, Johannesburg, South Africa \(Corporate Office\)](#)

Application: [Continuous On-line Monitoring of River Water for Uranium Concentrations](#)

About Gold Fields: Gold Fields is a globally diversified producer of gold with eight operating mines in Australia, Ghana, Peru and South Africa with attributable annual gold production of approximately 2.0 million ounces. It has attributable Mineral Reserves of around 46 million ounces and Mineral Resources of around 102 million ounces. Attributable copper Mineral Reserves total 532 million pounds and Mineral Resources 5,912 million pounds.



GOLD FIELDS



Gold Fields South Deep Mine

ANDalyze Technology: ANDalyze offers products for testing water contamination using catalytic DNA technologies. The company has developed a methodology for detecting and quantifying chemical levels in public drinking water supplies, industrial water operations, mining water management, and environmental waters, including sea water. More details on the technology and its applications can be found at www.andalyze.com.

Problem/Concern: Mining applications typically require high volumes of water for various operational aspects, including extraction and processing. While some of the water may be recycled and reused, a significant amount is lost during the mining process, and operations often require additional volumes. At Gold Fields’ South Deep mine, south of Johannesburg, it was determined that the optimal source for this additional water was a nearby stream, which primarily consists of discharge water from a neighboring mine. This water contained levels of dissolved uranium in the parts per billion concentration range that needed to be monitored to comply with existing local discharge regulations. It has therefore become necessary to continually monitor uranium levels in the stream. Measuring uranium at these low-level concentrations is difficult and time consuming and traditionally requires a laboratory which is costly and causes delays in getting data in real-time. The ANDalyze product solved these problems by automatically measuring the water for uranium concentrations at the required range at a pre-determined site.



AND2000 On-Line Water Monitor for Metals tests for Pb, Cu, U, Cd, Zn and other metals at low part per billion concentration ranges and is data connected to alarm and report reading via standard communications networks.

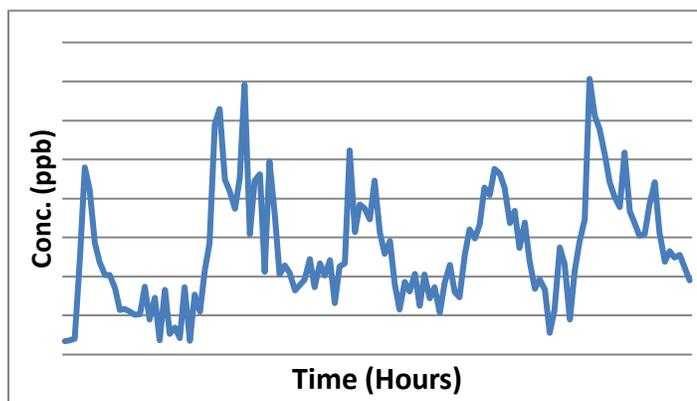
ANDalyze Solution: To monitor levels of Uranium in the stream on a continuous basis, an AND2000 On-Line Water Quality Analyzer was installed at the point (pipe opening) where the river water mixes with the pre-existing water volume. This sampling position required an outdoor mounting adjacent to the sample stream and a separate accessory enclosure to house the sample pump, filter and rinse water. The AND2000 tested a fresh sample of water hourly for approximately eight months (July 2016 through March 2017) using the ANDalyze DNAzyme-based technology and reagents. When required, Gold Fields personnel performed the monthly replacement of reagents and rinse water, downloaded result data and undertook maintenance and repair of the equipment.



ANDalyze team on-site at the Gold Fields mine in South Africa. The AND2000 On-Line Water Quality Analyzer, which tests for uranium concentrations in water.

Results/Discussion: Since it was essential to measure assumed high levels (often 100ppb+) of Uranium in the local river water, ANDalyze installed large 10" 1micron filters to clean sample water prior to entering the sample pump and sampling module. Since uranium levels were above sensor limits and to reduce potential interferences, an automatic 4X dilution was used.

The results show positive uranium levels in the river, however concentration levels vary during a typical work day. These varying concentration levels are depicted in the graph to the right obtained from the AND2000 over a five-day period of hourly tests. The higher concentration levels start daily at around 6:30am and end around 8:30pm, reflecting the times at which the water is discharged by the neighboring mine. Overnight the levels of uranium decline.



Continuous data on Uranium level concentrations from the AND2000 On-Line Water Quality Analyzer

Conclusion: Uranium levels in the stream show varying levels depending on location and time of day. This represents a potential health risk should personnel come into contact with the water. Furthermore, water "lost" or discharged accidentally could have an adverse impact on the nearby environment. ANDalyze believes that by placing AND2000 devices at various South Deep locations, the mine would have an excellent warning system about high uranium levels as well as a more complete picture of its water system.

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