Take Oil-Sample Analysis To the Cloud

Oil sample points should be clearly labeled. Photo: Acuren Group

Working together, an end user, an oil lab, and a reliability service provider improved an important predictive-maintenance technique and gained a wealth of reliability benefits.

By Jane Alexander, Managing Editor, with Kevin McGehee, Reliability Manager, Chemicals Div., Axiall Corp.

For years, the oil-sample analysis process was swimming in paper. Each sample was documented in its own analysis report, and all reports were emailed to the responsible plant employee. From a reliability perspective, questions remained: Was a work order generated? If not, why? What was found at the repair? Is this a repetitive problem? Did the corrective work order solve the problem?

Companies are finally starting to drop the spreadsheets and approach oil analysis from a more systematic, interactive perspective and, as a result, are increasing equipment reliability and performance.

U.S. chemicals manufacturer Axiall Corp., headquartered in Atlanta, is one example. Within just four years, the number of machines tested has tripled and is growing with help from cloud-based, automated systems for oil-analysis and reliability-information management.

Reliability-service providers and oil labs are also using browser-based systems to improve their oil-analysis processes. Acuren Group (Acuren), a Canadian-based supplier of asset reliability, nondestructive, and materials testing services in the U.S. and Canada, and Tampa-based R&G Laboratories (R&G), a full-service oil-analysis lab, are among those leveraging cloud technologies to better meet the needs of their customers. (Acuren is a division of Rockwood Service Corp., Greenwich, CT.)

All three companies recognize the crucial role of oil analysis in a predictive-maintenance (PdM) program and have succeeded in using the potential of the cloud to make oil analysis more timely, accurate, scalable, and visible. Their experiences and recommendations can help others optimize oil analysis.

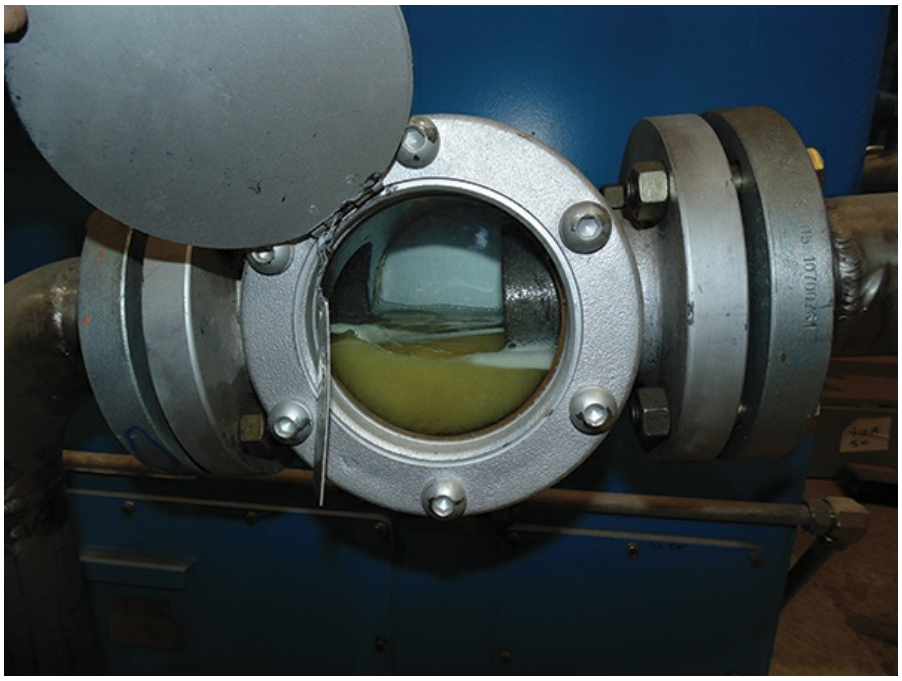
Why analyze oil

Oil analysis is like blood work from a doctor. Axiall takes samples and looks for problems before they manifest into an emergency situation. Oil samples are relatively cheap compared with the cost or value of the equipment. If a machine is worth $700,000/day in profit, then it’s well worth taking an occasional $30 sample to keep it running.

Leading performance indicators such as ISO particle count or the contamination level in the lubricant can be

considered a measure of the performance of the lubrication tasks. Viscosity or mismatched additives can be an early indication of cross contamination of lubricants. Alternatively, lagging performance indicators, such as the acidity of the lubricant, signs of wear, or progressing failures, signify existing problems.

Oil analysis complements other PdM methods such as vibration analysis, infrared thermography, and ultrasound. Sharing oil-sample data with a cloud-based reliability information system that tracks all PdM techniques enables better decisions from a more complete picture of asset health. When the reliability information is integrated with an existing computerized maintenance management system (CMMS), it further simplifies the execution and tracking of recommended actions.



Left. Oil analysis is one of the simplest ways to start a PdM program. Photo: Acuren Group

Upgrading the process

At Axiall's plant in Plaquemine, LA (near Baton Rouge), some machines hold 3,000 gal. of oil while others hold just 2 qt. Those most important to the business are monitored with oil analysis, regardless of their size.

The site's prior oil-analysis approach was manual and inefficient. Oil samples were sent to a free service for testing, and Axiall's analysts would later log into the service-provider's system to view the findings. There was no follow-through and no one to call when questions arose. The new approach is more automated, interactive, and effective.

Now, preventive-maintenance work orders in the CMMS tell the plant to take oil samples at predetermined frequencies—usually quarterly. A trained technician takes and labels the samples and has them shipped to the lab. For the plant, the rest of the process is automated.

The lab runs the samples and performs analysis using standard limits that determine whether they are good or bad. It automatically populates the information in Oilography, a web-based oil-sample management solution used by the lab and the plant. That system, in turn, automatically updates Tango, the reliability information-management system used by the plant. Both are products of Louisville, TN-based 24/7 Systems.

Next, a plant engineer reviews each sample using a web browser and determines what actions, if any, need to be taken. If there is a question about a sample, the lab is called to discuss the findings and interpretation. The engineer's recommendations are then entered in the reliability information-management system where they are tracked to completion.

Between the Samples Waiting Review screen, Integrated Condition Report, and metrics that show the number of assets in the oil-sampling program and percentages of samples that are good or bad, Axiall has a good understanding of equipment health and also where to concentrate efforts for improvement.

"The beauty of it is not having to enter anything; the results show up in the oil sample-management system," explained Forrest Pardue, president of 24/7 Systems. "Having that system connected to the plant's reliability information-management solution is an almost seamless method to create and track action items, and to force them

to completion."

R&G Laboratories uses the cloud to help its clients perform timely and accurate oil analysis without cumbersome paperwork. According to Cheryl Huff, R&G's customer-service coordinator, "When samples are received from the customer, sample points are set up in our database and the assessments are posted online in Oilography. From there, the customer can access their records and take appropriate maintenance actions."

Results are provided in the customer's format of choice, whether online or through email, an interface with their CMMS, or some other preferred export format. "The lab's oil analysis results can potentially feed into the customer's failure-mode assessments, improving the visibility and quality of actionable information," added Huff.

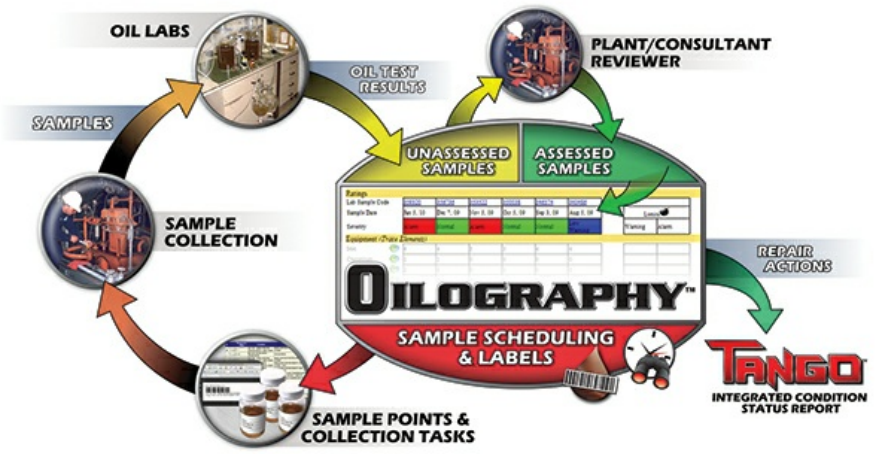
Bridging knowledge and communication gaps

Program success comes from understanding the equipment, the results of the oil analysis, and what to do about it. Unfortunately, managing PdM programs entirely in-house is often an unsustainable goal. To counter the situation, Acuren Group provides fully trained and equipped PdM technicians who translate test results into meaningful maintenance actions to its clients across North America. Moving to the cloud has streamlined the company's service delivery.

"Our recommendations are entered in Tango alongside the results from other technologies. They flow directly to the CMMS used by our clients in the form of work requests, which are then planned and executed," noted Wesley Albert, senior reliability engineer at Acuren Group. "By interpreting the results of all PdM technologies in a holistic manner, we are able to pinpoint issues and their severity."

The specific test slate is determined by the asset's criticality and type, as well as the goal of the testing. Improvements to the lubrication systems include the addition of proper filtration, desiccant breathers, and external filtering to achieve particle count targets.

Systematic oil-sample management ensures that nothing is missed. (Source: 24/7 Systems)



Steps to oil-analysis optimization

Integrating oil-sample management, reliability information management, and the CMMS puts plant professionals, oil labs, and reliability service providers on the same page. Online visibility, dynamic interactivity, and instant information updates improve the availability and quality of actionable information and assure completion of recommended actions. Combining that platform with the following recommendations optimizes program results:

Educate the masses. Companies beginning or improving an oil-analysis program should start with a fairly broad lubrication-training program for anyone who touches the oil and grease. Everyone needs to understand the importance of oil and oil analysis, that it's worth a lot of money to the company, and that machines don't run without proper lubrication.

Training should include how wear works, how particle contamination works, how important it is to keep it the oil clean

and dry, and how all of that impacts the machine. It should also include the different places where someone can make a mistake or contaminate oil, and how that will lead to reduced machine life. Ultimately, it should encourage more attention to oil-related practices. For instance, an operator on shift may rethink storing an oil container outside near a machine if rainwater is getting into it.

Be selective and precise in sampling. Albert suggests beginning with a small number of the most critical assets and those with the largest volumes of oil, and aligning the test slates and sample frequencies with the asset-maintenance strategies. Label the sample location points with the equipment/component identifier, oil brand/type/viscosity, sample type, sample volume, and purge volume. Then, perfect the process on these assets before expanding the program to include others.

The most important thing is not to start "too big." As R&G's Huff put it, "A company that wants to begin oil analysis on 400 components might not have planned how to handle the lab's analysis on 400 samples. "If it pulls too many samples at once and doesn't have enough time to make the necessary system improvements," she said, "we'll repeatedly get samples rated critical and severe, and the client will be throwing its money out the window." The better approach is to start out small in one section of the plant or in a problem area, make good decisions based on the analysis results, and grow from there."

Fine-tune the sample frequency. Sampling frequency depends on the machine's criticality. Quarterly is most common at Axiall, but samples are taken monthly on extremely important machines, such as those that could shut the entire complex down if they failed.

More-frequent sampling provides more resolution when trending the condition of the oil and detecting problems when they occur. For instance, if someone inadvertently adds the wrong oil to a machine, with monthly sampling, a step change in the properties will be visible so questions can be asked and actions can be taken before there is unintended machine wear. Quarterly sampling is probably too late to catch an issue such as this.

Optimal sampling regularity reduces the urgency of problems, *i.e.,* being proactive vs. reactive. Don't wait until a machine is behaving erratically and then take a sample to send to the lab. Companies should routinely take and send oil samples and monitor the trends to see when a problem is coming.

Focus on continuous improvement. Pardue stated that using web-based systems to integrate oil-sample analysis and other PdM technology is a best-practice type of approach. "Cloud systems allow labs, contractors, plant teams, planners, and managers to all have access to the reliability system and its centralized dashboards of condition problems and statuses, enabling continuous improvement."

It's important to review the status of work orders with plant production areas weekly—and to hold people accountable for completing the work. Get to the root cause of failure by aggregating all problems into equipment and fault types and looking for patterns that provide opportunities to improve the lubrication program.

For example, if consecutive oil samples indicate that water is getting into a machine during normal operations, then better seals or machine-cleaning procedures should be applied. If most oil samples sent to a lab come back either too wet or too dirty, then a persistent systemic problem with the facility's lubrication process needs to be isolated and improved.

Finding and controlling contamination is probably the most important step in an oil-analysis program, but, too often, it lags in priority, according to Huff. She believes companies that look at contamination control on the front end will usually have a more successful oil program.

"A sample rated severe could have an equipment condition, such as a failed bearing," she said, "but frequently it's a water condition or high particle count that takes the life out of the component and contributes to premature failure." The bottom line is that an operation can't get the estimated life span out of a component without having clean oil running through the system.

Going forward

For Axiall, the overall oil-analysis program itself is also a candidate for continuous improvement. The site is working to achieve a higher level of maturity with its program.

Eventually, between 1,000 and 1,500 total machines will be on the oil-sampling route. The plant is also increasing utilization of its systems. As time permits, it is setting up customized high/low limits for individual machines in the oil sample-management system so it can automatically alert to problems. **MT**

Based in Plaquemine, LA, Kevin McGehee is reliability manager of the Chemicals Div. of Axiall Corp. He has spent 20 years in industry, working in the areas of capital-project management, maintenance, six sigma continuous improvement, and reliability.

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