July - August 2022

Machinery Lubrication

INDIA

machinerylubricationindia.com

MACHINE LEARNING & ARTIFICIAL INTELLIGENCE IN TRIBOLOGY

INSIDE

- What to Know about Safety Data Sheets (SDS) — Including Lubricants!
- Why Industrial Facilities Should be Utilizing Lubrication Tagging and Labeling

NORIA

VAS TRIBO Solutions Unlimited

Noria Skill Certification
Live Online Training

Expand your skills from the convenience of your home or office with Noria's Live Online Training. Featuring the same benefits of live Instructor interaction and the convenience of learning in a comfortable setting, Live Online Training is conducted by industry experts with years of experience.

Machinery Lubrication Engineer (MLE)

AUGUST
22-26th

Oil Analysis Level -III (MLA III)

SEPTEMBER
20-23th

Machinery Lubrication Level - I (MLA I / MLT I)

OCTOBER
18-20th

Oil Analysis Level - II (MLA II) Ferrography and Interpretation

DECEMBER
13-15th

***Self Paced Training Programs also available at attractive price**

+91-9431117604 | E-mail : info@lubrication-institute.com | Website : www.lubrication-institute.com

TABLE OF CONTENTS

Machinery Lubrication INDIA

Publisher's Note

In the era of smart phones, I am sure all users of these device are already aware, least little familiar with artificial Intelligence primarily through virtual assistants, such as Siri, Alexa, and Google. Artificial Intelligence makes automate repetitive learning and discovery through data after initially being set up by a human being. Artificial intelligence adapts through progressive learning algorithms. The more we use these the more they become accurate. These are still very much first-generation products and many of these are unable to go beyond a single threaded conversation, but in other fields like health, education, automobiles , space, logistics , machine learning and tribology etc. many advances have been made which have made the human life a little easier.

Artificial intelligence (AI) based on object recognition, image classification and deep learning is now being used to spot cancer on MRIs with the same accuracy as high trained radiologist. This medical artificial intelligence has already gone beyond our helpful assistances.

An artificial Intelligence technology making future development as it could replace the laboratories & technicians within the next decade due to the astronomical rise in the cost. It could become indispensable to our current reliability practitioners, allowing them to reach the right prognosis quicker and with greater accuracy. In recent newly innovated sensors have replaced the routine laboratory analysis of in-service lubricants. This avoids the need to take sample, dispatch to the laboratory, testing and then interpretation. The sensor could be programed to give live readings of the parameters with alert and alarm limits setup to keep you warned on the condition of the lubricant and a indicator of when the oil needs to be changed.

The combo of blockchain, Artificial Intelligence, deep learning could personalize lubrication in a truly amazing way. Recommendations based on equipment history, working and environmental conditions, load factors, current lubrication regime, geography, atmospheric conditions, and past maintenance history.

This may sound a little futuristic, but these are the developments that we are most likely to see in the days to come. Millions of Dollars are being spent to AI and useful applications are being devised to improve the quality of work, save time and save on manpower.

Besides the cover story on Machine Learning and Artificial Intelligence in Tribology, we have several other articles on lubricants, lubrication & reliability. It also includes a brief report on recently concluded Reliable Plant Conference & Exhibition which was organsied by Noria Corporation from 25-28th July 2022 at Orlendo, Florida (USA). This is one of the biggest shows on "Lubrication Enabled Reliability". Several international companies from around the globe participated in the exhibition. Besides this several topical papers were also presented on the subject.

We would be happy to receive your feedback on how we can make our magazine more informative and interesting for our readers.

Meanwhile stay safe & healthy.

Warm regards,

Udey Dhir

Jim Fitch | Noria Corporation

The Power of 10X

Cleaner...Dryer...Cooler...Better Aligned...More Training

"One might think that if you make a 10-times improvement, you should expect a 10-times gain."

Have you ever considered how we might be rewarded if we improved something by 10 times? For instance, what if we were 10 times richer; would we be 10 times happier? How about if we were 10 times smarter; would we be 10 times more successful? What if we worked 10 times harder? How might it apply to being more physically fit, taking initiatives, having more drive, being kind and more empathetic, having more friends/connections, etc.?

One might think that if you make a 10-times improvement, you should expect a 10-times gain. In such cases, your gain or benefit would be incremental or proportional. In maintenance, we have control over many factors that can lead to gain. We've all heard of the gains that are the most important to us: better quality, lower production costs, lower repair costs, higher asset utilization, improved safety; the list goes on.

Invariably, we are looking for factors within our realm of control, factors that we can affect with relative ease and sustainability.

We have so many options at our disposal. What do we choose, and what do we push aside? Understandably, if we are going to change something, we'd want the biggest bang for our buck.

To that end, I have prepared a list of options to consider where we have good data and/or experience to rely on. Let's get started.

10X Cleaner

This one is easy; the contaminant sensitivity of machine components has been reasonably well-established. This includes bearings, gearing, pumps, valves and even engines. A test procedure, known as the accelerated life test (ALT), is followed to determine a machine's tolerance to particle contamination. During the test, the machine or component is subjected (exposed) to known and controlled levels of contaminants to measure changes in service life.

Of course, there are a lot of factors related to particles that influence service life. These include particle size, number, hardness and angularity. We must also consider machine and operating factors: loads, speeds, working clearance, metallurgy/surface hardness and contact geometry.

With rare exception, the life-extension from improved fluid cleanliness is disproportionate, meaning that one unit of improved cleanliness translates to multiple units of extended life.

Using a hydraulic piston pump as an example, if the fluid is 10 times cleaner, the pump may last 50 times longer (see the nomograph in Figure 1). The disproportionality works in your favor if the oil is cleaner (5 to 1) but works against you if it's dirtier (1 to 5). Hydraulic fluid that is twice as dirty reduces service life down to 20% or less. This might occur if a filter bursts or is in bypass mode.

https://www.machinerylubrication.com/Read/95/machine-life-extension

Figure A

You can use the online calculator linked to in Figure A to get a better idea of how increased cleanliness might affect machine reliability. It is based on Noria's well-known life extension table.

For rolling element bearings, I recommend that you consult the charts in Annex A of the ISO 281:2007 standard (Rolling Bearings — Dynamic Load Ratings and Rating Life).

10X Times Drier

The relationship to water contamination is also rather easy to predict. Similar to the impact of particle contamination, the detrimental effects of water on bearing service life have been shown through ALT testing. This data is explicit and authenticates the relationship between water concentration and life expectancy. An example of one such study is summarized in the graph in Figure 2.

Just like particles, there are many different factors at play, including bearing type, operating temperature, lubricant type (base oil additives), the state of water (dissolved, emulsified, free), etc. The damage caused by water includes corrosion, impaired pressure-viscosity coefficient (poor film strength), hydrogen embrittlement, two-body abrasion and lubricant oxidation.

Machinery Lubrication India

Publisher
Udey Dhir
udeydhir@tribologysolutions.com

Creative Director
Sumita Maniktala
smassociates@gmail.com

Advertisement Sales (US/Canada)
Brett O'Kelley - bokelley@noria.com

Advertisement Sales
(India/all other countries)
Kaustav Das
kaustuvdas@machinerylubricationindia.com

CORRESPONDENCE
You may address articles, case studies, special requests and other correspondence to our

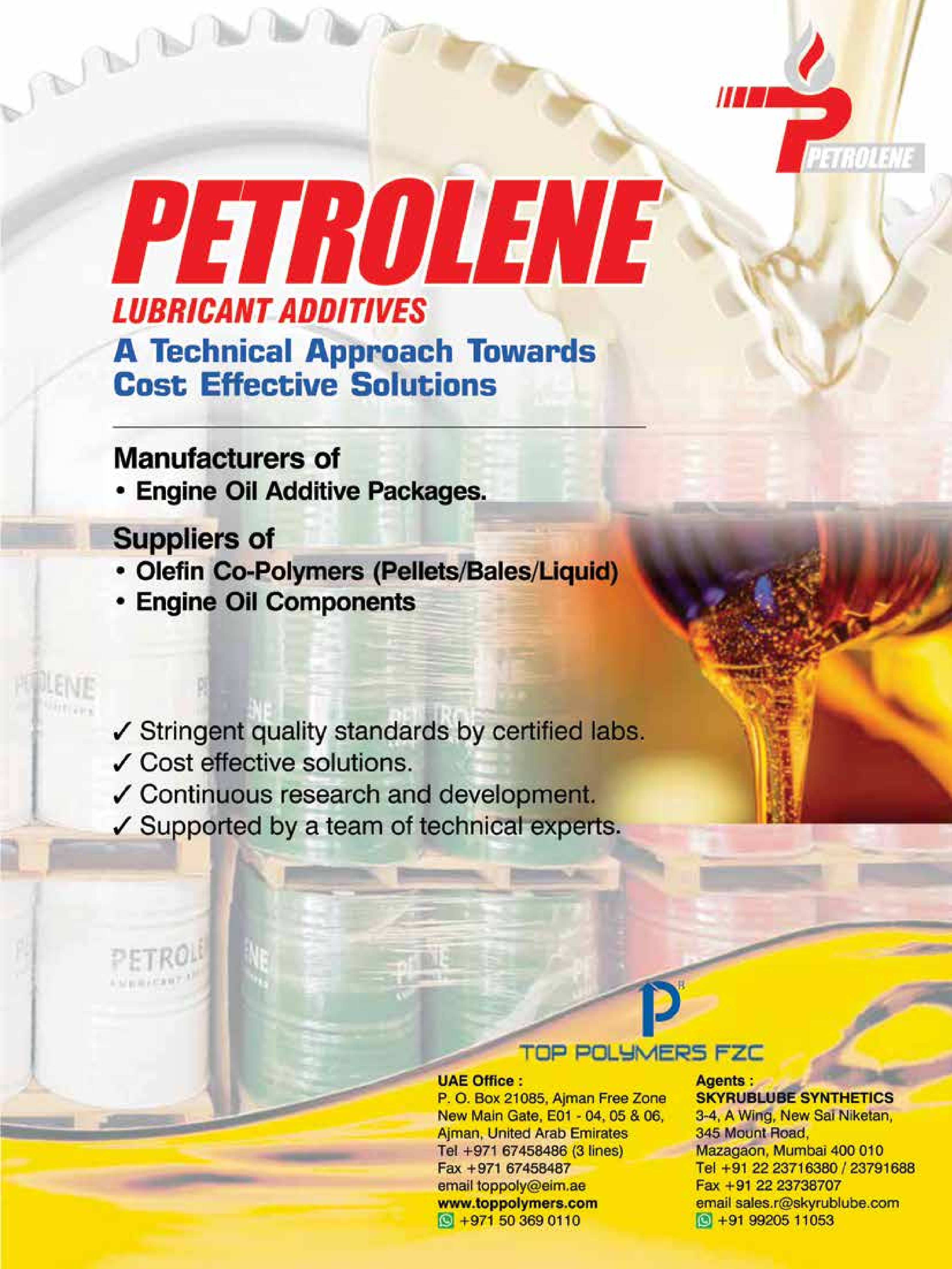
Operation office :

Editor
213, Ashiana Centre, Adityapur,
Jamshedpur-831013, India
email : editor@machinerylubricationindia.com
Tel: +91-657-2383238
Tel:(USA): +1-918-960-9738

Marketing Office
Rider House, 136,
Sector 44, Gurgaon-122003, Haryana
National Capital Region, India

Machinery Lubrication India Volume 59 - Issue 3, July-August 2022 is published bi-monthly by VAS Tribology Solutions Pvt. Ltd. Operation Office:213, Ashiana Centre, Adityapur, Jamshedpur-831013, India.

SUBSCRIBER SERVICES: The publisher reserves the right to accept or reject any subscription. Send subscription orders, change of address and all related correspondence to: VAS Tribology Solutions Pvt. Ltd. Operation Office:213, Ashiana Centre, Adityapur, Jamshedpur-831013, India.



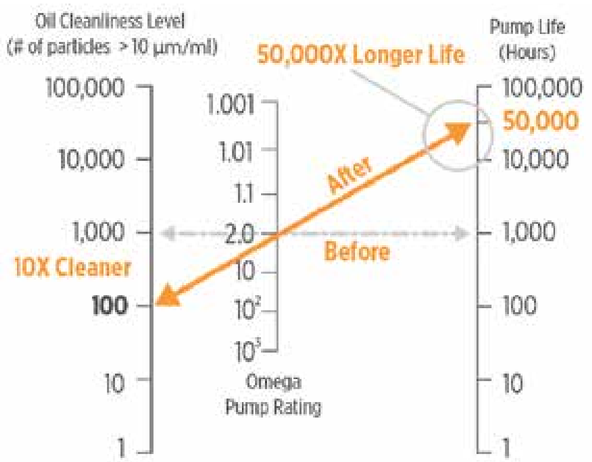


Figure 1: Relationship of particle contamination to pump life.

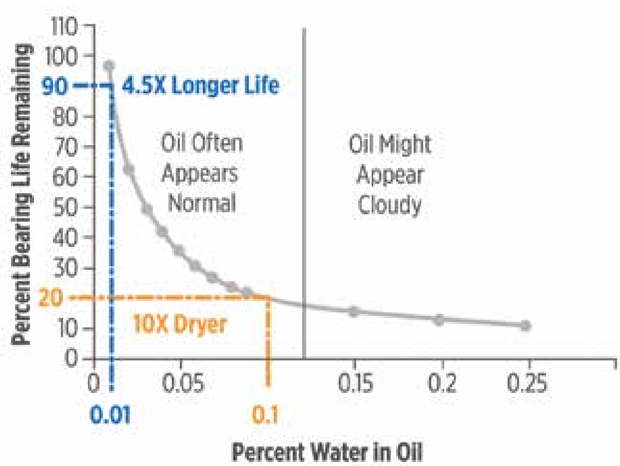


Figure 2: Relationship of moisture contamination to bearing life.

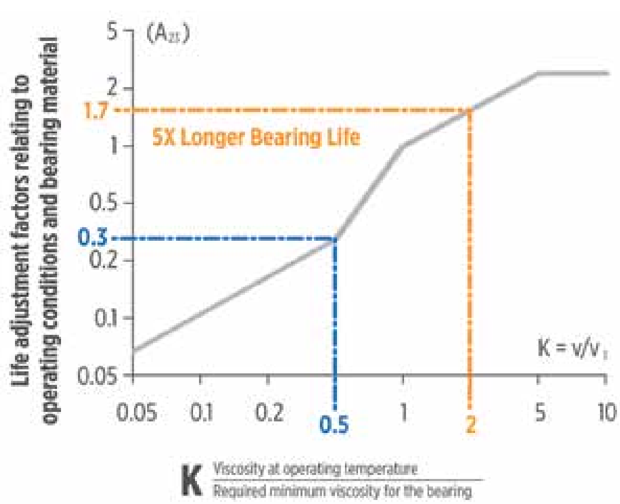


Figure 3: How temperature and viscosity affect bearing life.

Like particles, water contamination is disproportionate to service life. For example, by going from 1,000 ppm (0.1%) water to 100 ppm (0.01%), bearing life is roughly 4.5 times longer.

Take a look at the article linked to in Figure B, which discusses nine ways in which water is responsiblefor damage and failure of rolling element bearings:

20 Degrees Cooler

Determining the relationship between lubricant temperature and bearing life is more complex. The best place to start is to establish the change in viscosity resulting from the change in temperature. Instead of referencing "10 times" with temperature, we'll say 20 degrees cooler instead. How would reducing an oil's temperature by 20 C impact bearing life?

For bearings, too much viscosity (too cool) is destructive, as is too little viscosity (too hot). Ultimately, we're trying to optimize the viscosity relative to factors like energy consumption, fatigue life, abrasion (and other forms of mechanical "contact" wear) and general reliability objectives. This can be done by tweaking the ISO viscosity grade, the viscosity index, additives (AW/EP) and operating temperature.

5X Life Extension Example:

- Let's say our bearing at operating temperature (40 C) requires an ISO VG 68 R&O oil. This would achieve a Kappa (K) of one. Kappa is the viscosity at operating temperature divided by the required minimum viscosity.
- Furthermore, let's say current conditions normally run at a temperature of 55 C. Using a standard ASTM temperature-viscosity chart for ISO VG 68, the actual viscosity is 34 cSt at that temperature, resulting in K=0.5. The service life factor (A_{23}) is 0.3. See Figure 3.
- If we reduce the temperature of the lubricant by 20 C (from 55 C to 35 C), the viscosity rises to 135 cSt and K=2 and A_{23}=1.7. This 20 degree temperature reduction, using the chart in Figure 3, increases the bearing life estimate by five times (5X). So, in this example, a 20 C reduction in oil temperature translates to five times longer bearing life.

10X Better Aligned

The relationship between shaft alignment and bearing reliability is reasonably well understood. The graph in Figure 4 above does a good job of representing how misalignment can nibble away at bearing service life. Going from 5 mils/inch to 0.5 mils/inch (10 times improvement) can translate to over

https://www.machinerylubrication.com/Read/1367/water-bearing-failure

Figure B

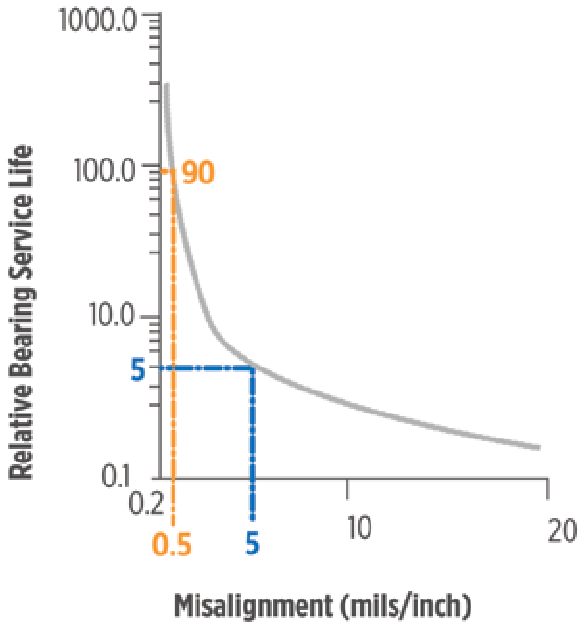


Figure 4: Rough estimation of the relationship between misalignment and bearing life.

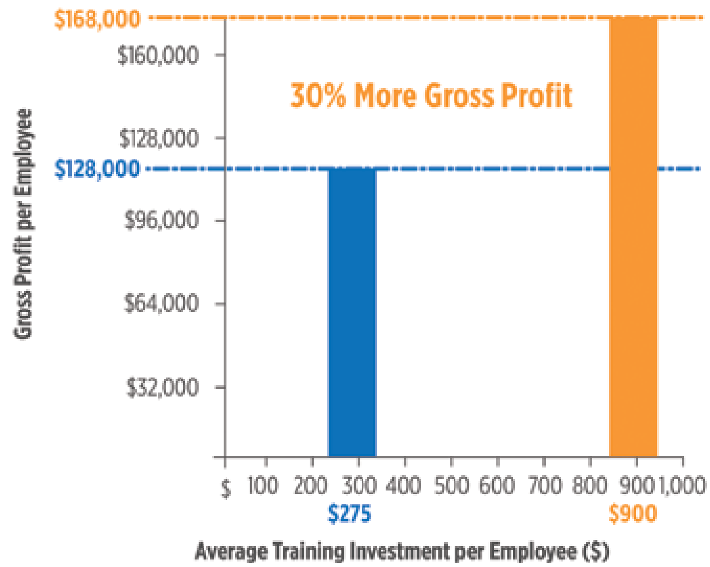


Figure 5: Relationship between training investment per employee and company gross profit per employee.

10 times longer bearing service life. Of course, like the previous examples, many other factors play a role as well, including load, speed, bearing type, lubricant, etc.

10X More Training

So far, we've only been talking about bearings. The chart shown in Figure 5, published by the American Society for Training and Development, shows an interesting relationship between gross profit per employee and training. According to their numbers, an annual investment of $625 per employee yields an annual return of $47,000. Extrapolating from this chart, a 10 times increase in training investment (going from $90 to $900/year) yields roughly $68,000 return per employee.

How does more training of maintenance personnel affect the life of bearings? Here are a few ways: better lubrication, better inspection, better condition monitoring, better fit and clearance, better balance and alignment, less mechanical looseness and better contamination control. *ML*

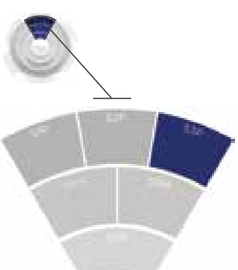
About the Author

Jim Fitch has a wealth of "in the trenches" experience in lubrication, oil analysis, tribology and machinery failure investigations. Over the past two decades, he has presented hundreds of courses on these subjects.
Contact Jim at jfitch@noria.com.

Travis Richardson | Noria Corporation

Why Industrial Facilities Should be Utilizing Lubrication Tagging and Labeling

More about this **ASCEND™ Factor**



Factor:
S3P — Lubricant Identification System

Level:
Platform (P)

Stage:
Lubricant Selection

About:
A lubricant identification system is a crucial step to ensure that technicians can correctly match the right lubricant to its corresponding machine through visual aids, labels and color-coding.

Learn More:
noria.com/ascend/

As a Technical Consultant here at Noria Corporation, I see many different failures related to lubrication issues. We are called out to consult on and fix the problems through better, more precise lubrication practices. One of the most common issues we run into is that the Lubrication Technician accidentally put the wrong lubricant into the machine; this is very easy to do when a proper lubricant labeling system isn't in place and can lead to many different types of problems within

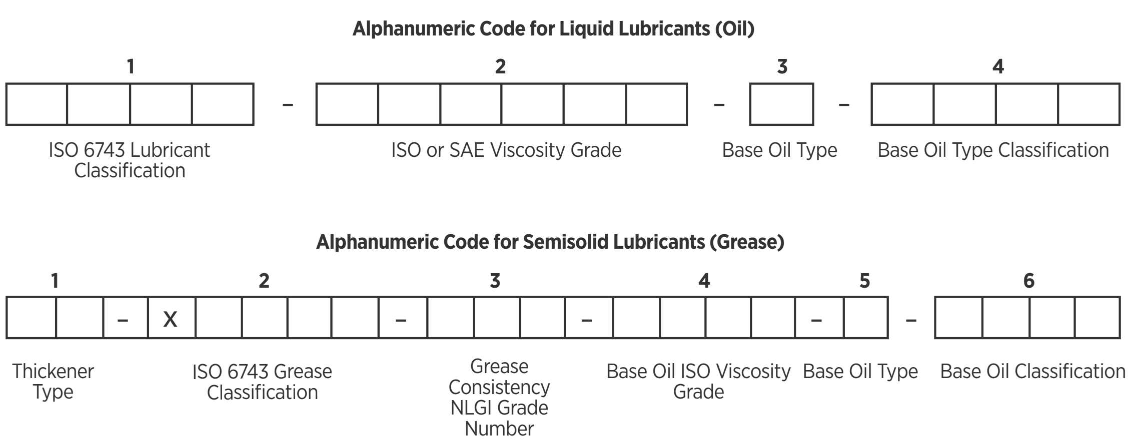


Figure 1: LIS Breakdown

the machine. The mixing of incompatible lubricants can cause a vast array of issues, such as seal expansion or shrinkage, additive precipitation, loss of anti-wear performance, loss of demulsifying properties, etc. When these problems arise, they ultimately lead to machine failure.

Above, I have provided two examples of our Noria Lubricant Identification System (LIS) tags. The circle tag is for greases, and the square is for oils. The shape of the tag is the first identifier of what gets utilized in the machine, whether it be grease or oil. The next identifier is the shape on the tag; we offer 32 unique shapes, ranging from a plus sign to a twelve-point star. The addition of a shape onto the tag allows for easier identification by individuals with color-blindness.

Furthermore, we have the color. We offer nine different colors that correspond to the colors found for the lids on the sealable and refillable containers, no matter the brand. Lastly, we include the LIS code on the tag: “CKD-220-S-PAO” and “PU-XBEIA-2-115-M-G2” on the examples shown.

An example of how LIS codes are formulated is shown in Figure 1.

The way lubrication tagging and labeling works is fairly simple. The hypothetical plant has six different types of oils; any of those six can be accidentally used in the wrong machine. However, when you place a label on the oil drum, bulk tank, S&R container, and finally the corresponding machine that utilizes this oil, lubricating these machines becomes foolproof. The same idea can be applied to greases: If a machine takes grease, the tag will be a circle tag; these tags go on the grease gun and the corresponding machine for that particular grease. It really is that simple.

We constantly preach best practice methods and precision lubrication. What is the definition of precision? “The quality, condition, or fact of being exact and accurate.” The first step to achieving precision lubrication is labeling and tagging. This makes lubrication so much easier, and when it is easy to do, it gets done right. I would like to add that the examples that I have provided are the way that Noria creates a tagging system. Each facility can tag and label however they want. We have seen systems as simple as labels made by a label maker that provide the exact name and viscosity of the lubricant placed on each lubricated machine and component. It doesn’t have to be as complicated as an LIS tag; however, that is best practice. Anything to ensure that the correct lubricant is going into the correct component. We do not want to mix, contaminate or diminish the current lubricant in any way.

The next time you are walking through the plant, take tags with you and make sure that each machine you walk by is properly tagged and labeled. This is the most overlooked low-hanging fruit of any lubrication program. Knock this out and watch the program soar to lubrication excellence. ***ML***

About the Author

Travis Richardson is a technical consultant for Noria Corporation. He holds a Level II (MLT) and Level III (MLA) certification . Contact Travis at trichardson@noria.com.

BY IAN TAYLOR

MACHINE LEARNING & ARTIFICIAL INTELLIGENCE IN TRIBOLOGY

Almost every day, impressive new developments in machine learning and artificial intelligence (AI) are reported, such as:

- A computer program that taught itself the strategy game "Go" and beat the current world champion
- Impressive advancements in facial recognition software
- Almost instantaneous translation of one language to another (either written or spoken) using freely available online software

With all these advancements, it is natural to ask whether such techniques could be effectively applied to lubrication problems.

The rise in these many examples of machine learning/artificial intelligence is directly linked to the availability of high-quality data (and lots of it). Machine learning and artificial intelligence can generally be split into two types: supervised models and unsupervised models. Simply put, supervised models typically find statistical (or regression) models relating input data to output data and provided new input data that is covered by the training data set. These techniques should work well, although they are not able to reliably extrapolate if the new input data is outside that of the training set.

Unsupervised models typically use neural networks. Neural networks, also referred to as "deep learning", are a collection of algorithms loosely modeled on the human brain, designed to recognize patterns. These unsupervised models can effectively "work out" the best model for themselves — however, once a good model has been found, it is not always obvious why it works. In other words, the underlying algorithm that the machine learning model has found is not easy to unravel. There are numerous examples where artificial intelligence and machine learning have already been applied within the lubrication/tribology community, including:

Condition monitoring — Machines are now being supplied with an increasing number of sensors that can report their operating conditions (speeds, loads, lubricant temperatures) back to the OEM and/or machine owner. These machines can be fitted with additional sensors that monitor vibrations and electrical currents going in and out of the machine. Lubricant sensors can also detect wear particles or monitor lubricant degradation (such as dielectric-based sensors).

By monitoring a large number of machines, warning signs of likely future failure can be predicted based on previous failures and correlating such failures with the various sensors data. Customers can be advised to service their machines or replace specific components once early signs of failure are detected. Even better, they may catch the root causes before they lead to failure symptoms. The schematic in Figure 1 below shows the type of signals that can be picked up before failure occurs.

The most commonly used techniques for condition monitoring are vibration monitoring and thermography (looking for "hotspots"). A number of commercial solutions are available today that use artificial intelligence and machine learning for condition monitoring (from companies such as SKF, GE, Siemens, and Bosch). There are also numerous start-up companies using more specialized techniques, such as ultrasound (UK-based Tribosonics; US-based UE Systems, with their OnTrak SmartLube system). For high-value machines, other specialized techniques such as lubricant monitoring by infrared and wear particle sensors may also be used. Although the general application is to advise customers of machines that may need service or components replaced, these techniques can also be used to monitor energy consumption, and customers can be given advice on how to reduce their energy consumption (and related cost savings can help pay for such monitoring systems).

Chatbots for Lubricant Helplines — Shell offers an online chatbot (Lubechat)

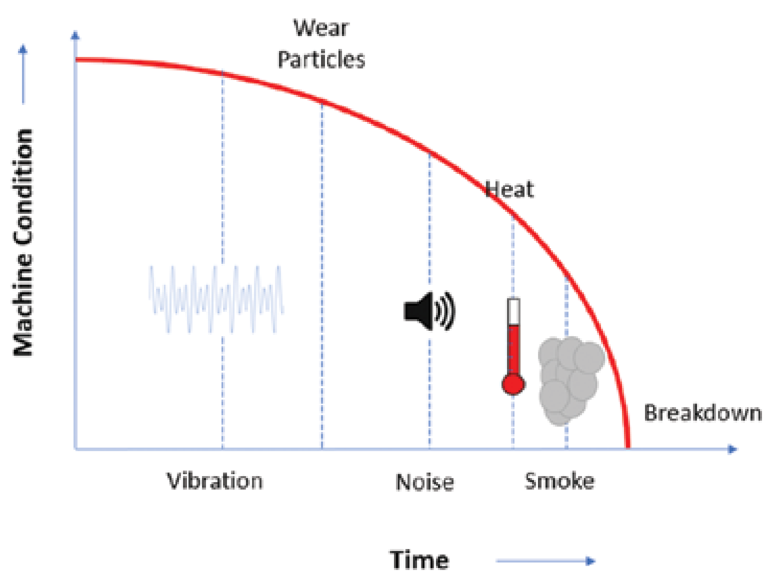


Figure 1: The types of events preceding machine failure.

that can answer simple customer queries and provide technical data on lubricant products. The 24/7 service is available in twelve countries and several different languages (including Chinese, Russian, German, etc.) Questions that cannot be answered by the Virtual Assistant are passed on to human experts for answers.

Fleet Telematics — There are commercial companies (such as Microlise) that extract data from heavy-duty vehicle electronic control units (remotely). The data contains speed, load, temperature data, route data and fuel consumption data. By combining data from many trucks, the most efficient routes between two or more places can be identified. This data can also identify improvements in logistics efficiency and fuel-heavy drivers (who can then be given training into how to reduce their fuel consumption).

Visualization and Classification of Wear Particles — AI and machine learning techniques are particularly powerful for image identification and classification. A number of researchers have used such techniques on wear particles. Size, texture, shape and color are all parameters that contain information about the wear mechanism and where it occurs. Neural network algorithms have been used to identify if the wear particle is metallic or an oxide; and whether the wear is due to fatigue or severe sliding.

Design of New Materials — Machine learning has been used by a number of researchers to optimize the properties of metal alloys and vapor-deposited hard coatings. For coatings, the thickness, composition, hardness and Young's modulus all contribute to the tribological performance. Hard coatings are usually used to reduce wear. Similarly, for metallic alloys, properties such as density, hardness, Young's modulus and fatigue life are all properties that researchers are attempting to optimize.

Prediction of Lubricant Properties — Lubricants are often a complex mixture of two or three different base oils, an additive package (which could comprise from 1% to 15% of the final lubricant), and in some applications (such as engine oil), large polymers known as viscosity modifiers. Predicting the various viscosities of the lubricant for different temperatures and shear rates is not straightforward; historically, such properties have been measured experimentally on a number of slightly different blends to find the optimum.

This type of problem is amenable to AI and machine learning since there are only a limited set of base oils, additive packages and viscosity modifiers in widespread use, and such techniques would be useful to lubricant and additive companies to improve the efficiency of their lubricant design process. Such companies are also likely to have good viscometric data on a wide range of lubricant formulations to test their AI models on. Unfortunately, since the composition of lubricants is usually a closely guarded secret or can change without warning, these techniques are likely to be kept "in-house" and used by lubricant suppliers for their own products.

Prediction of Lubrication Regime — Recently, researchers have used machine learning to predict the lubrication regime of a journal bearing. Key parameters such as speed, load, oil and surface temperatures, contact conditions and friction coefficient were recorded. Characteristic frequencies were found for the different lubrication regimes, and the model developed was able to distinguish between journals in the hydrodynamic, mixed or boundary lubrication regimes.

Numerous researchers have attempted to use artificial intelligence and machine learning to predict friction and wear. This is a much more complex problem since friction and wear are properties of the complete system rather than its individual components. The figure below shows a schematic of the complicated nature of a simple lubricated contact. Often, "running-in" takes place over a number of hours, during which contact conditions change. The simple passage of a loaded ball or cylinder over a flat piece of metal can induce hardness and other changes to the metals, which can influence friction and wear.

In addition, there are complex tribo-films formed by the lubricant, whose composition and other properties are not precisely known. The contact conditions (hydrodynamic, mixed or boundary lubrication) are determined by the operating conditions (speed, load, lubricant temperature, surface roughness), and, if wear occurs, the type of wear (abrasive or adhesive) depends critically on the loads and speeds. A large amount of data is needed to characterize the complete system; this data is not normally reported in sufficient detail

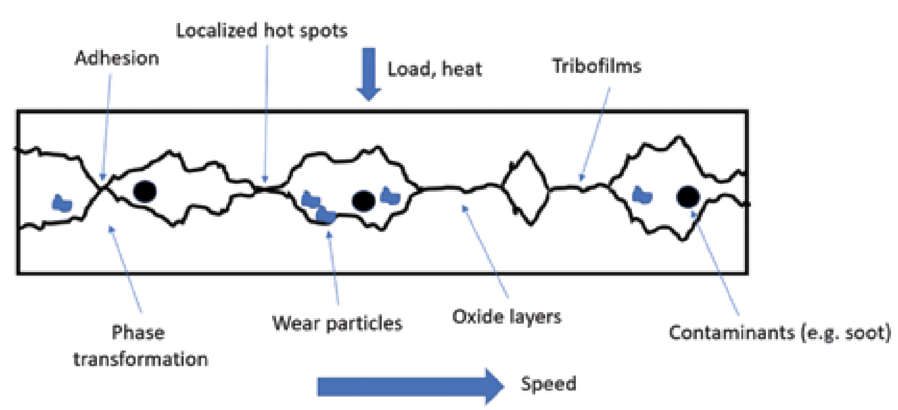


Figure 2: The complex nature of a typical lubricated contact.

in research papers for machine learning to be applied. In addition, the composition of lubricants is proprietary and usually only known to the lubricant and additive suppliers.

Researchers, such as Professor Daniele Dini at Imperial College, are actively attempting to develop a "digital twin" of a tribological contact, but this is likely to be a long-term project which requires advances in a number of key areas (wear modeling, lubricant tribochemistry, material changes during sliding, etc.). In addition, any successful machine learning model will need to distinguish between the "good wear" that occurs during "running-in" from the "bad wear" that occurs near the end of a component's life.

Looking further to the future, researchers at the University of Central Lancashire, led by Professor Ian Sherrington, are actively working in the field of tribotronics, in which individual tribological systems are monitored, and contact conditions can be changed depending on the sensor data. For example, in two-stroke marine engines, the oil film thickness between the piston ring and liner can be measured using a capacitive sensor, and the oil feed rate to the cylinder can be increased or decreased depending on the oil film thickness. Such systems could benefit from machine learning algorithms too.

Artificial intelligence and machine learning algorithms have already been used for many applications in lubrication and tribology. To progress further, the lubricant and tribological community will need to develop ways to share the large amounts of data that such models need. To date, most tribology tests generate relatively small amounts of data (compared, for example, to the number of photographs or text online, used for facial recognition and language translation); key material, surface roughness, and lubricant properties are not generally available for later analysis.

In the near future, when machines are connected and routinely sending information back to their manufacturers (and customers) about how they are performing, the use of AI and machine learning to give early warning of potential issues or faults with the machine will enable proactive maintenance to be undertaken, and customers will avoid potentially costly breakdowns und unscheduled machine downtime. *ML*

Further reading:

1. Condition monitoring: see for example, https://www.ge.com/digital/iiot-platform, https://www.skf.com/uk/products/condition-monitoring-systems, https://www.boschrexroth.com/en/xc/company/press/index2-31872, https://www.tribosonics.com/, https://www.machinerylubrication.com/Read/31982/ue-systems-ontrak-smartlube
2. Shell Lubechat: https://www.shell.com/business-customers/lubricants-for-business/shell-expertise/lubrication-services-for-your-industry/shell-lubechat.html
3. Fleet telematics: https://www.microlise.com/
4. Classification of wear particles: https://www.sciencedirect.com/science/article/abs/pii/S0888327015004732
5. Design of new materials & lubricant properties: https://www.mdpi.com/2075-4442/9/1/2/pdf
6. Lubrication regime: https://www.mdpi.com/2075-4442/6/4/108
7. Predicting friction and wear: https://my.demio.com/recording/X4TOkK8i
8. Tribotronics: https://www.sciencedirect.com/science/article/abs/pii/S0301679X07000631

About the Author:

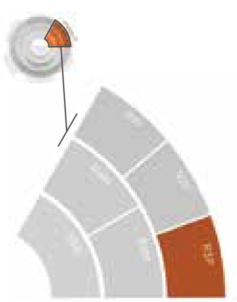
After a degree in Physics and a Ph.D. in Applied Physics and Electronics, Ian Taylor joined Shell Research in the UK in 1991, where he worked mainly in lubricant/lubrication research (including being the Global Technology Manager for Shell's Lubrication Science team from 2006 to 2012).

Bennett Fitch | Noria Corporation

Factor: R3P

What to Know about Safety Data Sheets (SDS) — Including Lubricants!

More about this
ASCEND™ Factor



Factor:
R3P—Lubrication Safety Practices:

Level:
Platform(P)

Stage:
Lubricant Reception And Storage

About:
Lubrication safety practices involve the proper storage and marking of lubricants, as well as safety equipment.

Learn More:
noria.com/ascend/

For many of us, getting oil or grease on our hands may seem harmless. In fact, the inconvenience of the mess it makes is usually considered more than the health and safety factors. But certain types of lubricants, especially in larger quantities, can pose significant concerns to our health and the environment when not managed correctly. Many have been made more aware of this with media attention in recent years, but there have been actions taken to communicate the impact and safety measures of lubricants for over a century. These are written and provided in a document called a Safety Data Sheet (SDS).

- If the lubricant is spilled, how should it be cleaned up, and with what materials?
- How should the lubricant be disposed of properly?
- What type of personal protection (masks, gloves, etc.) should be used when handling the lubricant?

Questions like these are a few examples of what is answered by the Safety Data Sheet. Lubricants are just one of the many kinds of substances that are required to have Safety Data Sheets provided by the manufacturer and easily accessible anywhere they are used, stored or otherwise possibly exposed to humans or the environment. For anyone who has worked in an industrial environment, particularly in maintenance, the availability and purpose of these documents are a routine reminder as part of safety trainings. Nevertheless, many of the key aspects of these documents remain unclear to those who handle these lubricants. And for anywhere where exposure is a more frequent occurrence, like when adding grease or oil to a machine, this is particularly important.

Here are a few things to know about Safety Data Sheets (SDS):

What is a Safety Data Sheet? Safety Data Sheets (SDS) are a required Hazard Communication Standard (HCS) for information about a potentially hazardous material's chemical and physical properties, particularly how the material should be handled and how exposure to the material could impact health, safety and the environment.

Who Develops Safety Data Sheets? Safety Data Sheets are prepared by the manufacturers for all chemicals, including lubricants, and particularly those that are known to pose a hazard to health and safety.

What Hazard Concerns Could be Identified by the Safety Data Sheets? Hazards relating to physical, chemical, health and the environment are identified and detailed in sections 2 and 3 of the Safety Data Sheets. Further sections provide recommended measures for first aid (section 4), fire-fighting (section 5), actions to take for accidental release (section 6), toxicological information (section 11) and more.

Who Needs to Know about Safety

Data Sheets? While it is not uncommon for all personnel tasked with work in areas where these chemicals are used to be provided awareness training on these documents, it's particularly important for those responsible for the selection and management of chemicals onsite. For example, anyone who manages the storage of lubricants or handles their transportation and application into machines must have access to and an understanding of the Safety Data Sheets.

Who Regulates and Defines the Format for Safety Data Sheets? While the Globally Harmonized System (now aligned to the Hazard Communication Standard) for the SDS format is universal, each country dictates how and when these sheets are to be used. In the United States, Safety Data Sheets fall under the jurisdiction of the Occupational Safety and Health Administration (OSHA).

What is the Format of the Safety Data Sheets? Safety data sheets are formatted in a standardized 16-section layout, allowing for consistency across industries. The sixteen sections are listed in the adjacent infographic (see later text).

Who Should be Responsible for Managing Safety Data Sheets? Typically, these practices are monitored by safety personnel and managed by inventory personnel. Ultimately, anyone who works in an area where exposure to chemicals, including lubricants, is a possibility should be provided the necessary health and safety precautions as well as the necessary SDSs.

Is Technical Information, Such as Performance Properties, Provided on the Safety Data Sheets? While the Safety Data Sheets contain quite a bit of technical information, the details are intended for only the purposes of safety, health, environmental impact and the like. However, most lubricant manufacturers provided Technical Data Sheets (TDS) (sometimes called Product Data Sheets) for more technical and marketing information about how the lubricant should be selected, precautions for use and overall performance properties.

Where Can Safety Data Sheets be Found? These are free publications that are easily accessible online through the manufacturers' websites, but they can also be provided directly from the supplier. Typically, on any page where the lubricant information is identified, both the Safety Data Sheet and the Technical Data Sheets can be downloaded.

Where Should Safety Data Sheets be Stored? At a minimum, they need to be made available physically in a printed form in areas where lubricants are more frequently stored. Many facilities print and bind the sheets and place them in an accessible location, like a lube room or warehouse. In recent years, SDSs are being made more available in a digital database. There are safety and inventory software programs that can help with this, for example, with services provided by Safetec (hsi.com).

There are also lubrication management programs, like LubePM (LubePM.com), that conveniently list all the lubricants in the plant and where they are applied; LubePM also makes Safety Data Sheets and Technical Data Sheets easily available for each lubricant on mobile devices.

What is the Most Important Thing to Know About Safety Data Sheets? Emergency phone numbers are listed in Section 1 — if someone is injured, poisoned or made ill by a lubricant, you can call this number for more

information; it is available 24/7.

Safety First. Often, lubricants (and other chemicals) are routinely taken in and out of areas in the plant. Sometimes there may be uses for lubricants that create risks that some personnel are unaware of, including the risks created if mixed or exposed to other lubricants. The goal of Safety Data Sheets is to always communicate any important information that can maintain a high level of safety in the workplace, especially in industrial environments where exposure is common, such as with lubricants. While handling and applying lubricants to machines, it's not uncommon for there to be fumes and skin contact. In most cases, this is inconsequential if these exposures are limited; but certain lubricants can be much more harmful when not properly considered. Safety Data Sheets can be comprehensive in listing these possible concerns, and whenever uncertain about any possible risks, always reach out to the emergency contact information provided for clarity. ***ML***

About the Author

Bennett Fitch is the Chief Strategy Officer for Noria Corporation. He is a mechanical engineer who holds a Machinery Lubrication Engineer (MLE) certification, a Machine Lubricant Analyst (MLA) Level III certification and a Machine Lubrication Technician (MLT) Level II certification through the International Council for Machinery Lubrication (ICML). Contact Bennett at bfitch@noria.com.

The 16 Sections of a Lubricant

Section 1: Identification

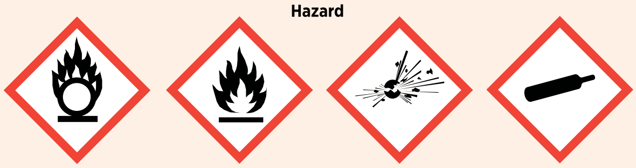
The first section of an SDS is devoted to identifying the lubricant and listing its intended use. This section also identifies other names that the lubricant might be known as and must also contain the lubricant supplier's essential contact information. The recommended use portion of this section describes the purpose or function of the lubricant, although the Product Data Sheet will be more comprehensive in describing the applications and performance properties.

Common Sub-Sections Include: Product Use, Product Numbers, Company Information, Transportation Emergency Contact, Health Emergency Contact, Technical Information Contact.

Section 2: Hazard(s) Identification

This section states the hazard classification of the lubricant, along with pictograms and precautionary advice. For hazards that are not classified, a description is provided.

Exclamation Mark | Acute Toxic | Environmental Hazard | Health Hazard | Corrosion



Flame Over Circle | Flammable | Exploding Bomb | Gas Cylinder

Common Sub-Sections Include: Classifications, Chemical/Physical/Health/Environmental Hazards, Label Elements, Precautionary Statements for Prevention and Disposal.

Section 3: Composition/Information on Ingredients

Section three lists the ingredients (including stabilizing additives and impurities) of which the product is composed. It is in this section that mixtures are further explained. Additionally, if a chemical is subject to a trade secret claim, the amount of that chemical within the lubricant must be stated here.

Common Sub-Sections Include: Table Listing Included Components, CAS Number and Amount (percentage).

Useful fact about lubricant ingredients provided in Safety Data Sheets:

In Section 3 — Composition/Information on Ingredients: this can be helpful in determining specifics about the base oil type and the additives. For example, the table below shows the "highly refined mineral oil" at 70 - 99% weight, confirming that it is a mineral- based oil. When available, the Chemical Abstract Service (CAS) numbers listed for the component can be searched using an online chemical lookup search engine for details about the type of base oil or additive used in the specified amount. Section 15 (Regulatory Information) may also have ingredient information along with the CAS numbers.

COMPONENTS	GAS NUMBER	AMOUNT
Highly refined mineral oil (C15 - C50)	Mixture	70 - 99% weight
Olefin sulfide	Confidential	1 - 5% weight
Amines, C12-14-tert-alkyl phosphates	92623-72-8	1 - < 2.5% weight
Phosphoric acid ester, amine salt	Mixture	1 - < 2.5% weight

Example of Ingredient information available in Section 3 of the Safety Data Sheet.

Section 4: First-Aid Measures

If exposure to a hazardous chemical occurs, this section lays out the necessary first-aid steps required by responders. This section also contains descriptions of the symptoms and effects of exposure.

Common Sub-Sections Include: Inhalation, Skin Contact, Eye Contact, Ingestion.

Section 5: Fire-Fighting Measures

This section describes how to proceed if the lubricant combusts, including recommendations of extinguishing material and equipment as well as hazards born out of chemical-specific fires. This section also includes recommendations for special fire-fighting equipment.

Common Sub-Sections Include: Extinguishing Media, Fire Fighting Instructions, Hazardous Combustion Products, Flammability Properties.

Safety Data Sheet (SDS)

Section 6: Accidental Release Measures

If a lubricant is spilled or leaked, this section should be referred to for both containment measures and clean-up processes. These measures may vary based on the volume of the spill. Also included in this section are recommendations for clean-up materials (such as absorbents) and protective equipment.

Common Sub-Sections Include: Notification Procedures, Protective Measures, Spill Management, Environmental Precautions.

Section 7: Handling and Storage

Safe handling and storage of lubricants are important for both safety and lubricant health. This section outlines how lubricants should be properly handled and measures that can be taken to prevent accidental releases during storage.

Common Sub-Sections Include: Handling, Storage.

Section 8: Exposure Controls/ Personal Protection

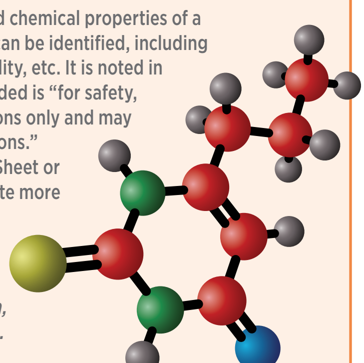
Based on potential material hazards, this section outlines exposure limits and engineering controls. Personal protective measures are also recommended.

Common Sub-Sections Include: Exposure Limit Values, Engineering Controls, Personal Protection, Environmental Controls.

Section 9: Physical and Chemical Properties

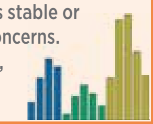
This section describes the physical and chemical properties of a lubricant and ways that the lubricant can be identified, including appearance, odor, viscosity, flammability, etc. It is noted in this section that the information provided is "for safety, health and environmental considerations only and may not fully represent product specifications." Rather, referencing the Product Data Sheet or contacting the supplier would elaborate more on performance information and recommendations for use.

Common Sub-Sections Include: General Information, Important Health, Safety and Environmental Information.



Section 10: Stability and Reactivity

This section includes details of the hazards associated with the chemical's stability and reactivity potential. The reactivity section must include chemical test data. The chemical stability section must indicate whether the chemical is stable or unstable under normal conditions and list potential stability safety concerns. There may also be information about conditions or materials to avoid, such as in excessive heat, high energy sources, or strong oxidizers.

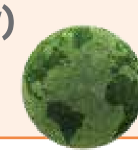


Section 11: Toxicology Information

Toxicological effects information is usually listed as a table listing out the hazard classes and the conclusions for each. Hazards classes include inhalation, ingestion, skin, eye, sensitization, aspiration, germ cell mutation, carcinogenicity etc.

Section 12: Ecological Information (non-mandatory)

This section describes the potential impact that a release of the chemical into the environment would have.



Section 13: Disposal Considerations (non-mandatory)

Information regarding the proper disposal, recycling or reclamation process of the chemical will be stated in this section.

Section 14: Transport Information (non-mandatory)

This section includes transportation considerations, including guidance regarding bulk transportation and necessary special precautions.

Section 15: Regulatory Information (non-mandatory)

This section is a catch-all for safety and environmental regulations not listed elsewhere in the data sheet.

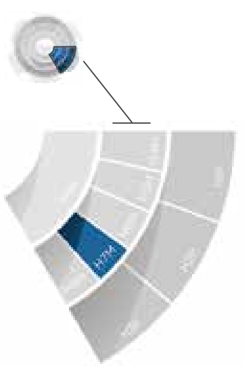
Section 16: Other Information

The final section typically includes information about the safety data sheet itself, including when it was created or last updated. Other information deemed useful can also be included in this section.

Paul Farless | Noria Corporation

How to Use Goals and Rewards to Optimize a Lubrication Program

More about this **ASCEND™ Factor**



Factor:
H7M – Goals and Rewards Systems

Level:
Management and Training(M)

Stage:
Lubricant Handling & Application

About:
Setting and defining goals clarifies a lubrication program's objectives, and implementing rewards systems encourages staff to reach those goals.

Learn More:
noria.com/ascend/

What is not measured cannot be controlled, and what is not motivated cannot be achieved; this is especially true in the field of machine reliability. The lack of clear objectives and the absence of a reward system to assess and encourage compliance with the activities of the handling and application stage leaves the success of the lubrication program open to subjective interpretation. In order to reduce faults and stoppages caused by improper lubrication, an effective lubrication program should establish clear goals, which should eventually result in, reduced lubricant consumption and increased equipment availability and reliability.

Effective programs also use rewards for meeting goals to motivate staff performing the lubrication tasks. These rewards can be either economic or take some other form. Plant managers will decide which ones to select; the important thing is that the lubrication team is motivated and has the right attitude and aptitude to achieve their daily work objectives.

Once the goals have been established and the course laid out, there is a need for benchmarks by which to measure the progress of the various aspects of the program. Performance metrics should be identified to assess the degree to which improvements have been completed and to measure the overall effectiveness of the lubrication program. These metrics should show the value obtained from advances in the program, which will keep everyone focused and provide justification for continued improvement. Having defined action plans for unmet goals will also facilitate the success of the program.

Training and Certification Goals

Many of the plants we go to have an established lubrication program that we are being hired to improve. The primary goals we see in these lubrication programs are certification goals; these incentivize professional growth and knowledge; they turn that tribal knowledge into standard knowledge that becomes THE WAY to perform lubrication. Usually, the incentive is something like, "Receive an

ML1 Certificate, receive a pay raise." The more certified you are, the better you will get paid. Sometimes the incentive is tied directly to advancement.

Lubrication Tasks Goals

Tracking the completion of the lubrication tasks (weekly, monthly or daily tasks) on time every week or month, continuously, is very important. These tasks include completing all of the inspections, sampling, relubrications and machinery hardware modifications. Although these tasks are simple, the sheer quantity of tasks can be overwhelming for a lubrication team that is understaffed or made up of maintenance personnel whose primary job is not lubrication. Sometimes this is tracked as a compliance metric as well.

Lubricant Consumption Goals

This is a very important goal; it is how the cost of a lubrication program is partially justified. Tracking consumption allows for a more precise volume of lubricants to be stored, which means less lubricant is getting ordered and wasted due to sitting on the shelf for too long. Often, we see a lube room full of old oil drums — they are usually way in the back, and the date on the label is typically several years old. The goal of lubrication is precision, and it starts with inventory and utilizing the "First In First Out" method. Stock rotation rewards can be shared with warehouse staff, encouraging them to become stakeholders in the lubrication program.

Safety Goals

Pretty self-explanatory, this refers to the number of days without a lubrication-related safety incident. Every program leader wants their technicians to be safe on the job. As leaders, we want to see each team member go home to their family every night in one piece. Safety doesn't necessarily have to be incentivized, but if it is, then lube tasks are more likely to be safely completed. What I am trying to say is: sometimes the "easy way" is much less safe than the correct way. The safest way to lubricate is the correct way to lubricate.

Rewards

Some technicians do the job right and do the job well. Conversely, some technicians get the job done, but it's not exactly up to standards. Understand that the men and women of industrial maintenance and reliability are the sole reason the plant machinery actually runs as it should. The fault, whether it is due to lubrication or lack thereof, is typically laid at the feet of the technician. But what if the machinery is running smoothly and flawlessly?

We go to different facilities all over the world and are met with a vast array of different personality types, attitudes, thought processes, etc. The most common trait that we see across the board is overtasking and under incentivizing. A large portion of this problem is simply due to understaffing. What we can suggest is that each facility produces a "Goals and Rewards Program" for the lubrication program. Now, a paycheck and company benefits are incentives to come to work and perform your job properly and to the best of your ability, but what follows are a few ways to encourage and motivate your lubrication team members to go the extra mile and strive to achieve the world-class status that is so heavily sought after.

Monetary

This is not necessarily a large pay raise, although that is always nice. Monetary rewards can come in a few different varieties. Gift cards are common and are often viewed as more significant than their monetary value. Three months without a safety incident? Each team member receives a restaurant gift card to take their families out to a nice dinner.

If you want the team to do extra, then the leadership has to follow suit. If a team member is truly going above and beyond their job title and description, reward them. Some of us have been there: we always try our best to do the right thing and go the extra mile but end up being unsatisfied at the job because we are doing all of this extra work and not reaping any benefit from it. On the other hand, the team members doing the bare minimum get paid the same amount and get rewarded with the team as a whole, even though the member didn't contribute as much as others. Incentivizing the extra mile could motivate the bare minimum members to go that extra mile.

Time

This is huge. When it comes to most industrial facilities, time off is very hard to come by, even though the team members and their families deserve it. Technicians often work to mental and physical exhaustion: turnarounds, startups, shutdowns, etc. At refineries, it isn't uncommon to see men and women working twelve-hour shifts (or more) for weeks on end without a break. That can wear on your mind, your body and even your relationships outside of work. Our families are why many of us work in the first place; family is what it all boils down to.

Hard work and long hours are what it takes to meet and exceed facility goals. When these goals are met through sweat and time, then the return should be just as swiftly met. Time to decompress and destress can help alleviate tensions in the workplace and motivate workers. It shows that the facility and leadership actually care about the team members and not just about the dollar sign at the end of each year's financial report.

Advancement

As stated in the "Training and Certification Goals" section, some facilities incentivize certification with advancement. You get certified, you move up on the pay scale. It shows that there is a ladder to climb, and there is positional growth potential, which encourages ambition and inner competition in the team and creates leaders. When every team member knows when to take the lead and when to follow, it creates a storm of potential within the team. We're all just junkyard dogs trying to get to the top. Incentivize that hunger for knowledge and advancement. Incentivize dependability. This will not only benefit the team members, it will ultimately benefit the lubrication program.

Goals and rewards are often mistakenly viewed as being synonymous. Each facility has a specific set of goals, but what happens when the team smashes those goals? They get rewarded, and then the facility sets higher goals. This creates a pattern and routine of success. This is a large step down the path to lubrication excellence. This is how your facility achieves World-Class Lubrication. ***ML***

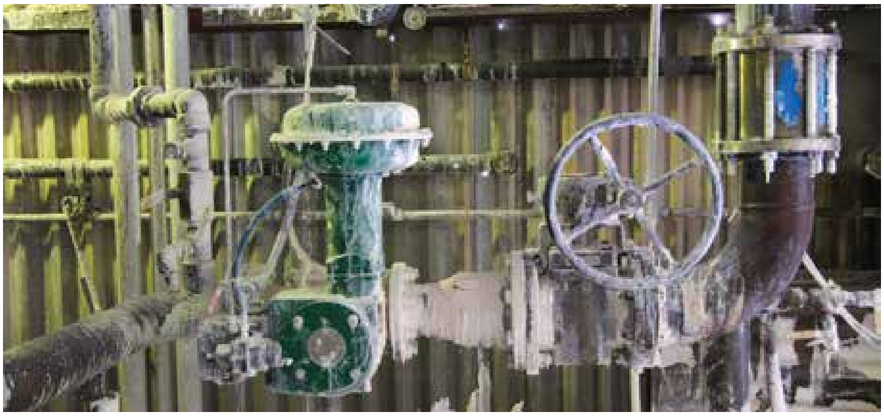
About the Author

Paul Farless is an industrial service technician for Noria Corporation. His duties include collecting data and preparing reports for the engineering team. Prior to joining Noria, Paul worked as an automotive maintenance technician for an auto-repair service company. He also served four years in the U.S. Navy as a gunner's mate third-class petty officer and as a seaman deckhand, where he was responsible for the troubleshooting and maintenance of electromechanical and hydraulic systems. A detail-oriented team player, Paul works well in fast-paced environments and uses his military background to excel and maximize efficiency.

The "Lube-Tips" section of *Machinery Lubrication* magazine features innovative ideas submitted by our readers.

New Grease **Gun Caution**

Before installing grease into a new grease gun, consider disassembling the gun and cleaning it thoroughly. Metal shavings have been found in new grease guns. These metal shavings appear to be from the manufacturing process of the grease gun.



Avoiding Contamination **in Dirty Environments**

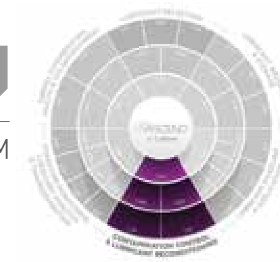
Machines operating in an extremely dirty environment, such as in a forge or foundry, require extra care to prevent contamination. Try to keep the equipment sealed and avoid unnecessary opening of the reservoirs. Install quick disconnects in tanks and on fill vessels for filling or topping up hydraulic tanks. Add mainstream sampling taps on all equipment. This will result in a true indication of the oil's condition, avoiding any bottom sampling.

Preventive Measures **Make Sense**

Catastrophic pump failure on circulating and hydraulic systems can damage more than just the pump. Consider using oil strainers or filters upstream of all equipment components to prevent pump failure debris from damaging these machines. This is also important for kidney-loop systems with expensive heaters and oil/water separators. ***ML***

Jeremie Edwards | Noria Corporation

Factor: C3M



THE DO'S AND DON'TS OF SETTING CONTAMINATION CONTROL OBJECTIVES

More about this **ASCEND™ Factor**

Factor:
C3M – Contamination Control Objectives

Level:
Management and Training(M)

Stage:
Contamination Control & Lubricant Reconditioning

About:
Implementing contamination control objectives and goals increases machine reliability. Highly critical machines should have stringent objectives.

Learn More:
noria.com/ascend/

It is pretty well understood, or at least widely stated, that what gets measured gets done. So it should come as no surprise that contamination control objectives should be implemented; they are our means of measuring the effectiveness of our equipment relubrication processes, not to mention how many of our other contamination control measures are going. When we set these objectives, though, we need to keep a few things in mind: consider this the Do's and Don'ts of setting contamination control objectives.

DO

Do set measurable and achievable goals.

Having solid goals that you can actually hit makes a huge difference, not just for the equipment but also for the entire reliability team. How frustrating would it be to have a goal that can never be achieved? Look at your process, operating conditions, lubricant demands, machine demands and criticality, and see what makes sense for your capabilities and reliability goals. "Pie in the sky" dreams are great, but we live in the real world, and we need real goals.

DON'T

Don't set a blanket statement and make it "the goal."

We can't just say, "I want clean oil in all of our equipment," and call it a day. We can't measure this in any meaningful way, and we don't even have a definition of "clean" to shoot for. ISO cleanliness codes are a simple way to start on this.

DO

Do create a standard for how we are going to go about reaching the goals.

We need to have a set way of accomplishing something, and we need to all be on the same page (for both processes and procedures). When we are all doing these procedures, whether it is re-greasing a bearing or topping off a gearbox, we remove variables that will mess with the data that we are using to track our progress.

DON'T

Don't set standards and then forget about them.

If we have created standards,

whether procedures or targets for oil cleanliness, we should have done so with a specific goal in mind, right? So why would we set those things and then just let people completely forget about them? The standards should become a part of our everyday lives, integrated into how we complete tasks and do our jobs in general.

DO

Do modify your equipment and review your tools.

Machine modification can be a daunting task, but it doesn't have to be. Look at your reliability goals for that piece of equipment. Look at the aspects that might prevent you from reaching those goals, i.e.:

Does this machine need to breathe? Does it have clean and dry air to breathe? What do I need to do to make sure that it does have clean and dry air to breathe?

Are there tight targets for cleanliness? Do I have a way of getting clean oil into the machine? Would something like hydraulic quick connects help prevent unwanted contaminants from entering my machine? Is this machine susceptible to water contamination? How is water/moisture getting into my machine? Am I using lip seals where I should be using labyrinth seals? Are there any early warning indicators, like bottom sediment and water bowls, or even moisture sensors, that can be installed?

DON'T

Don't buy every sensor on the planet and put it on your machine.
Sensors, quick connects and desiccant breathers are great tools, but not every piece of equipment warrants the investment. A non-critical piece of equipment may be more efficient if left to die on its own versus using every piece of technology available to extend its life.

There is no magic bullet when it comes to setting cleanliness targets or reliability goals for your facility, but doing proper contamination control doesn't have to be some daunting task. The first task should be to figure out your reliability goals for any given piece of equipment. Once that is figured out, you need to determine what cleanliness target will help you reach those goals. Here www.machinerylubrication.com/Read/29526/oil-cleanliness-targets is a great calculator to help you out with cleanliness and dryness targets (remember, moisture is the second most damaging contaminant to your oil and machine).

Great! Now that we know how clean and dry we need to get our oil, how often do we actually sample it to make sure we are hitting our targets? We made a calculator (Figure 1) for that too!

Sample Frequency Generator

1. Select 'Best Fit' Default Frequency

Bearings	500 hrs	Gearing, Low Speed	1000 hrs
Chillers	500 hrs	Hydraulics, Aviation	150 hrs
Compressors	500 hrs	Hydraulics, Industrial	700 hrs
Differentials	300 hrs	Hydraulics, Mobile	250 hrs
Engine, Aviation Recip	50 hrs	Transmissions	300 hrs
Engine, Diesel	150 hrs	Turbines, Aviation	100 hrs
Final Drives	300 hrs	Turbines, Gas	500 hrs
Gearing, Aviation	150 hrs	Turbine, Steam	500 hrs
Gearing, High Speed Industrial	300 hrs		

Write Default Here
Default
Hrs

2. Score Application Adjustment Factors

Economic Penalty of Failure - Circle Factor

Very High				Normal				Low
0.1	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0

Consider downtime costs, repair costs and general business interruption penalty.

Fluid Environment Severity - Circle Factor

Very High				Normal				Low
0.1	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0

Consider pressures, load, temperature, speed, contaminants in oil and duty cycle.

Machine Age - Circle Factor

Infant					Middle Age					Old Age
0.1	0.5	1.0	1.5	2.0	2.0	2.0	1.5	1.0	0.5	0.1

Infant machines are those going through break-in and have operated for less than 1% of expected machine life. Old age machines are those showing symptoms of distress.

Oil Age - Circle Factor

Infant					Middle Age				Old Age
0.1	2.0	2.0	2.0	2.0	1.5	1.0	0.5	0.25	0.1

Infant oils are those that have just been changed and are less than 10% into expected life. Old age oils are showing trends that suggest additive depletion, the onset of oxidation or high levels of contamination.

Target Tightness - Circle Factor

Tight				Normal				Loose
0.1	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0

Oil properties that trend extremely close to targets and limits are 'tight'. Oils that typically trend well within targets and limits are loose. For instance, an oil with a cleanliness target of 13/11 and trends around 13/11 is tight.

Place Lowest Circled Factor Here
Adjustment Factor

3. Sample Frequency = Default x Adjustment Factor

Sample Frequency
Hrs

Figure 1: Sample Frequency Generator

Now, using these two calculators in tandem, along with your overall criticality, you should be able to easily determine what sensors or modifications should be performed to help you achieve your goals. If you are still having issues, or have questions about criticality and how to calculate that, send us a message, we will be happy to talk you through it (we might even have some tools available for that, too). ***ML***

About the Author

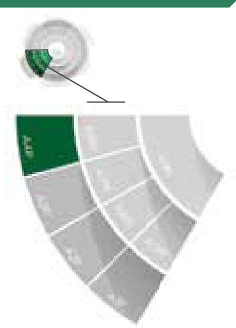
Jeremie Edwards is an Associate Technical Consultant at Noria Corporation. He is one of an elite few certified by the International Council for Machinery Lubrication (ICML) as a Machinery Lubrication Engineer (MLE) and did so in order to become the best advisor for clients when it comes to their continuing education needs. Before joining Noria, Jeremie served six years in the U.S. Army as a parachute rigger and was deployed in Afghanistan, Uzbekistan, Turkey and Germany.

Paul Farless | Noria Corporation

Factor: A4P

Sampling Tools and Methods

More about this
ASCEND™ Factor



Factor:
A4P – Sampling
Level:
Platform (M)
Stage:
Condition Monitoring, Lubricant Analysis and Troubleshooting
About:
Accurate sampling is critical when developing a lubrication analysis program. Inaccurate samples can lead to incorrect decisions regarding machine performance.

Learn More:
noria.com/ascend/

When we think about oil analysis, it really begins with the tools and modifications that are necessary to properly take an accurate oil sample. The key to accurate oil sampling is minimizing data disturbance by preventing contamination of the sampling equipment. When outside contaminants are introduced in any way, the analysis will come back with inconsistent reports. Oil analysis, at its core, tracks and predicts failure modes by trending data over time. Let's explore the equipment that needs to be installed to ensure contaminant-free sampling and the oil sampling methods that each of these tools requires.

Minimess Sampling Valves

Often called a sample probe, the minimess valve is one of the most common and consistently accurate modifications for oil sampling. These valves should be installed on an elbow for lines with a high viscosity. Minimess valves can also be used on low-pressure systems; however, low-pressure systems require a soft valve seat to avoid leakage.

Portable Minimess Sampling Valves

Portable Minimess valves can be installed onto the female end of a standard quick-connect coupling; the male end is permanently fixed to the pressure line at the proper sampling location. These can be utilized on both low-pressure and high-pressure systems.

Vacuum Pumps

A vacuum pump is a tool used to extract oil samples from a system that doesn't have a sampling valve and is a great tool that every oil analysis program needs to have in its arsenal. A vacuum pump, like the name suggests, creates a vacuum to suck out a representative oil sample from the proper location. This pump is accompanied by some flexible hose that leads from the sampling bottle up through the "knurled nut" and down into the reservoir. The vacuum pump may be used in conjunction with minimess valves to extract samples from low-pressure systems.

Ball Valves

Ball valves are a viable option for sampling; however, it is an option that requires a lot of due diligence on behalf of the technician collecting the sample. It is difficult to collect a contaminant-free sample from a ball valve and really depends on the location of the ball valve; if it is piped out from the bottom of the sump, then all of the samples will be consistent with what is found in the bottom of almost every sump: crud.

The idea is to collect a sample either in a turbulent zone or from the center of the reservoir. If the sample is taken from the bottom of the sump, it will be full of whatever debris and particles settle to the bottom of that sump. If, however, it is collected in a turbulent zone, it will be a better representation of the unsettled particles and wear debris that is found in the system.

What is a turbulent zone? A turbulent zone is where the lubricant is not flowing in a straight line. That is why we install minimess valves at an elbow of piping. Some facilities install sampling ports after each lubricated component in the return piping. They will then utilize oil sampling as the first line of defense in failure analysis or root cause analysis. Think of it as a grid of sampling ports throughout a circulating system that gives you representative data at each point. This will help the technicians narrow down from where exactly the failure is originating.

As mentioned, the key to any successful oil analysis program is contaminant-free sampling. The bag method is what allows us to achieve this. In short, the bag method works by using a vacuum pump:

- First, you purge a few pumps of oil from the system, utilizing a purge or flushing bottle; this ensures that there are no contaminants in the sampling valve or sampling equipment.
- Next, you place the actual sampling bottle in a sealable bag. Once in the bag and properly labeled, you take the cap off while the bottle is in the bag. Then thread the bottle onto the vacuum pump through the bag, and puncture the bag with the sampling tube.
- Finally, pump the vacuum pump and fill the sample bottle no more than three-quarters (¾) full. Unthread the bottle while never removing it the bag, and place the cap back on it.

Ideally, you would place the sample bottle in the bag before going into the plant to help prevent any airborne contaminants from finding their way into the baggie. It is also easier to use larger bags, such as gallon size, to help with this process: the extra room allows for better navigation of the cap. I highly recommend utilizing the procedure verbatim, according to your facilities analysis program. *ML*

About the Author

Paul Farless is an industrial service technician for Noria Corporation. His duties include collecting data and preparing reports for the engineering team. Prior to joining Noria, Paul worked as an automotive maintenance technician for an auto-repair service company. He also served four years in the U.S. Navy as a gunner's mate third-class petty officer and as a seaman deckhand, where he was responsible for the troubleshooting and maintenance of electromechanical and hydraulic systems. A detail-oriented team player, Paul works well in fast-paced environments and uses his military background to excel and maximize efficiency.

Bernie Hall | Checkfluid

Sampling Toward **a Sustainable Future**

"Corporate objectives are being rethought to align with investor and government objectives."

Discover how maintaining proper machine lubrication by reducing contamination and increasing oil cleanliness through oil sampling, oil analysis and filtering can help you achieve machine efficiency and improve your facility's carbon footprint. Why? It's simple: Efficient machines consume less energy and oil.

Introduction

Climate change is an important discussion in the news and on the financial pages. Earlier this year, the United Nations published a report that unequivocally recommended rapid and significant changes in resource consumption. The report states that "observed increases in well-mixed greenhouse gas (GHG) concentrations since around 1750 are unequivocally caused by human activities," and that "in 2019, atmospheric CO2 concentrations were higher than at any time in at least 2 million years [1]."

Increasing carbon dioxide and pollution levels have been identified as major contributors to these changes. Rising temperatures around the world have resulted in out-of-control forest fires destroying trees. Additionally, melting polar ice and rising water levels are causing erosion and threatening coastal towns and cities.

Public opinion and governments are responding. Corporate objectives are being rethought to align with investor and government objectives. For example, this summer, several environmental activists were elected through proxy votes to the board of Exxon Mobil. McDonald's is close to achieving its goal of sourcing all of its paper food packaging in restaurants from recycled or sustainable fiber, and A.P Moller-Maersk is gearing up to run its first carbon-neutral ship in 2023. These are just some examples of how major companies are setting goals towards reducing their carbon emissions.

How can companies move to both a more sustainable and profitable future? By creating a company-specific sustainability plan as a grassroots approach that would be welcomed by the community and investors alike. A great place to start is to revisit their lubrication program.

Maintaining oil cleanliness is vital to the performance of lubricated equipment. Oil contamination accelerates the rate of component wear and leads to premature component failure. In a globally competitive market, companies that can maintain machine reliability and uptime will be able to keep their costs at a more competitive level. These more efficient machines will consume less energy, and companies will be able to see monetary savings while running a greener operation.

The Greener Savings

Investing in oil analysis and improved oil sampling will help you achieve a greener machine by:

- Extending equipment life
- Improving equipment functioning
- Reducing unnecessary maintenance
- Reducing consumption

Extend Equipment Life

Extending out equipment's life simply keeps equipment and waste out of the landfill. Landfills are full of equipment and their components that have been neglected, often simply due to poor lubrication. Each buried piece of equipment has used resources throughout the supply chain. You can extend your equipment's life by cleaning your lubricants. In fact, by cleaning your lubricants by as little as one ISO cleanliness code, you can provide a 35% increase in equipment life.

What is an ISO cleanliness code? ISO 4406:21 is the reporting standard for fluid cleanliness. A code number is assigned to particle count values derived at three different micron levels: greater than 4 microns, greater than 6 microns, and greater than 14 microns.

Life Extension Factor

INITIAL ISO	2X	3X	4X	5X	6X
23/20	20/17	19/16	18/15	17/14	17/13
22/19	19/16	18/15	17/14	16/13	16/12
21/18	18/15	17/14	16/13	15/12	15/11
20/17	17/14	16/13	15/12	14/11	13/11
19/16	16/13	15/12	14/11	13/11	13/10
18/15	15/12	14/11	13/10	12/8	12/8

Figure 1: Hydraulic Life Extension Chart

The Noria Life Extension Chart demonstrates the relative life of a component based on its cleanliness. Let's take hydraulic systems as an example — if you improve oil cleanliness levels from an ISO 21/18 to an ISO 15/12 (as demonstrated in Figure 1), component life can be increased by a factor of 5 [2]. It is important to remember that actual savings will vary depending on lubricant performance, oil sample frequency, equipment type, equipment condition and previous condition, and the ability to keep the fluid clean.

There was a chemical manufacturer who installed condition monitoring equipment onto their gearboxes to meet the facility cleanliness targets of ISO 16/14/12 or better. As the reports came back, they noticed a gearbox was trending higher iron levels. They realized this was due to the gearbox operating outside its original design envelope. While they still had to order a replacement gearbox, they were able to make the necessary adjustments to prolong the remaining life to bridge the replacement lead time. Because the gearbox was still in operating condition, they were able to relocate the gearbox to continue its use.

Improve Equipment Functioning

You can also evaluate the equipment's energy efficiency by tracking its production output. For example, if a machine is capable of producing a certain number of parts in a given amount of time and after proper lubrication and monitoring practices are implemented, it can produce a higher volume of parts in the same amount of time, then the machine has become more energy efficient.

During times of supply shortages, improving equipment performance can have a significant impact on a company's profitability. Here is an example of how to document performance improvement. These cases can be invaluable when determining which projects return the best value.

For example, by installing condition monitoring equipment, a plastics manufacture was able to reduce machine contamination, improve oil cleanliness and increase machine productivity by sampling and filtering on the fly.

Reduce Unnecessary Maintenance

Oil analysis is one of the earliest predictors

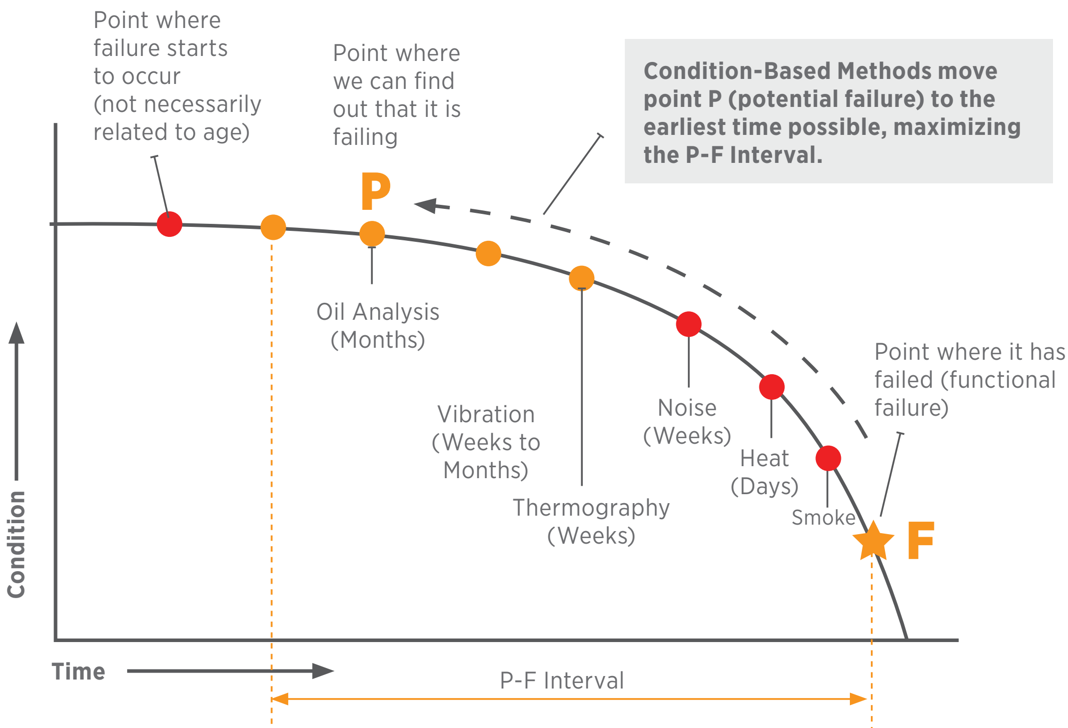


Figure 2: PF Curve

of impending machine failure on the PF Curve. The PF Curve represents the behavior of an asset or component before function failure has occurred. The P-F interval may vary, lasting days, weeks or months, depending on the equipment's condition. When used effectively, it can provide a significant amount of time between the latest inspection and functional failure to prioritize, plan and execute the necessary maintenance activities before the failure occurs. Machines can still run after failure has begun, but once an incident occurs, it is only a matter of time before the machine fails.

A mature oil analysis program can sample and analyze suspended particles in lubrication oil and then reveal specific individual component wear early in the deterioration phase. As we saw in the earlier example, early detection allows for the necessary parts to be obtained and the development of a restoration plan to rebuild a component before complete failure.

Typically, this knowledge can be invaluable when considering what maintenance is really necessary and avoiding crises with scheduling and shutdowns. In these times, with fewer people doing more work, unnecessary maintenance is not sustainable in the long term. However, sometimes due to improper oil sampling, these reports can be misleading. Improving oil sampling methods can improve the accuracy of these reports. Take these cases into consideration:

A pulp and paper company found their oil analysis results on a pump set frequently came back with high particle counts; their solution was simply to replace the pumps — an $8,000 cost. A new reliability engineer hypothesized that their sampling method might be the cause behind these high counts, as they were just drop-tube sampling from the breather port on the shared reservoir. It was decided to install sampling valves separately on each pump so they could tell which pump might be failing. They also added filtration so that high particle counts did not contribute to further deterioration or replacement of the pump. These changes resulted in reports that no longer showed high particle counts, saving them from replacing perfectly functioning pumps.

A marine company in the Pacific Northwest suspected a problem when their main engine's oil analysis report continuously came back indicating coolant was in their system. They would drain the engine, inspect and see nothing wrong; this would cost them $3,000. It was not until they switched their sampling method to the Checkfluid LP & KP Pushbutton valves that the real problem was discovered. The technician taking the samples was using the same plastic tubing when he sampled the coolant and then the engine, leading to cross-contaminated samples.

Reduce Consumption

By upgrading your lubrication program, you will most likely see a reduction in the machine's energy and oil consumption. These reductions will oftentimes give companies the biggest return on investment and the biggest demonstration of carbon reductions.

The carbon credit system being proposed is intended to discourage, where possible, carbon products like oil from adding to the CO2 in the atmosphere. As we saw in a recent United Nations short report on climate change, science is telling us that CO2 acts as a blanket like a greenhouse. The more CO2 that blankets the atmosphere, the more the sun's rays will heat the planet and cause climate and ecosystem disruption.

The carbon credit is a way of keeping score. Whether it is part of a company, national system or international system, the carbon credit is used to fund initiatives that reduce CO2 emissions.

Figure 3: Examples of Dedicated Sampling Valves

These initiatives can be entirely local or, in the case of multinational companies, can be international.

For example, Shell in Canada offers consumers, when they fill up with gas, the opportunity of contributing two cents per liter to offset their carbon footprint. Unfortunately, politics can get in the way of taking action. Our objective should be to make our department or company carbon-neutral.

First, let's look at oil consumption. Did you know that each gallon of lubricant consumed contributes to 23.6 pounds of CO_2 emissions [3]? This means that a 55-gallon drum contributes to approximately 1,300 pounds of CO_2 emissions. A carbon credit is equal to 1 ton of CO_2, or approximately 85 gallons (320 liters) of oil. Using the current system, carbon neutrality would cost a company a $35 surcharge for consuming 85 gallons of oil. But by actually reducing oil consumption by 85 gallons, a company can save approximately $640 based on a $2 a liter/quart price of oil. It pays to optimize your drain interval.

Here is an example: A company-wide KPI for a plastics manufacturer was to reduce carbon emissions by reducing lubricant waste. For them to optimize drain intervals on their machines, they installed condition monitoring hardware and looked at in-service filtration.

From 2017 to 2018, the company increased the amount of oil they were able to filter and retain in their machines by 27.4%. They were able to reduce their CO_2 emissions from wasted oil from 22,533 pounds of CO_2 in 2012 to 3,779 pounds of CO_2 in 2018, an 83% decrease in emissions by optimizing their drain intervals. This company was also able to save thousands of dollars in oil disposal costs.

Let's talk about fuel consumption. Reducing fuel consumption in mobile equipment can be the most significant contribution to reducing CO_2 emissions. Many of these strategies are outside of the scope of this article, but they include:

- Burning low sulfur fuels
- Reducing unnecessary trips
- Keeping tires inflated to correct levels (especially important for on or off-highway trucking)

Oil viscosity can also play a role; moving a thicker fluid takes more energy. If you reduce viscosity, less energy is consumed in the moving parts and in pumping the fluid around the engine. But at a lower viscosity, base oils are more volatile and likely to evaporate; you need the additives to work a little harder. To reduce fuel consumption and emissions, oil analysis and proper oil samples are vital to make sure the engine oil is clean, the viscosity is correct and the additive levels are good.

Next up is a reduction in electrical consumption as energy savings can be looked at in terms of what is used to operate the machine. An efficient running machine will use less energy than its counterparts. For an electric motor and/or gearbox, this would be a reduction in electric energy (voltage, current and power factor). Tracking electrical consumption is a reliable way to document energy efficiency improvements regarding changes in a lubrication program. Studies have seen that, typically, companies that upgrade their lubrication and reliability practices have been able to document a 5-15% reduction in power requirements [4].

Another interesting way of measuring improvement on a day-to-day basis is tracking the machine's operating temperature. Proper lubrication and monitoring can reduce the friction between two surfaces, and thus, the amount of energy needed to move those parts against each other. When that friction is reduced, less electricity is required to operate the machine. Although it's unlikely to reveal the amount of energy saved, there will be a clear indication of the reduced energy consumption.

What You Need to Do

Making changes to your lubrication program will help move you and your company towards a more sustainable future. To start, you need to invest in good

Figure 3: Examples of Dedicated Sampling Valves

lubricants. More and more people are becoming aware that often the advantages of synthetic oils greatly outweigh the initial added cost. Remember to check and double-check with the manufacturer and your lubricants distributor to ensure that the right oil is in the right machine.

Then, you need to invest in a good oil analysis program. An oil analysis program with condition-based maintenance is one of the best strategies that can be used to maintain lubricated equipment. Through oil analysis, companies can monitor oil health, contamination and machine wear. When abnormal conditions are identified, immediate action can be taken to correct or negate a developing failure. Oil analysis labs can provide a tremendous staff resource with the expertise to uncover changing equipment health along with the expertise to suggest the appropriate corrective actions.

Your oil analysis result will only be as good as the sample you submit. This is why the importance of oil sampling cannot be underestimated. Labs often report that over 20% of the samples submitted are not representative of the system.

Dedicated oil sampling valves make it possible to take reliable oil samples safely while the equipment is running. This ensures that the sample is a direct representation of the equipment's condition. The location of the sampling valves guarantees that the sample pulled will contain hot, information-rich oil that can be trended against previous samples to show the condition of your equipment. Lastly, sampling valves typically can collect the sample in a faster and cleaner way compared to other sampling methods.

Proper Sampling at All Stages

Start right. Starting with clean new oil that meets the OEM specifications will ensure you're not introducing harmful particles to your system. At a minimum, you should ensure that the oil received is clean and is the correct viscosity. While several companies now offer their oil at a certified level of ISO cleanliness, it is still important to inspect and filter the oil as necessary before putting it into service.

Drum and tote mounts like Checkfluid's DT adapter will enable you to sample, monitor, filter and cleanly transfer your oil from a storage container. The quick-connect (ideally flush face style) will let you cleanly connect your drum tote mount to your filtration system. A high-flow sampling valve option allows you to continually check on your oil without opening the drum to external contamination. The optional desiccant breather provides additional protection from moisture and particulate contamination without opening the system to dirt or moisture.

To sample in-service oil, look at installing sampling valves. Dedicated valves can be installed on most lubricated systems, such as gearboxes, hydraulic return lines, compressors, engines, etc.
Incorporating condition-based monitoring tools with your oil sampling valves will only help you increase program savings. Condition-based monitoring versus time-based monitoring enables a company to complete necessary maintenance when it is needed rather than when it is scheduled. This condition-based monitoring system (CBM) is at the heart of newer international standards for asset management, such as ISO 55000.

To incorporate condition monitoring tools into your oils sampling program, look at solutions such as Checkfluid's CORE Solution. It is comprised of a breather mount and drain mount. With the CORE Solution, you can:

- Establish cleanliness requirements for all equipment
- Establish guidelines for incoming lubricants
- Get best practice oil sampling
- Baseline your oil
- Perform in-service filtering through a closed system when required
- Complete visual oil analysis inspections
- Protect your system from particles and moisture contamination
- Complete clean oil top-ups
- Drain your oil

As always, controlling contamination is a top priority. It continues to be one of the biggest causes of component failure and productivity declines. It is estimated that it costs 10 times more to remove contamination from equipment than to exclude contamination altogether. Remember, machine problems can be kept to a minimum with good oil and good oil plans.

With a better lubrication program, you can be sustainable and profitable at the s ame time. ***ML***

Oil storage in **IBC Containers**

Lubrication Program / Lubricant Analysis Sector: Power Generation Topic: Storage of oil in IBC-type containers (1000 liters) and its impact on the availability of generation groups Publish date: December 2021

The storage of lubricants in 1000 liter deposits is quite common in the vast majority of industrial areas and is the preferred type of storage especially in power generation plants that have gas or steam Turbines, compressors and turbochargers. The oil in these containers can be stored for a long time until it is necessary to transfer it to the generation system and in many cases this is where some problems begin.

This article addresses a couple of case studies in order to guide the end user on the necessary considerations that must be taken into account when working with this type of containers and, above all, reveals the impact it has on the availability of the power generation group.

Case 1: Stored oil

Perhaps one of the main questions when buying oil in this type of container is, how long does the oil last? Redirecting the question from a more technical aspect, the end user wants to know the time he has to store the oil without changing its properties and functional characteristics. For strictly commercial reasons, the combined cycle (2 gas turbines and one steam turbine) which we will call "CCA" had up to 18,000 liters of ISO VG 32 oil stored in IBC tanks.

OIL BRAND	OIL TYPE	BATCH DATE
A	1	2003 – 2009
A	2	2009 – 2013
B	1	2013 – 2017

Among the doubts of the plant O&M team was knowing the possibility of putting the stored oils into service. A question formulated in time can avoid many problems, as we will see in the following case. With the help of a manual pump, a sample was taken as close as possible to the central part of each tank and the results of the oil analysis were decisive in knowing its status. The following graph shows the percentage of IBC's with oils above the acceptable limits of water and solid contamination, as well as those samples with clear evidence of loss of organic additive (the one that slows down the effect of oxidation in these formulations) and signs of degradation of the base oil.

Loss of Organic Additive	14%
Base Oil Degradation	16%
Water Contamination	32%
Solid Contamination	38%

Based on this first analysis, it is evident that the commissioning of oils that have a level of degradation and/or those that have organic additives below acceptable levels does not make sense and could affect the performance of the oil in the short term and later the availability of the turbine. Therefore, the CCA disposed of 8 of the 18 IBCs of turbine oil.

A connector with two outputs was installed in the upper part of the 10 units that remained in the site, one of them for a desiccant filter and the other for a quick connector; while in the lower part of the IBC a quick connector was installed to facilitate the filtration and subsequent removal of contaminants.

Thanks to a previous compatibility analysis between the oils, a single filtration equipment was put into operation that is used periodically to keep the conditions of the oils under control, in addition, a semi-annual oil analysis is carried out on each

IBC in the plant.

The question that arises after reading this case is to know if there is any relationship between the date of manufacture of the oil and the loss of chemical properties (degradation and organic additives). At least in this case, there is no relationship between the age of the oil and the mentioned parameters. As a side note, the purchasing department plans to continue purchasing at least 2,000 liters per year of turbine oil.

Case 2: Commissioning and group trip

Turbine OEM's are quite clear about commissioning their equipment, either at the start of operation or after a maintenance shutdown. The manufacturer's manuals include a lot of information regarding the conditions of the oil, the recommended tests as well as the applicable regulations and the limits that the results of the oil analysis must meet.

Based on all this information and often with the support of an oil analysis laboratory, the end user must make the decision to put the oil into service or not.

In 2014 the CT generation plant was ready to start up the new group only in the absence of the results of the oil analysis. A little back in time, the 6000 liters of ISO VG 46 oil arrived at the plant around 8 months before the group started up and the oil analyzes carried out at that time did not show any problem with the oil, at least from the point of view of the laboratory in charge of the analyses.

A second oil analysis carried out a couple of weeks before the unit was started revealed that the vast majority of results were within OEM approved parameters. It was decided to start the group and after 30 hours the temperature of the oil increased by 4^0 and reached 7^0 after 45 hours.

For safety reasons it was decided to shut down the group and send another sample to the laboratory, the parameters were very similar to the sample before start-up, the site changed the filters and after a visual inspection they gave green light for the group to start working again. Once again, after a short period of time, the temperature exceeded 7^0 and it was decided to permanently shut down the group.

As mentioned in the previous case, in some cases turbine oil that has been stored for a while tends to degrade. Now, measuring the degradation is very easy for a laboratory with experience in the area of power generation, but the alarms can be missed in those cases where the end user chose to work with a laboratory that lacks resources and knowledge.

As my friend Luis Garcia from TBN Canarias says, "when the rook flies low..." referring to the fact that when something is wrong, it is very obvious, at least for those who know how to read it.

The explanation in this case is relatively simple. The degraded oil base slightly lost one of its functional properties, minimizing the foam effect (please don't look for Silicon!). There is clear evidence of this in oil analysis that was overlooked. Once this oil is put into operation, the normal operating temperature is responsible for enhancing the problem and the trapped air bubbles, due to the poor antifoam effect, implode in the high pressure areas (effect known as micro dieseling) this generates increases in temperature in the system, degradation by-products are generated and some of them agglomerate and transform into semi-solids, known as lacquers or varnishes.

TEST OEM	NEW OIL	IN SERVICE OIL
Viscosity@40^0	46	46
Metals	OK	P: +10ppm
TAN	0.14	0.16
Particle Count	16/14/9	17/14/10
Water KF	49	42
Varnish	3	12
Degradation	YES	YES

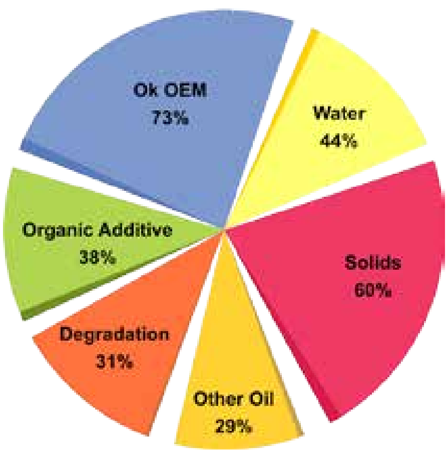
Unfortunately the CT plant had to postpone the startup of the group for 3 months, it also had to dispose of all the oil, change the filters and perform a deep cleaning of the system.

The economic impact of the previous points is incipient compared to the economic loss due to not having produced energy within the established period.

Returning to the beginning of the article, the storage of oils, at least turbine oils, in IBC-type containers requires special attention and the analysis should be carried out by a laboratory with sufficient knowledge to detect problems in advance.

Case 3: Some IBC's under the microscope

The two previous cases denote the importance of making decisions based on oil analysis. But how many generation plants really take the necessary measures



to minimize these problems? How many maintenance teams are aware of this potential problems?

These are questions that will remain up in the air, meanwhile let's see a much more extensive study on the conditions of turbine oil that I have been carrying out for more than a decade and in more than 8 countries.

The results of the analysis are overwhelming. If we read them carefully and understand how they can affect the performance and availability of a power generation group, we would understand how critical it is to have the right oil analysis at the right time. Logically, contamination with solids and water is one of the factors that attracts the most attention and is probably the easiest to treat due to its characteristics.

On the other side of the coin we have other types of problems whose only solution is probably to dispose of the oil and not put it into service.

29% of the samples show signs of being contaminated with another type of oil or fluid! This coincides with plants where an oil tanker transfers a volume into containers that are in use at the plant. This type of contamination is irreversible and depending on the conditions the oil can be used or not.

We have already seen what can happen when an oil shows signs of degradation and the chaos it can cause to the operation. Similarly, the organic additive plays an important role in certain types of oils and requires regular analysis and control.

Some recommendations, they can save the day!

Does your plant store oil in IBC containers? Treat them with more care, deposit them under a roof and four walls, and verify that when breathing (expansion and contraction of the material) the air that enters the interior of the IBC is clean and as dry as possible. If they are too translucent, in other words if you can see the color of the oil through the container wall, cover them with a dark sheet to avoid the effect of UV radiation. If the sheet is waterproof and antistatic, you got a 10! This is one of the main causes of all headaches in these types of oils. Do regular oil analysis and do it with a lab with experience in the area of power generation and if the lab has a reliability engineer on staff, you've hit the nail.

Do not take a dim view of the price of the analysis. No! You are not wasting money, you are investing in the protection of the generating group. If possible, include this analysis in your Industry 4.0 project budget, just at the bottom where no one can see it (this has nothing to do with AI or ML… sorry)

If possible, coordinate with your purchasing department the acquisition when necessary, at the same time coordinate with your oil supplier the response time in case of an emergency and, if possible, avoid storing the product for a long period of time.

About the author

Jorge Alarcon, Global Technical Manager, OCM. Reliability engineer, project manager, researcher and consultant in the power generation, manufacturing and wind energy industries, among others. Extensive knowledge of the European and the America's Predictive Maintenance markets. Full customer technical support, focused on improving plant reliability through lubricant condition monitoring, lubrication best practices and digital transformation strategies.

SHELL LAUNCHES

USED OIL MANAGEMENT SERVICE - AS A MOVE TOWARDS SUSTAINABLE BUSINESS PRACTICES

Shell launched a used oil management service, a new initiative to organise India's waste oil disposal system and to increase the rate of re-refining, as it aims to achieve circular economy goals while reducing waste. This is part of Shell's overall commitment to achieve net-zero emissions by 2050. As part of the initiative, Shell has partnered with used oil re-refiners to initiate collection and re-refining of used oil on a pan India basis. These partners share the vision of driving circular economy for the lubricants industry.

Shell signs its first partnership with IFP Petro Products (P) Ltd. for used oil collection

Shell plans to strengthen its network of partners to further scale-up the initiative in the coming years. The service aims to create an ecosystem for transitioning used oil disposal, which is acknowledged as being the biggest challenge in promoting circularity in the industry, to a formal setup. Shell intends to create awareness about best practices for waste oil management and help set standards for RRBO in collaboration with re refiners and industrial partners.

Speaking at the launch, Ms. Mansi Tripathy, Vice President, Shell Lubricants Asia Pacific, said, "Used oil management service is the latest testament of how we are leading the process of reducing waste alongside the industry's larger environmental footprint in India. We aim to play a pivotal role to embed circular economy in lubricants and see a high growth potential for this service to reduce waste and thereby, reduce our overall emissions. We will continue to seek opportunities to support our customers in reducing their emissions via our products and services."

"Being a solutions-driven, customer centric organization is at the core of our business model. This initiative reinforces that value and will help us support our customers with a more holistic value proposition that goes beyond lubricants. Even more significant is the fact that we now have the opportunity to pioneer towards the first step towards circular economy", added Ms. Debanjali Sengupta, Country Head, Shell Lubricants India.

Used oil has been categorized as hazardous waste and contains harmful metals. One litre of used oil can contaminate one million litres of freshwater . Without proper disposal procedures in place, 50% of all lubricants end up in the environment. India witnesses the generation of ~1.3 million tons of used oil annually of which, less than 15% is re-refined. Used lubricating oil is a hazardous waste which is disposed for various uses, with fuel being by far the most common method in India. Burning of used oil leads to harmful gas emissions, increasing health and safety risks. Re-refining used oil would help in:

- Conserving natural resources
- Reducing the emissions related to end-of life of the lubricants, helping India meet its carbon neutral targets

Masterclass In Lubricants Blending and Quality Assurance

Masterclass in lubricants blending and quality assurance was conducted from 6th to 8th June, 2022 for India Oil Corporation Ltd. This 3 day training course provides an in-depth understanding of the principles, economics and flexibility of lubricant blending plants and how to operate a lubricants blending plant efficiently and economically.

20 participants from Chennai, Trombay, Taloja, Silvassa, Asaoti, Washi, Kolkata & Budge Budge lubricant Blending plants of Indian Oil Corporation Ltd. Participated in this training conducted at there Taratala (Kolkata) plant.

Prakash Nath
Officer (Lube-QC),
Navi Mumbai

Program was very good, interactive and informative. Trainer nicely explained about lubrication mechanism, how to handle customer complain, quality related issues, blending mechanism of both lube oil and grease etc.

Inhouse Training on Oil Analysis Level – II (MLA-II) Training At MCPI Private Limited, Haldia, West Bengal

Oil Analysis Fundamentals which is equivalent to ICML's Machine Lubricant Analyst Level II (MLA II) was conducted from 12th to 14th July, 2022. This 3 day in house training conducted for 15 participants was conducted on this premises.

This fully customized training designed to theirs requirements trained this team to fully understand and utilize the Oil Analysis Program.

Beside the class training, there was a session which was conducted in the laboratory, so participants could understand the principal and working of various laboratory equipment being used by them for Lubricant Oil Analysis.

Chandan Kanti Chattopadhyay
Adviser- Mechanical

Easy, comprehensive and informative training. Also excellent explanation and relevant study material.

Anirban Adhikari
Sr. Executive

What I liked the most about the trainer is that in very simplified manner, he explained many complicated things.

Against a tropical background of palm trees and sunshine,maintenance and reliability professionals from 24 countries congregated at the Caribe Royale Resort in Orlando, Florida, to attend the 2022 Reliable Plant Conference & Exhibition from 25th-28th July 2022.

This year, the event shifted its education content focus to align with 12 reliability tracks, and on Monday, July 25, attendees were already filling the Caribe Royale for half-day and full-day workshops. Noria's Wes Cash, vice president of services, conducted a full-day workshop in the Leadership and Communication track on "Lubrication for Reliability Leaders: Building the Business Case."

Along with Cash's workshop, several international professionals from the field of lubrication excellence conducted other Monday workshops.

On Tuesday, July 26, the conference officially opened with the Opening Ceremony on the Reliability Stage. Led by Cash and Bennett Fitch, Noria's Chief Strategy Officer. The theme of the conference was "Turn ideas into action".

After the Opening Ceremony, there was tremendous buzz as the exhibit hall opened for the first day. A steady stream of attendees, looking for the latest technologies and solutions to their everyday challenges, visited the 100 industry exhibitors. This diverse mix of companies, which covered all facets of the maintenance and reliability industry, provided any type of solution for issues facing the industry.

New to Reliable Plant this year was the Emerging Technology Zone. Consisting of carefully curated companies, the Emerging Technology Zone showcases innovative technologies serving the maintenance, reliability and operations sectors.

Tuesday, 27th July also boasted a keynote panel on "Building and Sustaining a Strong Reliability Culture." The panel consisted of Garrett Bapp, senior technical service advisor, Petro-Canada Lubrications; Megan Johnson, plant manager, Blue Buffalo; Nathan Wright, president, Transformational Performance Solutions; and Ryan Chan, CEO and founder, UpKeep.

The panelists shared their perspectives on what makes a strong and sustainable reliability culture, and covered questions ranging from how culture impacts day-to-day to operations and sustaining culture during high turnover to sharing advice on building a positive workplace culture.

Wednesday, 28th July closed on a high note with the Casino Reception. Featuring an array of games – Blackjack, Craps, Texas Hold'em and more – Casino Night gave everyone the chance to unwind and relax. Everyone was a winner as they played with "house money," and four lucky participants won prizes at the end of the night.

The final day of Reliable Plant 2022 featured more learning sessions and then the Closing Ceremony.

Reliable Plant Conference & Exhibition returns to the Caribe Royale Resort in Orlando to celebrate its 25th installment on July 31-August 3, 2023.
To register for Reliable Plant 2023. bookmark the conference website https://conference.reliableplant.com/ and stay tuned for more details.