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Controlling the
Silent Killers
of Strategic
Asset Management



Oil Analysis “House Calls”

Help Reduce Offshore
Equipment Failures



It's hard to think of another environment where an equipment failure could have an immense negative impact on employee safety and lost production than an offshore oil and gas production platform. Yet, offshore platforms are among the world's most difficult locations to operate and maintain equipment. In most cases, skilled people and supplies can only reach the platform by ship or helicopter, so the cost of bringing technical specialists, replacement equipment, spare parts and tools to the platform is very high. On nearly every offshore platform, oil analysis plays a critical role in alerting the maintenance team to problems that have the potential to damage a vital system and providing information that makes it possible to efficiently allocate scarce resources by planning maintenance based on actual need as opposed to simple intervals of time.

Nearly all offshore platforms take oil samples on the platform and ship them by helicopter to onshore labs where they are analyzed. The results are processed and sent back to the platform. The problem with this approach is that it might take a week for the sample to reach the lab, another week for the lab to perform the analysis, another week to process the results and get them back to the platform and, perhaps, one more week before technicians have the time to look at the results and take action. By the time the results are acted upon, it's possible that equipment may fail, in the worst case putting personnel at risk and causing production outages and, in the best case, requiring a replacement or spare parts to be flown or shipped to the rig at a very high cost.

A new approach to address this problem involves flying in a technician with a portable oil analysis solution to the rig. The technician samples all the equipment on the rig and provides instantaneous feedback on equipment that requires immediate action to avoid failure, equipment that requires maintenance, but not urgently, and equipment for which maintenance can safely be postponed to conserve scarce on-platform resources.

by Chad Dyson

Value of Oil Analysis on Offshore Platforms

It costs more than \$1 billion to operate a typical production platform over its 10- to 20-year lifecycle, so operating costs per day can be estimated at \$100,000 to \$300,000. A typical offshore platform contains millions of dollars of machinery that, at any moment, could become critical to the crew's safety and whose failure can easily put the platform out of operation until it is repaired or replaced. Oil analysis has long been the gold standard in the offshore industry for monitoring the condition of critical equipment. 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, such as 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 the high cost of changing and disposing of oil in heavy machinery.

But, as with other activities, oil analysis is much more difficult to perform offshore than onshore. The crew operating the platform typically does not

Figure 1: Oil analysis technician inserts sample into portable instrument



Figure 2: A four module portable analyzer (image provided by Spectro Q5800)



have the time or equipment needed to perform oil analysis themselves. They typically collect samples from the various rotating equipment on the platform, such as flooded screw compressors, turbo gas-powered generators, fire water pumps, diesel engines, gearboxes, pumps, crane engines, hydraulic systems, etc. They label the samples, put them on the helicopter for shipment to the onshore lab and wait for the results. One problem with this approach is that mechanics are very busy and work long hours on the platform, so there is always the potential for mislabeling a sample, which leaves the results subject to question. Another concern is when a positive result is received. Usually, action must be taken immediately, even when there is some doubt about the validity of the results, because it would take too long to analyze another sample from the same piece of equipment.

Moving From Onshore to Offshore Oil Analysis

One major oil producer using the onshore oil analysis approach sent an oil sample to a lab and approximately one month later received results that indicated a problem with an air compressor. Unfortunately, the compressor failed the day before the results were received and the company incurred a very high cost to replace the machine. The oil producer researched companies whose technicians could travel to its platforms with a portable oil analyzer and provide immediate oil analysis results. An industrial equipment distributor researched the available portable oil analysis instruments and selected a portable analyzer that is comprised of four modules:

- Infrared spectrometer with flip-top cell design tests for total acid number/total base number, water content, soot, oxidation and new fluid validation;
- Kinematic viscometer that determines viscosity without solvent and with a low sample volume;
- Filtration particle quantifier (FPQ) for providing solvent-free particle counting to less than 4 $\mu\text{m}/\text{ml}$;
- Element analysis module to perform wear metal and sand/dirt analysis to identify abnormal wear and contamination ingress using X-ray fluorescence (XRF) technology.

The oil producer then requested on-site oil analysis at its offshore platforms in the Gulf of Mexico. A technician flies by helicopter to the offshore oil platforms with a portable instrument that performs the same tests offered by full-service laboratories. The portable instrument provides the same accuracy as full-size laboratory instruments, yet it fits into a backpack so it can be easily carried on a small helicopter. The portable instrument provides immediate oil analysis results, so if there is an abnormal result, the platform personnel can take action immediately to resolve the problem. Another key advantage of the portable instrument is that the technician can immediately recheck every positive result for validation purposes to provide certainty that the initial test results were accurate. The ability to retest prevents false positives and has the potential to offer substantial savings by avoiding the need for repairs or replacements that are not actually needed.

Examples Where Offshore Oil Analysis Saved Time and Money

1. In the past year, there has been several cases where the savings from on-site oil analysis exceeded the full year's cost of the service. For example, technicians on one platform replaced the diesel engine on a crane. When the oil analysis technician visited the platform and tested the oil, the viscosity was 70 when it should have been 120. The technician ran additional tests that discovered the presence of diesel fuel in the oil. A mechanic put dye in the fuel supply and discovered a broken injector line was leaking diesel fuel into the oil sump. This leak had the potential to damage the engine or even cause a fire, which could have been catastrophic. The oil analysis results made it possible to fix the problem with only the small cost of replacing the injector line.
2. In another case, the oil analysis results on a large gas turbine compressor showed a high metal particle count. The technician queried the platform's maintenance team and discovered they had recently replaced a valve in the lube oil system. Wondering whether the oil particle count might have spiked in response to this maintenance, the technician flushed the lube system and ran another test. This time, the test showed a much lower particle count, although still above normal values. After discussing the situation with the maintenance foreperson, the decision was made to do nothing immediately, but to retest the equipment the following month. When the equipment was retested, the particle count had returned to normal levels. According to the maintenance foreperson, if the oil had been tested by an onshore lab, there would have been no chance to do an immediate follow-up study, so it would have been necessary, at the minimum, to perform vibration testing and possibly perform even more expensive repairs.

The results of offshore oil analysis are uploaded to a cloud-based information management system, which is optimized for laboratories that specialize in the analysis of in-service lubricants for machine condition monitoring. The results are available not only to the maintenance team on the platform, but also to onshore managers and analysts who can track trends that may be useful in making decisions, such as whether or not to invest in a certain piece of equipment.

The current oil analysis method used on most offshore platforms takes up to a month to send samples to a lab and get the results. On-site oil analysis has the potential to provide major improvements by flying a technician to the offshore rig, testing oil samples on the rig and providing immediate answers to the maintenance team. In some cases, faster results prevent breakdowns and in others, they avoid doing unnecessary maintenance. In both cases, of course, the savings are magnified by the extra costs of getting things done on an offshore rig.



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