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- Contamination Control & Lubrication Reconditioning
- Condition Monitoring

AS I SEE IT

Introducing Condition Alarm Mapping (CAM)

COVER STORY

Beware! Lurking Lubricants

EDITORIAL FEATURES

Publisher's Note

India's net import of petroleum was 185 Mt at a cost of US $ 551 billion in 2020-21. Most petroleum products are used in transportation. Hence, a successful E20 (20% blend of fuel and ethanol), program can save the country US $4 billion per annum, i.e., Rs. 30,000 cr. Besides, ethanol is a less polluting fuel and offers equivalent efficiency at a lower cost than petrol. Availability of large arable land, rising production of food grains and sugarcane leading to surpluses, availability of technology to produce ethanol from plant-based sources, and feasibility of making vehicles compliant to ethanol blended petrol make E20 not only a national imperative but also an important strategic requirement. Different agencies of government have made rapid moves to put in place a favorable regulatory and retail ecosystem for the safe, and effective use of ethanol-blended petrol. With the recently approved interest subvention incentives for grain-based distilleries, the target of 20% blending of petrol in the country by 2025 thus appears feasible and within reach. Oil Marketing Companies have prepared their plans for a phased rollout, and vehicle manufacturers have assured of making a similar plan once the intention of the government with timelines is publicly declared.

However, bioethanol employment also poses some undesirable issues. Firstly, bioethanol is miscible with water which can cause a corrosive effect on engine components such as fuel injectors and electric fuel pumps. Moreover, bioethanol attracts more water from the environment because it is hygroscopic in nature. Secondly, vehicle startup problems can happen in cold weather when the engine is fueled with pure ethanol which is hard to vaporize. Thirdly, when bioethanol is used to fuel the engine, the tribological effect on lubricant properties and performance resulting from fuel dilution always appears. During the combustion process, some amount of unburned fuel will impinge on the cold wall of the combustion chamber and then be scrapped into the crankcase of engine oil through the cylinder liner. It shall be notified that the impact of bioethanol on lubricating oil's properties and performance is completely different from that of gasoline because bioethanol has a higher tendency to enter the oil sump of an engine due to its high heat of evaporation compared to gasoline. The amount of bioethanol inside the lubricant can degrade the properties and performance of engine oil significantly. As mentioned earlier, bioethanol is miscible with water but immiscible with oil, so there would be the formation of emulsions inside the bioethanol–water–oil mixture, which leads to serious engine wear and catastrophic engine failure. Consequently, engine oil needs to be drained frequently. It has been observed that even a small amount of fuel dilution is possible to degrade the physicochemical properties of lubricant (viscosity, total base number, and total acid number) which play an important role in the lubricating system.

Given these, some modifications may be needed in the current engines and specially formulated lubricants may need to be used in vehicles using ethanol-blended fuels.

We look forward to your suggestions and feedback on how we can make Machinery Lubrication India more interesting for our readers.

Wishing you and your families Merry Christmas &A Happy 2023.

Stay safe & healthy

Warm regards,

Udey Dhir

Introducing Condition Alarm Mapping (CAM)

> Infographics are effective at helping people comprehend difficult concepts that integrate an array of variables and factors."

The sheer number of infographics in the condition monitoring field is staggering; they show up on social media, and in conference presentations, whitepapers, websites and books. Infographics are effective at helping people comprehend difficult concepts that integrate an array of variables and factors.

My soon-to-be-published book, "Inspection 2.0," covers a host of different condition monitoring methods, including sensory inspections. I was looking for an infographic to illustrate failure modes and detection methods in the time domain for different types of machines and applications but was unable to find a graphic that fit my needs.

Necessity is the mother of invention. Left without choices, I decided to construct my own graphic, naming it Condition Alarm Mapping (CAM). The final product is shown in the figures on the following pages. However, the number of variations and uses of the CAM graphic is extensive and goes far beyond the scope of this article. As an introduction, I can show and describe what it is, why it is needed, and how it is used.

Deconstructing Condition Monitoring

I set a high bar for myself when

developing the CAM. I wasn't sure it was even possible. I kept trying different sketches and graphical schemes, a few of which were bizarre and far-fetched. I knew it needed an unconventional look but, at the same time, I fought to keep it simple and intuitive.

The following describes what I attempted to encapsulate in my graphic:

Different Machine Types and Applications — In addition to the large number of machine types and applications, there are also different operating factors (speeds, loads, temperature, etc.).

Ranked Failure Modes — The Pareto Principle is a method that has been used to illustrate and rank failure modes. Failure Mode and Effects Analysis (FMEA) and Root Cause Analysis (RCA) methods are also widely applied to better understand failure modes specific to the machine and its application. By ranking them, failure modes are put in proper order based on frequency and destructive potential.

Detectable Failure Signals — During failure, different failure signals are transmitted. These can relate to the root cause, the effect (symptom) or both. Root causes could be mechanical looseness, misalignment, lubricant starvation, contamination, etc.; symptoms could be vibration, acoustic, heat, wear debris and operating malfunctions. These are the signals that condition monitoring seeks to detect and interpret.

Time Domain to Failure — A transmitted signal varies in strength (amplitude) in the time domain. The time domain starts at 100% remaining useful life (RUL) and ends at zero (functional failure). Weak signals are harder to detect and discern. Strong signals are often too advanced, being associated with limited RUL of the machine. Early detection is what condition monitoring seeks to achieve, but it is also the most challenging for the condition monitoring analyst to achieve.

Condition Monitoring Detection Methods — The technologies and methods of detection give asset owners numerous options. Optimizing the selection and use of these methods is the name of the game. Knowing how one method measures up to others is difficult for people new to the field. The CAM graphs are particularly useful in that regard.

The table in Figure 1 compares conventional graphic methods (on the left) with target factors or variables (shown in the columns to the right). Only the CAM graphic shows comprehensive visual integration.

Structure of the CAM Graphic

Figure 2 shows the basic structure of the CAM graphic using mechanical looseness as a single failure mode. The graph is basically a semicircle with the central point representing the proactive domain (PaD). This central point represents 100% RUL. Failure inception (I) occurs in the proactive domain. If the problem is not quickly detected and removed, failure will progress in an outward direction to the first ring. Each successive ring in the predictive domain (PdD) after 80% reduces the RUL by 50% until functional failure (F) is reached (the final outward ring).

The colored spikes refer to condition monitoring methods and the failure signals they can (potentially) detect. Going clockwise from the left side, you can see particle count, analytical ferrography, ferrous density, elemental analysis, etc. The tip of these spikes approximates the point of earliest detection (P) in the time domain. The diameter of the spikes is the signal strength (amplitude) at that point in the time domain. The signal strength becomes greater as failure progresses.

From the CAM graphic, you can get an

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idea of the condition monitoring methods that are the most promising for early detection. Note that the placement and shape of the spikes can vary as influenced by various factors, including skill, technology, frequency of use, machine type, etc. As such, the CAM graphic can be tweaked to more accurately fit the application.

While this CAM is representing mechanical looseness as the failure mode, other similar CAMs would be constructed for each highly ranked failure mode, such as contaminated oil, wrong oil, misalignment, etc.

Detection-Based CAM Graphic

While Figure 2 presents a single failure mode (looseness) against multiple detection methods, Figure 3 presents the chart in inverse form. Specifically, it shows a single detection method (sight glass inspection) against multiple failure modes.

Each spike has the same meaning as previously described. Early detection and effectiveness of detection are characterized by the length and width of the spike. Similar CAM graphs could be constructed for each of the other detection methods being considered, such as vibration, ultrasound, etc.

Pareto-Based CAM Graphic

The Pareto Principle provides a practical ranking of failure modes based on the probability of occurrence and consequences. This ranking comes from experience and RCM methods such as Failure Modes Effects Analysis (FMEA). Root Cause Analysis (RCA) can be extremely helpful too.

The CAM graphic in Figure 4 shows the failure modes for rolling element bearings in order of their ranking from left to right (clockwise). Again, this can be customized to the application. The single detection method is represented in each chart. The

	What's included in the Infographic			
GRAPHIC FORM	RANKED FAILURE MODES	DETECTABLE FAILURE SIGNALS	TIME DOMAIN TO FAILURE	CONDITION MONITORING DETECTION METHODS
P-F Interval	X	X	✓	X
Remain Useful Life Chart	X	X	✓	X
Pareto Principle	✓	X	X	X
Weibull Analysis	X	X	✓	X
Condition Alarm Mapping (CAM)	✓	✓	✓	✓

Figure 1. How conventional infographics used in condition monitoring compare to Condition Alarm Mapping

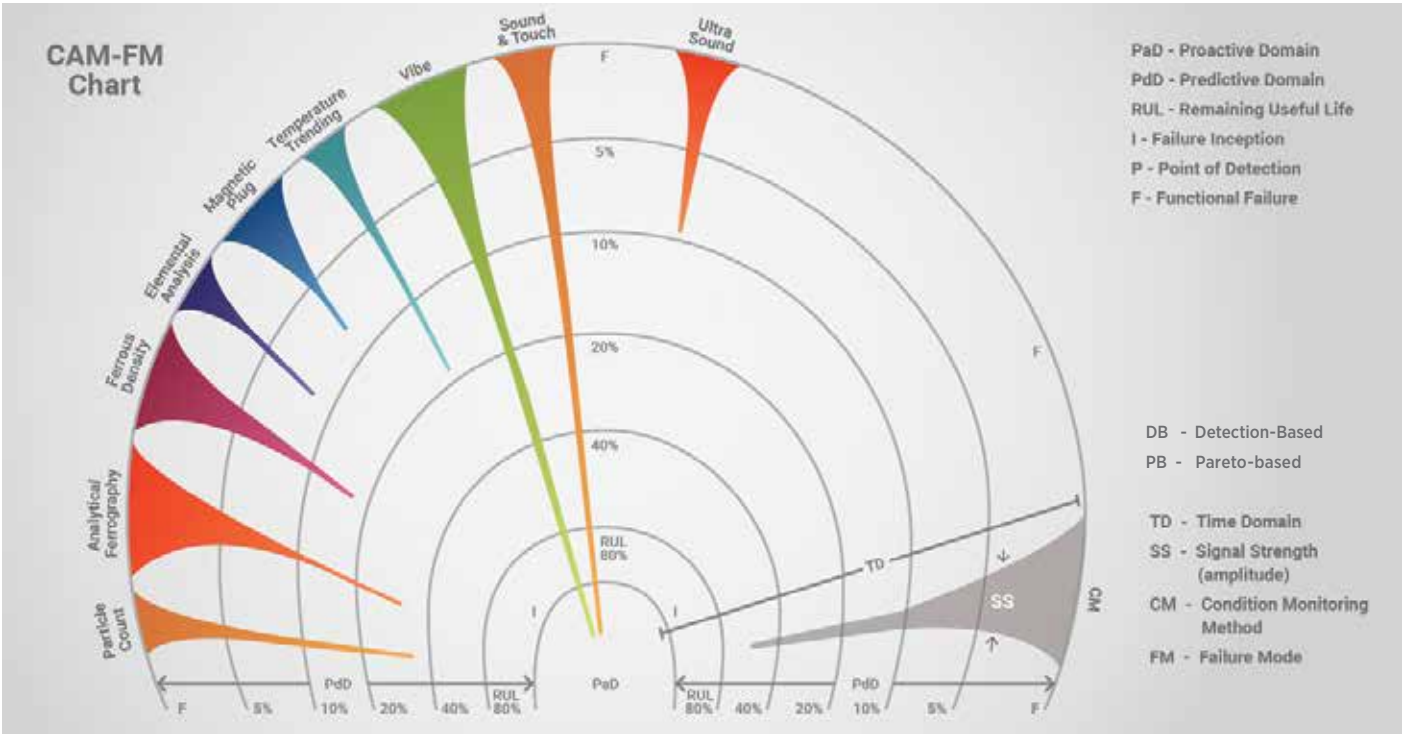

Figure 2. Mechanical Looseness (FM)

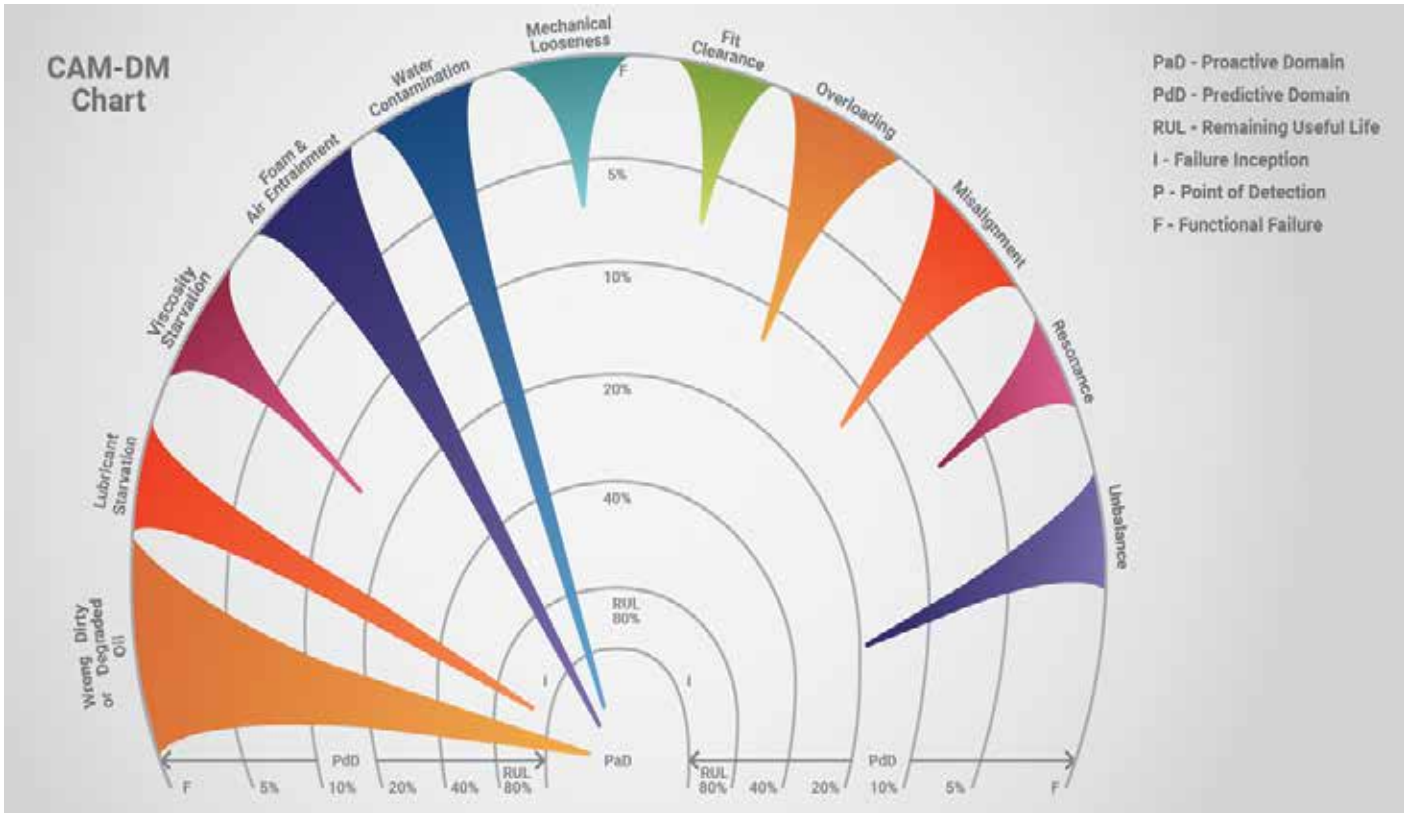

Figure 3. Different failure modes as detected by visual sight glass inspection with magnetic plug & corrosion indicator

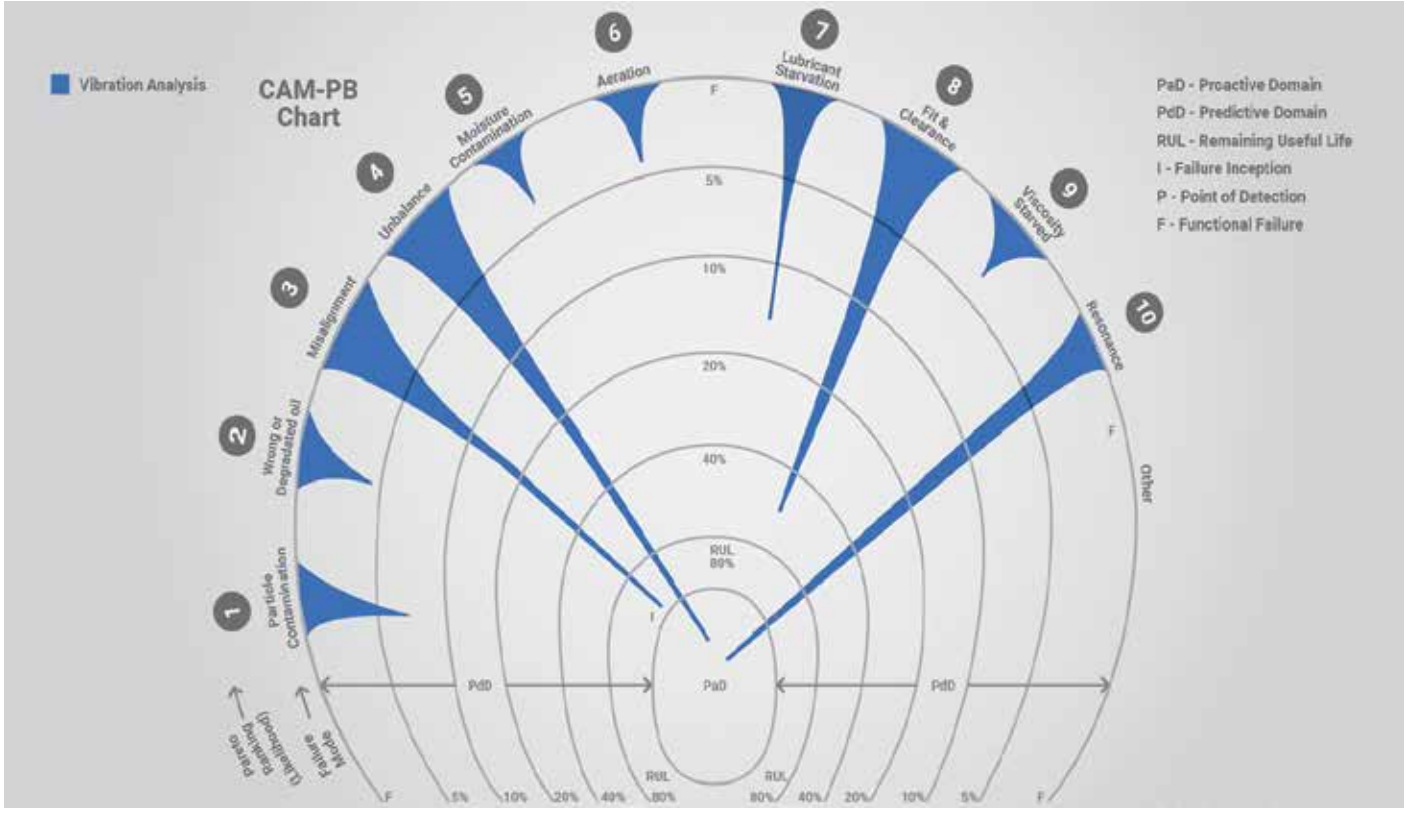

Figure 4. Rolling Element Bearing – ten failure modes as detected by vibration analysis

CAM graph shows vibration analysis as an example. As can be quickly seen from the spikes, vibration is really good at some failure modes (misalignment, unbalance, resonance) and far less effective at others (particle contamination, degraded oil, viscosity starvation).

Viewed in this way, it is apparent that a single condition monitoring method (vibration) is inadequate for protecting the bearings of the machine from all the highly ranked failure modes.

By combining the best detection methods with the Pareto ranked failure modes, the most comprehensive level of coverage and protection is achieved, as illustrated in the CAM graph in Figure 5. The spikes are color-coded to represent the different detection methods, as shown in the legend (upper left corner). Unlike Figure 4, each spike reaches down at or near the proactive domain (central region of the CAM graph).

Figure 4 and Figure 5 represent the same machine or component (rolling element bearing). Figure 4 applies only a single detection method (vibration), whereas Figure 5 applies five methods. The final optimized selection of the detection methods and frequency of use can now be easily rationalized to achieve the best results.

In Sum

Condition Alarm Mapping is a graphical representation of condition monitoring across multiple machine types, applications and detection methods. It emphasizes the importance of showing the time domain from failure inception and the ability of the detection methods to deliver good results. Using this method, the user can better achieve:

- Early fault or problem detection
- Prolonged P-F interval
- Optimized choice or selection of condition monitoring methods (including inspection)
- Prioritization of resources, based on ranked failure modes for individual machines and applications 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. Jim has also published more than 200 technical articles, papers and publications. He serves as a U.S. delegate to the ISO tribology and oil analysis working group. Since 2002, he has been the director and a board member of the International Council for Machinery Lubrication. He is the CEO and a co-founder of Noria Corporation. Contact Jim at jfitch@noria.com.

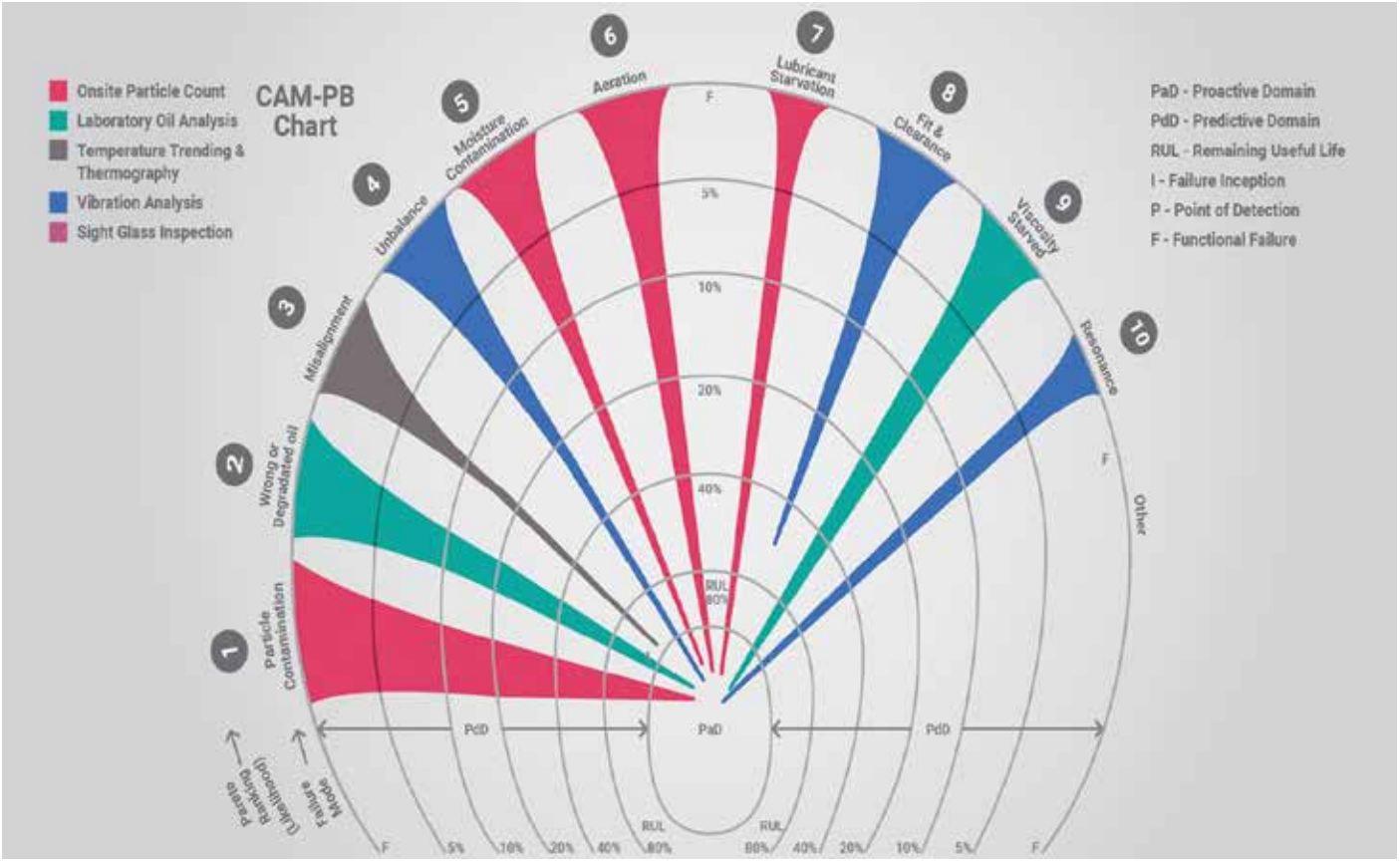

Figure 5. Rolling Element Bearing – optimized detection across multiple failure modes and multiple condition monitoring detection methods

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How many lubricants do you use in your plant? How many are kept in inventory? How many are on your lube list? These are some of the first questions to ask during a lubricant selection review — one of the most fundamental steps in a lubrication assessment. Most people working around lubricated machinery think they have a rough idea of how many lubricants are used in the facility, yet they're usually surprised by the truth uncovered during a lubricant selection review; there is often a significant gap in the perceived number of lubricants in a plant versus the actual number. In many cases, there are lubricants in use and found around the facility for one-off reasons or for other reasons that deviate from the best practices of optimizing lubricant selection.

I call these lurking lubricants — sometimes hiding literally behind beams or other structures, intentionally or not. And even when they are in plain sight, they often stay there due to a lack of awareness of the threat they have to plant reliability. There is good news though: the efforts required to avoid these lurking lubricants can be quick and simple, and the benefits are immediate and long-lasting.

Locating These Lurking Lubricants

Try this: take a couple of hours to walk around the plant (maybe during daily inspections) and write down every lubricant found in the facility. Be sure to note every lubricant labeled for use in machines, lubricants in various types of containers, etc., and don't leave off any that you find. Even if the products are similar, they must be listed separately. How many did you come up with? 25? 50? 75?

Having lubricants scattered around the plant, unaccounted for, is cause for concern. Sometimes these lubricants are simply in their jug or top-up container by a machine, left for innocent reasons. Other times, the lubricants are intentionally hidden in discreet places to get around approval processes. Look for all of these. Those of you who have worked on the plant floor for years, especially older facilities, are likely already smirking because you're aware of this truth. Either way, innocent or devious, the mismanagement of these lubricants can lead to serious problems with machine reliability.

Machine failure is often linked to lubricant failure. While part of that is due to causes such as lubricant starvation or the degradation of the lubricant over time, too often, the problems start before the lubricant ever enters the machine. When lubricant selection is not managed properly with the right policies and accountability, this bleeds into a perpetration of incorrect lubricant storage practices and inconsistent ways grease or oil is applied to machines.

What Triggers a Lurking Lubricant?

Managing all the lubricants used in a plant can be challenging, even with the right intentions. But when lubricant selection is not viewed as important, it can get out of control. I've seen this countless times performing lubrication assessments over the years and have noticed a few themes behind lubricant mismanagement.

1. Lack of Central Ownership of the Lubrication Program

When no single person or committee is responsible for lubrication decisions, there are bound to be mistakes and slipups. Conversely, if there are multiple people making their own decisions independently in different areas or on different shifts, they can overlap and cause a number of problems such as cross contamination.

Those charged with ownership of the lubrication program, often referred to as "Lube Champions," will have duties that include:

- Managing plant-wide lubricant selection decisions
- Organizing and displaying the lubricants and their intended applications in a "Lube List," either posted around the plant and/or in an accessible digital dashboard
- Managing lubrication tools and storage areas
- Taking responsibility for lubrication practices and inventories
- Making observations and adjustments when lubrication-related issues occur
- Monitoring lubrication metrics and KPIs

Ideally, the Lube Champion will provide solutions to lubrication issues and regularly report the status of various aspects of the program to upper management.

More about this **ASCEND™ Factor**

Factor:
S4M —Consolidation and Optimization
Level:
Management & Training (M)
Stage:
Lubricant Selection
About:
Establishing a lubricant consolidation involves optimizing the number and types of lubricants used.

2. No Training in Lubrication Best Practices

Those expected to handle daily lubrication activities and other reliability tasks cannot properly do so if they don't have the required knowledge and skillset. A failure to understand the lubricants or the lubrication-based tasks can lead to confusion regarding the proper handling and storage of lubricants. Thus, we see lurking lubricants left scattered around the plant as well as being mislabeled and misused.

Lubrication personnel, especially those with ownership of the lubrication program, must be provided with training if they are to do their job well and communicate to others the pitfalls of unintuitive and often overlooked lubrication practices and procedures.

3. Lubricants Not Managed by Storeroom Clerk

The storeroom is often managed by a dedicated person or team in a controlled area, this includes accountability on what is brought in and sent out and what the inventory minimum and maximums need to be. When lubricants are included under storeroom management, then there can be some benefits namely, keeping inventory controlled so that lubricants don't simply get taken without that removal being tracked.

On the other hand, lubricant selection decisions should not be made by the typical procurement personnel often associated with the storeroom. It takes a careful analysis of machine requirements, environmental conditions and operating variables to properly identify the right lubricant, with the cost of the lubricant being secondary. Even when an alternate lubricant shows viability and there is a temptation to switch to save money, there can be more costly consequences if not done with the right maintenance considerations. It becomes a lurking lubricant poised to create problems. You cannot assume the two lubricants with similar application intents and performance properties will be compatible with each other if mixed together within a machine.

4. OEM-Based Selection

With the many variables that go into selecting the right lubricant, it's easy for some to defer to the OEM to determine which lubricant is right for each machine. While this is important to consider, it certainly is not the only variable. Additionally, using certain lubricants just to meet the stipulations of the machine's OEM-warranty is not always advisable when considering what's best for business plant-wide.

OEM recommendations can often be generic, typically based on an assumption of ideal conditions. Factors unique to your facility (such as the ambient temperature and degree of contamination) can alter lubrication qualities, rendering an OEM-recommended lubricant insufficient to maintain the expected reliability of the machine. Defaulting just to OEM-based lubricant selection can create a false sense of security and present itself as a lurking lubricant.

5. Fear of Deviating From the Current Lubricant

If things have always worked just fine a certain way, why deviate? Many people are resistant to changing lubricants, especially when they haven't run into any problems using the current lubricant (such as the lubricant tied to the original warranty) or when they're dealing with a highly critical machine. While these lubricants may still be the best option, it's important to allow room for reconsideration.

Lubricant formulations are being improved every year, or better alternatives can exist, especially when taking a plant-wide lubricant optimization into account and consolidating like-lubricants.

Reducing the number of lubricants helps with not only bulk buying but can reduce the chances of cross contamination in machines. Comprehensive lubricant labeling should be a reliability consideration when optimizing lubricant selection and can help avoid lurking lubricants.

CREATING A PLAN

As you can see, the problem is part leadership, part training, and part just daily housekeeping. This can lead to further issues when those dealing with daily lubrication tasks are pressured to get their basic requirements done. This ultimately will result in confusion and a plant full of lurking lubricants.

Creating change requires a plan. But before the plan is constructed, it's important to understand where we currently are and what the goal is. In this case, the goal is to achieve optimal lubricant usage in the plant and minimize the negative impacts on machine reliability. The plan to meet that goal should look something like this:

- Review the current lubricants in use in the machines (where possible) and identify all lubricants stored in any way throughout the plant (and yes, look for those lurking lubricants hidden away).
- Review who is making lubricant selection decisions. If this cannot be answered quickly, then a person or a committee needs to be created that goes through the necessary machinery lubrication training and certifications.
- Review the storage conditions. How are they being kept clear of contamination influence? What are storage reception practices like?
- Make lubricant optimization guidelines and policies, usually including direction from lubrication consultants and lubricant representatives. Note there are dozens of good articles at machinerylubrication.com on lubricant optimization and storage best practice. Additionally, Noria can support in selecting the optimal lubricants through a consulting effort.
- An effort to optimize the lubricant selection involves accounting for the needs and operating conditions of the individual machines while also considering plant-wide objectives. Typically, this results in reducing the number of lubricant products in the plant, which is why this process is often referred to as a consolidation effort. However, it is not unusual for the number of lubricants to increase, which is sometimes due to an over-consolidation of lubricants performed during a previous initiative.
- Finalize a lubricant list through a digital platform that supports the implementation of lubricant changes in machines and manages the updated lubricant information to the machines dynamically.
- Throughout the stages of implementing lubricant changes, provide machinery lubrication training to all personnel who manage or handle lubricants in any way.
- Make those involved in lubrication activities accountable for lubrication tasks and program maintenance which can be supported by the right key performance indicators reported.

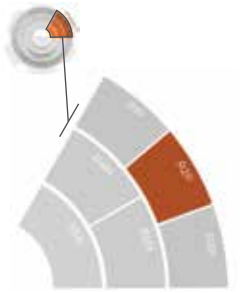
Once lubricant selection is optimized, it will ultimately make it easy for the right things to be done right. Use the right lubricant, at the right time, from the right place, and you can avoid a lot of problems. When lubricant usage is not treated with the appropriate level of importance, lurking lubricants can find their way into the plant, and machine reliability will suffer. ***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.

Are You Protecting Your Stored Lubricants?

More about this **ASCEND™ Factor**



Factor:
R2P— Lubricant Storage & Lube Room

Level:
Platform(P)

Stage:
Lubricant Reception And Storage

About:
Lubricant storage should be centered around a designated lube room. Proper storage should protect lubricants from environmental and contamination threats.

Learn More:
noria.com/ascend/

The effort to consolidate, label and organize lubricants usually results in a neat, manageable lube storeroom. When things are organized and lubricants are easily identifiable, the chance of a machine-damaging lubricant mix-up is lowered. But, a properly managed storeroom doesn't just make handling lubricants easier; best practice lubrication storage techniques serve to protect the lubricant until it is ready to be used.

The location and environment of stored lubricants will affect their performance when it comes time to use them. A lubricant's recommended shelf-life is largely influenced by its additive package. Some additives, like rust inhibitors, decay quickly, weakening performance in as little as six months of storage. Some turbine oils, on the other hand, have a light additive dose, allowing them to be stored for up to three years. OEMs can provide recommended storage times for specific lubricants, but it is important to remember that they make these recommendations based on ideal conditions; longevity will also be affected by environmental factors unique to your facility, including:

- **Humidity**
  Moisture accelerates oxidation and degrades lubricant additive packages. As such, lubricants should not be stored in humid environments. Moisture can be combatted by attaching desiccant breathers to lubrication storage containers.
- **Extreme temperatures**
  Extreme temperatures, both hot and cold, can cause chemical degradation. Cold storage, specifically, can lead to precipitation.
- **Temperature variations**
  Fluctuations in temperature cause the air within lubricant storage containers to move. Essentially, as temperatures fall, lubrication containers

exhale, and as temperatures rise, they inhale. This thermal siphoning can quickly degrade lubricants and is one of the reasons that temperature control is so important.

Indoor vs. Outdoor Storage

Indoor storage is always preferable to outdoor storage. Indoor storage spaces allow for more consistent temperature control and typically provide more protection from potential sources of contamination. Ideally, the storeroom will be set up in such a way that oil containers can be rotated and a first-in-first-out system can be implemented.

Unfortunately, it is not always possible to store lubricants indoors. If outside storage is the only option, store oil drums horizontally and try to find some covering to protect the lubricants from the elements. You can deal with outside storing conditions more effectively by carefully tracking lubricant consumption. By using up all the stored lubricants and replacing them just before you run out, you can minimize exposure to outdoor conditions.

Maintaining Storage Conditions

As with most aspects of a quality lubrication program, best practice lubricant storage techniques can only be effective if they are properly maintained. It is essential to keep the lube room neat and the lubricants and tools properly labeled. And unless lubricant reception and usage are carefully tracked, the system will quickly become ineffective, and lubricants will degrade at devastating rates. ***ML***

About the Author

Travis Richardson is a technical consultant for Noria Corporation. He holds a Level II Machine Lubrication Technician (MLT) certification and a Level III Machine Lubricant Analyst (MLA) certification through the International Council for Machinery Lubrication (ICML). Contact Travis at trichardson@noria.com.

TEST YOUR KNOWLEDGE

This month, *Machinery Lubrication* continues its "Test Your Knowledge" section in which we focus on a group of questions from Noria's Practice Exam for Level I Machine Lubrication Technician and Machine Lubricant Analyst. The answers are located at the bottom of this page. The complete 126-question practice test with expanded answers is available at store.noria.com.

1. Grease tubes should be stored in a climate-controlled space in what manner?

A. Vertically with the plastic cap up
B. Horizontally with the plastic cap facing out
C. Vertically with the plastic cap down
D. Horizontally with the plastic cap facing in

2. Which vent treatment is best for controlling contamination?

A. Mesh screens
B. Desiccant breathers
C. Plugs
D. J-tubes

3. What is another name for extreme-pressure (EP) additives?

A. Anti-foam
B. Anti-friction
C. Anti-squawk
D. Anti-scuff

4. What common grease thickener does NOT provide good water resistance?

A. Sodium
B. Calcium
C. Barium
D. Aluminum

5. The viscosity of ISO 220 oil is similar to what SAE gear oil at the same temperature?

A. SAE 90 gear oil
B. SAE 85W gear oil
C. SAE 140 gear oil
D. SAE 80W gear oil

ANSWERS

1.A 2.B 3.D 4.A 5.A

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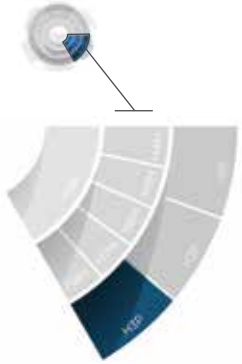
When and How to Clean a Sealable and Reusable Top-Up Container

More about this **ASCEND™ Factor**



Factor:
H3P – Handling and Application Devices

Level:
Platform (P)

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 an S&R Container?

A sealable and reusable (S&R) container assists in contamination prevention when topping up most normal-sized reservoirs. I say most because an S&R container isn't practical in some cases, such as larger hydraulic reservoirs and circulating systems (these would be better suited for indirect filling from a barrel by way of filter or transfer cart). I wanted to write this to serve as an unofficial guide on why, how, and when to clean these containers.

New Oil is Not Clean Oil

If S&R containers are best practice when it comes to preventing contaminant ingression during top-ups, why would I have to clean them still? Well, the answer is simple new oil is not clean oil. I often use the practical experiment of going to the back of an O'Reilly's or Wal-Mart and looking at the bottom of a five-quart jug of new oil. Hold the jug up to the light and observe all of the sediment in this brand-new oil that has settled to the bottom of the jug while in storage. This will show you that an unused, clean container can still introduce potential contaminants into your machine. Now, if your facility is utilizing a bulk tank system that filters the oil into and out of the bulk tank, then you are likely to have cleaner oil and the frequency with which containers need to be cleaned will be reduced.

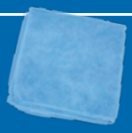
Why Am I Cleaning a "Clean" Container?

Generally, these containers rarely get cleaned. We visit sites all over the world and have seen just about every container on the market in use. There isn't a single container that maintains absolute cleanliness throughout its life. No matter the bulk tank system or method of transferring oil to these containers, somewhere in the process, contaminants always find their way in. This is why we usually recommend a thorough cleaning once a month on higher-use containers and once a quarter on lower-use containers. This is important when the facility is tracking cleanliness targets through oil sampling utilizing the ISO Standard 4406:99

How to Clean a Sealable and Reusable Container

The importance of cleaning S&R containers doesn't mean that doing so has to be time-consuming or hard. With a few cleaning materials and a well-defined procedure, these containers can quickly and easily be cleaned and returned to service.

Materials and Tools Needed

Brush 	Cleaning Solvent (mineral spirit) 
Lint-free Cloth 	LIS Labels 
Permanent Marker 	Gloves 

Cleaning Procedure

1. Take the top-up container to the appropriate cleaning station and remove the dispensing top.
2. Remove any residual lubricant and drain into the proper waste oil container.
3. Clean interior and exterior thoroughly with a sponge and soapy water. A mild detergent or solvent may also be used. Rinse through all hoses, pumps, extensions, and nozzles to ensure it is fully clean. Rinse out all soap or detergent residue.
4. Wipe out interior and exterior with a lint-free rag until dry.
5. Check the labeling on the outside of the container and replace it if it has become damaged or is hard to read.
6. Return the container back into service.

Cleanliness Code. According to this standard, 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. For example, it will look like this: 18/16/13, 19/17/14, etc.

Excluding Future Contaminants

Once the S&R container is thoroughly cleaned and returned to service, like any aspect of lubrication, maximum effort must be put towards preventing contaminant ingression. This includes maintaining the cleanliness of the transfer wands, bulk tank dispensing spouts and quick connects that may be utilized to refill these containers. Oftentimes, even if the oil is filtered in and filtered out of the bulk tank systems, it is the dispensing tool that introduces the contamination into the container and lubricant. This goes back to lube room cleanliness; if the lube room is all grimy and dusty, then there is a likely chance that the dispensing tools will collect that dust and grime. When it comes to lubrication, the three most important words any lube tech could remember are, in order of importance, "CLEAN, COOL, and DRY." Print those words out on paper and hang them up all over the lube room. Even though it is a tedious task in a sea of other maintenance priorities, trust me when I say that if your lubricant stays clean, your job will be so much smoother in the long run. The machines will run better, the plant will run better, and the technicians will have a more complete and organized strategy moving forward. ***ML***

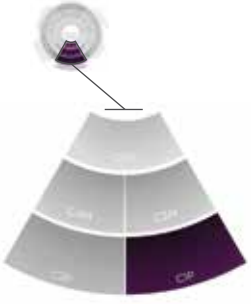
About the Author

Paul Farless is an industrial service technician for Noria Corporation. He holds a Machine Lubricant Analyst (MLA) Level II certification through the International Council for Machinery Lubrication (ICML). 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 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. Contact Paul at pfarless@noria.com.

Factor: C1P

Dealing with Oil Mist, Fog and Haze

More about this **ASCEND™ Factor**



Factor:
C1P - Contaminant Exclusion

Level:
Platform (P)

Stage:
Contamination Control & Lubricant Reconditioning

About:
Developing a contamination exclusion strategy can protect against machine failure and increase the life of both lubrication and machinery.

Learn More:
noria.com/ascend/

Coming from the farm, oil mist was something that I became fairly familiar with, not because I had to deal with anything directly in any substantial way, but because I have always been a bit persnickety when it comes to maintaining my combine. My cab was always kept as spotless as I could get it. Anytime I had to stop my machine, I was out there cleaning my windows for better visibility; any place there was dirt building up on the normal flat surfaces, I would run over there and clean it up. One of the issues I started to notice was the build-up of dirt right on top of the feederhouse (a section of the machine that draws the cereal crop into the separator section from the header section) that seemed to always form in a strange but consistent pattern. Being a young guy and not having too many harvest seasons under my belt, I had no idea what was causing this, but I cleaned it up nonetheless.

With hindsight being what it is, I know that a fine hydraulic leak was the root of this build-up. A small pinhole in my hydraulic lines (I ran an older machine with an even older header) was causing a fine mist spray in a specific pattern onto that feederhouse, and all of the dust and chaff was sticking to that oil that would settle on the machine. There probably aren't too many of you out there running a combine in a manufacturing plant, but believe it or not, this is relevant

information We often forget about what is causing some of our minor (or major) headaches.

Oil mist/fog can be a good thing. If I have a high-speed turbine, I am likely to have a mist system incorporated into the lubrication of that turbine. If I have some obscure gearboxes that I keep on hand because they are hard to find, an oil fog being maintained inside the headspace can protect those surfaces.

The mist and fog we need to worry about is the stuff we aren't generating on purpose. Oil is really good about sticking to stuff for the most part, so if I have a reservoir that has an open breather and it keeps generating a bit of mist, I will likely see indicators of this (as long as I know what I am looking at), like dust settling and sticking to the oil on top of the reservoir.

The mist is causing a bit of housekeeping, so what? What happens if I am maintaining the headspace in that reservoir? The oil is going to permeate the filter media and either plug a spin-on filter or coat the desiccant and prevent it from doing its job. So that little bit of mist could end up causing moisture accumulation in the headspace and oil, or it could create a situation where the reservoir won't breathe at all.

If the reservoir needs to breathe and can't, something else somewhere in that system is going to give. It might be a seal somewhere, control valves, or it could be that the machine goes into a safe mode and just shuts itself down. None of these situations are going to help production or reliability. So, the next time you walk past a reservoir, gearbox, hydraulic system or pump and you see that bit of dust that always settles in the same spots, or worse yet, actual mist coming out of the breather, take a minute to figure out why this is happening and what can you do to fix it. **ML**

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. Contact Jeremie at jedwards@noria.com

Expert High-Velocity **Oil Flushing Tips**

"The goal is to get a quality job done as quickly, safely, and in as environmentally friendly a way"

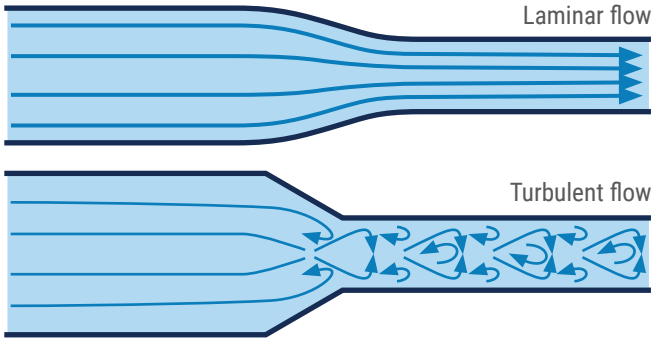
I've worked as a Project Manager at Gaubert IFM for over seven years. During this time, I've had the opportunity to work on many different high velocity oil flushes; I've been able to learn a few things along the way. This article contains some helpful tips for performing an oil flush or finding a high velocity oil flush service provider.

When it comes to planning and performing a high velocity oil flush, the goal is to get a quality job done as quickly, safely, and in as environmentally friendly a way as possible. For this to happen, certain steps must be taken. There are technical and human elements to high velocity oil flushing; when you're looking for a flushing service provider, you should make sure they perform well in both categories.

High Velocity Flushing Project Tips

1. Before starting or introducing oil, test all flushing circuits with compressed air; it's a lot easier to clean up an air leak than an oil leak.

2. Remove any restrictions. All filters and flow orifices must go; they slow the flow.
3. Cycle the coolers. Most units have two oil coolers and two filter vessels; do 12 hours on cooler A and then 12 on cooler B. Much of the debris gets trapped in the cooler, and if they aren't properly cleaned, this debris will be reintroduced to the system after the flush is complete.
4. Avoid hand-cleaning pipes whenever possible. It is a common practice in the industry to pull pieces of pipe from the machine, wipe them out, and then put them back in. This is insufficient; if a piece of pipe doesn't fit where it's at during the cleaning, try to loop it in elsewhere: on another jumper or the discharge of the pump. Hand cleaning is not a good substitute for flushing the pipe because you can't achieve the level of abrasion, turbulent flow, or pressure that comes with a high velocity oil flush.
5. Aim for a high Reynolds number. Most vendors require a Reynolds number of 4000 (the point at which laminar flow becomes turbulent flow), but this is too low. While turbulent flow is achieved at a Reynolds number of 4000, it is still not turbulent or abrasive enough to do a proper cleaning. I only do jobs with a minimum Reynolds number of 10,000; this cleans better and is faster (you can theoretically, but not always, cut flushing times in half).



6. Chemically clean carbon steel pipe before flushing whenever possible. We use a simple acid. This step helps remove possible scale and rust build-up and ultimately speeds up the flushing process.
7. Implement sparging and vibrators (this is one of the most important tips and tricks). Sparging, or gas flushing, is the introduction of air to the liquid and can increase the abrasive effects of the flush. Vibrators knock the piping to loosen and remove contamination build-up from the pipe walls.
8. Run two verification screens to ensure a successful high velocity oil flush. If one screen passes, it doesn't necessarily mean that the system is clean; it is always best to double-check.

Tips for Selecting a Service Provider

1. Be sure the service provider is prepared when they arrive on-site; this will avoid any delays on startup. There needs to be an engineering walk down, a good plan in place, and a marked-up drawings showing exactly what is going to be done to the system.
2. A quality flushing service should work with you, not for you. It is important for a service provider to become a team with the customer; this includes working together to form the flushing plan. You have information about your operations that the flushing service does not, and they need this information to do the job right. A flushing service that comes in with a pre-made plan does not consider the unique aspects of your machinery, which will lead to delays and insufficient cleaning.
3. The flushing service representative should over-communicate. They should get the e-mail addresses of everyone involved and send a nightly report detailing both what happened that day and the plan for the next. Financial records should also be included in this report. Constant communication allows you to follow the progress of the project and provides assurance that the flushing provider is not "nickel and diming" you with delays.
4. Ultimately, the flushing service providers are guests in your facility, and they should act as such. You should be informed of everything that is going to happen before it does, and you should sign off on everything.

Flushing Done Right

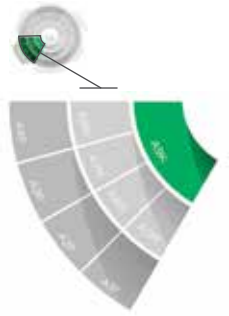
There is a lot of value in partnering with an experienced high velocity flushing service provider. Choosing a partner that works with you and gets the job done quickly means less downtime. When selecting a service provider, don't be afraid to ask questions; it is crucial to make sure they know what they're doing. ***ML***

Factor: A9K

The Top 3 Condition Monitoring KPIs

Condition Monitoring is becoming the mainstay for maintenance and reliability groups in virtually all industries; as such, there needs to be a system in place to demonstrate the effectiveness of the activities involved. While it is hard to argue the impact of detecting problems early, the question remains: how in-tune are we with our equipment? The best condition monitoring programs utilize metrics to answer this question along with others. What follows are are the top three condition monitoring Key Performance Indicators (KPIs) in no particular ranking.

More about this **ASCEND™ Factor**



Factor:
A9K – Lubricant Analysis KPIs

Level:
Platform (K)

Stage:
Condition Monitoring, Lubricant Analysis and Troubleshooting

About:
Key performance indicators allow the lubrication analysis program to be monitored for effectiveness and consistency.

Learn More:
noria.com/ascend/

1

Percent abnormal readings/measurements/results —

The key to good condition monitoring is to take routine measurements in the field. These may include oil or grease samples, vibration readings, ultrasonic inspections and myriad others. When we interpret these measurements, we should be looking to find the equipment that is in an "alarm" or "abnormal" state. By comparing the number of machines in this state compared to the total number of machines in the program, this percentage takes shape. Programs in their infancy are often inundated with the number of problem samples coming back, so this serves as a metric to show the evolution of the program over time as well as a leading indicator of unplanned downtime. While the goal is to have as low of a percentage as possible, it is likely that some percentage of equipment will be flagged for some reason, such as contamination, fluid health or machine health.

2

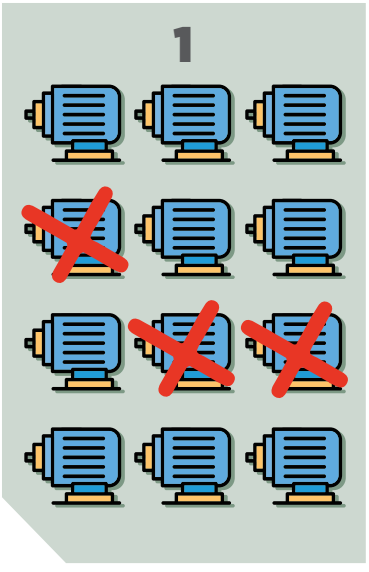
Issues found via in-person (non-instrument) inspections —

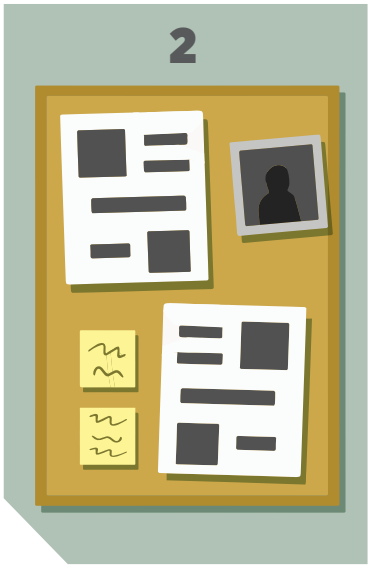
Much emphasis is put on the technology side of condition monitoring, but it's important to remember the value of the daily inspection. This KPI is so important because it can be a shared metric across multiple departments within the facility. It is not uncommon for mechanics, operations and lube technicians to all have a set of daily routes and rounds that they have to accomplish at the beginning of their shifts. Since we have different sets of eyes on the equipment, we should be tracking the abnormalities or problems found during these events. Remember that what gets measured gets done; all too often, the inspections are pencil-whipped because no action is taken on problems reported or sheets are simply turned in and filed away, never to be reviewed. By having a dashboard or bulletin board indicating the number of "saves" found by the inspectors, you can promote a culture of equipment care across multiple sets of employees and help break the silos and constant struggle of maintenance against operations or any other conflict that seems to be present in facilities.

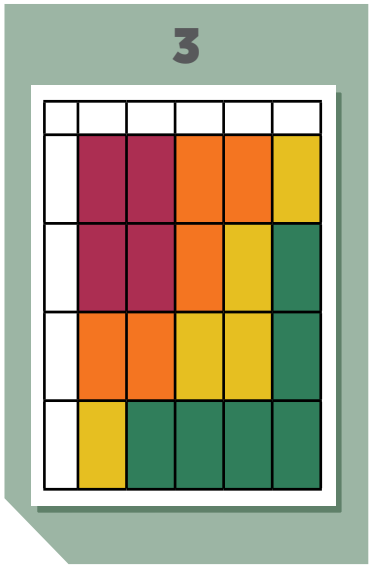
While there are many more metrics that could be measured and tied to specific condition monitoring activities, starting with the few key metrics will help narrow the focus of the program to exactly what we are trying to achieve.

3

Effectiveness of corrective actions taken for equipment — Finding problems early is the ultimate goal of condition monitoring, but we need to look beyond finding the issues and work to determine how well we are correcting the problems. This can be done based upon how long the equipment stays in an "alarm" state and, even better, can be crossed with the specific action taken to remediate the problem. Not only will this metric answer the question of "are we addressing the problems," but it also serves as the beginning of a decision matrix that should be developed for each type of alarm that is triggered when the equipment develops issues. The matrix can be reviewed and makes the troubleshooting and correcting of the problem much simpler as opposed to just guessing at what may fix the issue. Obviously, good documentation is key to this one as the information recorded in the decision matrix will serve as the foundation for equipment corrective action in the future.







About the Author

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Noria Media

The Basics
Food Processing Lubrication

"Without the use of appropriate food-grade lubricants and standard operating procedures (SOPs), any food and beverage manufacturer can be vulnerable to contamination."

Regulatory responsibilities, consumer awareness and a focus on public health are challenging food and beverage processors to choose the right food-grade lubricant for every application in their processes. Here's what you need to know.

Consumers report a "bad taste" or a "smell like tar." Some say they had an upset stomach or a burning sensation in the throat. The culprit? Lubricants. During the last 25 years, contamination stemming from machinery lubricants in food and beverage manufacturing has resulted in lost consumer confidence and recalls, not to mention threats to public health. Without the use of appropriate food-grade lubricants and standard operating procedures (SOPs), any food and beverage manufacturer can be vulnerable to contamination.

Despite contamination risks, research shows that about 60% of U.S.-based food and beverage manufacturers have not switched

from conventional oils and greases to food-grade lubricants. Many still use oils that elevate the risk potential for contamination that could essentially shut down an operation. With the adoption of the Food Safety Modernization Act (FSMA) in 2011, manufacturers creating food, pharmaceuticals and dietary supplements must implement systems and controls to address hazards. This includes assuring that lubricants are food-safe.

So, what exactly are food-grade lubricants, and how can a food and beverage manufacturer achieve compliance? What essential training and maintenance programs should be put in place to prevent contamination? This article will explore these food-grade lubricant basics and more.

Assessing Risk — A Closer Eye on Lubricants in Food Processing

Before diving into the types of lubricants commonly used in food manufacturing, new responsibilities due to regulations and how to effectively implement a safe and healthy program, let's address why the food manufacturing industry is under pressure to adopt stringent best practices related to lubrication. The United States government

agencies involved in food processing are the U.S. Department of Agriculture (USDA) and the U.S. Food and Drug Administration (FDA). Before 1998, all food-grade lubricant oversight and formulation review were the responsibility of the USDA. Lubricant manufacturers were required to prove that their formulas complied with a series of guidelines referred to as Title 21 under the Security Code of Federal Regulations (CFR).

Then, the USDA put the responsibility on manufacturers to assess risk following a shift in its program in February 1998. This meant lubrication manufacturers were charged with assuring their lubricant ingredients were safe. Because of the weighty responsibility, this major program change resulted in third-party consultants and vendors entering the market to help manufacturers develop systems, identify risks and create SOPs so they could receive lubrication certification.

Today, the NSF oversees a food lubrication evaluation program. It's basically what the USDA designed, which requires manufacturers producing lubrication for food processing applications to deliver supporting documents that prove health and safety compliance.

What does this mean for lubricant manufacturers and operations that use food-grade lubricants? Essentially, there are layers of compliance, required systems and sets of checks and balances that must be adhered to for the sake of public health.

Common Lubricants Used in Food and Beverage Manufacturing

Lubricants used in food and beverage processing are rated based on how safe they are if they come in contact with food. The National Sanitation Foundation (NSF) oversees a lubricant evaluation program that includes a list of approved lubricants.

Based on NSF ratings, an H1 lubricant can be used in food processing areas and is safe for incidental food contact. H2 lubricants can be used in food processing areas but must not be in contact with food. H3 lubricants can be used in contact with food, but are limited by FDA regulations. HT1 lubricants are heat transfer oils and also may be used in situations where incidental food contact could occur. The NSF offers a list of additional food-safe solvents and degreasing agents and constantly updates its product list.

To help guide food and beverage manufacturers in selecting the right food-safe lubricant for every application, these are the NSF lubrication basics to understand.

H1 Lubricants

These food-grade lubricants can be used in food and beverage processing when there is a potential for incidental contact. These lubricants can contain basestocks, additives and thickeners. H1 lubricants can be petroleum-based or synthetic. Petroleum-based lubricants used in food and beverage manufacturing include white mineral or USP-type white mineral oils that are refined, colorless, tasteless, odorless and will not stain.

Synthetic food-safe lubricants include: basestocks like polyalphaolefins and polyalkylene glycols and silicons like dimethylpolysiloxane.

H2 Lubricants

H2 lubricants can be used in food and beverage manufacturing facilities but not in applications where contact with food is a possibility. There is no defined list of ingredients that H2 lubricants must contain, but there are ingredients that cannot be present in food processing areas: carcinogens, mutagens, teratogens, mineral acids and heavy metals like arsenic, lead, mercury and others.

H3 Lubricants

These are edible or soluble oils generally used for cleaning and preventing rust on machine parts. They are composed of oils from corn, cottonseed, soybean or minerals.

What Makes a Lubricant Food-Grade?

The FDA specifies the components that food-grade lubricants must be made of to safely have incidental contact with food. Lubricants that are NSF-certified as food-grade and achieve the FDA's zero-tolerance standard are listed as an NSF H2 certified non-food compound.

Food-grade lubricants are safe for use in meat, poultry, and other food processing equipment and applications.

The FDA Codes in Title 21 explain what ingredients are allowed in food-safe lubricants. For example, H1s are more limited because they are allowed for incidental exposure with foods. H2 guidelines are less restrictive and include a broader selection of lubricants, yet they still meet governing guidelines and require manufacturers to have compliance protocols in place, as with any lubricant.

Food-grade lubricants are odorless, tasteless, and rated safe for incidental exposure. Also, food-grade lubricants can withstand extreme cold and hot temperatures. They are more stable than traditional mineral and white oil-based food-grade lubricants. Aside from complying with stringent regulatory standards, food-grade lubricants also have been shown to extend equipment life and reduce maintenance costs.

How Can Lubricant Contamination Occur?

There are many moving parts in food and beverage processing equipment. The lubricants used to grease bearings, chains, gearboxes and other machine components can potentially drip, leak, mist or otherwise "touch" a product that consumers will eventually eat or drink. Every step of the production process can include some potential hazard. Identifying those potential hazards is the first step to putting controls to reduce risk exposure in place.

Understanding Your Responsibilities — Regulation 101

Food and beverage manufacturers have a responsibility to ensure safe, reliable manufacturing — and this accountability is mandated by the FSMA. SOPs must be in place to ensure FSMA compliance, guided by Hazard Analysis and Critical Control Points (HACCP) and Hazard Analysis and Risk-Based Prevention Controls (HARPC).

What is the FSMA?

According to the Centers for Disease Control and Prevention (CDC), about 48 million people in the United States get sick — that's 1 in 6 — and 128,000 are hospitalized. More than 3,000 die each year from foodborne diseases. The FSMA shifted "response" and reactive measures to a proactive, preventive approach.

FSMA is designed to dramatically change the way we identify and prevent foodborne illness in the global food system. It acknowledges foodborne illness as a significant threat to public health and the economy. It also emphasizes that food safety is a shared responsibility, and every player in the supply chain must be held accountable by putting defined protocols and procedures in place to prevent contamination.

The FSMA gives the FDA enforcement authority to promote compliance and encourage risk-based food safety standards. That way, when an exposure occurs, there are plans for a timely and effective response to help contain the problem.

In the Know — Implementing FSMA

There is quite a bit of confusion surrounding FSMA and hazard systems such as HACCP, and misunderstandings about what the regulations require can put a food and beverage manufacturer at risk of noncompliance. "Not understanding" FSMA will not excuse a processor from audits, fines and penalties. Because FSMA covers a broad scope of industries and manufacturers, some that might not think their facilities require food-safe lubricants could unknowingly be violating the law.

> "Not understanding FSMA will not excuse a processor from audits, fines and penalties."

Here are some FSMA requirements and steps that will help manufacturers comply:

- All plants must have a food safety plan that is documented and developed with a preventive controls-qualified individual trained by an FDA partner.
- Manufacturers should designate someone as the FDA liaison to assist with inspections.
- A lubrication program must list all steps in the manufacturing process.
- Manufacturers must assess the severity of every listed potential hazard.
- The risk of listed hazards must be weighed against the benefit to explain why it exists in the process.
- Risks must be limited with documented controls that are put in place.
- Controls must be proven to be effective to prevent a hazard from occurring.
- The entire process must be on record and produced on demand for an FDA inspector.

What are HACCP and HARPC?

HACCP is a system to help stop hazards in food production, and it includes seven principles:

1. Hazard analysis
2. Critical control point identification
3. Establishment of critical limits
4. Monitoring procedures
5. Corrective actions
6. Record keeping
7. Verification procedures

HARPC is a hazard analysis provision of the FSMA that was created to identify potential risks of contamination to food and ingredients in processing, manufacturing, packaging and holding. Every hazard must be identified, evaluated, prevented, monitored and corrected.

Because of the HACCP and HARPC responsibilities that are necessary for complying with FSMA, food and beverage manufacturers shoulder a significant burden to develop airtight SOPs. Basically, there is zero tolerance for contamination.

What does all this have to do with food-grade lubricants? The right lubricant must be assigned to each application in the manufacturing process, and those food-safe lubricants must stand up to FSMA requirements. Otherwise, a manufacturer is at a significant risk of threatening public health, losing consumer confidence and footing costs of recall and notification that could inhibit the ability to operate.

Overcoming Challenges — Safely Lubricating Food Processing Equipment

Unlike other industries, the food and beverage processing industry faces unique circumstances that can pose hazards to food safety when it comes to lubrication. Lubricants must stand up to extreme conditions — heat, cold, water and steam, to name a few.

Machine parts — For one, there's the complexity of manufacturing equipment involved in the process that includes a range of components that require lubrication — pumps, mixers, tanks, chain drives, conveyor belts and more.

Internal surfaces — Beyond lubricating critical machine parts, food and beverage processors also use lubricants for internal surfaces to control factors like heat and corrosion.

Other lubricant qualities — In a food and beverage processing facility, lubricants must perform effectively by offering effective pumpability. Plus, the lubricants should stand up when exposed to water, oxygen and heat.

Systems and SOPs — Defining Processes

Selecting the right food-grade lubricants and putting required hazard prevention and SOPs in place will prevent potential risks and exposures. And, in today's environment, no food processor can afford to take short-cuts with training and process implementation.

Where to start?

To develop a program in keeping with FSMA standards that will reduce liability and help protect public health, there are several factors to consider:

- Identify every step in the manufacturing process.
- List every potential hazard tied to those steps.
- Assess the severity of all potential contamination risks.
- Weigh the risk vs. benefit of steps in the process — what's critical; what is not?
- Ensure sufficient controls across the entire operation.

In pursuit of zero accidents, zero defects and zero failures, the Japanese Institute of Plant Maintenance (JIPM) developed its Total Productive Maintenance (TPM) concept. Because lubrication is critical to ensuring safe, effective food and beverage production, TPM is an effective strategy for covering all the bases of plant management to reduce risk. A plan should address HACCP, and all employees should understand processes.

While developing a training and staying compliant with FSMA might seem overwhelming, it begins by listing every step in the manufacturing process. Assemble the team, refer to a plant diagram, outline every step in the production process, and then break down those steps into machines and specific components that require lubrication.

While doing so, keep in mind what "hazard" means in the food processing arena as it relates to food-grade lubricants. Any situation that could compromise the integrity of a food product or ingredient is considered a potential hazard. By including a range of individuals involved in manufacturing processes, more intelligence about potential hazards can be compiled and reviewed.

Identifying potential risks is the foundation of establishing SOPs and training.

Below are additional tips for creating procedures to ensure lubricants are used properly, safely and in compliance with FSMA and FDA requirements.

- Perform a site survey to help assign an appropriate food-safe lubricant to every component that requires one.
- Seek out NSF registration to ensure that lubricants are suitable for use in food and beverage processing.
- Outline specific SOPs and identify who (an individual or team) in the organization will be held accountable for each step.
- Test and monitor the controls put in place.
- Ensure that the maintenance plan meets HARPC requirements.

Take the Guesswork Out of Training

Food and beverage processors are not alone in their pursuit to achieve FSMA compliance, properly select lubricants, and develop maintenance plans. From learning precision lubrication skills to maximize machine reliability to analyzing lubricants for use in food processing, an experienced training partner can lift the burden so manufacturers can focus on production and profitability. Noria offers a Food Processing Equipment Lubrication course that outlines the FSMA, how it impacts food processors' lubrication program and lubricants used, and how to develop a risk-based prevention control plan that will ensure compliance. ***ML***

Factor: E4M

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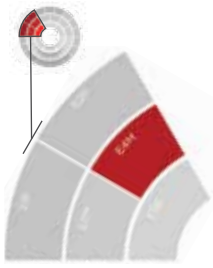

Factor:
E4M — Energy Conservation, Health & Environmental Training

Level:
Platform (M)

Stage:
Energy Conservation, Health & Environment

About:
To implement lubrication excellence, all staff should receive training on the impact of lubricants on the environment, ecological disposal options and strategies to reduce consumption and environmental impact.

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More and more these days, you will hear people (in almost any industry) talking about their concerns with locating and acquiring biodegradable lubricants. In most places, even non-machinery lubrication related, everyone seems to be very concerned with going green and utilizing biodegradable containers and packaging. I personally think it's a great shift in our culture to not waste and litter as much. Going back to machinery lubrication, though, I often get asked a few questions about biodegradability: What is it? How is it determined or measured? Why does it even matter?

What is it?

Biodegradability refers to the ability of an object or substance to decompose by way of bacteria or other living organisms. Examples of biodegradable objects include paper and food. However, "biodegradable lubricant" is, to me, kind of a weird term. You see, petroleum or "crude oil" is a fossil fuel but not in the sense that it is old, degraded dinosaurs: a common misconception that even I believed for a long time. Petroleum is actually formed from 300-400 million-year-old aquatic phytoplankton and zooplankton: essentially really old algae. My point is that petroleum is inherently biodegradable in nature. It is a product of millions of years of biodegradation. However, that doesn't necessarily mean that all lubricants are inherently biodegradable. As we all know in the lubrication industry, lubricants are made up of a lot more than just crude oil. Industrial oils and greases are complex and calculated combinations of specific base oils, thickeners and additives. Regarding lubricant biodegradability, we are mainly talking about lubricants that are READILY biodegradable, more along the lines of vegetable oils and some synthetic ester base stocks. Polyalkylene glycols (PAG) are generally a good biodegradable lubricant to use in place of vegetable oil and are manufactured in such a way as to increase the performance of

the lubricant to meet a wider variety of requirements and conditions.

What Industry Requires Biodegradable Lubricants?

Generally, food processing requires biodegradable lubricants. Food processing facilities aren't so much concerned with the biodegradability as they are with the non-toxicity of the lubricants that are associated with biodegradability. Not that food processing facilities are going to put out a product that potentially has an accidental lubricant leak somewhere in their process; they are very stringent on their quality requirements regarding what enters and leaves those facilities. I know this from personal experience with food processing facilities; they all take this ultra-seriously, so rest assured that food safety is at the top of their priority list. As a consultant with Noria, I also take this very seriously when making food grade lubricant recommendations to meet the operational requirements of their machines. It is a long and tedious task, but it is of the utmost importance that we recommend a lubricant that is safe and exceeds the desired performance requirements.

How it is Determined/ Measured

ISO 9439 is the standard that must be met for a lubricant to be deemed readily biodegradable. In some other cases, OECD 301B Standard can be performed in place of ISO 9439. A biodegradable lubricant has to be degraded by more than 60% within 28 days in order to qualify as a READILY biodegradable lubricant. The biodegradability tests treat a lubricant sample using a variety of microorganisms with oxygen present, which will produce CO2. The amount of CO2 produced is measured and used to determine the biodegradability of a lubricant.

Along with meeting those standards, the lubricants are run through quite a few different toxicity tests. For instance, OECD 202 Daphnia Sp., Acute Immobilization and Reproduction Test and ASTM D6081 Aquatic Toxicity Test are two of the common toxicity tests run on potential biodegradable lubricants. Although a lot of the toxicity tests are for marine and aquatic toxicity, there are also tests that utilize bacteria, plants and various other organisms.

Why it Matters

As we all know, resources are becoming more and more scarce. So, being able to extend the life of a machine through better lubrication practices is becoming a higher priority for a lot of the facilities we visit. Not only because they are changing lubricants less but because they are also spending less in the long run on high volumes of lubricant and specialty lubricants like biodegradable lubricants. Couple that with the reusability of biodegradable lubricants, and we have the perfect storm for maximum recyclability. By utilizing fewer resources, specifically oil and grease, some of the higher price points of these Environmentally Acceptable Lubricants (EALs) sting a little less. Both biodegradable and regular industrial lubricants are often recycled through a process called vacuum distillation to remove contaminants and produce a new base oil.

Every company, every industry and every employee is running very lean. I'm talking ten percent body fat lean. Most people we interact with in these plants and facilities are usually wearing multiple hats and performing multiple jobs. Our lubricants also need to be able to perform multiple jobs, not in the application sense but in terms of sustainability, cost-effectiveness, reusability and recyclability. Before, there were obvious causes of concern with the performance of these EALs; the other concern was price point. With a high cost and low performance, most industries were very reluctant to change to EALs if they were required to do so. Now lubricant manufacturers have sort of figured out a way to meet all of the specific machinery requirements while still meeting biodegradable standards and it is becoming slightly easier to make the switch to EALs. A lot of these facilities are making the switch and becoming greener processes; in return, the world is still receiving quality products while reducing the wasting of our precious resources. ***ML***

About the Author

Paul Farless is an industrial service technician for Noria Corporation. He holds a Machine Lubricant Analyst (MLA) Level II certification through the International Council for Machinery Lubrication (ICML). 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 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. Contact Paul at pfarless@noria.com.

QUALITY CHECK AT DOORSTEP: WHY AND HOW

What have you learned from the pandemic? This question hits us to think that even our bad times teach us the most important lesson for the future. Among all the lessons, I want to highlight which I can relate to my industrial experience as well i.e., "Quality of the Product". We do remember those days of checking the hygiene level of consumable items (even though it is labeled as "100% hygienic") entering our home, at the very first doorstep to avoid any possibilities of viruses. It is because of our awareness of the impact of a single virus that can be fatal to us and our dear ones

Likewise in industries, our machines are like our dear ones and it impacts us if it fails or does not work efficiently. The studies of Machine Reliability & Tribology show that 70% - 80% of machine failures are attributed to Lubrication which is around 1-3 % of the total maintenance budget. Lubrication represents a 1:40 investment rate, which means if $1000 spent on lubrication is properly taken care of & maintained, it can yield a saving of $4000 resulting in $3,900% ROI.

The quality of lubricant our machine consumes plays a significant impact on productivity, its life period, efficiency, and many more to meet goals. So, from where do we need to check the quality of our lubricants? It's a question that needs more awareness in the industries.

Though Industrial practices for lubrication management vary from plant to plant but assuming "New oil as clean oil" is the most common problem. During reception of the oil barrel at the site it is either stored at warehouses or a defined shed area within the premises. With the variation in temperature throughout the day, the barrel breathes, and the exposure to sunlight, heat, dust, dirt, moisture or any climatic challenges leads to the ingression of contamination into the barrel.

This is how the quality of lubricants starts to degrade before the start of their actual service life. But what happens before it reaches your site? And what are the factors which hamper the oil quality before its reception? Here, I would like to mention that it varies from manufacturer to manufacturer. In general, let us understand the route by the below stages:

Stage 1: Production of Lubricants

Lubricants are produced by the blending of Base oil and additive (also thickeners in case of grease) in a proportion to match the specification of the required application. The process of mixing is done by various methods like using air to agitate or a large slow-speed blender in a closed climatic condition.

Possible Concerns during this stage:

- Hygiene/ cleanliness of blending vessel.
- Quality of air used for agitation (moisture free).
- Blending components are filtered or not
- Lack of breather at the blending vessel

Stage 2: Intermediate Storage of Lubricants

As the lubricants are manufactured in huge batches, they are initially stored in large tanks before reaching the site. New intermediate vessels are built as per volume requirement or the earlier ones are used.

Possible Concerns during this stage:

- Occurrence of welding/ grinding dust in new containers.
- Lack of proper flushing of used containers.
- Inadequate installation of the breather to prevent particles & moisture in the tanks.
- Absence of Filtration possibilities while transferring the lubricants.

Stage 3: Transportation of Lubricants

Delivery of Lubricants at your site is done either in bulk or in batches. In the case of bulk transport, the oil tankers are cleaned either by steam or diesel fuel, and the hoses, pipelines, or in-between components used could add to the cleanliness issues of the finished oil. Drums or totes used for batch delivery also create disturbance in the cleanliness level.

Possible Concerns during this stage:

- Lack of dedicated/oil-wise containers & their material.
- Chances of cross-contamination.
- Inadequate handling practices led to the Ingression of contaminants if bungs, pipe connectors, and couplers remain open.
- Improper flushing of used tanks/drums for further usage.

Above all factors hamper the required cleanliness of oil to such an extent that sometimes it adversely impacts the system. The acceptable values of oil cleanliness levels are different as per respective applications e.g., the Servo valves require more clean oil than gearboxes. It has been observed that even the fresh oil that arrived at the site is having ISO code 21/19/16 or above NAS 10.

Let us see how we can adopt quality check practices/programs at the onsite reception of lubricants to improve the Lubricant and system reliability:

Inspect the Lubricant Container condition: There is a lot of information you can gather from the oil drum/ container about the condition before reaching your site. Whether the labels/ stickers are torn, damaged, or misprinted restricting giving clear information or it is clean and shiny enough to reflect their storage condition before their arrival. In a quality control procedure, a checklist or documents can be prepared to monitor and record the label condition, manufacturing, or expiration date to know shelf life, batch number, supplier quality certificates details, inspection date & time, and the signature of the quality inspector, reception environmental condition, etc. The robust documented procedure not only helps to check the lubricant quality but also to train the team on the importance of Reliability centered maintenance or proactive maintenance.

Ask for the test Certificate: It is the right of the consumer to ask for the test certificate of the lot along with the supply of the lubricants at their site. Test certificates should have detailed information about the quality check done before its dispatch like oil analysis, test results, analysis performed details, etc. Make sure to have this at least for the supercritical or critical machines.

Perform basic oil analysis: It is always suggested to randomly check a few samples from each batch to determine the ISO cleanliness level (particle counting), moisture, viscosity, and other basic tests. Either the plant can set up an onsite lab to perform the test in-house or select the neutral laboratory which can provide the correct analysis detail within the required time. There are many benefits of establishing in-house labs such as rapid sample turnaround time, quality control for purchase and optimization of lubricants, awareness of knowledge of lubrication analysis, report interpretation, test limits, cost and time saving, and many more.

Adopt Oil filtration practices: With the help of a test certificate or oil analysis, one must get to know the required cleanliness level of oil. To achieve the same at the initial stage, a simple mechanical filtration machine able to remove solid particles or moisture can be placed in the lube room before the oil starts its service. Ensure to keep a dedicated machine for it or proper flushing is done in case of changing oil grades.

Standard Lubricant Storage: The main objective to store lubricants should be to keep them away from particles, moisture, or any other type of contaminants. Firstly, it must be stored at an indoor warehouse and avoid outdoor storage as much as possible. A standard storage area should have concrete walls & roof (avoid asbestos sheet because it increases heat level in the room), a non-skid or epoxy floor, a ventilation system, a closed climatic control arrangement like AC, a marked aisle or work area on the floor, educational poster, dedicated lubricants handling hardware, safety equipment, and

proper housekeeping to clean the premises & make the environment dust-dirt free.

Educating the team: Lubrication is a subject that has a huge impact on the productivity of any plant, but at the ground level, its management is ignored or taken lightly. Education is the only key to creating awareness which can be done in various ways like presenting any case studies of machine failure resulted due to poor lubrication, placing proper checklists or graphs of lubrication trends on the shop floor, implementing the Color Code identification system, and displaying it on each lubrication hardware, including lubrication activities in Toolbox talk, dedicated training on Lubrication enabled Reliability through external parties and many more.

Following a basic quality control program at the reception of oil can help in reducing the possibility of costly mistakes that can lead to downtime of the entire operation or production process. Lubricants that are out of specification, expired, or severely contaminated, can be returned to the supplier or can be discussed to improve their quality. Establishing a collaborative relationship with a lubricant supplier is very essential for your quality control program. Lubricants quality is something that requires the utmost care starting from its manufacturing to disposal. Lastly, always keep in mind that "Lubricant is the blood of the machine" and you know how important it is to take care of your Blood.

About the Author

Preeti Prasad is a Senior Technical Engineer at Ecolab. She is ICML Certified-MLA/MLT-1 and experienced as a Technical Consultant in the field of Lubrication Reliability. A Chemical Engineer with work experience in O&G and providing lubrication consultancy services to various companies/sectors. Preeti may be contacted at preetiprasad25@gmail.com.

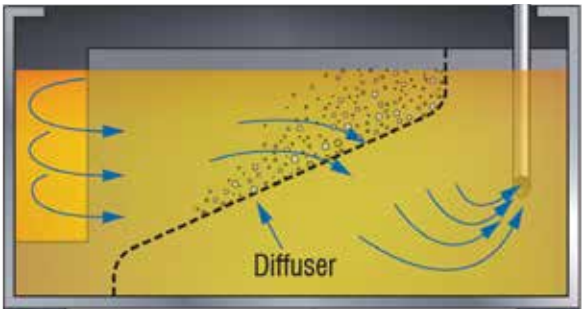
The "Lube-Tips" section of *Machinery Lubrication* magazine features innovative ideas submitted by our readers.

Determining **Additive Levels**

The most important aspect of determining additive levels is having an overall understanding of the state of the fluid. If there are unanswered questions with the initial batch of tests that are performed, it is imperative to perform additional diagnostic tests.

Remove Particles with **Electrostatic Separators**

Electrostatic separators remove insoluble byproducts of thermal and oxidative oil degradation (varnish particles) and submicron hard dirt or wear particles that are too small to be removed by conventional mechanical filters. When conditions are right, they make an excellent addition to an overall contamination control strategy, bringing into balance the focus upon large particles and water with the elimination of varnish particles and silt.



Reduce Foaming with **a Diffuser**

A diffuser fitted to the return line of the tank can reduce foaming and thus reduce oxidation and aeration, as well as decrease the risk of cavitation. It can also lessen the potential for varnish, erratic fluid flow, spongy hydraulics and overheating. ***ML***

Did You Know?

Additional tips can be found in our Lube-Tips email newsletter. To receive the Lube-Tips newsletter, subscribe now at MachineryLubrication.com.

Have Some Tips?

If you have a tip to share, email it to editor@noria.com.

ExxonMobil partners with Racing Promotions to blaze the trail for the Indian Racing League (IRL)

To usher in a new era and build up the motorsports ecosystem in India, IRL aims to create visibility for the sport on global racing platforms. ExxonMobil Lubricants Pvt. Ltd. is associating with Racing Promotions Pvt Ltd (RPPL) for the Indian Racing League as the official lubricant partner to revolutionize motorsports in the country – starting November 19 in Hyderabad, the first edition of IRL.

The first edition, powered by Wolf Racing, is the only 4-wheel racing league featuring six city-based franchise teams. Drivers both women and men, including Ex Formula One & Le Mans drivers will be racing in this inclusive equal platform. The Round 2 and Round 3 will be held at Madras Motor International Circuit (MMRT) on late November and December over weekends, with the grand finale back in Hyderabad on December 10-11.

The partnership with ExxonMobil will add further value to the sector in India, which is already among the top five fan markets for F1 and has witnessed tremendous growth in popularity for motorsports in recent years. With a history in motorsport dating back to 1978, ExxonMobil has a rich legacy of supporting motorsports globally, including Formula One championships. ExxonMobil supplies the current world champion – Oracle Red Bull Racing team, with Mobil 1™ engine oils and provide world-class engineering support throughout the race season. It will be the first time that street racing will take place in India for which extensive safety and security arrangements are being made. With its proximity to the city centre, this track will prove to be a huge crowd puller for the league.

Vipin Rana, CEO – ExxonMobil Lubricants Pvt Ltd, said: "Our partnership with RPPL to power the Indian Racing League – Wolf Racing builds on our focus to support motorsports in India, where a community of racing enthusiasts are building a powerful new circuit. We believe it is our commitment to support this emerging sport in the country and create a compelling platform of world-class reputation and reach. We see motorsports gaining tremendous traction across the country, and we want to offer our proven support to the teams and contribute to building the real next big thing in motorsports – from India for the world."

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