March - April 2025

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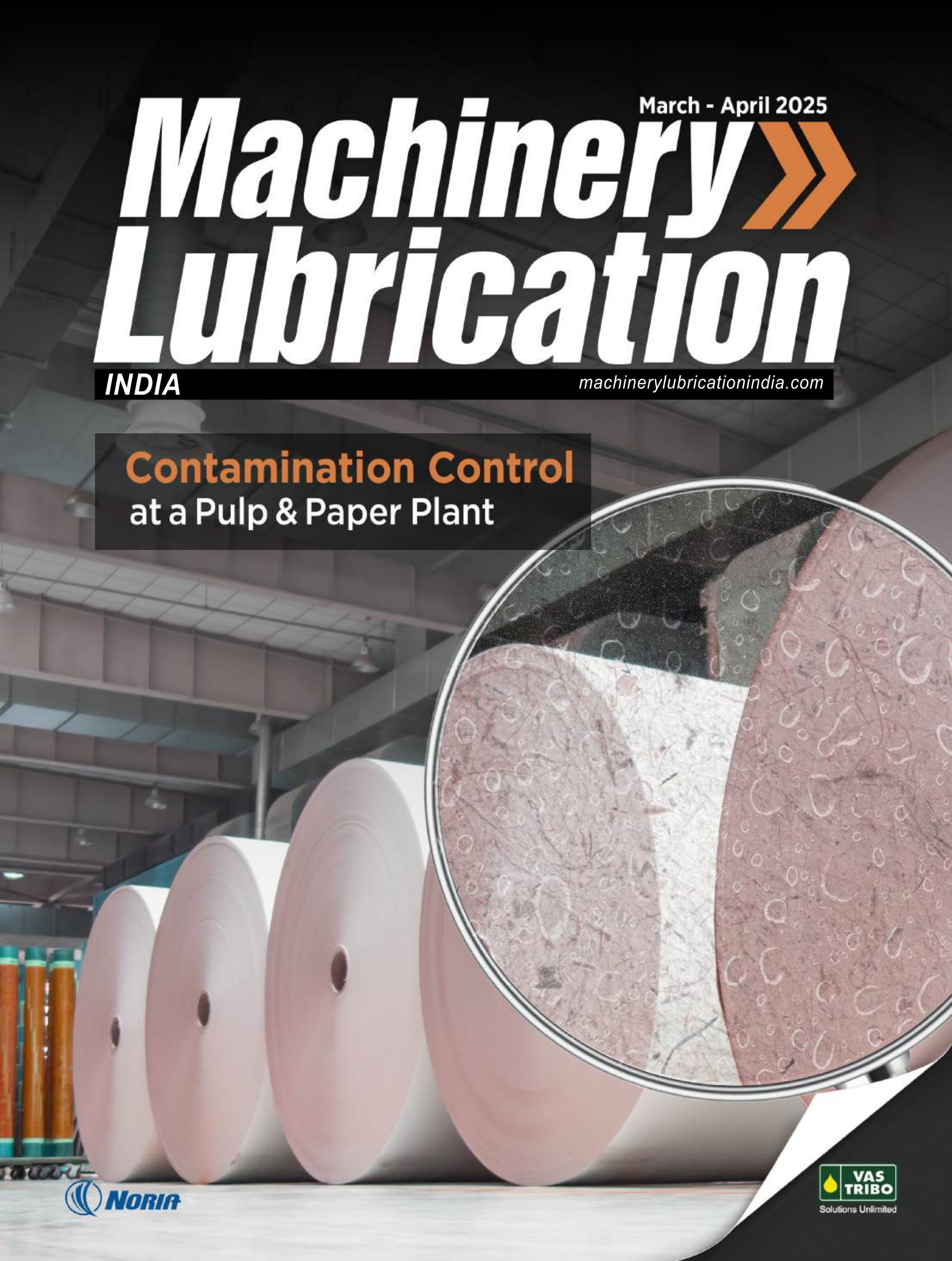
Contamination Control at a Pulp & Paper Plant



AS I SEE IT

Map Your Lubrication Program's Workflow

COVER STORY

Contamination Control at a Pulp & Paper Plant

EDITORIAL FEATURES

Publisher's Note

Success, whether on the field or in industry, is never accidental—it is the result of meticulous preparation, strategic execution, and unwavering focus. India's recent triumph in the ICC Champions Trophy 2025 is a testament to this principle. Every winning team invests time in refining skills, analyzing weaknesses, and implementing proactive strategies to stay ahead. The same holds true for machinery reliability. Preventive maintenance, contamination control, and continuous improvement are the winning strategies that ensure operational excellence and prevent costly failures.

Machine breakdowns don't happen overnight; they stem from gradual wear, unnoticed contamination, and maintenance gaps that allow small issues to escalate into major failures. Studies show that nearly 80% of machinery failures are linked to lubrication contamination—yet many industries still adopt a reactive approach, addressing problems only after they occur. Take the case of a pulp and paper mill that reduced unscheduled shutdowns by 40% through proactive contamination control. Simple yet effective measures—such as desiccant breathers, sight glasses, and scheduled oil sampling—transformed their maintenance strategy, ensuring machinery longevity and peak performance.

The key to machinery reliability lies in going beyond basic lubrication practices. A multi-layered approach—incorporating proper storage, handling, monitoring, and filtration—ensures that lubricants remain clean and effective. Setting cleanliness targets, monitoring oil quality, and upgrading to advanced filtration systems can drastically reduce contamination risks and extend component life.

Oil analysis isn't just about detecting contamination; it's a predictive maintenance tool that provides early warnings of potential failures. Organizations that integrate oil analysis into routine inspections can detect water ingress, particle contamination, and viscosity changes before they escalate into major issues. Additionally, proper storage, sealed containers, dedicated transfer pumps, and color-coded identification systems help prevent cross-contamination and exposure to harmful elements.

Even the most advanced contamination control measures will fail without proper awareness. Regular training on lubrication techniques, contamination sources, and failure prevention strategies ensures that best practices are consistently followed. Industries that prioritize reliability understand that machine health is not a matter of chance but a deliberate outcome of disciplined maintenance. Investing in contamination control isn't just about protecting equipment—it's about securing operational efficiency, lowering costs, and staying competitive. The future of machinery performance depends not only on technological advancements but also on the strategic application of knowledge and best practices. Companies that embrace these principles today will lead the industry tomorrow.

As we step into a season of new beginnings, marked by diverse cultural celebrations like the Hindu New Year and Eid, it is a time for renewal and reflection—not just in our traditions but also in the way we approach industrial excellence. Just as purity, preparation, and attention to detail are essential in celebrations, maintaining the purity of lubricants and implementing proactive maintenance strategies are key to long-term success. By embracing a forward-thinking approach today, industries can prevent costly setbacks and drive sustainable growth.

Thank you for being an integral part of our journey. As we move forward into this season of innovation and progress, we look forward to advancing lubrication excellence together. This issue brings you the latest insights on proactive maintenance, contamination control, and emerging lubrication strategies. Let's take the next step toward reliability and performance.

Warm regards,
Udey Dhir

MAP YOUR LUBRICATION PROGRAM'S WORKFLOW

Throughout my career in lubrication something has become apparent as it relates to many lubrication programs out there; there is a lack of an actual workflow that is expected to be completed in the program. For most operational or production-related events, there are dedicated processes, systems, and checklists to ensure that they are completed uniformly and consistently. However, when we look at lubrication, nothing exists. Oftentimes there is a maintenance workflow that is overseen by planners and schedulers to make sure things aren't getting missed, but once again, lubrication is left on an island and there are assumptions made that it is likely getting done but we don't know for sure. While there can be workflows for many tasks around the lubrication program, let's hone in on just those that are related to the application of a lubricant to the machine.

The process of lubricating equipment is one of the most important tasks we perform in maintenance. It has more impact on the overall reliability of the equipment than many other maintenance activities. Lubrication is also performed more frequently, in many cases, than other maintenance work so we need to ensure that it is being performed correctly and that we have some level of visibility in that work.

This is where we encounter one of the first problems plaguing many lubrication programs, often the lubrication work is assigned in a scheduled PM that includes many other tasks. While it is a common practice, we begin to lose the insight on the lubrication work itself as it becomes diluted with the other random tasks that exist on the same PM. We need to break lubrication into its own activity that becomes more trackable and with more detail. When lubrication exists in a PM with other work, the instructions are often vague, and we miss many of the details required for proper lubrication.

If we were to plot out the major steps in performing lubrication work there would be at least seven over arching steps, with many sub-steps below them. Keep in mind this is only related to performing the actual lubrication work and doesn't include anything related to maintaining the lube room, interpreting oil analysis reports, receiving incoming lubricants, or the countless other sub-tasks that consume a significant amount of time through the course of a year.

Request/Identify Lubrication Tasks

The first step in the process is requesting or identifying the need for lubrication on a particular machine or group of machines. While this may appear very straight forward, it is more complex than you might think. To do this correctly we need to understand many different aspects of our equipment, the environment they operate in, and the types of lubricants we have in use. A significant portion of lubrication work is performed on a time-based approach which can lead to over extended intervals, or changing out lubricants that are still good. But before we can even broach the subject on "when" the lubrication needs to be performed, we should first identify "what" is lubricated in the first place.

Your asset hierarchy has a lot to do with this activity. When performing lubrication tasks, we are not lubricating machines, but rather maintenance points (lube points) of specific components. Take the example of a conveyor, the PM may say something generic like "lubricate conveyor." In reality we can have head, tail, snub, idler, and take up bearings all requiring different volumes of lubricant. We would also have a motor, gearbox, coupling, and hundreds of rollers that would all have their own unique requirements of lubrication as well. We need to get specific in the lubrication work that is being requested to understand exactly how long it will take to assign it properly.

Aside from determining what is lubricated and when it should be lubricated, we need to also know what type of lubrication tasks is required for the work. Greasing activities are greatly different than oiling activities and then there are several different aspects of each that must be further defined. Does this lube point get greased by a manual grease gun or is it on an automatic system? Are we changing the oil in the component or is it total-loss and just needs to be topped up? Perhaps the task is more inspection-based or requires taking samples. In all cases we need to move away from the general description of "lubricate machine" to the specific level of task that will help in later steps of the process.

Plan Lubrication Tasks

Once all the tasks and lube points have been identified and requested to be tackled, the work now shifts to planning the proper way to accomplish these tasks. Planning and scheduling are common in most maintenance organizations and may even go as far as gathering all the necessary items to perform the work and placing them in an assigned area prior to the work being performed. This activity is known as kitting. To get to the point where this is possible, you must understand all the aspects of what will be required to perform the task as it pertains to the work. In lubrication this should include several details such as the volume of lubricant, what type of lubricant, the application devices needed, and consumables to be expected to be used. Each of these details will require a level of understanding of proper lubrication and will likely go beyond simply copying the lubrication instructions from an equipment manual.

Determining the proper amount of lubricant can be difficult at times and may require a condition-based approach to gather feedback from the component in real-time to know that the ideal volume of lubricant has been applied. This is done frequently with greasing and the use of ultrasonic equipment to provide that feedback. Other greased components may need to be analyzed and the appropriate grease volume calculated for each regreasing event. For oil levels proper sight glasses and other level gauges will be required, especially for splash-lubricated equipment where oil level is more critical to proper lubrication regimes.

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When planning the work, it is good to know the volume of lubricant to be applied so that the technician can gather the appropriate amounts of lubricant. Knowing this in advance helps minimize multiple trips to and from the lube room and lets the technician know how large of a waste oil container to bring if the task involves a full drain and fill of the component.

Beyond knowing the volume of lubricant to use, the technician also needs to know what type of lubricant to be applied. In a typical lubrication program, there will be multiple oils and greases to choose from and each will have marked differences in properties that make it ideal for one application but detrimental to another. The task should spell out exactly what lubricant is to be applied so that the risk of accidental cross contamination is minimized. The lube point should be reviewed to ensure that the proper lubricant is matched to the application. During this process, it is also good practice to review the full stock of lubricants to determine if there are chances to consolidate which will further help avoid misapplication of lubricants to the equipment.

The final activity in this step includes understanding what the operational status the equipment needs to be in to perform the work and any additional PPE or safety requirements that should be spelled out prior to performing the work. If the machine needs to be off to perform the work, then a full lock out, tag out procedure may need to be performed as well. In some cases, lubrication tasks can be performed while the equipment is running but may require the modifi cation of the lube points or guarding to make this happen. Understanding the state of the equipment for the task to be completed aids greatly in the next step of assigning the work.

Assign Lubrication Tasks

The work needing to be performed has now been identified and planned, now it needs to be assigned to the proper staff to get accomplished. There are several criteria that should be analyzed to determine the proper assignment of this work. Among the top of those should be the competency of the technician performing the work. Not all tasks in lubrication require significant knowledge of the equipment or lubrication, and in some cases the more common tasks such as inspections may be assigned to groups outside of the maintenance/lube team. Ensuring that the technician is capable of performing the work to an acceptable level of quality is paramount to the health of the equipment and success of the lubrication program. Work audits as well as skill standards for the tasks should be implemented to help with the assignment of work.

Once the appropriate skill level has been identified for the task, we need to determine the volume of work that can be assigned. There are many different scheduling strategies that can be used but they all require an understanding of the amount of time the list of work is expected to take and how much available time the staff has available to accomplish them. Assigning work to staff that is already fully subscribed is a recipe for frustration and will likely lead to "pencil whipping" that is marking the work as completed without having even performed the task. Often the lubrication tasks can be combined into a lubrication route that can be assigned to be completed throughout a week or several days, but care should be given to not over-assign these tasks.

Assigning the routes or tasks can be done by splitting the facility into areas where specific technicians can be assigned to become experts on their pieces of equipment. Beyond separating the work based on physical location, the tasks can be further separated based on type of lubricant to be used, accessibility of equipment, and many other factors. If there is a known out age on the horizon it is common to group all the "down day" tasks to coincide with these events. With proper-planning and understanding of what needs to be done, the assigning of tasks does not have to be a Herculean task and once set up, it can often times be repeated on a set periodicity.

Perform Lubrication Tasks

This is where the actual work of lubricating equipment occurs. Once the work has been assigned to a technician the process of gathering the appropriate equipment to perform the tasks begins. This is where the lube room comes into play for the program. The technician goes to the lube room and grabs the lubricants that are needed, in the volumes that are expected, as well as the tools and consumables that would typically be used in these activities. Some tools may be simple hand tools to remove drain plugs or to gain access to equipment, oil catch pans, and lighting to make the areas more visible. Consumables could include lint-free rags, replacement breathers, replacement grease canisters, and spill containment/clean up materials. All of this might then be loaded on a cart or transported to the area that the technician is going to focus on.

Once the technician arrives at the assigned area, the work begins of applying the lubricant following the procedures that have been assigned. Care needs to be taken to ensure that the application process is done correctly as damage can occur to the machine. For instance, when greasing it is a good practice to add grease slowly and allow a couple of seconds between pumps of grease to allow it to distribute. Greasing quickly can increase pressure in the system and damage seals. Small nuances like these must be understood and followed rigorously to help prolong the life of the equipment and to ensure proper lubrication. This is why having a detailed,-step-by-step procedure is important to the overall sustainability of the lubrication program.

Procedures should be written in a manner that provides all the details necessary to perform the work in a consistent manner. These procedures should be viewed as a way to

prevent the knowledge of your lubrication technicians from leaving the facility. If someone with less experience must fill in for the regular staff, the work is performed to the same level of thoroughness. In addition to the procedures, having diagrams outlining the location of lube points can help minimize missed lube points or misapplication of the product.

Document Lubrication Tasks

Now that the lubrication task has been completed, we must document what was performed as well as the periphery information that is important to management and the overall success of the lubrication program. Since the technician is physically at the equipment to perform the work, it allows for an overall inspection of the machinery to occur. Corrective maintenance coming frompreventive maintenance is a common metric that is tracked in many programs today. The thought is that the technician should be finding some abnormalities or things that need to be fixed while they are performing other work. While this is true, deep inspections on equipment are seldom performed and when they are, they are mostly just oil level checks and looking for leaks. Taking the opportunity to inspect the machine holistically can be a valuable exercise and one that shouldn't be overlooked.

When the work is assigned and being completed, ideally there will be a mechanism that provides an outline of all the tasks that need to be completed. This may be in a checklist form, paper-based, or a hand-held electronic system. In any event it should provide a consolidated list of tasks to be completed and then checked off by the technician. An important aspect of the form is to provide an area for notes to be attached based on the work that was being done. Abnormal inspections results, amount of lubricant applied, or any accessories needing change are all valuable data that should be collected and actioned. This allows us to track consumption of the lubricant, identify machines that may require more attention (increased inspection frequency), and schedule any corrective work that needs to be done. It is during this documentation stage that any corrections needed to the detailed procedure or lubrication frequency should be noted and returned to management to update in the lubrication management system.

Close Out Lubrication Tasks

The work has been completed, notes have been added to our work order, and now we need to close out the work. This in essence is the formal stage of saying that it has been completed and accounted for. Some of the more closely watched metrics come from this step of the process as we want to ensure that what was scheduled was done. This is commonly referred to as route compliance or PM compliance and we want to aim for a very high percentage of this work to be completed when assigned.

The act of closing out this work may be a simple process of turning in a piece of paper that we have checked off or signed indicating it is completed, or using an electronic system to indicate that it is done. In any case, the follow up to this is reviewing the notes and performing the follow-up actions that are required based on the input from the technician. This may be initiating a new work order, or even updating the procedure to make it closer to what is performed in the field. The feedback loop at this stage needs to be formalized to keep the lubrication program relevant and to show that tasks are being accomplished in a timely manner.

Clean Up Tasks

The final step in routine lubrication performed by the technician is the clean up or disposal of the lubricants and consumables used during the lubrication work. If the work being performed included oil changes, there will be a volume of used oil that must be disposed of in accordance with company policies. This will also be true of any spill absorbent material or rags that were used to wipe down the surfaces when performing the tasks. Used liquid lubricants are typically handled differently than lubricant contaminated solids. Both need to be contained and stored in well-labeled containers and should not be thrown into the general waste of the facility. Liquids are typically held until a volume is adequate to have an outside company take ownership of them.

Outside of disposal of waste, there is also the returning of the lubricants that are still fit for service to the lube room. This is overlooked and usually results in lubricants that are in top-up containers and grease guns being left in the field and stored in a less than ideal environment. Bringing the tools and lubricants back to the lube room helps maintain their integrity so that when they are needed again, they are still in good working order. It also allows us to control contaminants by providing a place to decontaminate application devices and refill with filtered lubricant. The cleanup stage is important to start the process over again following the clean, cool, and dry mantra of your lubrication program.

While there are many other steps that can be included in a lubrication program's workflow, this should provide some guidance for those that are just starting out. We need to break the statusquo of just assuming lubrication is getting done and really focus on improving the program. By formalizing the lubrication process and workflow, it allows you to understand exactly what is happening and provides the visibility to know where the process needs to change to better match your unique plant environment.

Jeremie Edwards | Georgia Pacific

Contamination Control at a Pulp & Paper Plant

If you have ever worked in or around a paper facility, you might be familiar with the steam, smell, pulp, and water that seem to be everywhere. As you can imagine, contamination control is extremely important for the equipment's reliability. So, focusing on reliability and contamination control will have a direct impact on production. And if you weren't aware, the folks on the carpet are really interested in that production stuff.

So, what can we do to ensure that we get as much of that coveted production as possible? First, we need to understand what is getting into our machines and what it does to them.

Understanding Contamination Sources

In the bustling corridors of a paper mill, contaminants lurk around every corner, ready to wreak havoc on our lubricants and equipment. From airborne dust to moisture infiltration, these silent saboteurs can spell trouble for our machinery's longevity and efficiency. With a keen eye and strategic planning, we can identify these trouble makers and implement measures to keep them at bay. So, let's focus on some of the most common contaminants we face in paper production.

Moisture Management Strategies

Moisture is part of the process, so we can't eliminate it from the working environment, but we can try our best to prevent it from coming into contact with the internals of our equipment. Both reservoirs (gearboxes and hydraulics) and bearings are very susceptible to damage from moisture. Water gets into these locations, and it starts to rust the equipment, break down the lubricants, sacrifice the lubricating film, and can even lead to bacterial growth within our equipment. For reservoirs, mitigating water ingression doesn't have to be really difficult. We have to look at how the water gets in there, how to judge when water is in there, and how we get it out. I'll save the last part of that, getting it out, for a little later.

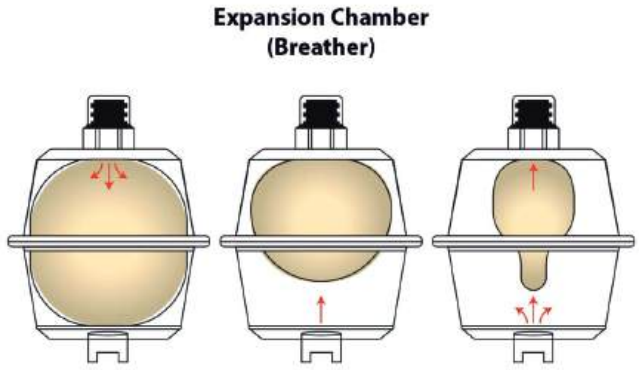
How do we keep it out? All of these reservoirs need to breathe in some way or another. OEMs give us these wonderful breathers and fill caps that do nothing. How about we look at the equipment's needs and the environment they are in and do something about it? Those fantastic breathers that these OEMs slap on there, why not replace them with something that actually works? How do we know what will work?

Let's look at how much our equipment needs to breathe, for starters.

Innovations in Equipment Breathing

If I have something that needs to breathe a lot, I will likely look at desiccant breathers. These things work great. They are tried and true. There are some drawbacks to them, though. They are consumable and need to be inspected regularly to ensure that they can still breathe for one, and we need to make sure that we change them out as soon as, or just before, the desiccant is spent. Now, there are some breathers better equipped than others, like some that have check valves (this way, the air traveling through the breather only gets dried and cleaned as it goes into the reservoir). Others might be equipped with washdown caps, which is fantastic for anything within a washdown area or where water spray is often nearby. Some might be outfi tted with both of these features!

But what if I have a little pump or gearbox, you might ask? Well, those things don't typically require a large amount of breathing to work properly. So why don't we put something on those that might last longer? Expansion chambers are an excellent alternative for desiccant breathers in this case. They are a straight forward contraption (essentially two cups pushed up against one another and a diaphragm in between them. The diaphragm rises when the little pump or gearbox needs to breathe out. When it needs to breathe in, the diaphragm lowers. It turns that little piece of equipment into a closed system, keeping moisture and dirt out. Although these little things are great, they still need to be inspected. That diaphragm can rupture over time. This is, once again, where quality components are essential. I suggest looking for expansion chambers with a built-in indicator for if the diaphragm ruptures.



Enhancing Hydraulic Systems

Hydraulic quick connects are another great way of preventing moisture and dirt from getting into your equipment. These versatile devices are the linchpin of efficient lubrication management. By enabling a constantly closed system, they help to offer seamless execution of maintenance tasks and quick connects to streamline operational processes, too. Their intuitive design minimizes the risk of contamination during lubricant transfer, ensuring that oils maintain their optimal condition.

I know we have all seen and used hydraulic quick connects at some point, but to take your game to the next level with these, I recommend switching to color-coded quick connects. This makes it a no-brain-

er when it comes to putting lubricant into a piece of equipment. It helps to take the guess workout of things and ensures that we don't have anyone accidentally cross-contaminating the oils. This can especially help out if the paper products being made require food-grade lubricants in some of the applications.

Real-Time Monitoring of Contaminants

So, how can we tell when contaminants have passed my other safeguards? Of course, there are laboratory and field tests, but we need to know ASAP when bad stuff is trying to do bad things inside our equipment. I am a massive fan of 3D bullseye sight glasses for anything that might have come with a 2D sight glass or even a level plug. Bullseye sight glasses provide invaluable insights into lubricant condition and contamination. These simple products empower maintenance professionals to confi dently make informed decisions by visually assessing lubricant clarity, turbidity, and even "milkiness." A good columnar sight glass will be my go-to item if I have a larger reservoir that needs a good, clear indication of lubricant level and condition. These won't show some stuff really well, like foam in a reservoir (unless it is REALLY bad), but they are in valuable for any reservoir with an oil level that changes while it is in use.

Wouldn't seeing water in a system before you get an emulsion be nice? It might even pay off to have something like a little bowl attached to the bottom of a reservoir that could show you free water and even sediment, like wear metals. Well, so I have news for you! Bottom sediment and water bowls already exist, and they are fantastic. When positioned at the lowest point of equipment reservoirs, these unassuming vessels play a crucial role in contamination control. Since they live on the bottom of a sump, they will catch water when it gets into your system. It also catches the heavy wear metals and even offers a place to drain moisture with a little petcock valve. Regular maintenance and periodic draining of accumulated debris ensure that lubricants remain free from impurities, safeguarding equipment from premature wear and damage.

The Critical Importance of Filtration

So what do we do after discovering that we have all of this stuff in our equipment that we shouldn't have? Filtration. From offline kidney loop filters to in-line filtration units, filtration systems are the frontline defense against particulate contamination and moisture in lubrication systems. By actively removing debris and moisture from our oils, these mechanisms mitigate the risk of equipment failure due to contamination-related issues.

Incorporating advanced filtration technologies into maintenance routines ensures that lubricants remain pristine and conducive to optimal equipment performance. And we have so many filtration options to choose from. Many people opt for filter carts, which are an excellent investment because they are versatile. Filter carts can be used as portable parts washers for filtering equipment that is in use; we can even use them to filter new oils as they come on-site. However, something that I have seen over the years is people buying filter carts and thinking that they have solved all of their problems. That is NOT the case.

These things are just tools, and if we don't know how to use them correctly or even what our specific goals are, we are as lost as having a whisk in our toolbox just because "well, it's a tool." We have to set cleanliness goals, which is something to shoot for — and not just cleanliness; we need dryness goals as well. We have to start making informed decisions about how we plan on extending the life of our equipment. Only then can we devise a plan and implement it in a way that can make an impactful difference.

INNOVATIONS IN ROOT CAUSE ANALYSIS AND FAILURE ANALYSIS FOR ENHANCED LUBRICATION PRACTICES

The lubrication industry is currently experiencing a transformative wave with the introduction of cutting-edge products focused on Root Cause Analysis (RCA) and Failure Analysis (FA). These innovations aim to elevate the efficiency and reliability of lubrication processes, ensuring smoother operations and prolonged machinery lifespan. In this article, we will delve into some of the latest products that are reshaping the landscape of RCA and FA in the lubrication sector.

1. **Advanced Lubricant Condition-Monitoring Sensors:** One of the game-changing innovations in the lubrication industry is the development of highly advanced sensors designed for real-time monitoring of lubricant conditions, particularly in large-scale machinery. These sensors utilize state-of-the-art technology to measure parameters such as viscosity, temperature, and contamination levels. Companies like SKF have introduced smart sensors that provide instant feedback and allow for proactive identification of potential issues before they escalate.
2. **IoT-Integrated Lubrication Systems:** Internet of Things (IoT) has made its mark in the lubrication industry with the advent of smart, connected lubrication systems. These systems leverage IoT to collect and analyze data from various lubrication points across machinery. By integrating with RCA algorithms, they can pinpoint root causes of lubrication-failures, providing invaluable insights for preventive maintenance. Companies like ExxonMobil and Shell have embraced IoT to enhance their lubrication solutions.
3. **Innovative Lubricant Analysis Software:** Cutting-edge software solutions have emerged to streamline the RCA and FA processes. These tools use artifi cial intelligence and machine-learning algorithms to analyze lubricant data, identifying patterns and anomalies that may indicate potential failures. Companies such as Spectro Scientific and ALS Tribology offer software solutions that enable predictive maintenance strategies, reducing downtime, and operational costs.

4. **Vibration Analysis for Gear Systems:** Vibration monitoring is a crucial aspect of failure analysis in gear systems. New products in this category include advanced vibration-monitoring devices specifically tailored for lubrication applications. These devices can detect ir regularities in gear systems and help identify issues related to lubrication breakdown or contamination. Brands like Emerson and PRUFTECHNIK offer vibration analysis solutions that play a key role in root cause identification.
5. **Nano-Additives for Lubricants:** Nano technology has entered the lubrication scene with the introduction of nano-additives designed to enhance the performance of lubricants. These additives provide superior protection against wear and tear, extending the life of machinery components. Companies like Nanotech Industrial Solutions have pioneered the development of nano-based lubricant additives, contributing to more effective failure prevention strategies.
6. **Augmented Reality (AR) for Lubrication Maintenance:** AR is making waves in a multitude of industries, including lubrication, by offering innovative solutions for maintenance personnel. Products like AR-enabled glasses provide real-time information and guidance while performing various tasks in facilities. Maintenance technicians can access relevant data, including RCA insights, directly through the AR interface, there by facilitating quick decision-making and reducing human error.
7. **Blockchain-Backed Lubricant Tracking Systems:** Block chain technology is finding applications in the lubrication sector with the development of tracking systems that ensure the traceability and authenticity of lubricants. These systems enable transparent documentation of lubricant usage, facilitating easier RCA by providing a comprehensive history of lubrication processes.
8. **Ultrasound Technology for Lubrication Monitoring:** Ultrasound technology has become a valuable tool for RCA and FA in lubrication systems. Portable ultrasound devices can detect issues such as cavitation and lubricant breakdown through soundwave analysis. Brands like UE Systems and SDT International offer ultrasound solutions that complement traditional lubrication-analysis techniques and help provide a holistic approach to failure prevention.

Digging Into the Root Cause

From advanced sensors to IoT-integrated systems, lubricant analysis software to nano-additives, these RCA and FA technologies collectively contribute to a more proactive and efficient approach to maintenance. As companies across the world continue to invest in these cutting-edge solutions, the future of lubrication practices continues to evolve and adapt to the changing times.

As digital solutions are being embraced across nearly every industry, the products discussed above, as well as from the suppliers in our Spotlight below, are ensuring that the lubrication industry is not left out.

THE ROLE OF OIL CHANGES IN REFRIGERATED TRUCK MAINTENANCE

Refrigerated trucks are working hard on our roads, and it's our responsibility to ensure they have everything they need to perform.

There's a reason why the truck-repair industry was worth $6.4 bn in 2023— people are obviously avoiding preventative maintenance for their vehicles! A malfunctioning transport refrigeration unit is a big problem, and it always will happen right when you need it the least. A breakdown can mean more than just a delay — it can mean spoiled cargo and a dent in your profits.

Refrigerated truck maintenance is vital, and the oil change process is a big part of it. This simple but important task could end up saving you the headache of unexpected breakdowns and cargo catastrophes.

The Inner Workings of Your Transport Refrigeration System

The cooling coil (or the evaporator) is the frontline soldier against rising temperatures. It ensures that hot air in the chilled environment meets its match, shedding thermal energy and keeping things frosty.

The compressor circulates and compresses the internal cooling agent before it hits the next stop on the refrigeration rollercoaster — the condenser — where the cool-down

happens. Here, the heated-up refrigerant gets the cold shoulder until it transforms from a sizzling vapor to a chilled-out liquid. Finally, the expansion device takes the chilled-out liquid from the condenser, throws in a pressure drop, and makes it ready to hit the cooling coil again for another round of temperature-taming action.

All four players need some care to keep this refrigeration process going. Regular maintenance ensures your transport refrigeration unit stays in great condition, especially when you hit the road hard.

Maintaining Optimal Performance for Your Refrigeration Unit's Compressor

Another type of oil needs to be considered before we get to the engine's oil. Oil analysis across the board for your vehicle means better predictive maintenance. Compressor oil is crucial for the longevity and efficiency of your cooling powerhouse.

Think of compressor oil as the lifeblood of your refrigeration system. As your trusty refrigeration unit hits the road and tackles temperature challenges, the integrated compressor works tirelessly to keep things cool.

However, this hardworking compressor oil can start feeling wear and tear over time.

Bad oil is the enemy within. It's the culprit behind excessive friction among the compressor's moving parts. This can lead to a premature compressor breakdown. You need a regular oil change in your compressor to combat this looming threat.

The Lifeblood of Your Refrigerated Truck's Engine

Engine oil: It's not just a liquid but the very essence that keeps your refrigerated truck running smoothly for miles while hauling heavy loads. This golden elixir deserves a spotlight in your truck's maintenance routine.

Imagine your engine as the beating heart of your truck and engine oil as its lifeblood. Engine oil works to reduce friction between the moving parts, preventing the kind of wear and tear that could lead to an early retirement for your engine.

Engine oil isn't just about reducing friction, however. As your engine works hard burning through fuel and generating heat, engine oil provides the ultimate cool-down. Acting as a coolant, it dissipates the excess heat and prevents your engine from turning into a meltdown disaster.

Finally, engine oil is a proactive force that sweeps away dirt, debris, and contaminants within the engine. It ensures that your engine stays squeaky clean, free from impurities that could spelltrouble.

Why Your Refrigerated Truck Needs a Wellness Routine

Due to oil deterioration, regular oil changes and express lube services should be non-negotiable components of your truck maintenance routine. Engine oil has its limits. Over time, it breaksdown, losing its lubrication, cooling, and cleaning powers.

Regular oil changes act like your truck's rejuvenation spa day, thus ensuring a constant supply of fresh, high-performing oil, and keeping your engine in peak condition.

Contaminant buildup is another issue to be aware of. As engine oil circulates through your engine's intricate maze, it collects dirt, metal particles, and other contaminants like a magnet. Ignoring this buildup leads to serious potential damage. Regular oil changes play the role of the cleanup crew, eliminating these contaminants and preserving your engine's health for the longhaul.

Speaking of the long haul, let's touch on engine longevity. Your truck is not just a mode of transportation; it's an investment. You want it to age like fine wine, not prematurely. Regular oil changes contribute to your engine's fountain of youth, reducing wear and tear and protecting against costly engine repairs and replacements.

Lastly, let's talk about performance. Fresh oil means better engine performance, literally. It ensures your truck operates at its peak, delivering the power and torque needed for those heavy loads and long hauls of refrigerated freight.

The Process of Routine Truck Oil-Change Services

The routine task of a truck oil change keeps your engine humming along at its optimum level. Here's what goes down during these essential services (a process that you can even take care of yourself if you feel confident enough):

1. **Draining the old oil:** Consider it a fresh start for your truck's engine. The old oil, which has dutifully carried out its duties of lubrication and cooling, now makes way for a clean slate. It's crucial to ensure that your engine gets the rejuvenating boost it deserves.
2. **Replacing the oil filter:** The oil filter traps contaminants and prevents them from wreaking havoc. It receives a well-deserved replacement during a truck oil change service to ensure-long-lasting protection against unwanted particles and impurities.
3. **Refilling with the appropriate oil grade and quantity:** Not all oils are created equal, and your truck's engine deserves the best. During the service, ensure that the engine is replenished with the right grade and quantity of oil, designed to meet the specific needs of your heavy-duty road beast.
4. **A comprehensive check and top-up of other fluids:** Your truck isn't just about oil — it's a complex system of various fluids working in harmony. During the service, go the extra mile, inspect and top-up other essential fluids to ensure your truck is ready and equipped to handle the long haul.

Improve Your Machine Reliability with More Best Practices

Machine Lubrication exists to help with lubrication and oil analysis. We work hard to change how organizations manage and monitor lubricants to ensure optimum reliability and safety. Let us be your trusted advisor, and bookmark our site for easy access to an invaluable resource to protect your vehicle or fleet.

WRITING A SMART INSPECTION PLAN

Like most business plans and strategies, an inspection plan should be built top-down. It should begin with a clear statement of corporate goals and objectives related to asset management. This approach is addressed in ISO 55001 on asset management. ICML 55, the global standard by the International Council for Machinery Lubrication, addresses optimized management of lubricated assets and is aligned with ISO 55001 guidelines. It covers inspection plans. The following refers to developing plans for Inspection 2.0, bringing inspection to a level as high or higher than condition monitoring technologies often used concurrently.

A full-on Inspection 2.0 plan should be a detailed and comprehensive document to ensure that key features and functional elements are not overlooked. From there, it can be abridged or streamlined for quick, readable review by technicians and operators. The unabridged version of the plan can also serve as a rough curriculum for training and competency testing for current and aspiring new inspectors.

Modern reliability and asset management programs expect documented, procedure-based work plans. This reduces the risk of variability, uncertainty and drift over time. The plan is best if it is consensus-based and should be continually improved. Before considering the input of stakeholders in writing the inspection plan, it is best to get everyone on the same page through training or self-study on the fundamental elements of Inspection 2.0 and condition-based maintenance. Of course, RCM, TPM, and asset management training would also be helpful.

Consensus-based inspection plans tap into the knowledge base and experience of skilled practitioners, old-timers and others with valuable craft skills. This provides a helpful foundation for the machine's operating conditions, critical inspection points, reliability history and known failure modes. It also establishes buy-in or ownership among operators, mechanics, technicians and other stakeholders who will be asked to execute and respond to the plan.

Further, a well-constructed inspection plan communicates the seriousness of effort and purpose. It documents that Inspection 2.0 differentiates considerably from the conventional inspection practices of the past. These differences are necessary to achieve the optimized level of machine reliability established by the asset owner. All forward progress depends on change.

When writing your inspection plan, consider the topics outlined below:

Multiple Disciplines

For many (but not all) organizations, inspections should be cross-disciplinary. They should include lubrication, mechanical maintenance, electrical, safety and operational inspections. It makes little sense to conduct one survey for lubrication, followed by a similar survey for electrical systems on the same machine. If your plant has different maintenance planners for different maintenance functions (mechanical, electrical, production, etc.), inspections can easily be divided once the information has been gathered. The critical path is getting good data and all the data. The rest will fall in place accordingly.

Ranked Failure Modes

What are the questions that inspections are supposed to answer? There could be many, but one is always your machine's general state of health. Specifically, is there confirmation of health or evidence of incipient or impending failure conditions. Therefore, we need to know the types of failures we should look for, ranked by likelihood and risk factor. Further, we need to know the specific inspection tasks and methods that can alert us to a failure in progress and how advanced it might be.

Next, we need to understand the root causes associated with each of these ranked failure modes and how inspection might recognize these root causes. One root cause can be associated with multiple failure modes. It's important to catch root causes early enough to prevent the onset of failure. We also care about knowing that all known high-risk failure modes have at least one or more methods (detectors) in our inspection plan that can reliably reveal their early presence.

Machine Inspection Ownership: Operator or Resident Expert

Each inspection task or method, defined by the inspection plan, must be performed with seriousness of purpose. The inspector should be responsible and accountable for quality work. In some organizations, the machine operator is the best choice for such an inspector. This person works physically close to the machines and can recognize subtle differences between normal and abnormal. This is often referred to as operator-driven inspection.

In other cases, the inspector may be an inspection technician who works full-time in many or all disciplines of condition monitoring, including inspection. Or perhaps the inspector is the resident expert who only does certain critical inspection routes. The advantage here is the more rigorous training and continuous practice. Combining deep inspection knowledge with a linguistic understanding of other condition monitoring technologies (e.g., oil analysis, vibration, thermography, etc.) can result in enormous value and effectiveness.

Inspection Points

Inspection points are physical locations on the machine that must be defined clearly in the inspection plan. These could be couplings, shaft/seal interfaces, breathers, hose connections,-sight glasses, gauges, reservoirs, etc. Some inspection points are not visible. For instance, consider the inspection task of touching the upper inside wall of the gear case through the fill port with your fingers. The inspection is looking for moisture condensation and soft deposits. This inspection point is not visible but is necessary to assess certain headspace and lubricant conditions. Another example might be using a probe or dipstick to reach into the machine to collect inspection data.

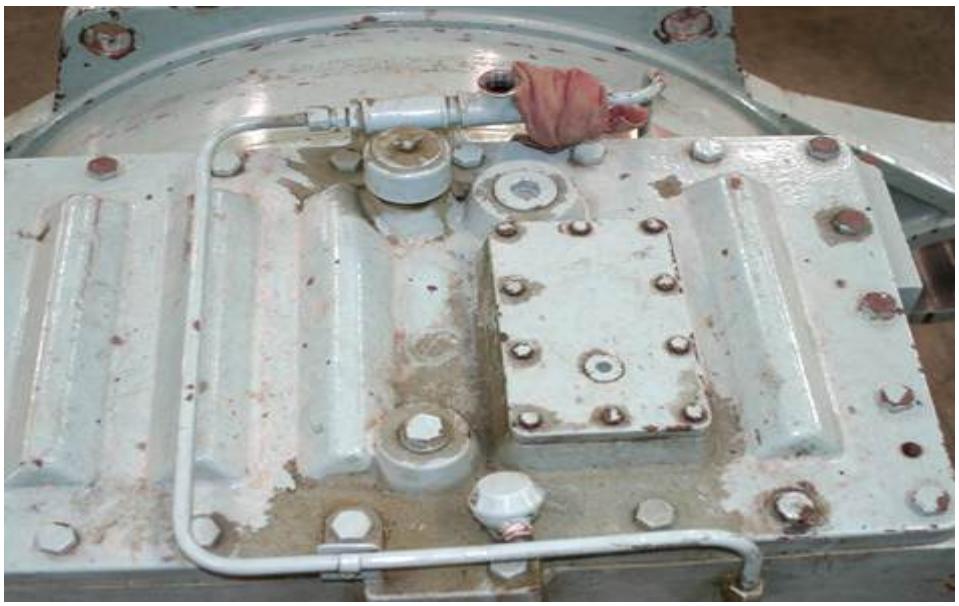


Figure 01 Large planetary gearbox

Inspection Tasks and Methods

Knowing where to inspect is the start. Next, you must perform the inspection (or make the observation) as designated by the inspection plan. This can be extremely simple (e.g., determine the oil level from the sight glass) or a bit more complex (e.g., use a laser point to determine the abnormal presence of hard or soft particle contamination). The inspection plan must reference a procedure if the task or method involves many steps or requires special techniques or tools. The procedure is a documented method of performing certain inspections and includes the steps, the tools and the means of data collection.

Figure 02 Sight glass

Inspector Skills, Training and Qualification

Inspection 2.0 requires qualified inspectors with the skills to perform the inspection plan's tasks and methods. The more complex the inspection method or task, the more there is a need for a detailed inspection procedure and training by the inspector on that procedure. An inspector must qualify to perform inspections.

This means we can't assign inspection assignments to anybody regardless of education, work experience or responsibility. Engineers with advanced degrees don't have the skills to meet the inspection tasks defined by Inspection 2.0 based only on the engineering curriculum.

Figure 03 Stroboscope gearbox inspection

Tools Needed

Inspection must be enabled to achieve condition monitoring quality and effectiveness to its full potential. This is the essence of Inspection 2.0. As mentioned, this increasingly means modifying and accessorizing machines to inspect better and to reach new inspection points. Additionally, inspectors, like any professional or tradesperson, need a toolbox to function fully in their craft.

Many tools or inspection aids enable inspections that otherwise could not be performed. In other cases, they might reduce the time needed to complete an inspection and/or they could enhance the quality and effectiveness of the inspection. The inspection plan (or the referenced procedure) should list the tools needed. Don't cripple inspection performance by pretending to save money by scrimping on inspection tools and aids.

Inspection Findings and Data Collection

The type of inspection data to be collected and how it will be reported need to be included in the inspection plan. This can reduce the variability that could occur, for instance, by two inspectors doing the same inspections on the same inspection point using the same methods and inspection aids. It is best if data collection is uniform and has structure. This is the concept behind using a structured form or checklist on a handheld data collector or manual paper-based data collection. Inspection is data acquisition that is meaningful, quality and timely. This data doesn't stand alone but needs to be an integral part of the overall condition monitoring scheme.

Figure 04 Revealed bearing damage from a teardown inspection

Handheld electronic data collectors can show images and comparators to help more precisely score an inspection result or finding. Rather than a binary yes-or-no response, it may be scaled from 1-10. Each possible result on this scale is defined by a range of comparator images or a short narrative using the data collector's software interface. This reduces individual subjectivity and provides a scalable analog-like feature to capture and quantify the degree of changing conditions. It's essential to identify an active change.

Numerical data collection from inspection routes can be integrated with condition monitoring software to show patterns of changing conditions across an array of data types on the same machine and machine condition.

Route-based Inspections

Many inspection points can be compiled and arranged into a route for a given plant or job site. This is especially helpful when a specialized inspection instrument or tool is used on only a few machines and inspection points. Like many other route-based condition monitoring data collection tasks, its use can be scheduled.

For example, a portable water contamination tester (for lubricants) may only be needed on machines used intermittently and exposed to water sources. In other cases, it might not be a required tool but a particular skill that one inspector might have but others do not. Of course, this skill may be associated with a tool or instruction — a person trained in ultraviolet leak detection. Patch testing and wear debris analysis are other specialized skills.

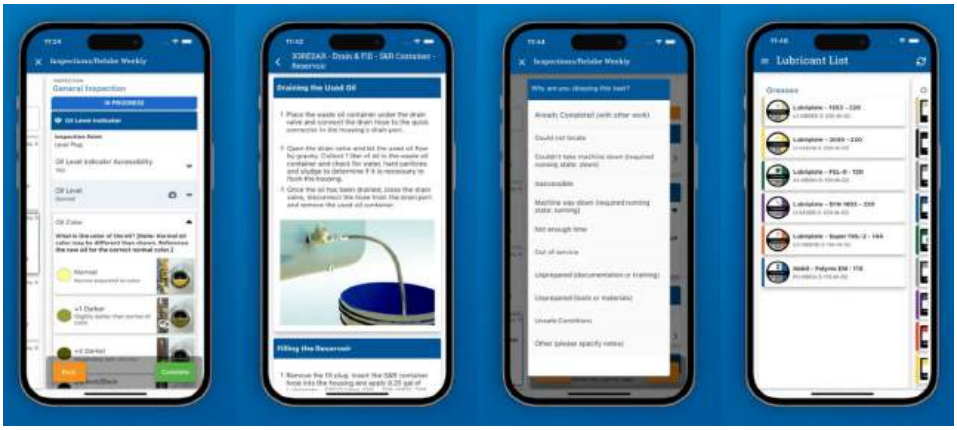


Figure 05 LubePM

Most inspections are done daily by the same inspectors or operators assigned to a group of machines. These are sometimes called "walkabout" or "walkaround" inspections. They should in no way be viewed as trivial or unimportant to machine condition monitoring.

Additionally, an inspection can be condition-based, triggered by concerning data or observations flagged during a routine inspection, portable data collector or remote condition monitoring data. In such a case, routes are not needed, and the activity is more diagnostic or troubleshooting in nature.

The inspection plan should document the timing and frequency of inspection routes.

Metrics and Compliance

All business areas and processes require measurement and reporting. Based on this information, managers can make better, more informed decisions based on an accurate representation of the business and the state of their machines. This is both at a macro level (the forest) and a micro level (the trees). Managers also need lagging indicators (what just happened) and leading indicators (what will happen).

Data for these metrics can come from numerous different condition monitoring sources and then be filtered or streamlined to make them ready for decision-makers use. Just like other forms of condition monitoring, inspection is a valuable source of information related to machine reliability and asset management. This is especially true when the data quality is at the level of Inspection2.0.

Metrics need to also include compliance. Inspections often trigger work orders to remediate current problems found by inspectors. Some work orders involve more probing inspections or troubleshooting tasks. Are these getting done in a timely fashion? Compliance tracking, measurement and reporting may also be needed to verify that all inspection routes are being effectively completed.

DIGITAL TRANSFORMATION IN MACHINERY LUBRICATION: REVOLUTIONIZING MAINTENANCE AND EFFICIENCY

In industrial maintenance, machinery lubrication has always been critical to ensuring the smooth operation and longevity of equipment. Traditionally, lubrication has relied on manual methods and routine schedules, often resulting in inefficiencies and unplanned downtimes. However, with the advent of digital transformation, the landscape of machinery lubrication is undergoing a significant revolution. This transformation is enhancing the efficiency of lubrication processes and redefining the maintenance strategies in industries worldwide.

The Traditional Approach to Machinery Lubrication

Historically, machinery lubrication involved manual application based on predetermined schedules. Technicians would apply lubricants at regular intervals, irrespective of the machinery's actual condition. While this method was straight forward, it was also fraught with challenges. Over-lubrication or under-lubrication were common issues, leading to equipment wear, unplanned downtimes, and increased maintenance costs. Additionally, manual lubrication was labor-intensive and prone to human error.

Enter the Digital Age: IoT and Smart Sensors

The digital transformation in machinery lubrication is primarily driven by the Internet of Things (IoT) and smart sensor technology. These advancements enable real-time monitoring and precise control over lubrication processes.

1. **Real-Time Monitoring:** IoT-enabled sensors are now embedded in machinery to continuously monitor various parameters such as temperature, vibration, and lubrication levels. This real-time data provides valuable insights into the machinery's condition and lubrication needs. For instance, if a machine part starts to over heat or vibrate abnormally, the sensors can detect these changes immediately and trigger alerts for corrective actions.

2. **Predictive Maintenance:** One of the most significant benefits of digital transformation in lubrication is the shift from reactive to predictive maintenance. With data analytics and machine learning algorithms, predicting when a machine will require lubrication is possible. This predictive approach ensures that lubrication is applied precisely when needed, reducing the risk of

over-lubrication and preventing equipment failures.

3. **Automated Lubrication Systems:** Automated lubrication systems, integrated with IoT and smart sensors, can dispense the right amount of lubricant at the right time. These systems eliminate the guess work and manual intervention, ensuring optimal lubrication. Automated systems can also adjust the lubrication based on real-time operating conditions, further enhancing the efficiency and effectiveness of the process.

The Role of Data Analytics

Data analytics plays a crucial role in the digital transformation of machinery lubrication. The vast amount of data IoT sensors collect is analyzed to identify patterns and trends. This analysis helps understand the lubrication needs of different machinery under various operating conditions. Advanced analytics can also provide actionable insights to optimize lubrication schedules and improve overall equipment performance.

1. **Condition-Based Lubricatio:** Data-driven insights enable condition-based lubrication , where lubrication is applied based on the actual condition of the machinery rather than fixed schedules. This approach ensures that lubrication is neither too frequent nor too sparse, maintaining the optimal performance of the equipment.

2. **Enhanced Decision-Making:** With comprehensive data analytics, maintenance teams can make informed decisions about lubrication strategies. They can identify potential issues before they escalate, plan maintenance activities more effectively, and allocate resources efficiently. This proactive approach reduces downtime, extends the lifespan of machinery, and lowers maintenance costs.

Benefits of Digital Transformation in Lubrication

The digital transformation in machinery lubrication offers numerous benefits to industries:

1. **Increased Equipment Lifespan:** Digital technologies help reduce wear and tear by ensuring optimal lubrication, thereby extending the lifespan of machinery.

2. **Reduced Downtime:** Predictive maintenance and real-time monitoring minimize unplanned downtimes, enhancing the productivity and efficiency of industrial operations.

3. **Cost Savings:** Automation and data-driven insights reduce the need for manual intervention and prevent costly equipment failures, leading to signifi cant maintenance cost savings.

4. **Environmental Benefits:** Optimal lubrication reduces the wastage of lubricants and minimizes the environmental impact of industrial operations.

The Future of Machinery Lubrication

The digital transformation of machinery lubrication is still in its early stages, but its potential is vast. As technology continues to evolve, we can expect even more sophisticated solutions that further enhance the efficiency and effectiveness of lubrication prcesses. Integrating artificial intelligence, machine learning, and advanced analytics will drive continuous improvements in predictive maintenance and automated lubrication systems.

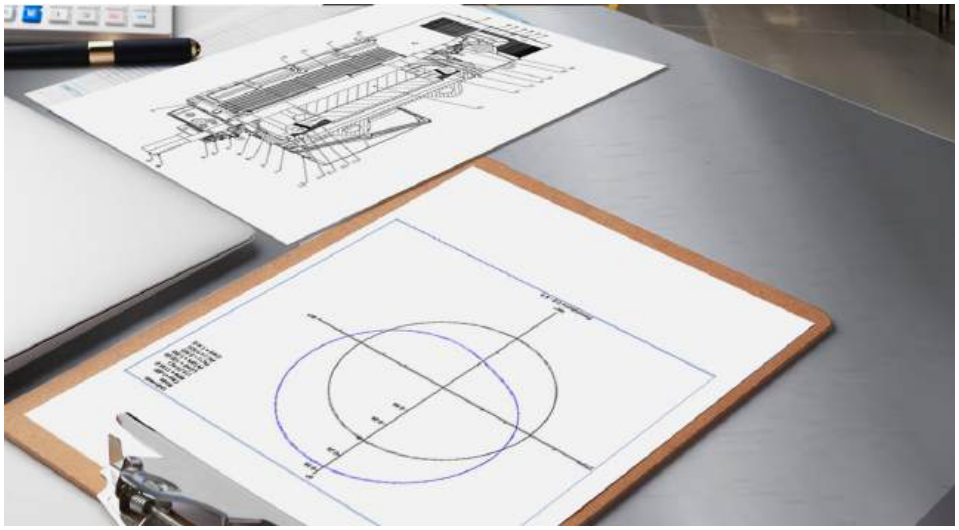
In conclusion, the digital transformation in machinery lubrication revolutionizes how industries approach maintenance. By leveraging IoT, smart sensors, and data analytics, companies can ensure optimal lubrication, reduce downtime, and achieve significant cost savings. This transformation not only enhances machinery's performance and longevity but also contributes to more sustainable and efficient industrial operations.

EDDY-CURRENT ORBIT PLOT ANALYSIS WITH A PORTABLE VIBRATION ANALYZER

The Curtis Bay plant recycle blower M53304 has a large 1000 HP Babbitt motor and fan oil-lubricated bearings, critical to optimal plant performance. Multiple motor failures resulted in lost production and increased maintenance expenses. Although monitored with an online vibration system utilizing eddy-current displacement sensors, these motor failures have been an ongoing problem for a long time.

It was only resolved with detailed vibration diagnostic information from the online vibration system to help address this problem. Connecting an AMS 2140 to the motor's online vibration monitoring system enabled the plant reliability staff to obtain detailed rotor displacement peak and phase vibration data. This route-based spectral, wave form, and phase data were combined in the AMS machinery manager software in an orbit plot format to help identify faults, such as:

- Imbalance
- Bent or bowed shaft
- Eccentricity
- Shaft preload
- Resonant response
- Machinery stability
- Mechanical looseness
- Rotor rub
- Misalignment in the drive shaft
- Cracked shaft behavior



- Foundation considerations
- Oil instability (Oil whirl and Oil whip)

In this case, we can correct a dynamic misalignment.

The Challenge

These critical plant assets are routinely monitored with online vibration systems for shutdown protection through a Bently Nevada 3500 rack and/or overall vibration data indicated on an operator's control panel. Although these online vibration systems are functional, in some cases, the lack of diagnostic information hinders the reliability team from assisting the plant with improving the asset operation. A failure of that asset can decrease plant production and incur additional unplanned maintenance shutdown expenditures. Employing the capabilities of the portable data collector to extract vibration data from an online system's buffered outputs with route-based measurements can enable the utilization of in-depth vibration

information for monitoring & diagnostic purposes consistently.

Interfacing the Portable Data Collector with an Online Vibration System

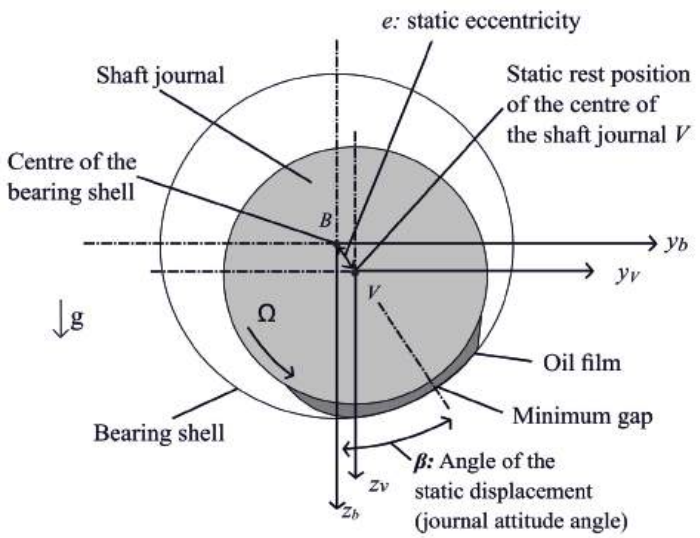
The data collector has an accelerometer and volts inputs, which can be used to measure online accelerometers and eddy-current displacement sensors via a connection to the online systems buffered output. Vibration data can be obtained from the routes, advanced analysis testing or transient firmware and then that data can be saved as a job in the AMS machinery manager software.

As the system already powers online sensors, caution must be taken to ensure the data collector does not have sensor power turned on when connecting to the online system for measurements. One method to ensure this would be to create machine points in the software with the sensor power 'turned off' and then create a separate online system route to ensure that no power could be input to the online systems' buffered output connectors. Collecting the online vibration data with a dedicated route would also allow that information to be trended over time for comparison to data/outputs from the online protection system. Energy bands included in the route points could be used for enhanced trending and alarming, making it easier to interpret the data.

Vibration Data

One recurring plant maintenance concern was an asset on a critical system impacting plant operations when a motor had repeated DE bearing alarms but lacked diagnostic information to provide corrective measures to resolve this problem.

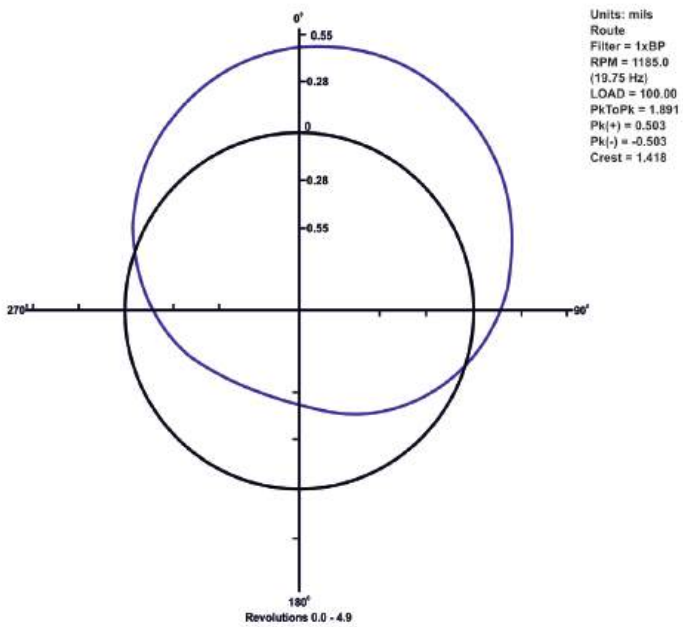
The alarms came from the dynamic displacement when we started the equipment and the shaft floating over the oil from the babbitt bearing in an offset position.



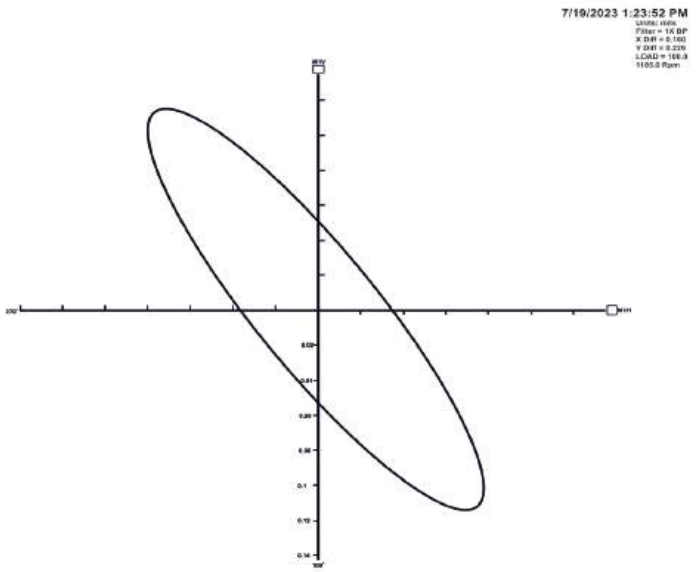
The Curtis Bay reliability team utilized the D25688 \ Splitter Cable, 8-pin M12 to BNC 0.2m" red, blue (Volts A & B) and tack, which plugs into the data collector Turk connector to collect measurements. This cable allows you to connect to 2-eddy-current probes and a TACH signal from the protection rack for displacement peak & phase data.

Once the measurement points and route were built, the reliability team successfully collected rotor displacement vibration data at 1185 RPM on the two fans for analysis. Our measurement points parameter settings include subharmonics, 1xRPM Peak-Phase, 2xRPM Peak-Phase, 3-4xRPM, and DC Gap Voltage parameters be included in this monitoring. As standard sensor measurements are configured with the analyzer sensor power turned on, it was also recommended to configure these points with the analyzer sensor power turned off. An additional precaution was to have these measurement points built into a special online system vibration route to ensure no power was accidentally input to the online system buffered outputs.

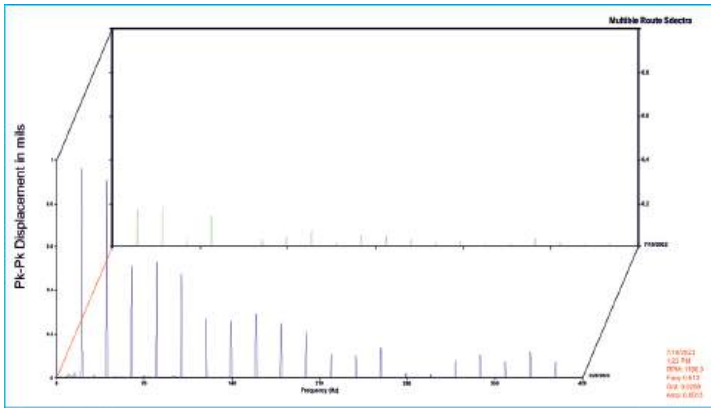
Machinery manager software was then used to view the fan trend, spectrum, waveform, orbit, and DC gap eddy-current data. This data confirmed the reliability team's suspicion of an alignment problem on the fan where the motor sleeve bearing failures occurred. A decision was made to adjust the motor alignment to 1.5 mils down and 4 mils to the left. The following orbit plots show the motor bearing displacement before and after the alignment change was made.



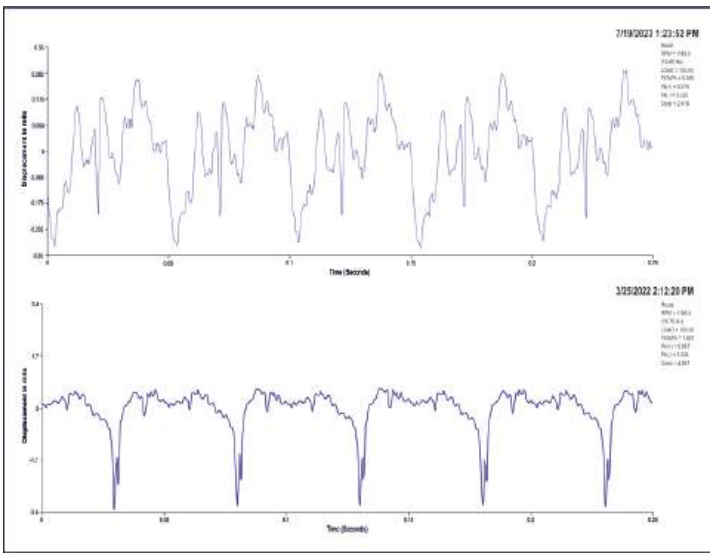
Eddy-current displacement vibration orbit plot before alignment change.



Eddy-current displacement vibration orbit plot after alignment change.



Motor eddy-current displacement vibration multi-spectrum plot before and after alignment change.



Motor eddy-current displacement vibration wavefor plots before and after alignment change.

Conclusion

A detailed analysis of the machine orbit plots collected with the AMS 2140 from the Bently-Nevada rack 3500 resulted in the recommendation for maintenance to align the motor to the fan differently. The misalignment defect was a primary source of the repeated motor DE bearing alerts and failures on this machine. Since this alignment change, the troublesome motor has run perfectly, and this improvement of the motor operations is considered a success for plant production. While the examples above were identified using a portable machinery health analyzer, the Curtis Bay FCC and reliability team continued monitoring online vibration spectral, wave formand orbit data.

MISTAKES IN THESE 6 AREAS ARE SABOTAGING YOUR LUBRICATION PROGRAM

Specific Questions to Ask Yourself Around Your Facility

Manufacturing facilities are like my second home. Each year I visit sites all over the world conducting assessments that analyze the overall performance of their lubrication programs. During these assessments as I am documenting, photographing, and completing my list of 540 yes or no questions, I find opportunities for teachable moments.

It's like living in your own house. You tend to walk past things multiple times a day. It takes an outsider to point something out that's alarming. Improving your lubrication program today or this month is possible. Look at this list of common problem areas and answer the same questions I ask our clients during assessments. Your responses will be great conversation starters with your team.

The Main Offenders

- Lube room
- Lack of documented lubrication tasks and procedures
- Contamination control
- Oil analysis
- Lack of training
- Using appropriate tools

Lube Room

When lube rooms are in a state of disarray, the health of the lubricants in the room comes into question. Questions we ask related to the state of a lube room include:

- Do you have procedures for receiving lubricants?
- Are you protecting lubricants in the lube room?
- Are you filtering oils?

Lubricants should be taken care of before going into machines just like the food we protect in our pantries in refrigerators.

Lack of Documented Lubrication Tasks and Procedures

Transferring experiential knowledge from person to person is a traditional and somewhat effective way to learn to the job but it is not an effective way to keep tabs on a lubrication program. One should even be careful when relying on a CMMS to run a lubrication program because it's not built to hold those granular pieces of data like specific maintenance points. Proper documentation ensures all lubrication points are addressed, preventing missed points that could lead to equipment failure.

- Are all lubricated points mentioned in

the lubrication database?
- Do all lubrication tasks have proper procedures?
- Do these tasks mention the specific lubricant to use?

Contamination Control

Activities related to contamination control have a large effect on the rest of the program. Storage practices like leaving open barrels and jugs or not protecting the lubricant during the transfer process from the lube room to the plant floor exposes your lubricants to contaminants. These particles will eventually end up in your machine. Protecting your machines from contaminants is paramount to the health and longevity of your equipment.

- Are you receiving clean lubricants?
- Are the proper steps being taken to protect the lubricant before it goes into the machine?
- Are machines outfitted in a way to protect the lubricant once inside?

Photo of a hose obstruction

Training

Trained personnel understand the nuances of lubrication, such as why you shouldn't mix lubricants and the importance of contamination control. They know the importance of applying lubricants correctly and completing tasks according to documented procedures. A trained team can completely change the trajectory of a lubrication program.

- Do all personnel that have an active role in the lubrication program have a baseline knowledge of lubrication fundamentals?
- Do those applying lubricants have specific training in lubrication training such as MLT I?
- Do those managing the program have a more in-depth knowledge of advanced lubrication topics such as selection and degradation?

Oil Analysis

Have you heard the term "junk in, junk out?" The use of incorrect sample ports and lack of sampling procedures will produce inaccurate results. Confidence in the data you are receiving back from a lab is crucial to taking the right corrective action. So, it's important to distinguish between a functioning oil analysis program and an effective one.

- Are there proper sampling ports on a machine?
- Are the alarms and limits set up correctly by machine type?
- Do those reading the reports have a thorough understanding of report interpretation?

Using Appropriate Tools

How many times have we been told, "use the right tool for the right job?" Improper tools like open-top transfer containers and funnels can put the lubrication program in jeopardy. Smaller tools and containers may seem insignificant but the impact these can have on contamination can't be underscored enough.

- Are sealable and refillable S&R containers being used?
- Are grease guns that are in use properly labeled?
- Are machines labeled with the corresponding lubricant?

Photo of a rusty oilcan

As I mentioned, I travel the world conducting assessments that show facilities where their lubrication program stands on a score of 1 to 100. The Ascend™ chart covers six weighted sections which contain 40 critical lubrication elements. Each weighted section deeply interconnects with the next. One under performing area can have a domino effect on the rest.

One of the joys of my job is the education I get to share with eager workforces as I move with them from asset to asset. The lightbulb moments and ensuing success in equipment failures and downtime reduction is a testament to the importance of proper lubrication practices. Ready for your lightbulb moment? Take your free self-assessment.

THE CRITICAL ROLE OF TRIBOLOGY IN ENHANCING INDUSTRIAL MACHINERY PERFORMANCE

In the world of industrial machinery, the pursuit of efficiency and longevity is relentless. As industries strive to optimize operations and reduce downtime, one field of study that has become increasingly crucial is tribology. This science, focusing on the interactions between surfaces in relative motion, plays a pivotal role in enhancing the performance and durability of machinery across various sectors.

Understanding Tribology

Tribology is the study of friction, wear, and lubrication of interacting surfaces in motion. It encompasses a range of disciplines, including mechanical engineering, materials science, and chemistry. The fundamental aim of tribology is not only to understand how these interactions occur but also to devise ways to improve them for industrial applications.

Impact on Industrial Machinery

The implications of tribology for industrial machinery are profound:

- **Reduced Friction:** Friction between moving parts can lead to significant energy losses and wear. Tribological innovations help in designing surfaces and lubricants that minimize friction, thereby enhancing efficiency and reducing energy consumption.
- **Extended Machinery Lifespan:** Wear and tear is a major concern in industrial settings. By understanding the mechanisms of wear, tribologists develop materials and coatings that can withstand harsh operating conditions, thus extending the life of machinery parts.
- **Improved Lubrication:** Effective lubrication is vital in preventing the direct metal-to-metal contact of machine parts, reducing wear and tear, and keeping machines running smoothly. Advanced lubricants and lubrication systems are continually being developed to meet the evolving demands of industry.
- **Enhanced Performance:** With reduced friction and wear, machinery operates more reliably and at optimum capacity. This not only boosts productivity but also decreases the likelihood of downtime due to equipment failure.

Applications Across Industries

Tribology is integral to numerous industrial sectors. In automotive manufacturing, for example, tribological research contributes to the development of engines and drivetrains

that are more durable and fuel-efficient. In aerospace, tribology is applied to improve the reliability and performance of aircraft components. Even in the renewable energy sector, such as wind turbines, tribology plays a key role in ensuring the longevity and effi ciency of gearboxes and bearings.

Future Directions in Tribology

The future of tribology in industrial applications is rich with potential. With advancements in materials science and nanotechnology, researchers are exploring the creation of 'smart' lubricants and surface coatings that adapt to changing conditions to optimize performance. Additionally, the integration of IoT technology in industrial machinery allows for real-time monitoring of tribological parameters, facilitating predictive maintenance and further reducing unexpected downtime.

Conclusion

The role of tribology in the industrial sector cannot be overstated. As companies continue to seek ways to improve efficiency and reduce operational costs, the contributions of tribologists will be increasingly valued. By advancing our understanding and application of tribology, industries can look forward to not only more robust and reliable machinery but also significant enhancements in performance and productivity. This crucial field of study, therefore, remains a corner stone in the ongoing quest for industrial innovation and excellence.

UNLOCKING THE FUTURE OF MACHINERY LUBRICATION: THE CRITICAL ROLE OF TRAINING & TALENT MANAGEMENT

The saying "knowledge is power" holds a unique significance in machinery lubrcation. With the rapid advancement of technology and the increasing complexity of machinery, the need for skilled professionals in lubrication management has never been more crucial. This article delves into the importance of training and talent management in the machinery lubrication industry, highlighting key strategies and best practices that can help organizations stay ahead in this ever-evolving field.

The Importance of Training in Machinery Lubrication

Adequate machinery lubrication is pivotal for operational efficiency and longevity of equipment. It involves meticulously selecting the right lubricants, applying them correctly, and maintaining their performance through regular monitoring. However, even the best lubrication practices can only fall short with proper training. Here's why training is essential:

1. **Enhanced Equipment Performance:** Well-trained lubrication technicians can identify the right lubricant for each piece of machinery, ensuring optimal performance and reducing downtime.
2. **Cost Savings:** Proper training reduces the likelihood of equipment failure and unplanned maintenance, leading to significant cost savings in the long run.
3. **Safety and Compliance:** Training ensures that all lubrication practices meet safety standards and regulatory compliance, reducing the risk of accidents and legal issues.
4. **Innovation and Adaptability:** Continuous training helps technicians stay updated with the latest advancements in lubrication technology, enabling them to implement innovative solutions and adapt to new challenges.

Key Components of Effective Training Programs

Developing an effective training program for lubrication technicians requires a comprehensive approach. Here are the key components to consider:

1. **Hands-On Training:** Practical, hands-on training is essential for technicians to gain real-world experience. This can

include workshops, simulations, and on-the-job training sessions.

2. **Certification Courses:** Enrolling technicians in certification courses from reputable organizations, such as the International Council for Machinery Lubrication (ICML), ensures they possess the necessary skills and knowledge.
3. **Continuous Learning:** Training should not be a one-time event. Implementing continuous learning opportunities, such as refresher courses, webinars, and industry conferences, keeps technicians updated with the latest trends and technologies.
4. **Mentorship Programs:** Pairing less experienced technicians with seasoned professionals fosters knowledge transfer and skill development, creating a robust talent pipeline.

Talent Management: Nurturing the Next-Generation of Lubrication Experts

While training is vital, it is only one piece of the puzzle. Effective talent management ensures organizations can attract, develop, and retain skilled lubrication professionals. Here's how to build a successful talent management strategy:

1. **Attracting Talent:** Organizations must highlight the importance of lubrication roles and the potential for career growth to attract top talent. Partnering with technical schools and universities, offering internships, and participating in career fairs can help raise awareness and interest in lubrication careers.
2. **Developing Talent:** Beyond initial training, providing career development opportunities is crucial. This can include advanced training programs, leadership development courses, and opportunities for cross-functional projects.
3. **Retaining Talent:** Retention strategies should create a supportive and engaging work environment. Competitive compensation, recognition programs, and clear career paths increase job satisfaction and loyalty.
4. **Succession Planning:** Identifying and grooming future leaders ensures continuity and long-term success. Succession planning involves assessing current talent, identifying potential leaders, and providing them with the necessary development opportunities.

Best Practices for Implementing Training & Talent Management Programs

Implementing effective training and talent management programs requires careful planning and execution. Here are some best practices to consider:

1. **Needs Assessment:** Conduct a thorough needs assessment to identify skill gaps and training requirements. This ensures that the training program is tailored to the organization's specific needs.
2. **Collaborative Approach:** Involve key stakeholders, including senior management, HR, and technical experts, in the development and implementation of training programs. A collaborative approach ensures alignment with organizational goals and objectives.
3. **Utilize Technology:** Leverage technology to enhance training and talent management efforts. Online learning platforms, virtual simulations, and data analytics can improve training effectiveness and track progress.
4. **Feedback and Evaluation:** Regularly evaluate the effectiveness of training programs through feedback from participants and performance metrics. Continuous improvement ensures that training programs remain relevant and effective.
5. **Cultural Integration:** Foster a culture of continuous learning and development. Encourage employees to take ownership of their professional growth and provide support through resources and incentives.

Conclusion

In the ever-evolving field of machinery lubrication, the role of training and talent management cannot be overstated. By investing in comprehensive training programs and robust talent management strategies, organizations can ensure that their lubrication teams have the skills and knowledge needed to excel. This enhances operational efficiency and equipment performance and positions the organization for long-term success in a competitive landscape.

Embracing the future of machinery lubrication means recognizing the value of human capital and committing to its continuous development. With the right training and talent management practices in place, the future of machinery lubrication is not just bright—it's unstoppable.

RE-OILING THE WHEELS: NAVIGATING INDIA'S USED OIL LANDSCAPE UNDER THE EXTENDED PRODUCER RESPONSIBILITY

India's Path to Sustainable Used Oil Management

India, as the world's third-largest lubricant market, faces a significant challenge in the sustainable management of used oil generated from its expanding automotive and industrial sectors. With lubricant demand expected to rise from 2.8 million tons to nearly 4 million tons by 2030, the country annually generates approximately 1,325 kilotons (kT) of used oil. Alarmingly, only about 15% of this vast quantity is collected for re-refining, while the remaining portion is either burned or illegally dumped, causing severe environmental harm. Addressing this issue is crucial, and adopting innovative reverse logistics models could enhance used oil management while benefiting other waste management sectors.

The Importance of Proper Used Oil Management

Proper management of used oil is essential to prevent pollution of air, soil, and water. Improper disposal, such as burning, releases harmful substances like sulfur dioxide and nitrogen dioxide, which contribute to respiratory diseases. Economically, low re-refining rates translate to missed opportunities in reducing reliance on imported virgin base oil. Re-refining used oil is significantly more energy-efficient than producing base oils from crude, requiring only one-third of the energy. Recycling 500 kT of used oil annually could prevent approximately 1 million tons of CO_2 emissions and save over Rs.5,000 crores in crude oil imports. A circular economy approach is, therefore, vital to closing the loop in the lubricant supply chain, minimizing waste, and maximizing resource efficiency.

Current Challenges in Used Oil Collection and Recycling

Despite having over 400 re-refining plants with a combined capacity exceeding 1,000 kT, India's re-refining industry operates at

only 30–40% capacity. This underutilization stems from inconsistent raw material supply, inadequate collection systems, low awareness of proper disposal methods, and the predominance of the unorganized sector in waste oil management. The collection process is often opaque, with cash transactions dominating the sector, leading to significant volumes of used oil being misdirected to unauthorized applications such as fuel adulteration and illegal burning.

Innovative Reverse Logistics Models

To address these challenges, several innovative reverse logistics models can be considered:

- Aggregator Networks: Small-scale aggregators collect used oil from sources like garages, service stations, and factories, transporting it to regional hubs for quality checks and segregation.
- Retailer-Driven Buyback Programs: Lubricant retailers offer discounts or loyalty points to incentivize consumers to return used oil responsibly.
- Digital Waste Collection Platforms: Technology-driven platforms connect waste oil generators with authorized collectors and recyclers, ensuring real-time tracking, transparency, and optimized collection routes.
- Urban Cooperative Systems: Organized waste collector groups can efficiently manage urban waste oil collection, improving working conditions and integrating collectors into formal systems.
- OEM Workshop Collaborations: Partnering with OEM workshops can ensure a consistent supply of high-quality, uncontaminated used oil. However, challenges remain, such as improper segregation, lack of proper storage, absence of transaction records, and unauthorized sales.

Challenges in Building a Robust Used Oil Collection Infrastructure

Several hurdles exist in strengthening the used oil collection system:

- The collection network remains fragmented, with a strong presence of informal collectors.
- Many service centers and industrial users lack awareness of responsible disposal methods.
- Illegal disposal practices and use as fuel substitutes persist due to economic incentives.
- Regulatory compliance enforcement remains weak, allowing used oil to be diverted to non-sustainable applications.

Advances in Re-Refining Technologies

Various re-refining technologies differ in efficiency and environmental impact:

- Acid Clay Refining: Requires low capital investment but produces low-quality base oil and hazardous sludge.
- Vacuum Distillation with Clay Polishing: Yields better-quality base oil but still generates waste.
- Hydrotreating (Advanced Refining): Produces high-quality base oil meeting industry standards but involves high capital investment.
- Solvent Extraction & Hydrofinishing: Offers superior-quality base oil with minimal environmental impact but requires specialized infrastructure and higher operational costs.

While some large-scale refiners are adopting advanced technologies, smaller players often rely on older methods due to cost constraints. The pricing mechanism for used oil is influenced by factors such as bargaining power among large-scale generators, black market activities, oil quality, and demand for re-refined base oils.

Extended Producer Responsibility (EPR) Framework

A major step toward sustainable used oil management in India is the implementation of the Extended Producer Responsibility (EPR) framework, effective from April 1, 2024. This policy mandates that producers of base oil or lubrication oil are responsible for the collection, treatment, and environmentally sound disposal or recycling of used oil. The Central Pollution Control Board (CPCB) and the Ministry of Environment, Forest and Climate Change (MoEFCC) have been instrumental in this evolution. The Used Oil EPR Portal for Producers has been live since June 24, 2024.

Key objectives of the EPR framework include:

- Re-refining up to 50% of used oil into Re-refined Base Oil (RRBO), reducing import dependence on Virgin Base Oil (VBO) and conserving foreign exchange.
- Formalizing the informal collection sector and enhancing collection infrastructure.
- Encouraging investments in advanced re-refining technologies.
- Creating employment opportunities in the MSME sector.

Under the EPR framework, different entities have specific responsibilities:

- Producers: Must register on the portal, fulfill EPR obligations by purchasing certificates, file annual returns, provide consumer awareness, and ensure compliance.
- Recyclers: Must register, maintain compliance with facility and process regulations, prevent environmental damage, and file quarterly and annual returns.
- Collection Agents: Must register, collect used oil from generators, supply only to

registered entities, and file required reports.

- Used Oil Importers: Must register, meet EPR targets, and file annual returns.
- Bulk Generators: Must establish collection points and ensure used oil is handed over only to registered recyclers, producers, or collection agents.

It is important to distinguish between Used Oil, which can be reprocessed if it meets specific criteria, and Waste Oil, which includes spills and sludge and can only be used as fuel for energy recovery under strict specifications.

Strengthening India's Circular Economy for Used Oil

To transition towards a circular economy for used oil, India must enhance collection infrastructure, enforce regulatory compliance, promote advanced re-refining technologies through incentives, conduct public awareness campaigns, and implement a transparent pricing mechanism. By embracing innovative reverse logistics models and effectively implementing the EPR framework, the country can minimize environmental harm, reduce import dependence, unlock economic value, and set a global benchmark for sustainable practices. Waste management companies and industry stakeholders have a critical role to play in driving this transformation.

About the Author

Bhaskaran Nagarajan is the COO and Principal Consultant at Rosefield Energy Tech Pvt Ltd. The company is actively contributing to India's circular economy in used oil through initiatives like RecykLube, which aims to maximize used oil collection for recycling and re-refining. Rosefield collaborates with partners to establish collection centers, assist corporates with ESG and SDG targets, implement tracking software, and conduct due diligence on re-refiners and generation points. The company also supports many organizations in EPR compliance efforts.

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LUBRICATION LENS CHALLENGE #1

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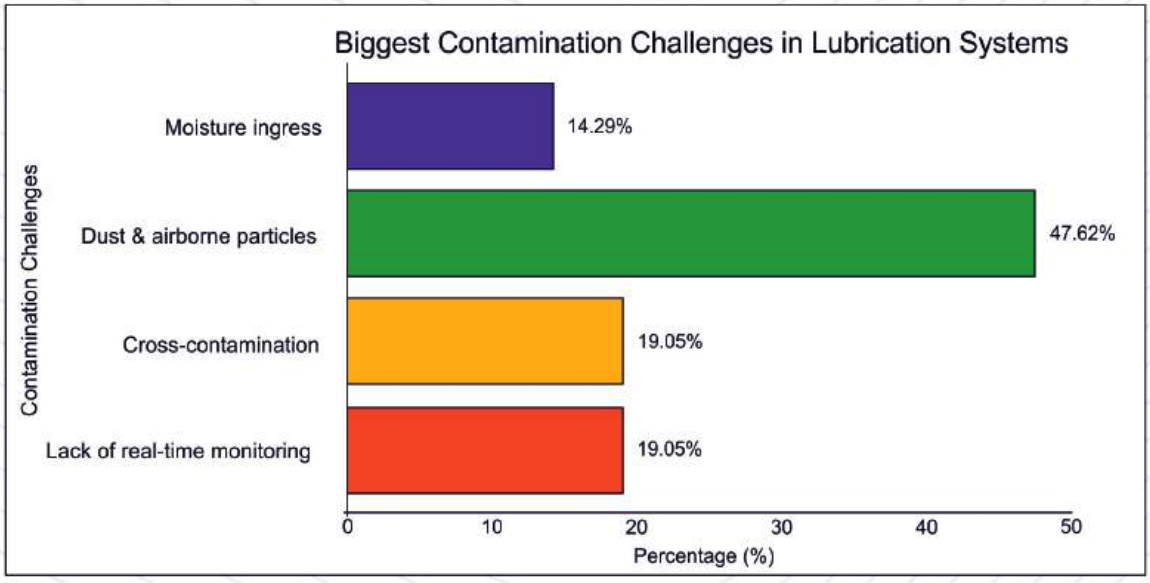
- This month, we asked: What's the biggest contamination challenge in your plant's lubrication system?
- Here's what the industry had to say!



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Sachin Hagare
Supervisor, Cummins India
(Rs.1500 Amazon Gift Voucher)

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Solutions:
- ✔ HEPA filtration
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Congratulations to the winners! Stay tuned for the next **Lubrication Lens Challenge!**

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BP MULLS CASTROL SALE: WHAT COULD THIS MEAN FOR INDIA'S LUBRICANTS MARKET?

BP is reportedly exploring the sale of its lubricants division, Castrol, in a move that could fetch around $10 billion. This potential divestment is part of BP's broader strategy to regain investor confidence after years of underperformance. Activist investor Elliott Investment Management, which holds a $4.7 billion stake in BP, has been pressuring the company to streamline operations and divest non-core assets.

The announcement came as early as BP's Capital Markets Day on February 26, though no final decision has been made. Analysts estimate Castrol's valuation at $8-10 billion based on its $1 billion EBITDA. The sale, if executed, would significantly impact the global lubricants market, particularly in India, where Castrol holds a strong presence.

Beyond lubricants, BP is restructuring its portfolio by selling clean energy assets, including offshore and onshore wind projects, and seeking partners for its solar and battery storage unit, Lightsource BP. The company has also scaled back its renewable energy commitments, realigning its focus toward traditional oil and gas operations.

Castrol, a globally recognized brand operating in over 150 countries, has a strong foothold in automotive, industrial, and marine lubricants. It has also expanded into liquid cooling solutions for data centers and maintains high-profile sponsorships in motorsports and the NBA.

Castrol is growing in fast-expanding markets such as India · Offshore Technology

The potential sale could reshape competition in the lubricants industry, with major players like Saudi Aramco rumored to be interested in acquiring the brand. As BP navigates this transition, industry observers are closely watching how this move will influence global and Indian lubricant markets.

LANXESS OPENS INDIA APPLICATION DEVELOPMENT CENTER IN MUMBAI

German specialty chemicals company LANXESS has inaugurated its India Application Development Center (IADC) in Thane, Mumbai. The state-of-the-art facility, located at LANXESS House, will drive innovation and enhance customer service, initially focusing on two key business units with plans for expansion. Marking its 20th anniversary, LANXESS aims to deliver customized solutions and innovation-led growth through this new center. The IADC integrates expertise from LANXESS's Lubricant Additives and Material Protection Products divisions. It will conduct advanced studies on lubricant performance, develop new materials, and evaluate antimicrobial solutions for paints, emulsions, and water-based chemistries. Namitesh Roy Choudhury, Vice Chairman & Managing Director of LANXESS India, highlighted the center's role in bringing expertise closer to customers and responding swiftly to industry needs. The initiative aligns with LANXESS's strategy to focus on high-value, less cyclical business areas like sustainable mobility and consumer protection. With around 800 employees and operations in Jhagadia (Gujarat) and Nagda (Madhya Pradesh), LANXESS has a strong foothold in India's specialty chemicals sector. The IADC's launch reinforces the company's commitment to localized solutions, strengthening its role in India's growing industrial and consumer markets.

LANXESS India Application Development Center will support innovation and tailored solutions for India's industrial and consumer markets

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