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CASE STUDY

In-House Oil Analysis Lab Saves Gold Mine Millions in Downtime, Repair and Replacement Costs

A low-grade surface mining operation depends upon huge and expensive equipment such as Hitachi 5500 shovels and Caterpillar 793 haul trucks. Oil analysis is essential to identify problems so they can be corrected before they cause equipment to go down for major repairs. In the past, a multinational mining firm sent samples to an outside lab for analysis but the cost of this approach limited the number of samples that could be analyzed. In addition, the four-day lead time to receive the results created the risk that damage could occur before results were obtained.

The mine overcame this problem by creating an in-house lab based on the SpectrOil 100 rotating disk electrode (RDE) atomic emission spectrometer and the Spectro FTIR oil analyzer. The mine can now obtain oil analysis results in only 12 minutes, and the reduced cost per sample has made it possible to increase the number of samples analyzed by nearly a factor of ten. In its first year of operation, the in-house lab has identified savings of over a million dollars in downtime and over a million dollars in repairs with several of the larger incidents generating savings that completely paid for the purchase price of the instruments.

Key role played by heavy equipment

The mine relies heavily upon enormous equipment designed to quickly and efficiently move massive amounts of ore. A typical example is the Hitachi 5500 excavating shovel which has a maximum payload of 280 tons and is powered by a 2600 horsepower engine. A Caterpillar 793 haul truck weighs 270,000 pounds and can haul 250 tons of ore. This truck is powered by a 16 cylinder, 2478 horsepower engine. These large pieces of equipment are worth approximately $15,000 per hour when operating, so minimizing downtime is critical to profitability. Repair costs are also enormous with, for example, the cost of rebuilding an engine running about $400,000. More importantly, the sudden failure of a major system in heavy equipment like a truck or shovel could create a safety issue.

Value of oil analysis

Oil analysis has long been an important part of maximizing uptime and minimizing repair and replacement costs at the mine as well as the vast majority of other major mines in the world. Oil analysis determines the amount of various metals in the oil, providing a fast and inexpensive way to gauge the amount of wear in the machinery. Oil analysis also helps determine the condition of the oil by measuring solids formed by oil oxidation and the viscosity of the oil. Tracking the

condition of the oil helps reduce the risk of catastrophic failure and can also reduce the high cost of changing and disposing of oil in heavy machinery. It takes only a few minutes to analyze an oil sample and the cost is low, so oil analysis is a simple and practical way to keep a mine operating profitably.

In the past, the mine performed some analysis itself with a very basic tool but its lack of reliability meant that the company primarily used an outside lab. The outside lab provided reliable results but it took two days to ship samples to the lab and another two days for the lab to analyze the samples. As a result, it was not uncommon that, by the time the mine received information indicating a problem, the equipment had already failed. This situation resulted in downtime and repair costs substantially higher than would have been incurred if the repairs had been made a few days earlier. Another weakness of the old approach is that the outside lab charged approximately $12 per sample in addition to the $15 for shipping costs. These costs limited the mine's analysis to an average of five samples per day.

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Establishing an in-house lab

"I got management approval to establish an in-house lab and spent over a year looking at different technologies and brands," said the reliability centered maintenance (RCM) coordinator for the mine. "I concluded that Spectro stands far above the rest both in performance and cost of their instruments. For example, with other instruments the sample has to be pumped through the machine and flushed out, creating the potential for cross contamination. The SpectrOil 100, on the other hand, has a disposable wheel that avoids this potential problem."

The mine uses the SpectrOil 100 to analyze wear, additives and contaminants in mineral or synthetic, petroleum-based products. It also uses the Spectro FTIR to measure oil degradation and contamination. The mine is also planning to purchase a SpectroVISC Q300, semi-automatic kinematic viscometer and SpectroT2FM Q500 analytical ferrography laboratory. The mine also uses the SpectroTrack laboratory information management system (LIMS) to automatically capture analysis results from the instruments and store them in a database where they can be accessed over the Internet and used to track trends. When a lab tech emails the RCM coordinator to alert him of a possible problem, he immediately logs into SpectroTrack and checks the history of the machine and other similar machines to help determine the best course of action.

Savings in downtime and repair costs

The in-house lab has already identified four problems, each of which would have cost more to fix than the entire cost of outfitting the in-house lab – if the mine had waited for an outside lab to identify them. In one case, the in-house lab identified a glycol leak in a Caterpillar 793 haul truck. "If we had waited for results from an outside lab, we would have ruined the engine which would have cost $400,000 to rebuild," the RCM coordinator said. "Instead we fixed the leak at a cost of a few hundred dollars. On the same truck a few months later we saw the tin and lead levels in the oil start to rise, indicating that the bearings were starting to go. Putting in new bearings avoided the catastrophic failure that was about to occur and saved $164,000, the value of the engine minus the cost of putting in the bearings. Rebearing cost only about 12 hours of downtime compared to 88 hours if we had to change the engine, saving another $1,140,000."

In another case, the lab detected copper in the oil of the transmission on a Caterpillar 992 loader. The level was so high that the core would have been ruined in another eight hours of operation. The transmission had to be rebuilt, but preserving the core saved $78,000. Oil analysis can also sometimes save warranty costs. When one engine was rebuilt the rebuilder pulled a sample from the bottom of the pan. High levels of glycol were found so they blamed the failure on a glycol leak which would not have been covered by the warranty. "I sent the sample to our in- house lab and they said there was no glycol," the RCM coordinator said "For confirmation, I sent another sample to an outside lab and they also said there was no glycol. So the manufacturer covered the cost of rebuilding the engine which saved us about $150,000."

"For every engine we save, we pay for the cost of operating the lab for an entire year, including the depreciation on the instruments," the RCM coordinator concluded. "We have already saved four engines in 18 months of operating the in-house lab, not to mention many other cases where we have had smaller but still substantial savings. The in-house lab is superior not only in providing faster results but also in providing results at a lower cost – about 12 cents per sample – which has made it possible to increase the number of samples we are able to analyze to about 50 per day. Finally, we are also saving a substantial amount of money on oil changes because the analyzers tell us exactly when an oil change is needed. With hydraulic shovels that use 1500 gallons of oil at a cost of $3 per gallon, these savings add up. All in all, in-house oil analysis has provided substantial savings in downtime, equipment repair costs and oil costs that have been paid back several times over in only 18 months."

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