WEAR CHECK
CONDITION MONITORING THROUGH OIL ANALYSIS

CASE STUDY
SA COAL MINE

MAJOR COAL MINE

OIL ANALYSIS SAVES R1,7 MILLION

An oil analysis and quality control programme implemented at a colliery near Gauteng saved the mine more than R1,7 million in a single financial year.

The mine had 45 units of equipment on the Wearcheck programme ranging from draglines, drills, haul trucks and track type dozers to secondary equipment such as front-end loaders, graders, water tankers, tyre dozers, trucks and LDVs.

Their quality control programme was implemented following repeated failures of the final drives on the 789 off-highway trucks (sometimes referred to as a dump trucks) without warning, resulting in massive repair costs and high downtime figures.

INVESTIGATION

FERROGRAPHY REVEALS ALL

The mine's condition monitoring specialist asked Wearcheck's Jan Backer to assist them in solving the problem. An investigation was launched and as much information as possible was gathered on the oil condition, contaminants, maintenance practices, environmental influences and operating conditions.

'Because of the common oil compartment of the differential and two final drives, we were able to see an increase in wear metals through standard oil analysis but this made it very difficult to pinpoint the component that was failing,' explained Mr Backer.

'I then asked the mine's maintenance team to gather magnetic plug debris to accompany every sample, hoping to identify the origin of the wear, and we hit the jackpot. Ferrography on the magnetic plug debris revealed all. Because of the layout of the component and the size and weight of the wear particles, the debris found on the magnetic plugs was representative of the specific component.'

With the use of ferrographic analysis it was possible to trend the wear on these final drives with a high level of accuracy. When the alarm level was reached, the measurement of wheel deflection was recommended. By comparing these measurements with given specifications, the amount of bearing wear could be determined. Whenever these measurements were above given specifications the strip-down of the final drive could be planned.

After implementing ferrographic analysis, the mine encountered only one unplanned failure on a final drive, which was due to a broken retainer bolt. Complete oil changes were reduced to 17 over the year in comparison with 35 changes the previous year, amounting to a saving of 10 980 litres of oil.

QUALITY CONTROL

FAILURES ARE ELIMINATED

A basic quality control programme was put in place, eliminating failures completely. The programme involved:

- An allotted torque wrench to do final drive bearing pre-loads.
- Installation of a sight glass on differential housings to detect early stages of hydraulic oil transfer into differentials.
- Measurement of wheel deflections every 500 hours.
- Replacement of all critical bolts with every final drive rebuild.
- Assigning one person exclusively to take oil samples to ensure sustained representative oil samples.
- Inspecting magnetic drain plugs.
- Effective communication between the mine's condition monitoring department and key personnel at Wearcheck.

The mine also took oil samples in advance of planned maintenance to improve maintenance planning and minimise downtime caused by components with concealed problems. The Wearcheck programme became an integral part of their formal predictive and preventive maintenance plan.

US MAINTENANCE MANAGERS SAVE THOUSANDS

US magazine, *Tribology and Lubrication Technology*, asked members of the Society of Tribologists and Lubrication Engineers to relate an experience where oil analysis saved a piece of equipment or system, and estimate the savings. These are some of the 160 responses they received.

IGNORED WARNINGS ARE COSTLY

'It's easier and more accurate to talk about instances when clients were warned and ignored the warnings. In a scrap yard in Dallas the baler fluid was analyzed and the client was warned of a pending failure in 60 days or less. Twenty-seven days later the failure occurred, costing six figures. At a wood yard in Georgia, a client was warned after a fluid analysis predicted failure on his crane's winch pump. He ignored the warning. In less than a month, the whole winch system failed catastrophically, costing six figures.'

EXTENDING OIL LIFE

'Prior to implementation of our lube oil and inventory test and reconditioning program, journal bearings for some of our most important auxiliary steam turbines, fans and pumps often were changed out during annual outage periods. Most problems were due to excessive moisture and debris. At the onset of our program we rotated two lube oil purifiers on/off about 12 pieces of equipment as deemed necessary by oil analysis, and I haven't lost a bearing because of moisture or debris problems. Also, our lube oil usage has decreased about 85% annually. Over the last seven years of the program, we've probably saved 25 sets of bearings and 10,000 gallons of lube oil.'

TURBINE SAVE

'Upon start up of a large steam turbine, oil analysis discovered a very large amount of iron in the lubricating oil. There were no outward appearances of a problem. Investigation revealed the unit's turning gear had not locked in the disengage position and was bumping against the bull gear on the turbine shaft, shearing off metal particles and depositing them into the lube oil. This catch allowed operations to take action and prevent complete failure of the turning gear and allowed quick clean up of the oil, thus preventing major damage to the turbine bearings. The catch was estimated to have saved a million dollars in repairs and downtime.'

WELL TRAINED STAFF ARE KEY

'We started performing oil analysis on a lot of our critical gearboxes. Our PMs were set up so that the technician would do a group of gearboxes at one time. In taking the initial round of samples, our technician found one gearbox that had a lot of metal in the oil. It turns out that this gearbox had been mislabeled, and the oil had not been changed in six years. This was an easy catch but one that might not have been found if we didn't have a person specializing in this area. The effect of a failed gearbox would have been lost production and easily could have run into tens of thousands of dollars.'

OIL ANALYSIS PAYS

- 'Every time you detect dust entering an engine on a haul truck in the mining industry, especially the big 2500-hp and above vehicles, you are talking a minimum saving of $250,000.'
- 'We have too many to list, but we've saved several hundreds of thousands of dollars in rescued equipment and generation capacity during the last 10 years.'
- 'I monitor the oil for HCl in compressors and have saved $2 million during the last two years.'
- 'The number of new diesel engines we've saved sure pays for a lot of oil samples.'