

LUBES'N'GREASES

HELPING YOU NAVIGATE THE LUBRICANTS INDUSTRY

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AUGUST

PACKAGING

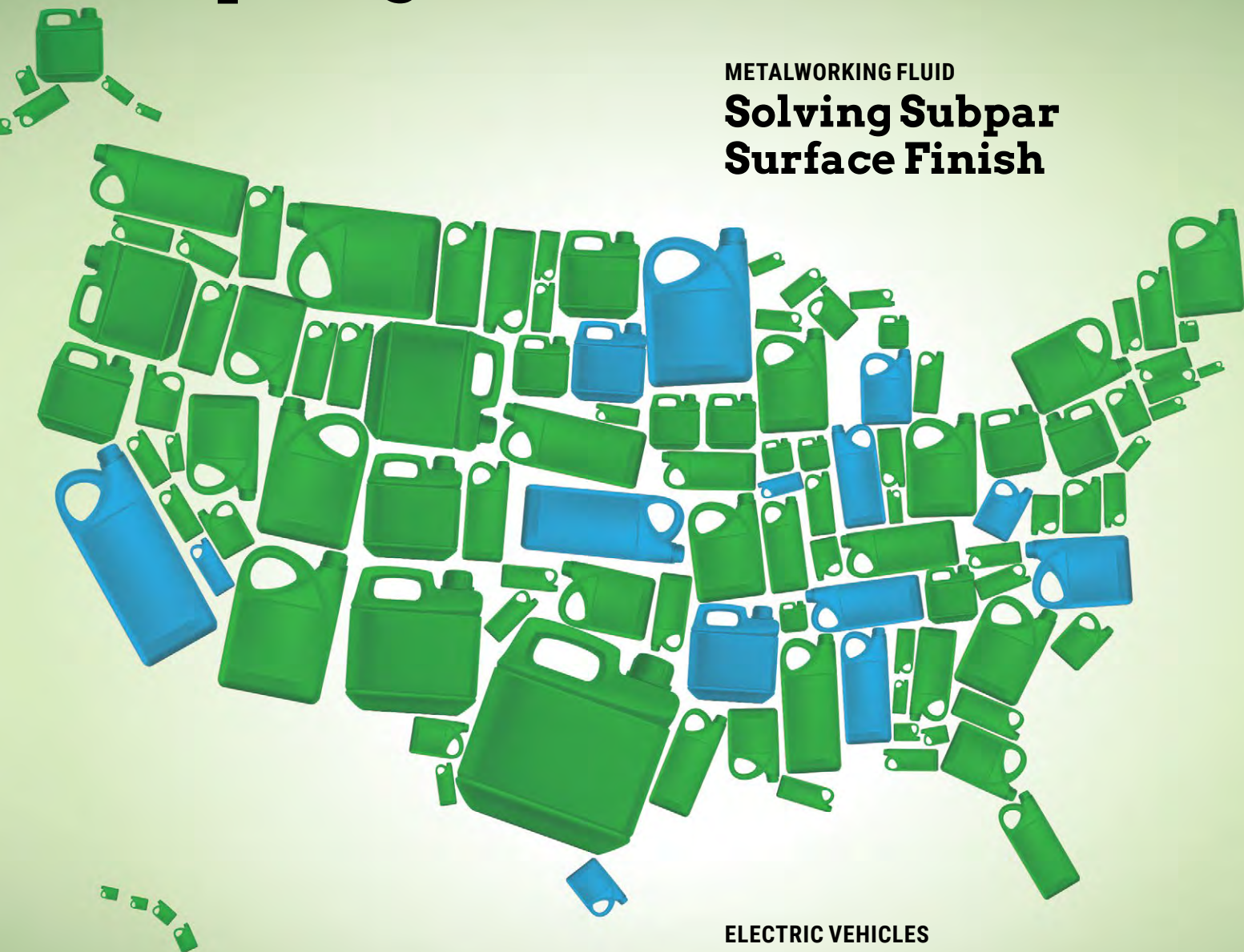
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HOWARD BRISKIN is publisher & president of Lubes'n'Greases. Contact him at HBriskin@LubesnGreases.com

Good Data Supports Good Decisions

Many companies around the world temporarily shuttered their offices at the onset of the COVID-19 pandemic.

With the uptake in remote work came a change in driving habits. Long commutes in bumper-to-bumper traffic were replaced by short strolls to the living room.

The extra time gained from no longer having to commute enabled many people to take up new hobbies, including changing the oil in their vehicles themselves. In fact, the top-growing aftermarket categories with online consumers last year included motor oil, which grew by \$67 million, or 72%, and filters, which grew by \$53 million, or 35%, according to findings by the NDP Group.

"Taking the time to better understand the who, what, where and why behind these changing consumer patterns will pay huge dividends in the future," Nathan Shipley, execu-

tive director and industry analyst for The NPD Group, explained. "Not only does our industry have all new people to market to, but consumers who were already engaged with us have changed their behavior, too. Marketing and pricing efforts should look different post-pandemic."

Collecting and analyzing the data exposes trends that may be counterintuitive or not readily apparent. Reduced pandemic driving should surely have led to reduced aftermarket consumption. But that wasn't so, according to the data. As seen through the data lens, marketing, pricing and production volume

adjustments are better viewed as opportunities to thrive in a changing marketplace.

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See for yourself at LubesnGreases.com/basestockplantdata

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PRICING

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Since the onset of the pandemic, the base oil market has displayed atypical patterns. It may be some time before it falls back into a more reliable groove.

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Base oil supply remains tight in the United States. Fortunately, supply in other regions of the world is bouncing back.

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Lubes'n'Greases. Contact
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BASE STOCKS | WORLD

Unboxing July

July turned out to be another busy month for base oil market participants, which is a far cry from years past when the summer months would typically usher in softer consumption levels along with muted pricing activity.

Demand remained unusually healthy throughout June and during the first half of July, supporting somewhat surprising increase initiatives. Chevron, ExxonMobil and Avista Oil introduced a price increase in mid-June—the sixth round of markups since the beginning of the year—and were quickly followed by a majority of base oil producers. The initiatives were driven by

persistent supply tightness, healthy demand, rising spot prices and firm crude oil and feedstock values.

The paraffinic base oil increases ranged from 15 to 55 cents per gallon, depending on the grade and whether the supplier had participated in all the previous rounds of price hikes.

Shortly after paraffinic producers raised their prices, naphthenic

producers followed suit, announcing increases of their own, with Cross Oil being the first to raise prices by 30 cents per gallon in early July. The company explained that the increase was driven by the steeper cost of crude oil as well as in-bound transportation. Other naphthenic producers—including Calumet, Ergon and San Joaquin Refining—introduced similar price adjustments.

The snug supply situation in the naphthenic segment was compounded by an unplanned outage and force majeure declaration at the Valero refinery in Three Rivers, Texas, following a fire there on June 6. The damage to the fuels unit forced the Valero refinery complex to shut down, and a restart was not expected until mid- to late July.

A majority of domestic suppliers

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Base Oil Report

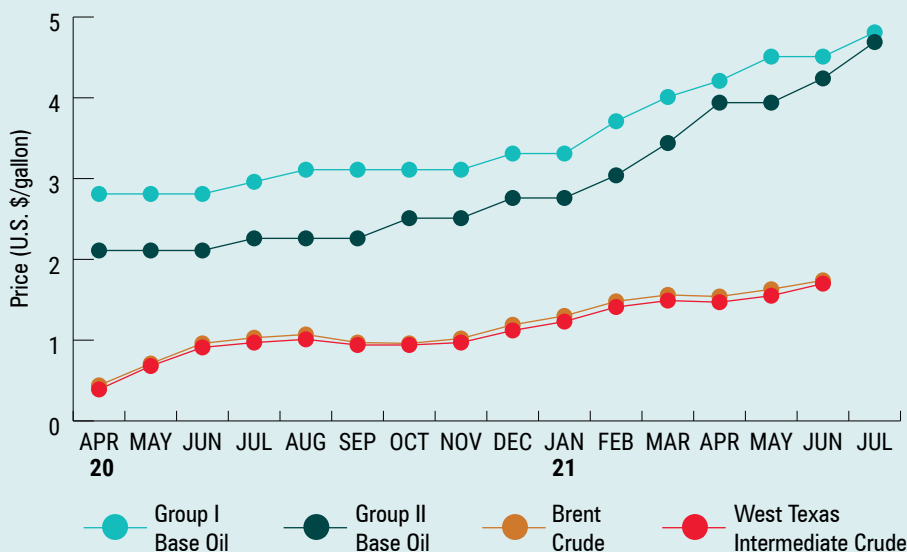
August 2021

Base oil prices are lowest U.S. postings of the month for mid-vis grade before applicable discounts. Crude prices are monthly averages.

Historic and current base oil pricing data are available for purchase at www.BaseOilPrices.com

BOF BASE OIL PRICING DATA

Sources: Lubes'n'Greases research,
U.S. Energy Information Administration






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Continued from Page 8

focused on meeting contractual obligations and were left with little to no availability for spot and export business. Many customers have remained on allocation since February, when a freezing winter storm disrupted production in large swaths of the United States, particularly the Gulf Coast region. Ergon lifted the force majeure on Group I and II supplies from its Newell, West Virginia, refinery on July 7 as the unit was restarted following a fire on May 29.

Supply of the heavy grades in both the Group I and II categories was especially scant beyond those barrels allotted to contract shipments. Bright stock continued to be the belle of the ball as many buyers were intent on finding supplies. However, they remained elusive. A majority of players have also been unable to build emergency stocks ahead of the hurricane season, which started on June 1.

At the same time, a slight oversupply of light viscosity grades in Asia prompted suppliers to look for takers beyond the region, and a number of light-grade parcels were shipped from South Korea to Brownsville, Texas. From there, they were likely to then move on to Mexico—where consumers use base oils for fuel blending—and other Latin American destinations.

The base stock supply shortages and climbing prices in the United States prompted manufacturers

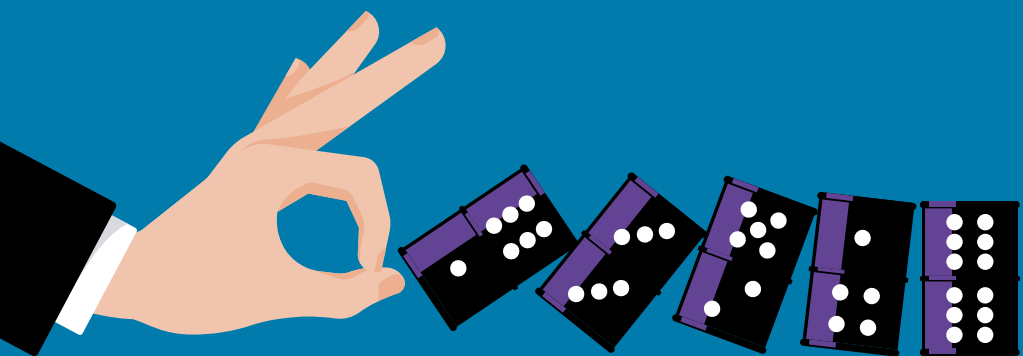
of lubricants, greases, additives and other products to communicate price increases between 5% and 19% for implementation in late July and August. These followed a series of similar initiatives during the previous months.

A shortage of certain base oils and additives also triggered reduced production rates or brief shutdowns at blending facilities and forced manufacturers to place customers on allocation.

Base oil shortages were also reported in Europe and Asia, where prices have skyrocketed since the last quarter of 2020. However, the availability of a number of grades had started to improve by July as plant turnarounds were completed and a more balanced supply-demand scenario was starting to emerge.

Spot prices in Asia stabilized, although a number of grades were still exposed to upward pressure due to strained supply levels. In Europe, prices in general were hovering at all-time highs, and availability of most grades was still extremely limited.

Just like a box received in the mail may reveal an unexpected gift, what may occur in the next few months in base oil segments remains a bit of a mystery. Since the start of the coronavirus pandemic, the market has displayed atypical patterns, and it may be some time before a more familiar and reliable environment is reestablished. ♦



BASE STOCKS | WORLD

Base Oil Outlook

Global base oil markets are looking mixed, with Asia showing greater supply of all types of base oils. Meanwhile, Europe and the Middle East are overcoming shortages, particularly for Group I. The United States remains tight, with shortages of all grades as refineries catch up on inventory replacement after severe weather hit the Southern states earlier this year.

This scene has altered arbitrage openings. In the first part of 2021, Asian suppliers had difficulty meeting rising demand after the COVID-19 pandemic began to fade. At that time, demand in Asia was being met by European stocks. Now Asian supplies are coming to the rescue of European and U.S. markets.

In Europe, Group I production is about 75% of total base oil output, which took a toll when the market started to shorten up as demand faltered for transportation fuels. Refineries cut run rates to prevent an overload on inventories of mogas, kero and diesel. This resulted in a shortage of feedstocks for base oil and wax, which shortened the market to the point that buyers found difficulty covering basic requirements to

produce finished lubricants.

Meanwhile, several prime refining sources went into turnaround, often for a month or more. This exacerbated the already short market. Group I supplies were rare and expensive, particularly for heavier viscosity grades, like solvent neutral 500 and bright stock.

Around this time, Europe saw a reduction in imports of Group II base oils due to weather-generated problems that left the U.S. domestic markets short of material. U.S. refineries focused on restocking their local markets instead of export sales.

The lack of flow of material from the U.S. started to infringe on the European Group II market, which accounts for only 11% of total European base oil production. This tightened



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supplies of these grades to a point where imports from Asia had to be considered to fill the gap in the supply chain. Fortunately, Asian sources were emerging from the COVID-induced nightmare, and product from that region became available for export to the Middle East and Europe.

Group III markets hit similar problems, with production from all sources maxed out. As demand rose in Europe and the U.S., this sector of the market became extremely tight. Furthermore, two major producers in Europe went into an extended maintenance schedule, invoking allocation programs and curbing all spot business. In July, many suppliers had no availability of 6-centistoke Group III product, which is the most-used grade throughout Europe.

The possibility of increased production from a Russian refiner had yet to be launched, and it was set to produce only a 4-cst grade. While the increase in production was significant at 47%, this extra availability of Group III hardly scratched the surface of the dearth of the Group III market.

These developments led to huge price increases. While the starting point was on the low side, price levels escalated at record rates. Some Group I levels rose by \$200 in one week, and these price movements continued over several months. Prices eventually reached their

zenith. Those levels were retained for May and June but began to show a modicum of weakening in July as greater quantities of material became available at the end of the Group I turnaround season.

Price volatility is challenging in the best of times, but with COVID surges in such regions as India and Europe, price variations became a blender's nightmare. Contract deals for finished lubricants had to be renegotiated.

To avoid price volatility, other petroleum products are hedged and stored for longer terms. This is impossible with base oils due to specification variations and overall smaller quantities of material being traded. Thus, the base oil scene has become risk intensive, with a number of small and medium blending operations disappearing from the stage in all regions.

Availability of base oils has become

the major driver of prices. As more product has become available, prices have drifted downward. In some instances, where domestic markets are down or extremely quiet, producers that rely on local sales have resorted to export tenders to move material out of storage. While this has been welcomed in export markets, odd-ball sources and voyages have been initiated to accommodate these trades. Such has been the case of the national refiner in Turkey, where three tenders for nearly 20 kilotons of base oils were issued from April through June.

Prices in the fourth quarter will be lower than in June, according to forecasts. Seasonal slowdowns will kick in, and supply availabilities are expected to improve for most grades. By the end of this year, global prices are expected to be lower by some

\$300 per metric ton than in June.

Regionally, there may be differences, with Asia leading the way to lower prices and greater availability of all grades. Europe may remain relatively firm, with increasing demand following vaccination programs. European prices are expected to drift downward at a slower rate than those in Asia and the Middle East. U.S. markets may be the least responsive to lower levels, since the hurricane season is predicted to be particularly fierce.

The future is far from certain, but base oil business will continue, albeit in a different manner. The pandemic has altered means of conducting trade, and while it is possible to make assumptions and assessments based on known facts, geopolitical events will occur and breakdowns and outages at refineries will happen. ♦

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BUSINESS | WORLD

Reinvigorate Your Safety Program

I am in New York City these days, and the “animal spirits” have been unleashed here due to the high level of vaccinations leading to low infection rates and thus increasingly high public confidence, coupled with the reopening of restaurants and sports and concert venues. However, along with this exuberance I see safety issues all around me, including people looking at cell phones while crossing the streets, and a growing number of electric delivery bikes and scooters going exceedingly fast. I think this combination of high spirits and increased risk is present in the workplace, too. I urge you to reinvigorate your safety program at this pivotal time.

Safety and health have been top of mind over the last year or so as everyone has been very focused on keeping healthy during the pandemic. As employees return to your offices, you may want to

follow what I thought was a very reasonable policy from J.P. Morgan, which requires all United States workers to log their vaccination status into a software portal. They also urge all employees to be vaccinated.



SARA LEFCOURT of Lefcourt Consulting LLC specializes in helping companies to improve profits, reduce risk and step up their operations. Her experience includes many years in marketing, sales and procurement, first for Exxon and then at Infineum, where she was vice president, supply. Contact her at saralefcourt@gmail.com or (908) 400-5210.

Those employees who are either not vaccinated or who choose not to log their status need to wear masks and socially distance. They are also encouraged to periodically test for COVID-19.

However, the overwhelming preoccupation with COVID does not diminish the continuing need for a robust and inclusive safety program. As employees return to work and operations ramp up, this is the time to ensure that your overall safety program is functioning well.

You may want to structure your thinking along the lines of the U.S. Occupational Safety and Health Administration’s seven core elements of an effective safety and health program, as I have done below.

Management Leadership

This is the most important element. Management must ensure that safety is a value that is instilled in company culture. Some key ways to do this are to make sure that all communications from the CEO and functional leaders include comments on safety performance and that this carries through to investments in improving safety in company facilities. There must be safety goals and metrics in place and continuous improvement in evidence. Safety performance should be an element of manager performance evaluation and promotion requirements. Consider whether you have delivered mixed messages to employees

Be sure to incorporate insights from the pandemic into your safety, health and human resource policies.

during the pandemic, such as whether your actions could be construed as prioritizing profits, costs or production over safety.

Worker Participation

Workers at all levels should have a voice and a role with regard to safety programs. There should be mechanisms by which they can voice concerns about safety without fear of reprisal, and management should provide feedback to workers on these issues. Safety committees should include colleagues at different levels, including union workers. Recognize that employees working from home during the pandemic have missed the opportunity to participate in such safety reinforcing activities as safety audits and “walkabouts” and in-person safety meetings. Seek opportunities to reinvigorate these safety activities.

Hazard Identification and Assessment

This is an area of prime concern due to the many changes that are likely to have occurred in your operations over the past year. Supply chain challenges have no doubt led to changes, like new suppliers for raw materials and different modes of transit and supply points, and perhaps not all of these were sufficiently assessed for risk. Plant operations have likely been strained by operations at both low and high capacity. New workers may have inadequate training or may not be sufficiently steeped in the corporate safety culture. Now is the time to take a fresh

look at these changes and identify any new risks you may have taken on intentionally or inadvertently.

Hazard Prevention and Control

Review the new risks identified above and seek ways to remedy them, starting with the highest risks. Ensure that an up-to-date risk assessment is developed and that there is a high level of risk awareness at all management levels, including at the corporate level. There should be a plan to mitigate the highest risks over time. Perhaps during the pandemic you have been able to find new ways of working that reduce employee exposure to certain risks; be sure to incorporate these new ways of working into operating procedures.

Education and Training

You have likely relied on online training tools during the pandemic, and these certainly are efficient. However, I suggest that you test how well this training has been understood and absorbed. Look for more hands-on training opportunities, especially in plant settings. For employees who are returning to the office, restart programs aimed at awareness of such office safety issues as ergonomics, tripping hazards and driving safety. Consider setting up cross-functional sessions for all employees with less than two years of service to introduce them to a wider group of management and educate them in company culture, mission, strategy and objectives, including a strong message of safety culture.

Evaluation and Improvement

Review your safety performance before and during the pandemic and determine what the data are telling you. Perhaps your safety performance improved significantly due to fewer employees present on site. Perhaps your performance declined due to taking on more risks. Maybe the type of injuries and incidents changed significantly during the pandemic. In any case, this data should be evaluated and learnings should be taken from it. Now is the time to get back on your corporate journey to continuously improve safety. Be sure to incorporate insights from the pandemic into your safety, health and human resource policies.

Management of Contractors

Safety performance includes not only your own staff but also that of contractors. Perhaps during the pandemic you reduced or eliminated contract staffing but are now reinstating it as demand returns to normal. Consider carefully the quality of the organizations you are working with and ensure adequate training and supervision of new contract staff.

As life and business, thankfully, begin to return to normal, reinvigorate your safety program through management attention and communication, risk identification and mitigation, and increased activities, including safety audits, safety training and goal setting. ♦

Our columnists are temporarily writing every other month. Look for the next Best Practices column in the October issue.



AUTOMOTIVE LUBRICANTS | WORLD

International Fluids Consortium

You'll remember that my column in June discussed the new heavy-duty engine oil category, currently called PC-12. It must be the year of new standards because Toyota has proposed a new process for light-duty vehicles called the International Fluids Consortium. There are always good reasons for change, and it's no different this time. It's important to see where we have come from, so we can see where we're headed. So, let's look at what led up to the IFC proposal and what the drivers are for this latest effort.



STEVE SWEDBERG is an industry consultant with over 40 years experience in lubricants, most notably with Pennzoil and Chevron Oronite. He is a longtime member of the American Chemical Society, ASTM International and SAE International, where he was chairman of Technical Committee 1 on automotive engine oils. He can be reached at steveswedberg@cox.net.

Many of you would be surprised to know that the first oil specification was developed in 1911 by the Society of Automotive Engineers. It was the forerunner of the J300 viscosity classification system in use today. The first iteration, published in 1923, included viscosity as well as such oil properties as color, pour point, carbon residue and corrosion resistance. The next version from 1926 removed the oil properties and kept only viscosity. This remained in place until 1947 when the American Petroleum Institute's system of regular, premium and heavy-duty designations was included. Generally,

© vipman4

regular was only base oil, premium contained oxidation inhibitors, and heavy-duty added dispersant-detergent to the oxidation inhibitor.

There were lingering questions about this system, so in 1952, API and the American Society for Testing and Materials developed the Engine Service Classification System. They reworked it in 1955 and again in 1960. The result was the service categories ML, MM, and MS for gasoline engines and DG, DM and DS for diesel engines. That lasted for only a few years.

By 1969 API, ASTM and SAE had developed an entirely new system, designed to meet the changing warranty, maintenance and lubri-

cation needs of automakers. SAE set up eight service categories for passenger cars. These were picked based on then-current commercial interests. ASTM set up the testing protocols, including test methods and performance characteristics, which technically described each of the categories defined by SAE. API created the user language, which included the letter designations we know as API Categories SA, SB, SC, etc. SAE, ASTM and API—referred to as the tripartite—then tied them all together in SAE document J183.

As all of you are aware, this system was changed as engine design evolved to meet more stringent emissions and fuel economy reg-

ulations. Categories were made obsolete when test methods were no longer available to demonstrate performance levels. For example, API SH was retired when some of the engine tests used to define the category ran out of parts. No parts, no test; no test, no category. API did make some provisions for older engines to be covered by insisting on “backwards compatibility,” which simply means that the latest category covers earlier category requirements even though the engine tests are unavailable.

This system survived for the next 20 years, but there were always concerns expressed by the OEMs. They were facing a changing tech-

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nological challenge. They needed better fuel economy, lighter vehicles and lower emissions. Designs were changing and there were customer issues. API, on the other hand, was concerned about the constant pressure to upgrade engine oils for smaller engines with higher output while containing emissions. This led to frustration for both organizations. In meetings where OEMs mentioned problems, marketers said they were not seeing the problems. Comments about seeing baskets of failed parts were batted back and forth.

While I was chairman of the SAE Technical Committee I (engine oils), a new concept was proposed by the OEMs. After much discussion and

compromises by both sides, Mike MacMillan of GM and Don Johnson from Pennzoil engineered an agreement in which the International Lubricants Specifications Advisory Committee defined engine needs, ASTM continued with their test development and management, and API developed user language and a system to oversee the oil, which came to be known as the Engine Oil Licensing and Certification System, also called EOLCS or API 1509.

The new system added licensing (including fees), while the American Chemical Council developed a protocol for testing and modifications to engine oil formulations as well as additional requirements for both the

“API, on the other hand, was concerned about the constant pressure to upgrade engine oils for smaller engines with higher output while containing emissions.”

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“The IFC’s goal is to accelerate the adoption of new global specifications by connecting and engaging industry experts to improve fluid performance through collaboration.”

OEMs and the oil marketers. The oil additive industry basically aligned itself with the oil marketers because the oil companies were their customers. This is the system that created the GF designations. The program was launched in 1992 and, after several modifications and updates, is still in force today.

One of the issues that has continued to nag the OEMs is the engine oil specifications defined by the European Automobile Manufacturers’ Association and Japanese Automotive Standards Organization. In fact, Toyota is the early driving force behind the IFC proposal and has been joined by four of the top 10 automotive OEMs in this effort.

The IFC consortium intends to develop international automotive fluid performance specifications. It will replace the current standards of API, ACEA and JASO. In addition, IFC will administer a licensing program for its specifications.

So, what’s the purpose behind the IFC’s proposal? As they have stated in a press release, “The IFC’s goal is to accelerate the adoption of new global specifications by connecting and engaging industry experts to improve fluid performance through collaboration.” As I noted earlier, one of the main sources of frustration for the IFC has been the slow pace at which the API and other systems have been able to implement new categories. The best example of that is the nearly 10 years required to go from GF-5 to GF-6. That’s way too slow.

JAMA members led the develop-

ment of JASO GVL-1 and successfully completed it in two years. They tried to keep it as simple as possible and stayed focused. They used existing tests from ASTM that covered the durability needs. But they chose to develop their own fuel economy tests. They use this as an example to explain how related industries can work together in a collaborative environment.

Lubricant manufacturers, oil marketers, additive makers and oil companies will all have input on draft IFC performance specifications through an advisory committee that will be subject to an annual membership fee. However, only the OEM consortium members will decide on the final fluid specifications. In addition, IFC plans to develop specifications for all vehicle powertrain and ancillary systems. Further, these specifications will cover both internal combustion engine vehicles and electric vehicles. They also envision a program to certify, license and audit approved fluids.

I’m definitely in favor of a set of international specifications for transmission fluids. It’s an expressed wish on my part that the large number of transmission fluid specifications in the market can be reduced to a manageable level. It would make it much better for fast oil changers, independent garages and even dealer service departments.

IFC intends to be an international platform to standardize any oils and fluids covering powertrain systems. Obviously, the starting point will be improving the current industry sys-

tem for near-future light-duty engine oils. Ultimately, IFC wants to be the true international platform supporting all regions including Asia, North America and Europe. So long as quality is managed correctly, JASO, ASTM, CEC or others can be included as a part of future specifications.

My take on this proposal is that it is a long time coming. To the surprise of my oil and additive industry colleagues, I have a strong leaning toward the OEMs’ position. After all, they are the ones who ultimately deal with any disgruntled customers. The pace of change due to technological advances, legislative decrees and societal insistence on environmentally appropriate products force them to make some quick improvements. If it’s done right and everyone is on board, it will inevitably produce some positive changes.

I know there will be a lot of push-back from the oil industry, not to mention the additive folks. They have a huge stake in this as well. It will take a lot of discussing, cussing, cooperation, compromise and consensus before this gets done. In the end, it will be a better system; not perfect but better. As an old friend from Japan said, “We hope our industry partners understand our intention and the benefit for them to participate in it.” ♦

Our columnists are temporarily writing every other month. Look for the next Automotive column in the October issue.

Spotlight on Packaging

FORM, FUNCTIONALITY AND A GREENER FOCUS

From the bag-in-a-box and the anti-glug bottle to the plastic pouch and tetra pack, packaging for lubricants and greases in recent years has proven every bit as innovative as the formulations inside them.

Gone are the days when generic bottles filled the shelves. Depending on application or product type, countless designs have been introduced, each boasting their own unique form, function and footprint to cater to the ever-changing market.

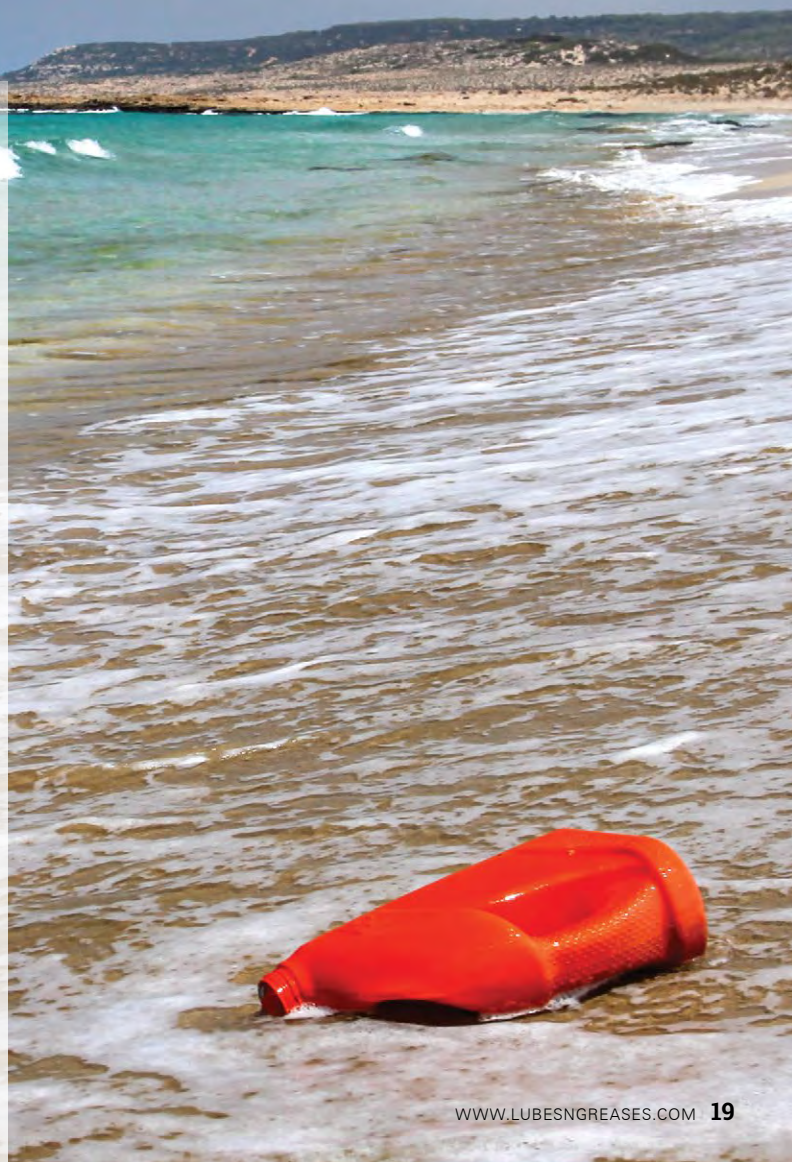
Designers continue to adapt and enhance industrial lubricant packaging to offer not only better protection and greater aesthetic appeal but additional features like anti-counterfeiting measures, clearer and more durable labeling, as well as advanced track-and-trace capabilities.

Sustainability has also become part and parcel of lubricants packaging. Growing awareness about the environment and the

need to be more efficient and generate less waste means it is no longer just the product itself that is being closely scrutinized.

"There are many different ways in which customers are driving for improving sustainability," said Jennifer Dally, director of global strategic marketing at Greif. "The range of what customers are doing is widespread, from using recycled or less raw material in packaging to establishing or supporting alliances to determine end-of-life solutions. While these latter efforts are primarily focused on smaller plastic packaging, there are many things related to end of life for industrial packaging on which we continue to partner with customers."

The onset of COVID-19



had a marked effect on all industries and sectors, including lubricants. Consumption suffered as the pandemic took its toll, particularly on core end use markets such as aviation, marine and automotive.

The disruption heaped pressure on the supply chain and stretched the availability of raw materials. As short supply forced up prices, especially in steel, this provided additional impetus for packaging providers to consider changes in terms of size, design or material.

"We are seeing some shifts from steel drums to intermediate bulk containers for faster moving products, and for slow moving products a move from large to small steel drums," said Dally. "There are also some cases where customers are migrating to plastic where there is product compatibility and other safety or transport criteria that can be accomplished."

In a highly-competitive marketplace, players are always striving to develop increasingly innovative options to store and ship lubricants and greases. Some are considering using more post-consumer resin

in their products, looking at light weighting, or finding ways to minimize waste for more eco-friendly and cost effective solutions.

"I believe COVID-19 showed the key role digital plays in supply management, awareness of inventory and communication," Dally added. "When people were not able to be onsite or managing certain tasks, it expedited the impact on technology. As we continue to learn about various environmental impacts, efforts around sustainability will only accelerate."

The challenges surrounding plastic waste, such as our reliance on landfill or the impact of microplastics on our oceans, were again in the headlines when leaders of the G7 countries convened in June. The annual meeting, held this year in Cornwall, United Kingdom, saw them stand united as they reaffirmed their pledge to tackle climate change and increase contributions toward more sustainable growth.

The lubricants sector is keen to play its part, too, according to Tristan Steichen, a sustainability consultant and director of the newly formed National

Lubricant Container Recycling Coalition. Launched in March 2021, the industry-led technical initiative is a grassroots movement that aims to shine the spotlight on the need for better solutions to recover and recycle plastic containers (see page 34).

"There is an overwhelming push from society to do something," he said. "Based on feedback we've been getting from retailers and their customers, there is a clear desire to reduce the amount of virgin plastic packaging being used.

There is interest from the lubricants producers to work closely with packaging manufacturers to come up with recovery and recycling solutions."

Oil and lubricant residues are notoriously tough to clean and remove, so lubricant packaging is often considered contaminated after use and is rejected by many recycling processes, said Steichen. He estimated that around 4.5 million tons of plastic lubricant containers—largely made from high-density polyethylene—heads to landfill each year.

The NLCRC plans to launch several pilot projects

across the United States over the remainder of the year to try to better understand consumer behavior and assess current collection procedures. It also hopes to establish some small-scale recycling schemes.

"Product and packaging manufacturers are taking the lead on this," added Kevin Whitehead, vice president of the Petroleum Packaging Council and manager for industrial automotive products at Plasti-pak—one of the founding members of the coalition.

"We felt this had to be done as a coalition. You see people trying to solve the problem independently, but it just doesn't work. You can't impact a transformation and industry shift with just your company alone; you need to have a collective action," he said.

"You have to be willing to work with your peers to solve this problem. This is a hot topic right now and we all need to start getting ahead of these sustainability issues rather than reacting to them."

Whether pouch, pail, carton or container, society's push for greener packaging solutions has rapidly accelerated in recent years.

With this growing awareness, environmental, social and corporate governance strategies are becoming more mainstream and have become a key pillar of most forward-looking companies' plans.

Castrol, for example, is

"There is interest from the lubricants producers to work closely with packaging manufacturers to come up with recovery and recycling solutions."

— TRISTAN STEICHEN
NATIONAL LUBRICANT CONTAINER RECYCLING COALITION

looking to halve its plastic footprint by the end of the decade. To help achieve this, it recently unveiled plans to work with packaging specialist Pulpex to create paper bottles made from wood pulp for its lubricant products.

It said that this innovative technology using renewable feedstocks offers a carbon footprint up to 30% lower than polyethylene terephthalate and glass (see page 34).

A container has become far more than simply a means of safe storage and a way to ensure longevity and minimal leakage or contamination.

Ziggy Garcia, managing partner at consultancy Inevitable Solutions, is also leading a project that aims to both reduce emissions and help companies reach their sustainability goals.

Its new lubricant packaging made from HDPE and PCR will boast a traditional

profile, be load bearing and be easy to stack and ship, he said. It also incorporates a unique design feature—a containment area that stops any leakages that may cause damage to surrounding products during transit.

These have been in development for 15 months and are soon to start trials, with launch expected in early 2022. The intention is to expand to larger plastic containers that range in size

from one quart up to 2.5 gallons.

Lubricant and grease suppliers no longer have to ensure their products are improving only in terms of performance; the outer packaging has become just as important. ♦

In this Spotlight, Biederman Enterprises highlights how its products combine both functionality and sustainability.

Biederman Looks to the Future



No matter the obstacles and pressures facing the lubes and greases sector this past year, the need for quality packaging has been unwavering.

While it has certainly been a challenging period, Biederman Enterprises—North America's leading supplier of plastic grease cartridges—has enjoyed robust and steady demand throughout.

Elizabeth Wagg, vice president of operations and sales, is proud the business has not only demonstrated its resilience but is confident of emerging from the gloom in a better position than ever.

"Just like the Biederman grease cartridge, our people and operation have proven very durable," she says. "We really believe we're going to emerge from this stronger."

"Order levels are high, and we're seeing unprecedented levels of demand for our cartridges. We've never had sales like this before," she says. "A lot of new and existing cus-

tomers seem to be building their inventories and protecting themselves in case there are any more supply chain issues."

Before the pandemic, the Ontario-based manufacturer had been focused on expanding its output, investing in new printing capabilities and developing an innovative non-leak cap design. Yet while the crisis meant its plans to fully capitalize on these advances had to be temporarily put on hold, Wagg insists the disruption has not dampened Biederman's ambitions.

"Now that we're seeing some light at the end of this, we will revisit those opportunities," she says. "Increasing capacity is still a priority, and we continue to focus on becoming even greener and more sustainable."

Biederman has recently completed several projects to enhance its cartridge and production systems to improve productivity and efficiency.

It has enhanced its direct offset printing process by making significant

equipment investments to allow for more intricate designs and greater flexibility, and has also been looking at how best to further minimize waste.

While functionality is key, customers are increasingly looking for greener alternatives, notes Wagg. Recycling, waste reduction and sustainability therefore remain a key area of focus for the business, she says.

Biederman already uses up to 10% post-industrial resin (PIR) in its cartridges but is looking to incorporate more scrap plastic moving forward. The business is also eyeing opportunities with post-consumer resin (PCR) after initial trials proved successful. Wagg says the business will look to work closely with its customers to see whether it can explore this further in the future. ♦

Find out more at www.biederman.ca/grease-cartridges/

By Boris Kamchev

PROGRESS BY FAILURE

Electric motor failure in hybrid buses caused by copper corrosion leads to the development of more effective e-transmission fluids.

The transportation sector is a major contributor to global carbon dioxide emissions. The sector accounted for the largest share of greenhouse gas emissions in countries like the United States, which reported the sector's share to be about 29% in 2019, according to the U.S. Environmental Protection Agency. Fortunately, automakers like Sweden-based Scania are working to drive the shift toward a sustainable transport system," Par Nyman, technical manager for transmission and axle lubricants with Scania, said at ACI's European Base Oils and Lubricants online series in February. "We would like to create a world of mobility that is better for business and society and the environment."

To make this goal a reality, the company said that by 2025 it will reduce carbon dioxide emissions from its own operations by 50% from 2015 levels. "Some of the activities

we will take will be to reduce the energy consumption in our factories and our office buildings," Nyman said. "We would like to reduce emissions in our internal logistics; we move a lot of parts between factories and workshops, and factories and other factories." Scania also plans to recycle materials from its assembly plants.

More important, Nyman said, Scania also plans to reduce the emissions of its vehicles while they are in operation by 20%. "This is a very big challenge for us," he said. "Electrification will be a big contributor to reaching this target."

Because of this, Scania has invested in hybrid and all-electric vehicle technology, particularly for trucks and buses. However, the new technology has come with a few obstacles that must be overcome.

Learning from Failure

Nyman explained that some of Scania's city plug-in hybrid buses failed

after about 6,000 hours in operation. The buses' drivetrain consists of a 9-liter diesel engine—often powered by biofuel—paired with a permanent magnet electric motor and a 12-speed automatic gearbox.

Like other electric motors, Scania's is made up of hairpins, a stator, permanent magnets and a rotor. "By switching on the electricity in the hairpins, we can create an electromagnetic field," Nyman said. "By switching them on and off in a certain pattern, we can make this electromagnetic field rotate. That will force the permanent magnets to rotate and thus the rotor to rotate and propel the vehicle."

Scania identified the cause of the failure to be corrosion of the copper wire hairpins, which caused the electric motors to short-circuit. Short-circuiting occurs when an electrical current strays from its intended path and completes its journey via a shorter route of less resistance. This

results in excessive current flowing through the circuit.

What caused the copper corrosion, though?

"We think that the likely root cause for this failure is the top-up of 10%-15% of axle fluid," Nyman said. Axle fluids are generally formulated with extreme pressure additives, which consist of chemically reactive sulfur species that cause corrosion of the copper hairpins and buildup of a conductive copper sulfide layer.

When this copper sulfide layer is allowed to progress, "it will form a contact bridge between the electrical phases, and we will have a short circuit" in the stator, Nyman said. "During the short circuit, it will become extremely hot, so you can see signs of molten copper."

For this type of corrosion to take place, two conditions must be satisfied, Nyman said. "You need good availability of reactive materials; that's copper and sulfur," he said. "But you

also need [high] temperatures for this to take place. It is quite interesting to think that the oil is contributing" to this failure.

To solve this corrosion problem, the automaker sought to devise a method for corrosion testing. In its preliminary work, it set up a test in which cutouts of the hairpin wires were polished on the ends. "We have one end of the copper rod below the oil level and one above," Nyman said. "We run the experiment in two different cups. We have one closed, where we will contain any gases or corrosive materials that would be produced in the oil phase. And we have another one mimicking what a real live system would look like with an open ventilation to the atmosphere."

The oil phase refers to the side of the hairpin that has been submerged in the oil, and the vapor phase refers to the end of the hairpin that was not submerged. Each sample in the test was heated to 125 degrees Celsius.

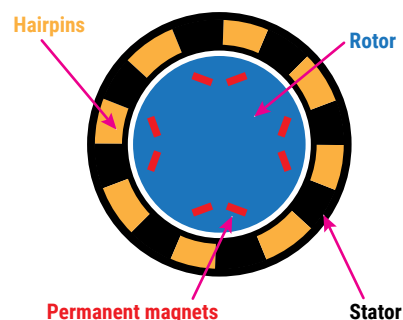
The test was run using four different fluids: an axle oil, a manual transmission fluid, an automatic transmission fluid and a dedicated e-fluid.

In the closed portion of the test, the axle oil was "quite corrosive," Nyman said. "We get this sort of blackish, very brittle layer."

Scania observed less corrosion of the hairpins in the oil phase with the manual transmission fluid but still a fair amount of corrosion in the vapor phase. Meanwhile, the automatic transmission fluid led to almost no corrosion in the oil phase, but corrosion persisted in the vapor phase.

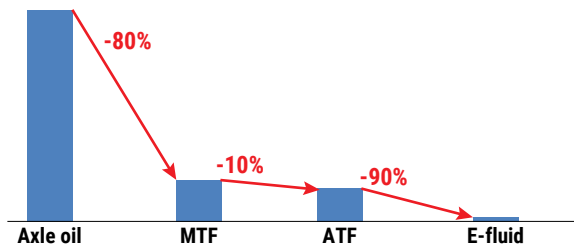
Because these fluids failed to

Permanent Magnet E-motor



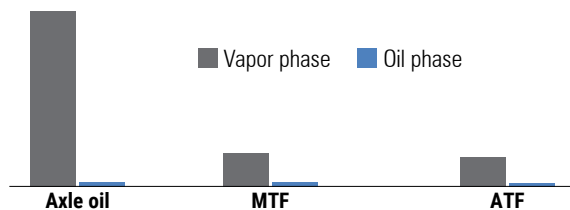
Source: Scania

Relative Corrosion Rate in Oil Phase



Source: Scania

Comparison of Relative Corrosion Rates in Oil and Vapor Phases



provide the desired results, it became necessary to develop a fluid that would. Raj Shah, director of Koehler Instrument Co., said, "One technique to combat copper corrosion is the development and application of the proper lubricating e-fluids, as this may help prevent corrosion."

Scania recognized this need and teamed up with a leading lubricant additive manufacturer to do just that. After putting the new e-fluid through the same test, Scania observed almost no corrosion in both the oil and vapor phases.

Scania and its research partners then developed another wire corrosion test in which a copper wire with a diameter of 64 nanometers was strung along the length of a plastic fixture. The bottom end of the wire was immersed in a beaker of axle oil, manual transmission fluid, automatic transmission fluid or the new dedicated e-fluid, while the top end was exposed to the oil's vapor phase. The entire setup was then immersed in an oil bath and heated to 140°C in the oil

phase and 80°C in the vapor phase. The test ran for 96 hours, during which the electrical resistance was monitored and the rate of corrosion was determined.

After running the new test, the company found that the relative corrosion rate in the oil phase was reduced by 80% when the manual transmission fluid was used in place of the axle oil. A further 10% decrease was observed with the automatic transmission fluid, while an additional 90% decrease was observed with the dedicated e-fluid.

"If you take all this together—going from the axle fluid to a dedicated e-fluid—we actually reduced the corrosion rate by 98%," Nyman said. "We can conclude that the corrosion rate is affected very heavily by what type of oil is used."

Conclusions

Nyman explained that a solution for the high rate of copper corrosion in Scania's hybrid drivetrains is the use of a dedicated e-fluid that can perform safely at high temperatures and high

power densities.

"The desire to increase the power density in transmissions and e-motors will inevitably lead to more power transmitted through gears and bearings, leading to higher surface pressures and higher temperature peaks in e-motors," Nyman said. "This means the surface pressures in the gears will increase slightly over the years. This will probably need higher scuffing resistance, thus making the need for a dedicated e-fluid very important."

Nyman stressed that lubricants formulated with EP additives are corrosive toward copper—especially in the vapor phase—and are not suitable for use in the electric motors in Scania's hybrid drivetrains, which do not feature separate oil systems between the gearbox and the electric motor. The company concluded that the corrosion rate in its hybrid bus e-motor's stator is about 10 times higher in the vapor phase than it is in the oil phase.

"Dedicated fluids that combine gear protection properties and excellent copper corrosion protection are desirable products for this type of machine," he concluded, adding that lube formulators will probably need to develop new types of chemistries that take into account the need for increased scuffing protection and better corrosion inhibition. ♦



A Scania hybrid bus



BORIS KAMCHEV is a staff writer with Lubes'n'Greases. Contact him at Boris@LubesnGreases.com.

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Supply Chain

Meets Quality

By Sydney Moore

The lubricant supply chain is both long and complex, and no group is more aware of that than lubricant distributors. Because distributors deal with a wide variety of products with different chemistries, the nature of the job requires them not only to understand the supply chain and how they operate within it but also to ensure product quality maintenance and reliability.

Why is it important to reliably maintain a lubricant in its original state during its long journey from the manufacturer to the customer?

"If the customer has accurately defined application, need and quality expectations, then it is the lubricant in this original state that was paid for; vetted in laboratory, bench and equipment testing; certified, qualified and licensed to meet various industry, original equipment manufacturer and quality standards; and found to work without issue in the application," Michael Roe of MJR Lubricant Distribution Consulting and Auditing said at the Society of Tribologists and Lubrication Engineers Virtual Annual Meeting and Exhibition in May.

To ensure that lubricant integrity is not compromised at any point along the supply chain, companies should have robust quality programs in place. "This is particularly true for lubricant distributors," Roe said, "as they are faced with a complex and daunting supply chain with multiple components."

According to Roe, the supply chain begins and ends with the customer

"There must be proper handling and segregation of lubricant products from each other, from non-lubricant products and from contamination."

— MICHAEL ROE

MJR LUBRICANT DISTRIBUTION CONSULTING AND AUDITING

application. "It starts there because the customer needs a lubricant for a specific purpose," he said. "It truly ends when the lubricant has performed satisfactorily in the application for the life of the lubricant."

However, the line from point A to point B is not often a straight one, and several supplier-customer relationships—like those between manufacturers and distributors or distributors and consumers—help to bridge the gap. "There are a number of different kinds of lubricant products involved" in the supply chain, Roe said. "Many manufacturers and many customers. Primary entities involved in the supply chain are the customer, the manufacturer and various intermediaries—chiefly distributors and transporters."

What's the Problem?

Along with a large number of components in the supply chain comes a higher risk of quality issues. A significant problem facing distributors is the commingling or contamination of products. "There must be proper handling and segregation of lubricant products from each other, from non-lubricant products and from contamination," Roe said. "This ultimately requires dedicated or controlled product handling equipment and proper change of assignment procedures for the products involved."

Product contamination can occur any time the product is handled, Roe said. It is exacerbated by management oversight; inadequate or incorrect equipment, processes and procedures; and inattention. "Internal



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A motor oil sample is tested for viscosity. Viscosity is a vital lubricant property that must be maintained throughout the supply chain.

sources of contamination include inadequate purging, filtration and crossover," Roe said. "External sources include incorrect or missing identification, contaminant ingress through improper storage or handling, lack of training or procedures, tampering, and failure to segregate non-conforming product," he said.

Commingling or contamination of products can lead to changes in physical and chemical properties. "A lubricant's physical and chemical properties must be maintained throughout the supply chain to properly lubricate in the application," Roe said.

For fluid lubricants—like engine oils and hydraulic fluids—the primary physical property that must be maintained is viscosity, while NLGI consistency grade is vital for greases, Roe said. "Distributors should be able to accurately check the viscosity of their products for at least one of the specification temperatures."

Maintaining product chemistry is essential. "For most fluid lubricants, the primary chemical property that must be maintained is the additive content," Roe said. "Additive content is identified by a variety of methods," including spectrometric analysis.

For grease, the integrity of the thickener system must be preserved. "The grease thickener can be affected in such a way—for example, by shear—that the grease lessens in consistency," Roe said. "In rarer cases, the grease may also increase in consistency due to prolonged storage, for example."

Fluid lubricants formulated with different base stocks "should be handled either with dedicated systems or with proper change of assignment on common systems," Roe said.

Greases of a specific thickener type and color should be handled with dedicated systems, too. "Common systems are difficult to purge," Roe said. Greases that are made with the same thickener but that differ in color must also be kept separate to avoid appearance issues.

If different grease thickener types

must be handled together, distributors should perform a compatibility test—such as ASTM D217—beforehand, Roe said.

Because commingling and contamination can compromise the integrity of lubricants, lubricant transfer is an activity of concern for many distributors. "Transfer activities need to occur under a rigid change of assignment method," Roe said. Changing assignment refers to switching from one

product to another during a transfer. Change of assignment methods include dedicating systems, drain drying, flushing, reverse pumping, pigging, air blowing and pushing.

"The best approach is to have dedicated handling systems," Roe said. "Where the ability to dedicate is limited, common systems may be used with products of the same additive chemistry."

Properly naming and identifying

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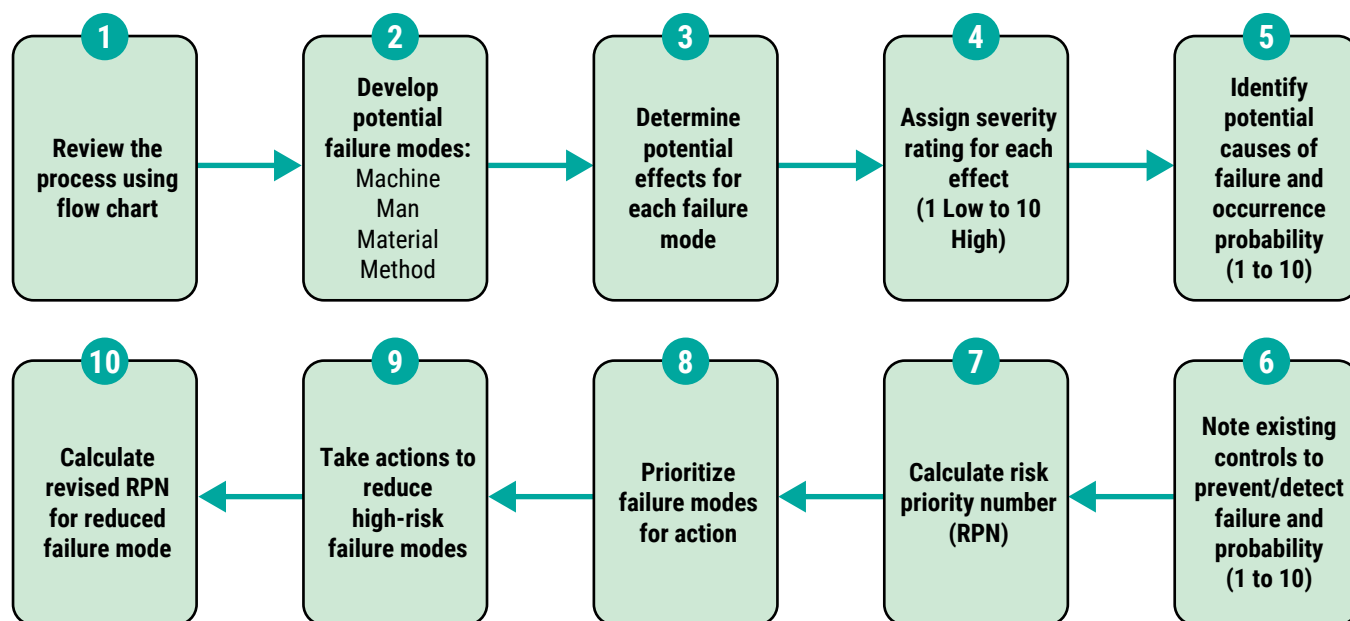


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Developing a What-if Scenario



Source: MJR Lubricant Distribution Consulting and Auditing

products can mitigate issues during lubricant transfer. “Product names can be very complex and similar at the same time,” Roe said. But to ensure proper handling, it is important to know what product is being handled and what its chemical and physical properties are.

Lubricants—especially those with different chemical makeups—must not only be segregated from each other but also from any non-lubricant products. “The typical lubricant distributor will handle a variety of non-lubricant products,” Roe said. “These include ancillary automotive and diesel products: engine coolant, antifreeze, windshield washer fluid, diesel exhaust fluid and brake fluid. They also include fuels—typically gasoline and diesel fuel. All non-lubricant products must be vigorously segregated from lubricants.”

In the same vein, equipment must be adequately purged of any cleaning fluids before a change of assignment is completed. “There are a variety of cleaning fluids available during change of assignment, chief among these being diesel fuel,” Roe said. “Diesel fuel is often used to clean equipment from previous lubricants because of its ability to readily

solubilize most oil- and polyalphaolefin-based lubricants. As such, it is critical to ensure that all the diesel fuel has been removed from the equipment after cleaning.”

Preventive and Detective Controls

“While R&D does a terrific job at formulating products to provide outstanding performance in customer applications,” Roe said, “its efforts would be of little value if effective preventive and detective controls are not in place throughout the supply chain.”

Preventive controls keep errors or irregularities from occurring in the first place, while detective controls find errors or irregularities that have already happened, assure their prompt correction and prevent their occurrence in the future. “The sooner an error is detected,” Roe said, “the sooner it can be prevented from spreading further into the supply chain.”

An example of a preventive control is a matrix chart in which products are arranged in all the possible ways they can be handled in a common system. Each system is identified based on product category, such as industrial gear oil or hydraulic fluid. The prior product is shown across the top of

the matrix, while the product to be handled next is displayed along the left side. “Based on product technical experts and compatibility, the change of assignment method is found where the two products intersect on the matrix,” Roe said.

However, using a matrix for change of assignment is recommended only for fluid lubricants, Roe said. Greases should be handled only with dedicated systems based on thickener type and color.

Documented procedures and records are also essential for maintenance and reliability in the supply chain. “There should be a documented procedure for every critical activity,” Roe said. “Documents and records provide evidence that effective preventive controls are in place and in practice.” They also clarify rules and responsibilities, while reducing the probability of errors resulting in quality incidents.

Procedures should be written, current, comprehensive and readily available to all those who need them to perform their job. Procedure revisions are triggered by new equipment, products, packaging, employee safety issues, customer feedback and quality incidents.

"A lack of, an incomplete, or an unfollowed documented procedure is a leading cause of product quality incidents," Roe said.

Training is also an integral preventive control. "Everyone engages in some kind of training," Roe said. Training must be competent, verified and sustained. "Training cannot be a one-time exercise. It is of little value if it's not being constantly reinforced, maintained and sustained by individuals, supervisors and management."

What-if scenarios are another preventive control. Also known as failure mode effects analysis or risk assessment, what-if scenarios help to identify critical activities and consequences of failure. "A typical what-if scenario is a method of identifying and preventing or mitigating process problems before they occur. The basic idea is to determine all the possible ways something can fail, how bad it can be, all the potential causes and the likelihood of occurrence."

Detective controls—such as quality programs, investigations and audits—are also useful in maintaining the integrity of the supply chain. "The quality incident investigation process is important to immediately address an issue, determine a root cause and take corrective, preventative and sustainable actions," Roe said. "Quality incidents, especially if repeated or not handled immediately, can lead to strained customer relationships."

Similarly, quality audits are essential to ensure that equipment, training and procedures are in place to satisfactorily handle lubricant products. Audits often lead to efficiency improvements, while detecting and preventing potential quality incidents. Roe suggested that audits should be conducted by someone as independent as possible from the process being audited. However, the auditor should have a basic knowledge of the process.

The steps of a quality audit process include initiating and preparing the audit, reviewing related documents, conducting the audit, reporting audit

results, and following up on those results.

Another detective control is sampling, testing and retaining, also known as ST&R. This should be in place for all critical activities, Roe said. "Employees need to be trained on ST&R, particularly in how to take samples and evaluate test results—whether a test is a pass or fail," he

said. Samples that are taken must be representative and non-invasive so as not to introduce contaminants. ♦



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SOLVING SUBPAR SURFACE FINISH



By Sydney Moore

Editor's Note: The terms metalworking fluid and metal removal fluid are used synonymously throughout this story.

Metalworking fluids play an important role in achieving the desired surface finish of metal workpieces, but "at some point, there are going to be some problems. Things aren't going to work as well as they should," Patrick Brutto of Faith-Full MWF Consulting said in a webinar hosted by the Society of Tribologists and Lubrication Engineers in March.

Because things inevitably go wrong from time to time, fluid formulators and end users alike are tasked with troubleshooting issues with surface finish. While the metalworking fluid often gets blamed for problems, "very often it's not the fault of the fluid," Brutto said. "There are other things; it could be the way the machining operation is being done."

Brutto listed factors that may cause issues with surface finish, as well as possible solutions for those problems. "The remedies that I'm suggesting are not going to solve every problem," he said, "but they are things to think about."

Problems and Solutions

One reason for inadequate surface finish could be that the metalworking fluid formulation is inadequate for the application. As the name suggests, water-dilutable metalworking fluids must be diluted with water before use. "Fluid formulators will make a concentrate and then sell that to whoever is going to use the fluid," Brutto said. "Then the end user will take that fluid and dilute it as specified by the fluid supplier—typically 5%-10% concentrate to 90%-95% water."

Because end users are generally

responsible for diluting the fluid, it is important to ensure that the fluids are being diluted in the correct proportions. "The best fluid is not going to work properly if it's not being diluted the way the fluid manufacturer is recommending," Brutto said. "It is surprising how much the dilution concentration can vary if the end user is not monitoring it. It's so simple to monitor concentration and yet inadequate monitoring is one of the main reasons these systems do not perform consistently."

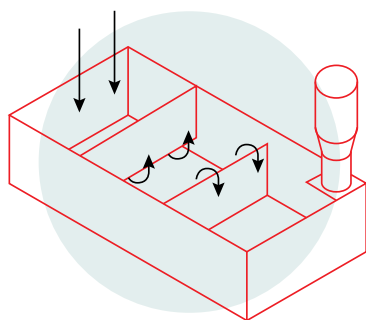
The types and amounts of additives in a formulation are also vital to good surface finish. "Let's say there are corrosion issues affecting the workpiece," Brutto said. "Why is that? It could be that the formulation doesn't have enough corrosion-inhibiting additives to help prevent corrosion or staining on a particular alloy."

How can this problem be solved? Brutto suggested adding higher molecular weight petroleum sulfonates or synthetic sulfonates in emulsion systems, as they tend to provide better iron and steel corrosion control than those with lower molecular weights.

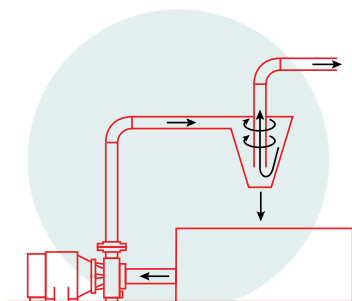
Introducing triazoles to the system may also alleviate corrosion and staining of copper alloys. "That's a very effective metal deactivator," Brutto said. For aluminum alloys, phosphate esters can often reduce staining.

Additives affect not only corrosion and staining of workpieces, but also lubrication. "You may be using one of the classic chlorinated, sulfurized or phosphorous-based additives," Brutto said, "but it could be that they're not being activated sufficiently due to different activation temperatures."

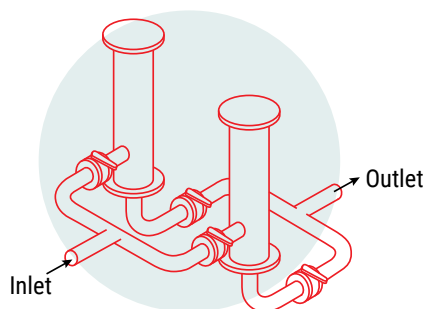
Filtration Systems



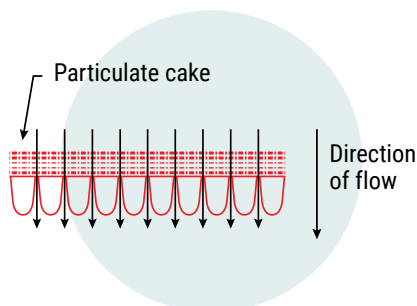
Setting tank



Hydrocyclone system



Cartridge filter system



Wedge wire screen

For instance, sulfurized additives are activated at higher temperatures. To achieve these high temperatures, it is important to evaluate whether the machining process is severe enough. Other variables may need to be adjusted as well. "You may actually have to increase the severity, for example the cutting speed, to activate these materials," Brutto said.

The addition of non-extreme pressure additives, like fatty acids and esters, may also help to bridge the lubricity gap.

Surface finish can be adversely affected when the chemistry of the metalworking fluid has been degraded by microorganisms. "Microbes generally are not helpful to metalworking fluids," Brutto said. "If the bacteria in the system are above 100,000 colony forming units per milliliter and/or the fungi are above 1,000 CFU/mL—especially if it's been going on for several weeks—some of the fluid components will have been degraded."

One solution for this is to dump the fluid, clean the system thoroughly and replace with fresh fluid. However, "choosing to dump the system should be a decision between the fluid supplier and the end user," Brutto said. "I'm not saying absolutely dump the fluid, but the system has probably been compromised to some extent, and there's some action that's needed or it is going to get to the point of no return."

Sometimes the health of the fluid can be recovered without dumping the whole system. To do so might require partly dumping the system and refilling with freshly diluted fluid and/or adding a tank-side biocide. But many end users try to avoid adding tank-side biocides if they can. "If you've made too many tank-side additions," Brutto said, "you may have that biocide accumulating to a level

where it could create health, safety and even corrosion issues."

Additionally, Brutto emphasized the importance of end users consulting with the fluid manufacturer to ensure that the tank-side biocide is compatible with the fluid and that the correct dosage is being used.

In any case, "monitoring is the key thing," Brutto said. "You don't want to get to the point where you have to start looking at dumping the system or even adding a tank-side biocide. Monitor, monitor, monitor."

If the fluid is being adequately monitored and maintained but microorganism growth persists, the formulation may need to be modified. "If all other things have been looked at and this fluid is just dying rapidly no matter how well you maintain it, then it could be it's just not the right fluid," Brutto said. "A different biocide may be needed, or a reduction of the bio-supportive ingredients could be necessary. You may also consider including more bio-resistant additives in the formulation, like certain amines, branched organic acids and synthetic esters."

Because water-dilutable metalworking fluids require water, poor water quality may also affect surface finish. "Water is by far the biggest component in a water-diluted metalworking fluid at the end use," Brutto said. "If the water quality is really bad, it's not going to have a good effect on the performance or longevity of that fluid."

What's more, water quality can vary tremendously, Brutto said. "It can introduce microorganisms, for example, and probably very often will."

Fluid suppliers generally have little to no control over the quality of the water that is used to dilute their fluids, but "you've got to work with what the end users have available," Brutto said. "You've got to also understand

"Higher speeds and feeds may be needed to activate certain extreme pressure additives to maximize lubrication."

— PAT BRUTTO
FAITH-FULL MWF CONSULTING

that representative water needs to be used in your testing when you're developing that fluid or trying to understand if the fluid is suitable for a given application and customer. What if the chloride content of the dilution water is above 50 parts per million, the sulfate is above 100 ppm, the conductivity is consistently above 500 microsiemens per centimeter, and/or the microbial concentration is high? You need to know how your fluid is going to perform with that water."

One way to sidestep poor water quality is to pretreat the water. "If pretreatment can be done, it should be," Brutto said. Pretreatment can include water softening, deionization, reverse osmosis or a combination of those things. Water softening removes only divalent cations, while deionization and reverse osmosis remove mono- and divalent cations as well as corrosive anions. Reverse osmosis can also remove some microbial contaminants.

However, the use of top-quality water does have one downside. "If the water has low total concentrations of divalent cations—say less than 50 ppm—you may have more foaming issues," Brutto said. "That's one reason for trying to understand how your fluid is going to perform with the water that's available" to the end user.

Surface finish can be negatively affected if multiple metals are being machined using the same fluid. The mixing of dissimilar metals can cause what is known as bimetallic or galvanic corrosion on workpiece, tool and machine surfaces. "That is contact

between metals having different electrochemical potentials," Brutto said. "All that means is if you stick two or more dissimilar metals together in a wet environment, electrons are going to flow, causing corrosion of the metals, which are losing electrons."

In situations in which the end user wants to machine several different types of metals using the same fluid, "increasing the fluid concentration possibly could help," Brutto said.

"If you're getting bad surface finish in that situation, maybe the filtration system is not properly sized for what it's being asked to do," he said. "Maybe it's dirty and needs to be cleaned. It could be a lot of things."

Brutto added, "It's also important to understand other factors that may have nothing to do with the metalworking fluid but could have a big impact on fluid performance." One of those factors is tool choice.

Metalworking fluid manufacturers may not always be primarily concerned with tool choice because it is outside of their control. However, Brutto explained that "the tool type and the geometry that's being used need to be properly selected. If you're a fluid supplier, you may not know much about tools. This is where communicating with knowledgeable machine operators and tool suppliers is important. Maybe there is a better tool for that operation, because the best fluid may fail if the wrong tool is being used."

Much like tool choice, machining variables may not be top of mind for a lot of fluid suppliers. However, in diagnosing potential issues with met-

alworking fluids, it may behoove the fluid field representative to ask questions about feed rate, speed, depth of cut and other factors to determine whether the fluid is malfunctioning or if the machining variables have not been optimized to meet surface finish requirements.

"Higher speeds and feeds may be needed to activate certain extreme pressure additives to maximize lubrication," Brutto said. "In some cases, that may help to correct the issue."

Another solution could be to ensure that the fluid is being applied to the proper location at the tool-workpiece interface. "Depending on whether you're trying to maximize lubrication or maximize cooling," Brutto said, "the place where that fluid is being directed and also the recirculation speed and so forth are factors as well."

Lastly, it is important to ensure that the fluid has not been contaminated by other fluids in the system. Hydraulic fluids, slideway lubricants, spindle oils and cleaners can leak into the metalworking fluid. "This is obviously something that can have an impact," Brutto said.

"If you're getting contamination or suspect contamination, this is something you need to really look at," he said. "You need to figure out how to stop it. If you can't stop it, how can you minimize it? Maybe you need to actually dump the system because you just can't get that stuff out. Once it's in there, there's no easy way of removing it." ♦



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10%

Plastics recycled
in the U.S.

By Will Beverina

THE SEARCH FOR PACKAGE RECYCLING SOLUTIONS

What becomes of that empty bottle of motor oil after it has been emptied? In the United States, chances are it will find its way into a landfill. The country lacks the infrastructure to properly dispose of the plastic containers and recycle them. A coalition of leading lube manufacturers and packaging companies aims to change that.

Plastic recycling is a growing industry, and high-density polyethylene—used to make lubricant containers—is among the more commonly recycled plastics. HDPE is a thermoplastic polymer also used in milk jugs and water bottles because of its strength and ability to withstand higher temperatures.

But used lube bottles present a singular challenge: they contain residual oil that can affect the recycling process and make empty containers less valuable. This has made recycling of the containers virtually nonexistent. The majority of used lubricant containers end up in landfills.

As a non-biodegradable material, plastic poses numerous threats to the environment and wildlife. Plastic that enters waterways or oceans can harm marine life through entanglement, ingestion or exposure to chemicals in the plastic. On land, chemicals can seep into the soil or groundwater. Oil also presents dangers on its own, whether it is ingested by animals, finds its way into the soil or seeps into water sources.

These are among the challenges facing the newly formed National Lubricant Container Recycling Coalition, which has a goal of establishing a program that reuses and recycles lubricant containers. The coalition's five founding members are



lube blenders Castrol, Valvoline and Pennzoil-Quaker State and packaging companies Graham Packaging and Plastipak Packaging.

Heading the coalition is Tristan Steichen of ALO Advisors, an environmental consultancy based in Bradenton, Florida. Steichen has worked in sustainability consulting for nearly 30 years.

While the group announced its formation in March, it has been over a year in the making. One of the packaging members of the coalition, which already had a working relationship with ALO Advisors, asked the consultancy about facilitating a summit on lube container recycling. A meeting with companies—including the founding members—ended in an agreement that a coalition should be formed. “Quite frankly I think this thing would have gotten off the ground last year if not for the pandemic,” Steichen said.

Steichen acts as a project manager of sorts for the coalition. “The role changes over time based on what we’re focusing on,” he told *Lubes’n’Greases*. “In the beginning, what we’ve been trying to do is define what this space is and who the players are.” Other tasks have included developing a website and defining what the coalition is trying to accomplish.

On a technical level, the coalition is searching for tangible solutions to the lack of lube container recycling. It wants to develop pilot projects, and to do that it must figure out who might be involved in implementing those projects, what the industry looks like and what legislative issues are influencing this issue. “We need

to look at that and understand what our position is and how we’re going to do that,” Steichen said. “I’m guiding that process and connecting with all the members during that process.”

The coalition meets every two to three weeks and is divided into three main groups. The governance board consists of a representative from each participating company and makes decisions for the coalition. A technical working group is involved with developing pilot projects and understanding the marketplace, the stakeholders and the value chain. A communications group is tasked with drafting press releases, creating content and managing social media channels. Different employees from each company work in different groups.

“We’ve structured ourselves so as we grow and get into more technical spaces we might have to draw on different resources within the companies, or if necessary outside of the membership for expertise on, say, a research project,” Steichen said. “It gives us flexibility over time to draw upon what we need to.”

The coalition also hopes for more collaboration with such organizations as the Petroleum Packaging Council, an association that provides support for lube packagers and brands. “The PPC hasn’t been able to meet in over a year,” said Kevin Whitehead, vice president of the PPC’s executive board and category manager for industrial and automotive products for Plastipak. The PPC Fall Meeting in August “will be the first chance we have to collaborate with the coalition face to face,” he said.

The research done in the early stages of the coalition’s existence suggests a difficult task ahead. The NLCRC estimates that 4.5 million tons of lube containers are purchased in the U.S. every year, and Steichen believes “not much, if any” is recycled. Some recyclers may have a relationship with a packaging company, he continued, and it is not for used containers, but rather a pallet of containers that may have been damaged before they were sold.

“The industry has been working on this issue for years and not making a lot of headway,” said Whitehead, who is also a member of the NLCRC’s governance board and works with the coalition’s technical and communications groups.

On a state and federal level, no programs are in place to handle these containers. California has a detailed waste oil collection program, but even that instructs users to throw away the container.

“We haven’t come across any situation where containers are being recycled,” Steichen said. “The quantities are very small. It’s not happening on a commercial level or a mass level.”

That makes collection the first and perhaps most important step in any program. As Steichen put it: “If you’re trying to collect a material like this and process it, you can’t do it in dribs and drabs. You need to create a significant amount of supply.” A recycler will not invest in a program if it is unable to collect a certain amount of supply. “It’s one of the reasons we struggle recycling anything in the U.S.,” he said.

The current recycling infrastructure simply rejects used lubricant containers, Steichen said. HDPE bottles that held oil do not conform to current standards, meaning they cannot be processed and will end up in a landfill. “The big issue is collection,” he said. “It’s not known what consumers do right now post-use, both commercially and residentially. We know some of them throw it into municipal

Continued on Page 38

\$14.5 million

U.S. Department of Energy’s investment for research and development to cut waste and reduce the energy used to recycle single-use plastics



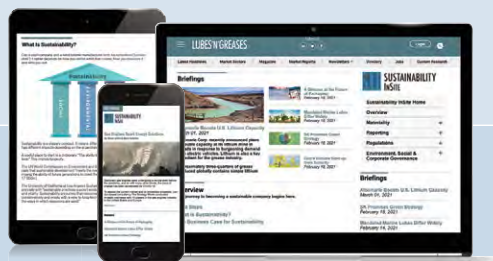
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"We hope some of these other oil companies—not just large ones but even the smaller regional ones—will see the importance in the recycling of oil bottles and want to participate."

— KEVIN WHITEHEAD
PLASTIPAK

Continued from Page 36

waste or the dumpster or put it into their recycling bin and don't realize it's not being processed anyway."

To help tackle the issue, research devoted to the economics and logistics of collection is needed. That includes determining what the collection points are, whether they be retail facilities, municipal recycling facilities, quick lube shops or all of them. Then entities willing to pick up containers and transport them to recyclers must be found.

"There's an entire collection and transportation infrastructure that needs to be put in place," Steichen said. "Municipal or private infrastructure can't pick up petroleum-impacted waste because there's contamination and Department of Transportation requirements." He pointed to other entities, like rerefiners, that could help in collecting lube containers. "They're already picking up oil and filters, maybe a natural addition would be to pick up the containers with it," he said. "There's an association that deals with agriculturally impacted containers, too."

Whitehead noted that in Michigan recycling products like soda bottles is "second nature." He said, "You take your beverage bottles back to the store, put it in the machine, collect the deposit, and then those materials are sent to recyclers." He suggests that the NLCRC can help make something similar a more widespread practice for consumers and recyclers of lube containers.

There are two recycling processes to consider: mechanical recycling and chemical recycling. The latter method, Steichen said, has less of

an issue dealing with containers that have residual oil in them because it converts the plastic into a monomer.

Mechanical recycling, on the other hand, differs. "You have to come up with solutions that clean the oil off of the plastic to an acceptable level for reuse for mechanical recycling," Steichen said. During this process, materials are melted down, run through an extruder and then mixed with other plastics.

That process, Steichen said, is being used for empty lube containers in parts of Canada. The recycled plastic is used in pallets and post-construction material, like piping.

Steichen said the coalition was not limiting itself yet to trying to reuse the plastic for more lubricant containers. "What we're trying to figure out is how much residual oil is okay for different types of applications," he said. "Maybe there's a bit of residual oil in the plastic through mechanical recycling which is perfectly acceptable for making it back into an oil bottle, or making it into a five-gallon pail, or making it into corrugated piping. But for other uses you have to use chemicals because you have to get it back to its base. The end use influences the kind of recycling you're going to do."

Even the color of used lube containers can present a problem. There is a market for recycled HDPE, which currently hovers around one dollar per pound, though the numbers are constantly fluctuating. But it is easier to recycle a clear milk jug than a motor oil bottle pigmented with brand colors, like Castrol's green bottles or Pennzoil's yellow ones. Clear HDPE can be turned into any color, giving

manufacturers more flexibility.

"Color in a recycled market is everything," Steichen said. "That's not just in packaging. That happens with non-plastic material like metal, too. Color becomes a problem post-recycling, though there are some technologies to deal with that."

To accomplish its goals, Steichen and Whitehead agreed, the coalition needs more members. "We hope some of these other oil companies—not just large ones but even the smaller regional ones—will see the importance in the recycling of oil bottles and want to participate," Whitehead said. Steichen added that some companies have taken notice of the group and have been in touch about membership.

"I think if you ask any company in the PPC or any companies dealing with retailers, they'll tell you this issue is important," Whitehead said. "I don't see how these companies can't join the NLCRC and have the aspirations that they do for recycling. Joining can help us find solutions quicker."

The coalition has already put together pilot projects that will go to its governance board for approval. Namely, there are two comprehensive lubricant container recycling processes that have been drawn up. These projects involve 100 or so locations in a few different markets with different geographies and political environments. They cover collections, customer engagement, transportation of materials to a recycling location, processing the material and delivering it for secondary use. There is also a small research project.

If these are approved, Steichen plans to present them in August at the PPC's Fall Meeting in Lake Tahoe, California. ♦



WILL BEVERINA

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Product News

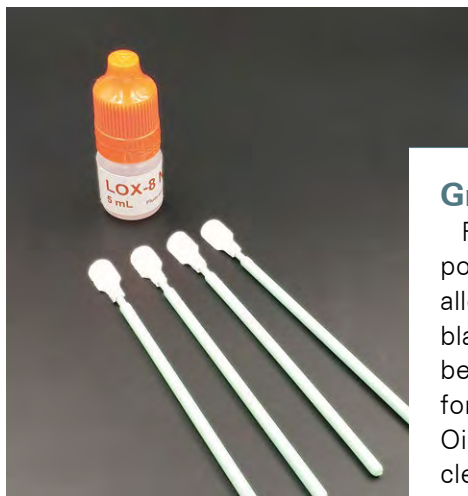
A Big Oil for Small Engines

Amsoil rolled out its 15W-50 Synthetic Small-Engine Oil, which is formulated to provide good shear stability as well as high film strength and excellent wear protection. It also provides a thick lubricating film that does not thin out due to mechanical shear, resulting in a durable barrier that protects against metal-to-metal contact. It can be used in small engines found in zero-turn, riding, stand-on and push mowers; generators; power washers; and other equipment. It offers protection for up to 200 hours in use. www.amsoil.com



Extended Engine Protection

Valvoline has introduced Valvoline Full Synthetic Extended Protection to the market. The new engine oil maximizes engine performance by minimizing sludge and deposits while also withstanding extreme heat. The oil also meets the API SP classification and is licensed under dexos 1 Gen 2. It is enhanced with a robust additive package that provides additional detergency, thermal stability and turbocharger protection, says Valvoline. The oil also protects against low-speed pre-ignition. www.valvoline.com



EAL Grease

Hycal 762 EPEF is an environmentally acceptable grease that has been developed for applications characterized by heavy loads as well as wet and corrosive conditions where adhesion and water resistance are of high importance. In spite of its high base oil viscosity, the new grease can be used in centralized lubricating systems, even at low temperatures. It can be used as a universal lubricant in the forestry, agriculture, construction vehicle, and marine vessel sectors, says maker Axel Christiernsson. The grease is Ecolabel and SS155470 certified as well as 2013 VGP compliant. www.axelch.com

Better Base Oils

Neste's Nexbase 4+ is the latest addition to Neste's Nexbase Group III base oil portfolio. It can replace fossil-based Group III+ base oils and polyalphaolefins in low-viscosity, low-volatility engine oils. According to Neste, Nexbase 4+ contributes to finished formulations that help to improve fuel efficiency, lower emissions, and increase machine durability and wear prevention. Over 60% of the molecules in Nexbase 4+ are manufactured from renewable raw materials, and it has a lower lifecycle carbon footprint compared to fossil-based base oil products. The new base stock was created in collaboration with Novvi LLC and is available worldwide. www.neste.com

Green Light for Black Light Inspections

Fluoramics Inc. has released LOX-8 NF Oil, which is a low-viscosity, inert polychlorotrifluoroethylene lubricant. The new oil is oxygen compatible, allows for lubrication of critically clean surfaces and will not fluoresce during black light inspections. LOX-8 NF Oil can be used on O-rings, seals and rubber gaskets. It can also be used in the maintenance of gas supplies and filters for laser systems, as well as to prevent galling in mating surfaces. LOX-8 NF Oil Kits contain 5 milliliters of oil and four microfiber swabs suitable for use in clean rooms. www.fluoramics.com

Places'n'Faces



Vertex Energy's Heartland rerefinery in Columbus, Ohio. The rerefinery is among the assets Clean Harbors will acquire from Vertex as part of a \$140 million deal.

Clean Harbors Pays Cash

Clean Harbors will pay \$140 million in cash to acquire Vertex Energy's Heartland base oil rerefinery in Ohio, a second rerefinery in Louisiana and its used oil collections businesses. The acquisition is expected to close in the third quarter.

The Heartland rerefinery in Columbus has capacity to make 55,000 metric tons per year of API Group II base oils and can process up to 20 million gallons per year of waste oil. Clean Harbors, based in Norwell, Massachusetts, will also acquire a rerefinery in Marrero, Louisiana, that can process up to 69 million g/y of waste oil and produces vacuum gas oil.

The deal includes Vertex's H&H

and Heartland used oil collections business and 17 service branches throughout the Midwest and U.S. Gulf Coast regions, supported by about 200 employees and a fleet of collection vehicles. Other assets that will be acquired include the Cedar Marine terminal in Baytown, Texas, and the Nickco oil filters and absorbent materials recycling facility in East Texas.

S-Oil Ties Up with Motiva

Motiva Enterprises announced an agreement to market, sell and distribute in North America API Group III base stocks supplied from South Korea by S-Oil Corp.

The deal increases the level of

cooperation between affiliates of Saudi Aramco, the parent company of Motiva and majority owner of S-Oil. It also constitutes a significant realignment of the North American Group III market as S-Oil's products have been distributed by Phillips 66.

Saudi Aramco has been gradually increasing its coordination of base oil assets since 2019 when it brought them together under the Aramco Base Oils Global Alliance in 2019. The state-owned Saudi oil giant owns 63.4% of S-Oil and 70% of Saudi refiner Luberef.

"The agreement solidifies Motiva as the face of Aramco base oils sales in the Americas, advancing a brand strategy that all Aramco-produced

Photo courtesy of Vertex Energy

base oils are marketed exclusively by affiliates,” Motiva Base Oils Director Colleen Murphy-Smith said. “The deal enhances Motiva’s existing product portfolio and allows us to offer our customers even greater value.”

S-Oil is one of the world’s largest merchant suppliers of Group II and III oils and has been one of the largest Group III exporters to the U.S., along with SK Lubricants, Royal Dutch Shell and HollyFrontier. Motiva declined to specify the volume of Group III that S-Oil supplies to the U.S., saying only that it exceeds the amount made at Port Arthur.

Motiva said it will continue making Group III in Port Arthur even after it starts to market Group III from South Korea. The Group III products made by the locations have different specifications but are both marketed under the aramcoUltra brand name.

Sanctions Hit Belarusian Base Oils

Belarus’ base oils effectively stopped flowing to the West after the European Union imposed sanctions against the country. The EU was retaliating for the country’s ongoing crackdown on protesters and critics, as well as the forced landing of a Ryanair flight in Minsk in May.

The new targeted economic sanctions include prohibition of trade in petroleum products and such exports as potassium chloride. The EU also restricted the country’s access to European capital markets, according to the European Council’s June 24 news release.

Similar sanctions imposed by the United States took effect on June 3, after the Department of the Treasury’s Office of Foreign Assets Control reactivated on April 19 longstanding sanctions against nine Belarus companies and their subsidiaries.

OFAC provided a 45-day wind-down period for activities with those entities that expired on June 3.

The companies impacted by the U.S. sanctions include Belarusian Oil Trade House, Belneftekhim and Naftan. State-owned Naftan operates a refinery in Novopolotsk, with capacity to produce 198,000 tons per year of API Group I base oils and 6,000 t/y of Group III base oil. Because of the EU sanctions, the refinery cannot ship its finished products to European consumers.

All Together Now

Saudi Arabia’s main business association formed a committee to promote reforms for the nation’s finished lubricant and base oil markets.

The Federation of Saudi Chambers of commerce announced June 22 that it had formed the National Committee for Lubricants and Base Oils, which held its inaugural meeting on the same day in Jeddah, according to several local news organizations.

Chairman Samir Nawar said the committee hopes to increase sales volumes for legitimate suppliers by as much as 20% by discouraging use of fraudulent lubricants.

The federation is an umbrella organization of regional chambers of commerce and committees representing specific sectors of the Saudi economy. The lubricants and base oils committee was created at the request of numerous businesses.

It is charged with a number of tasks, including reducing dependence on imports, raising the quality of products on the market, enhancing consumer understanding of lubes and recognition of products made domestically and boosting capacity of domestic blend plants. Officials said the group will also promote recycling of used lubricants.

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PLACES'N'FACES

It's Getting Hot in Here

A fire occurred June 17 at Infineum's lubricant additives manufacturing plant in Cologne, Germany. No one was injured, but the company said that it is still assessing damage from the incident. Infineum said the incident stemmed from a leak of hydrocarbon feedstock in the northern section of the facility.

The local fire brigade, assisted by Infineum firefighters, worked for some hours to control the incident. No injuries were reported, and

Infineum said there was no impact on neighboring residents.

In a written statement, the company said that it was still assessing the impact on plant operations. It did not say whether the facility was running or if any operations have been halted.

This fire occurred just three days after a massive fire at Chemtool's grease plant in Rockton, Illinois. The company declared the plant a total loss. The cause of the fire has not yet been determined.

Briefly Noted

Chevron Marine Lubricants announced June 15 that it will boost its presence in African ports after extending its joint venture with Casablanca, Morocco-based **Akwa Group**. Chevron is now an equal partner in **Afrikaia Lubrifiants**.

Russian oil major **Lukoil** increased production at its standalone lubricant blending plants by 17% to 161,000 metric tons in 2020. The company attributed the increase to its new plant in Kazakhstan.

GP Global has tabled plans to build a lubricant blending plant in Saranda, India, because of economic uncertainties stemming from the COVID-19 pandemic.

Ampol has formally commenced production and supply of Mobil lubricants at its lubricant manufacturing facility in Queensland, in northeastern Australia.

Idemitsu Kosan's U.S. subsidiary will establish a new lubricant distribution hub in Jeffersonville, Indiana. The site was chosen for its proximity to Idemitsu's manufacturing plant.

Faces in the News

Savita Oil Technologies Ltd. appointed **Vishal Sood** president of its lubricant division, succeeding division CEO **Sunil Aima**, who retired on June 18.

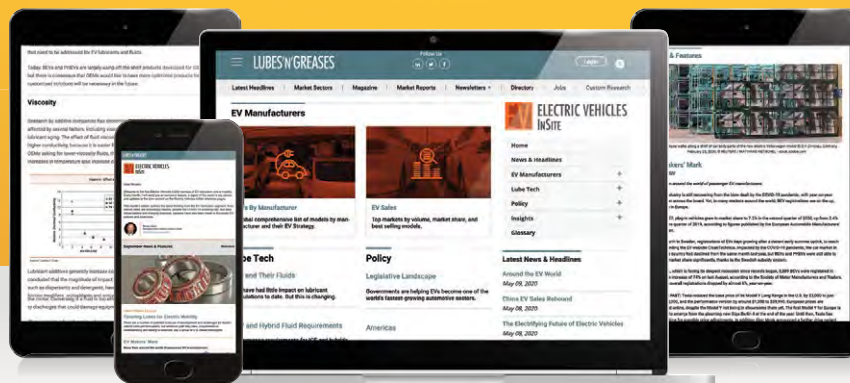
Italy's National Consortium for the Management, Collection and Treatment of Used Mineral Oils, known as Conou, elected **Riccardo Piunti** as its new president and **Massimo Ravagli** as its vice president.

ExxonMobil named **Bonnie Eckhart** as Port Allen Cluster manager, midstream, lubricants operations Americas for ExxonMobil Refining & Supply Co. Eckhart succeeds **Scott Gleason**, who was named Americas Lubricants operations support manager at the ExxonMobil Houston campus. ♦



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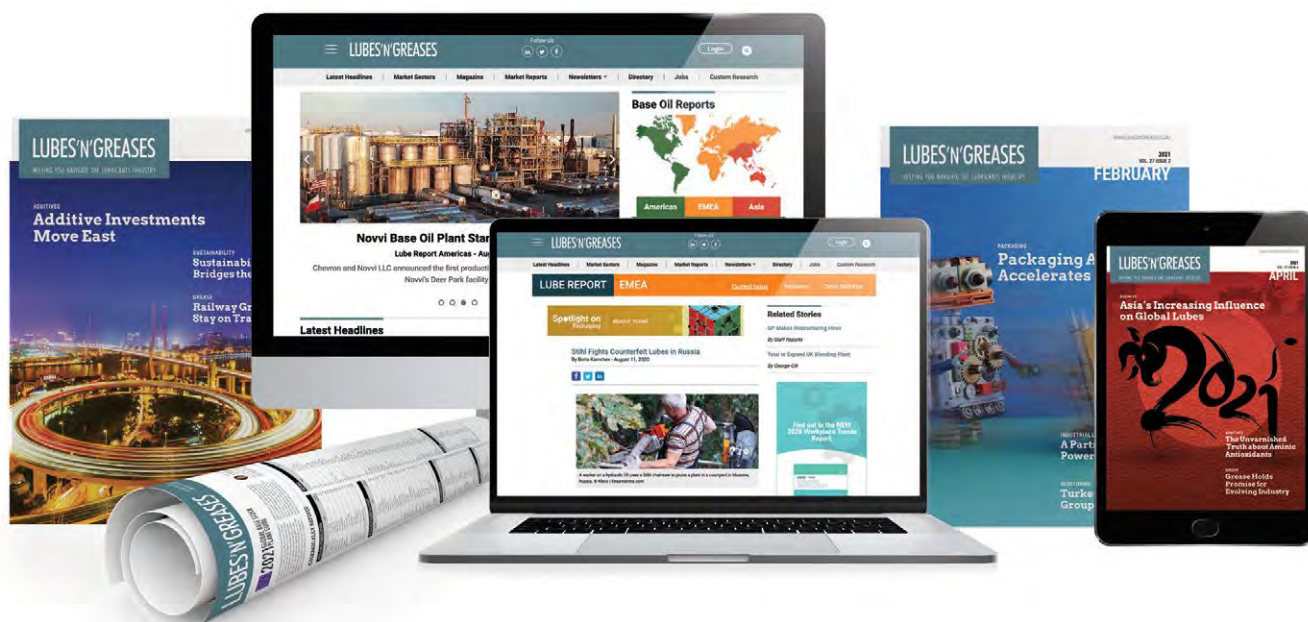
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