Nine Steps to Oil Analysis Success

Robert Scott, Noria Corporation

When oil analysis programs fail or are abandoned by a company, it is often because no apparent benefits from the program have been realized. Samples are taken and results are received from the lab but maintenance issues are not recognized or resolved. Often, the program seems to become more involved and labor-intensive than was originally anticipated.

Typically, the effort put into the program reflects the benefits derived. Don't be fooled by someone who claims that all the end-user has to do is collect the oil samples and pay the bills. There is more to it than that, and most of that effort will fall to the plant maintenance personnel.

The intent of this article is to help end-users who may not have been involved in an oil analysis (OA) program or who have had a program in the past, but it was discontinued. Now your company, possibly with new management, is considering starting a new program.

An OA program begins with an understanding of machinery reliability and a willingness to improve on the current reliability status within the plant. Oil analysis is a tool which can be used to help monitor oil-lubricated equipment. It's like taking a human blood sample. It doesn't provide all of the information regarding what is happening within the equipment, but it can provide valuable insight.

The purpose of an OA program includes the following:

- Proactively monitoring harmful contaminants within the oil.
- Monitoring the condition of the equipment and improving predictive maintenance, which in turn provides better control of downtime.
- Monitoring the condition of the oil including optimizing oil drain intervals.

The following steps should be addressed to implement a successful OA program, and more importantly which party, the lab or the end-user, must take ownership and responsibility for performing these tasks.

Step 1: Commit to a Program

Committing to an OA program includes accepting ownership and responsibility for the program by the facility. It is critical to understand that the program will require the facility to commit the necessary finances, manpower and training to provide the skills and abilities within the plant personnel to operate the program successfully. Measurable goals should be set for the program and monitored to determine if progress is being made and where adjustments need to be made in the future. The program should dovetail (work hand-in-hand) with other technologies such as vibration, thermography, ultrasonics and motor current analysis.

Step 2: Develop a Baseline

The second step is to develop a baseline of the current oil condition, equipment failures and reliability within the plant, which is needed to measure progress. It is likely that at some point, plant management will want to know how effective the program has been. Therefore, the individual responsible for the program must know the condition of the equipment, failure rates and costs before the program was initiated. To create a good baseline, it may take some time to pull the information from existing maintenance records, especially if past maintenance records are poor.

Step 3: Select a Laboratory

Plant personnel must be the ones to select a laboratory. The first consideration is whether the plant is large enough to warrant an in-house (on-site) portable OA laboratory. Generally, these bench-top pieces of equipment cost more than $35,000 and are suited for immediate and preliminary routine monitoring of numerous pieces of equipment. Generally, it is necessary to monitor more than 100 oil systems to justify such an expense. If an on-site lab is established, oil samples with nonconforming results may warrant further analysis of the sample at a commercial OA laboratory for better results. If the plant is not large enough to warrant in-house OA laboratory, then an outside commercial lab needs to be chosen to perform routine oil analysis. Here are some factors that need to be considered:

- Is the lab personnel adequately educated and certified?
- Is the lab equipment up to date and in relatively good condition?
- Is the lab clean and well organized?
- What test methods are being used and/or are available? (modified test procedures vs. ASTM standard test procedures)
- What is the ability of the lab to interpret data? (diagnostics)
- How will immediate emergency reporting be handled?
- What is the routine reporting format?
- Are the reports easy to read?
- Is the routine reporting timeframe within three to four days from sample shipping?
- What field technical/training support is available from the lab?

- How complete is the quality assurance/control programs? (lab equipment calibration, ISO accreditation, statistic process control used, and lab lube exchange analysis program participation)
- What is the cost of the service? What is included in a basic package vs. extra charges for additional or more comprehensive tests? (for example: ferrous density, Karl Fischer, water)
- How are payments made? (prepay vs. invoice)
- What exactly does the lab charge for, or in other words, what are the lab's charges triggered by? Is it the complete analysis, the sample bottle or the paperwork that accompanies the bottle? Remember, bottles occasionally get lost in the process.

If possible, visit a couple of laboratories to get a feel for what constitutes a good lab versus a mediocre lab.

Step 4: Analyze Equipment

Selecting the equipment to be monitored can take one of two approaches. One option is to select several pieces of no critical equipment in an attempt to become involved in OA without a large initial commitment to a program. But if plant management has a strong commitment to an OA program, then begin by selecting the major or critical equipment within the plant. Not every piece of lubricated equipment warrants being part of the OA program, just as not every piece of equipment is monitored for vibration. The qualities of major or critical equipment include:

- Critical to plant production and safety, the consequences of failure are high
- High capital cost
- High repair expenses
- Specific equipment with a history of maintenance or failure problems
- Units where the cost of the oil is a factor (large sump volume or synthetic)

Note that to this point, all of the responsibility and functions rest with the end-user.

Step 5: Select the Test Slate

Selecting the laboratory tests to be performed is based upon the equipment or component type with consideration of the failure history, any RCM and FMEA analysis, and oil change interval goals. This selection needs to be a collaborative effort between the laboratory personnel and the end-user. The end-user must bring the knowledge of the plant to the decision process while the laboratory will be more informed about the specific test options and costs.

Selecting the appropriate test methods to use will be based on the accuracy needed and the cost. A common observation is that a more critical piece of equipment with a history of water ingression may warrant a higher cost but more accurate (quantitative) Karl Fischer water test versus an inexpensive, less accurate (qualitative) routine crackle test.

Step 6: Sampling Guidelines

This step covers how to physically acquire the oil samples and the related decisions that need to be addressed. These decisions include selecting the appropriate:

- sampling locations on each piece of equipment
- sampling frequency
- sampling procedures (how to obtain proper samples for each piece of equipment)
- sampling tools and hardware (valves) needed

All of these decisions must be made by the end-user, who should have knowledge of the classic sampling locations, sampling dos and don?ts, the limitations of sampling at certain locations, equipment criticality, oil flow sampling options and the sampling hardware available. Lab personnel may be able to offer assistance with these issues, but the plant lubrication specialist should be the primary decision maker because these activities will take place on a routine basis within the plant by plant personnel. Installation of proper sampling valves will be the responsibility of plant personnel. Supplying sample bottles and ensuring that their cleanliness level is adequate for most applications is generally the responsibility of the laboratory. Providing sample information such as the oil type, hours on the oil, machine type and ID, as well as sending the samples to the laboratory in a timely manner will fall back to the end-user to ensure all procedures are completed properly.

Note that all of the work performed to this point occurs before the first oil sample has been taken and the first analysis performed. Once sampling has begun, the program will perform the following tasks.

Step 7: Analysis and Results

Laboratory sample analysis and data handling (which includes data logging and quality assurance of the laboratory data) is where most of the laboratory responsibility will lie. The lab is responsible for:

- logging the sample data into the laboratory computer
- ensuring correct lab testing procedures are in place and being followed
- ensuring the lab equipment is calibrated
- ensuring quality control samples are run and that action is taken for non conformance
- ensuring samples are analyzed within 24 to 48 hours of receiving the sample
- ensuring a report is provided to the client within 24 hours of completing the analysis

The end-user should accept the responsibility for providing samples of new oil to the laboratory for analysis to provide a baseline for the data interpretation.

Step 8: Interpreting Results

The responsibility for data analysis or interpretation is often a contentious issue. Many end-users want the lab to interpret the data because they do not feel competent in their analyzing skills. However, only the end-user has all of the information (maintenance records, oil top-up volume etc.) needed to interpret the data.

Typically, the laboratory data interpretation is computer generated with almost no human interpretation. Once the laboratory data is input into the computer, it is compared to the new oil reference data, and to general industry warnings and condemning limits which each laboratory has input into its own computer. These limits are the foundation of the computer’s interpretation. Although they are generally reasonable, these limits or flags can be modified or fine-tuned based on customer feedback and specific goals. Interpretive comments offered by the lab are usually computer generated and therefore are rudimentary and must conform to a previously recognized problem. They can be helpful, but should not be the only data interpretation.

The end-user needs to become educated to a level where he or she feels as confident in reviewing and interpreting the lab data as he would vibration data. The maintenance and/or reliability department(s) are the only people who have all of the maintenance and monitoring information available, which enables them to ultimately make appropriate maintenance decisions.

Step 9: Tracking the Performance

Tracking the OA program performance and analyzing its cost benefits is solely the responsibility of the end-user. The lubrication specialist or the maintenance department should monitor the program to ensure the benefits which were originally targeted are achieved. This could take the form of tracking and plotting the contamination control data from the lab and comparing these values to the contamination targets set for each piece of equipment. Eventually, plant management will want to see an evaluation of the cost of the OA program relative to the benefits received. This is where the baseline of plant performance, generated at the beginning of the program, will be beneficial.

In the end, the majority of the effort and responsibility of an OA program lies with the end-user. The laboratory must be relied upon to provide accurate oil analysis. The program will also progress when modifications and improvements are made as experience is gained and equipment within the plant is altered or renewed.

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