

Oil Analysis “House Calls” Help Reduce Offshore Equipment Failures

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A new approach

It is hard to think of another environment where an equipment failure could have a greater 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 high. On nearly every offshore platform, oil analysis plays a critical role by alerting the maintenance team to problems that may damage a vital system. An effective oil analysis program also helps to efficiently allocate scarce resources by planning maintenance based on equipment condition rather than time intervals. Most offshore platforms take oil samples and ship them by helicopter to onshore labs for analysis. Once the results are available, they are sent back to the platform.

The problem with this approach is 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 platform, and perhaps one more

week before technicians view the results and take action. By the time the results are acted upon, the equipment may have failed. This could put personnel at risk and cause production outages or require costly shipments of replacement parts.

A new approach involves flying a technician with a portable oil analysis tool to the rig. The technician samples all of the equipment on the rig and provides instantaneous feedback. Immediate maintenance actions can be taken to avoid equipment failure. The operator can also determine the equipment which requires non-urgent maintenance or the assets that do not require any maintenance. This information allows valuable on-platform resources to be used for other duties.

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 life cycle, 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 is critical to the crew’s safety and whose failure can easily put the platform out of operation. 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 by measuring solids formed by oxidation and by measuring the viscosity. Monitoring oil condition reduces the risk of catastrophic failure and can also reduce the high cost of changing and disposing of oil in heavy machinery.

As with other activities, oil analysis is much more difficult to perform offshore than onshore. The crew operating the platform typically does not have the time or equipment needed to perform oil analysis themselves. They 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. If any of the samples were mislabeled the results may be inaccurate. When a positive result is received, technicians must take immediate action before validating the results because it would take too long to analyze another sample from the same piece of equipment.



The Spectro Q5800 portable analyzer

Moving from onshore to offshore oil analysis

One major oil producer, now using this 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 had to incur the cost of replacing the machine. The oil producer asked John H. Carter Inc. to travel to its platforms with a portable oil analyzer and provide immediate oil analysis results. We researched the available portable oil analysis instruments and selected the Spectro Q5800 portable analyzer. The Q5800 is comprised of the following 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 determines viscosity without solvent and with a low sample volume.
- Filtration Particle Quantifier (FPQ) provides solvent-free particle counting to less than 4 $\mu\text{m}/\text{ml}$.
- Elemental analysis module performs wear metal and sand/dirt analysis to identify abnormal wear and contamination ingress using X-ray Fluorescence (XRF) technology.

The oil producer then contracted with John H. Carter Inc. to provide on-site oil analysis at its offshore platforms in the Gulf of Mexico. A Carter technician flies by helicopter to offshore oil platforms with a portable instrument and 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 and is easily transported on a small helicopter. The all-in-one unit provides immediate oil analysis results. If there is an abnormal result, the platform personnel can act immediately to resolve the problem. Another key advantage of the portable analyzer is the ability to immediately re-check every positive result to ensure the initial test results are accurate. The retesting prevents false positives and allows substantial cost savings by avoiding unnecessary repairs or replacements.

Examples where offshore oil analysis saved time and money

John H. Carter Inc. has been providing on-site oil analysis to an oil producer for a year. There have already been several cases where the savings from on-site oil analysis exceeded the full year's cost of the service.

1. For example, technicians on one platform replaced the diesel engine on a crane. When the technician visited the platform and tested the oil, the viscosity was 70 when it should have been 120. The technician ran additional tests and discovered the presence of diesel fuel in the oil. A mechanic put dye in the fuel supply and found 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. The oil analysis results made it possible to fix the problem with a low cost solution – replacement of 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. The technician wondered whether the oil particle count might have spiked in response to this maintenance, so he 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 foreman, 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 foreman, if the oil had been tested by an onshore lab, there would have been no chance to do an immediate follow-up study. It would have been necessary to, at the minimum, perform vibration testing and possibly perform even more expensive repairs.

Data management and reporting

The results of offshore oil analysis are uploaded to the Spectro Scientific SpectroTrack information management system. The results are available not only to the maintenance team on the platform but to onshore managers and analysts who track trends and provide recommendations on whether or not to invest in a certain piece of equipment.



Carter technician inserts sample into instrument.

Summary

The current oil analysis method used on most offshore platforms takes up to a month to send samples to a lab and receive the results. On-site oil analysis has the potential to provide major value and benefits by allowing testing on the rig and delivering immediate answers to the maintenance team. Faster results can prevent breakdowns and avoid unnecessary maintenance. The savings are realized by the ability to get answers quickly and better manage equipment uptime on the offshore rig.

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