

# Heavy Metal Mine Monitoring

By Marty Dugan

Isaac Plains is an open-cut coal mine in northern Queensland, Australia, that operates under an environmental authority. One of the environmental monitoring requirements that must be met is water monitoring. This includes monitoring potable water, mine-affected water, natural creek flows, water releases, groundwater and the receiving environment. The site water management system comprises sediment dams for containing mine-affected water, release dams for releasing good-quality water to the environment, a raw water dam for storing the allocated raw water supply and a drainage system that allows for clean water runoff collected by the catchment to be diverted away from the active mining area.

There was a need for compliance monitoring of heavy metals, which requires results for three target trace metal species—mercury, copper and lead—for discharge measurement. The Isaac Plains mine previously used inductively coupled plasma mass spectrometry (ICP-MS) for trace-level analysis, which took seven to 10

working days to get results—a costly delay for the mining operation.

## Testing Solution

The mine implemented ANDalyze handheld fluorimeter and heavy metal DNAzyme-based sensors to get one-minute test results at low parts-per-billion-level readings.

Correlation of the new test method results with laboratory results was more than 95% confidence. The DNAzyme-based sensors typically test well against ICP-MS, an industry standard for trace metals analysis. ICP-MS accuracy ranges are typically  $\pm 5\%$ . The DNAzyme sensor technology is typically rated at  $\pm 15\%$ . This accuracy rate is often well within acceptable limits for onsite testing at the low levels of concentrations that are required by regional environmental regulations.

The solution also enabled technicians to take readings in the field. Coordinating the shipment of field samples back to a central lab could be costly and time consuming. The new method not only shortened the time by eliminating that step, but also automated the data capture electronically, so that the consolidated data could be downloaded intact to other data reporting software.

The speed of results (less than one minute) allowed instant decisions on discharging, which has significant ramifications on mine production costs. Often, testing water sources for contamination is a result of operational changes in equipment or procedures. Getting a quick result that informs managers helped save time and money. Additionally, costs were lower than one-off lab metals analysis.

Isaac Plains mine employees found the new testing method easy to use, as it requires minimal sample handling, significantly reducing the risk of sample contamination.

The speed of the results not only allows instant decisions on whether to discharge or not, it also allows more staff members to be confidently involved in the decision-making process. It can be costly, especially in remote areas,

to maintain a staff of environmental chemists who are trained to do water analysis using expensive laboratory equipment. Portable, easy-to-use onsite solutions reduce the need for highly trained staff to be available for periodic or sporadic issues that need chemical analysis. At the Isaac Plains site, the DNAzyme-based instrument has enabled a broader list of technicians to do water analysis.

## DNA-Based Technology

This technology is a universal platform that offers simple and reliable detection of trace metals and other target chemicals. Measurement of the metal ions is conducted through a reaction that occurs when a water sample containing a target metal ion contaminant, such as lead, is introduced to a sensor unit specific for that contaminant. A reaction occurs between the metal ion and the DNA-based sensor. This produces fluorescence in direct correlation with the amount of metal ion present. The amount of light is measured by a fluorimeter, which produces a reading that relates directly to the amount of metal contaminant in the water solution. The ANDalyze handheld fluorimeter, in combination with the consumable DNA-based sensors, can quickly measure water contaminants at the sample site. Applications include public drinking water supplies, industrial water operations, mining water management and environmental water, including seawater.

At the Isaac Plains mine site, of the new DNA-based sensors were helpful in reducing the time it took to test mining water for dangerous levels of heavy metal content. It is a new alternative for collecting fast onsite data so that decisions can be made regarding mine operations. *wqp*

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Onsite testing technology helps mine meet water monitoring requirements



Fluorimeter with inserted syringe and sensor