PFAS RISK MANAGEMENT GUIDE

JULY 2026

INDEPENDENT LUBRICANT MANUFACTURERS ASSOCIATION

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INTRODUCTION

This PFAS Risk Management Guide is a component of ILMA's comprehensive PFAS Risk Management Program, developed to equip member companies with the practical knowledge and tools needed to navigate PFAS challenges. The Program reflects ILMA's commitment to serving as a resource for the lubricant manufacturing industry on emerging regulatory issues and includes access to specialized consulting services through partnerships with industry experts — including environmental and regulatory consulting through August Mack Environmental and fire suppression system assessments through ASK Distribution Consulting, LLC/The Vertex Companies, LLC.

This Guide is intended as a practical reference for ILMA member companies seeking to build familiarity with the PFAS regulatory landscape and tools for assessing and managing risk. It does not constitute legal advice, and members are encouraged to consult qualified legal and technical counsel regarding their specific circumstances.

ACKNOWLEDGMENTS

This Guide was developed under the direction of ILMA's Safety, Health, Environment and Regulatory Affairs (SHERA) Committee — the standing committee within ILMA responsible for monitoring and addressing regulatory matters affecting the lubricant manufacturing industry.

Recognizing the growing significance of PFAS as a compliance and liability issue for ILMA's membership, the SHERA Committee established a dedicated Task Force to oversee the development of this Guide, drawing on the expertise of member company representatives with diverse backgrounds across formulation, business development, and regulatory affairs. ILMA gratefully acknowledges the following member companies whose representatives contributed to the Task Force and provided invaluable input throughout the development of this Guide:

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August Mack Environmental

The Vertex Companies, LLC

ASK Distribution Consulting, LLC (Alliance for Chemical Distribution)

American Chemistry Council, Petroleum Additives Panel

Society of Tribologists and Lubrication Engineers

Their contributions informed and strengthened the final document; however, participation in the review process does not constitute an endorsement of the Guide's contents by any contributing or reviewing organization, and the views expressed herein remain those of ILMA subject to the disclaimers set forth in this Guide.

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Section 1: PFAS Background

Per- and polyfluoroalkyl substances (PFAS) comprise a large and diverse class of synthetic, fluorinated organic chemicals that have been used in commercial, industrial, and consumer applications since the mid-20th century. Their distinctive physicochemical properties—including exceptional thermal stability, hydrophobicity, and oleophobicity—have enabled widespread use across sectors such as firefighting, aerospace, automotive manufacturing, semiconductors, textiles, and consumer packaging, where durability and performance are critical. At the same time, these same properties contribute to their environmental persistence and potential for bioaccumulation. In addition, certain PFAS have been associated with adverse toxicological effects, prompting increasing regulatory scrutiny worldwide.

Certain subsets of PFAS have been explored for lubricant applications because of their ability to perform under demanding mechanical and thermal conditions. Their resistance to oil and water, combined with stability at elevated temperatures, has made these substances useful in minimizing friction and material degradation in various engineered systems. A prominent example is polytetrafluoroethylene (PTFE), which has been incorporated into surface treatments and lubricant formulations due to its friction-reducing behavior, tolerance for high operating temperatures, and chemical inertness. Within automotive and industrial applications, some PFAS have been incorporated into engine oils and hydraulic fluids to support functions such as wear protection, corrosion inhibition, and foam control.

> **For an in-depth account of the role of PFAS in tribological applications, consult the following resources:**
>
> OECD, Per-and Polyfluoroalkyl Substances (PFAS) and alternatives in hydraulic oils and lubricants: Report on commercial availability and current uses, OECD Series on Risk Management of Chemicals (2025).
>
> Darrius Dias et al., Forever Chemicals, Per-and Polyfluoroalkyl Substances (PFAS), in Lubrication (2024).

a. Physiochemical properties of PFAS

The class is challenging to define exhaustively. However, PFAS are generally understood to share a defining structural feature: the presence of at least one fully fluorinated carbon atom (–CF_2– or –CF_3–), most commonly arranged within linear or branched aliphatic chains. The carbon–fluorine (C–F) bond is among the strongest in organic chemistry, and this exceptional bond strength underlies many of the physicochemical properties that distinguish PFAS from other synthetic organic compounds.

PFAS are commonly categorized into **polymeric** and **non-polymeric** substances. Polymeric PFAS consist of large macromolecules formed by repeating fluorinated subunits and include materials such as fluoropolymers, perfluoropolyethers, and side-chain fluorinated polymers. These substances are typically solid, have high molecular weights, and are generally considered less bioavailable due to their size and limited mobility. In contrast, non-polymeric PFAS are lower–molecular weight compounds with shorter chain lengths, generally containing between two and fourteen carbon atoms, and include many substances of regulatory focus such as perfluoroalkyl acids (PFAAs), fluorotelomer alcohols, and related precursors.

Within the non-polymeric category, PFAS are often further distinguished as **long-chain** or **short-chain** based on carbon-chain length and functional group. Long-chain PFAS include perfluoroalkyl carboxylic acids with seven or more carbons (e.g., PFOA) and perfluoroalkane sulfonic acids with six or more carbons (e.g., PFOS) (Buck et al. 2011; other sources may use slightly different definitions). Long-chain PFAS are typically more bioaccumulative, exhibit longer biological half-lives, and have been associated with a greater degree of environmental persistence and toxicity. Short-chain PFAS—generally defined as perfluoroalkyl carboxylic acids with fewer than eight carbons and sulfonic acids with fewer than six carbons—were developed in part as alternatives to long-chain PFAS. While short-chain PFAS tend to be less bioaccumulative, they are often more mobile in the environment and can be more difficult to remove from water, raising distinct exposure and management concerns.

The defining physicochemical properties of different types of PFAS—particularly their thermal and chemical stability, hydrophobicity and oleophobicity, surface activity, and resistance to degradation—directly influence their environmental fate, transport, and functional utility.

Thermal and Chemical Stability

The high bond dissociation energy of the C–F bond imparts exceptional resistance to hydrolysis, photolysis, oxidation, reduction, and biological metabolism. As a result, many PFAS—particularly perfluoroalkyl acids (PFAAs) such as PFOA and PFOS—are highly resistant to environmental degradation and can persist for decades or longer.

Hydrophobicity and Oleophobicity

Fluorinated alkyl chains repel both water and oils, enabling the formation of surfaces with non-wetting, stain-resistant, or lubricating characteristics. These properties have driven the widespread use of PFAS in coatings, treatments, and surfactant applications.

Surface Activity

Many PFAS function as highly effective surfactants, capable of achieving exceptionally low surface tension. This characteristic underlies their use in aqueous film-forming foams (AFFF) for firefighting, as well as in industrial processes requiring emulsification, dispersion, or enhanced wetting.

Volatility and Environmental Partitioning

PFAS exhibit a wide range of environmental behaviors. Long-chain PFAAs are generally non-volatile, water-soluble anions that persist in aquatic environments and may bioaccumulate. In contrast, certain volatile PFAS precursors—such as fluorotelomer alcohols (FTOHs)—can undergo long-range atmospheric transport and oxidative transformation, ultimately yielding persistent PFAAs.

b. Environmental and Public Health Risks

The environmental and health concerns associated with PFAS arise directly from their physicochemical properties, which influence how these substances persist, move through environmental media, accumulate in living organisms, and interact with biological systems. While these characteristics have enabled valuable commercial and industrial applications, they also underpin the challenges associated with managing PFAS releases and exposures. The following sections summarize key aspects of PFAS environmental fate, bioaccumulation potential, public health considerations, and mobility in water systems that are central to current scientific and regulatory assessments.

Environmental Persistence

A defining characteristic of many PFAS is their resistance to environmental degradation. Because these substances are not readily broken down by natural chemical, biological, or physical processes, they are often referred to as “forever chemicals.” Persistent PFAS have been detected in surface water, groundwater, soils, sediments, and biological systems, reflecting their long environmental residence times.

Bioaccumulation

Certain PFAS—particularly long-chain perfluoroalkyl acids (PFAAs) such as PFOS and PFOA—have demonstrated the ability to bioaccumulate in organisms and biomagnify through food webs. These substances have been measured in fish, marine mammals, birds, and humans across diverse geographic regions, including remote areas far from known sources.

Water Mobility

Many PFAS—particularly short-chain acids—exhibit high mobility in aquatic environments and readily migrate through soils into groundwater. These characteristics, combined with resistance to conventional water treatment technologies, have contributed to the widespread detection of PFAS in drinking-water supplies and present ongoing challenges for remediation and exposure control.

Toxicological Considerations

Epidemiological and toxicological studies have reported associations between exposure to specific PFAS (most notably some long-chain PFAAs) and a range of adverse health outcomes. Reported associations include:

- elevated serum cholesterol levels;
- developmental effects;
- immune system suppression, including reduced vaccine response;
- alterations in liver enzymes;
- thyroid hormone disruption;
- increased incidence of kidney and testicular cancers (primarily linked in some studies to PFOA exposure); and
- reproductive and fertility effects.

Importantly, the degree of hazard varies widely across the PFAS class, and toxicological data remain limited for many individual substances. Given this variability, a chemical-by-chemical risk management regulatory approach may be more scientifically appropriate than treating PFAS as a single, uniform class. Such an approach allows regulatory decisions to be based on the specific hazard, exposure potential, and use conditions of individual substances, directing regulatory attention toward those PFAS that present the greatest risk while avoiding unnecessary restrictions on lower-risk chemistries. However, due to concerns regarding shared environmental behavior and the risk of regrettable substitution, several jurisdictions are adopting class-based regulatory approaches.

For a more detailed account of the properties that could drive environmental and toxicity concerns, consult the following resources:

Henry, B.J., Carlin, J.P., Hammerschmidt, J.A., Buck, R.C., Buxton, L.W., Fiedler, H., Seed, J. and Hernandez, O. (2018), A critical review of the application of polymer of low concern and regulatory criteria to fluoropolymers. Integr Environ Assess Manag, 14: 316-334.

Korzeniowski, S.H., Buck, R.C., Newkold, R.M., El kassmi, A., Leganis, E., Matsuoka, Y., Dinelli, B., Beauchet, S., Adamsky, F., Weilandt, K., Soni, V.K., Kapoor, D., Gunasekar, P., Malvasi, M., Brinati, G. and Musio, S. (2022), A critical review of the application of polymer of low concern regulatory criteria to fluoropolymers II: Fluoroplastics and fluoroelastomers. Integr Environ Assess Manag, 19: 326-354.

Javed, H. et al. 2025. A critical review of the application of polymer of low concern and regulatory criteria to perfluoropolyethers. J Flu Chem.

c. Regulatory Definitions

As mentioned above, defining PFAS can be a challenging endeavor—there is no single, globally accepted definition. Regulatory authorities define PFAS differently depending on statutory authority, regulatory objectives, and the breadth of chemical coverage intended.

U.S. Environmental Protection Agency (EPA)

While most federal regulatory actions addressing PFAS have taken an individualized, substance-specific approach, EPA has codified a class-based structural definition of PFAS pursuant to the National Defense Authorization Act (NDAA) of 2020. For purposes of reporting under the Toxic Substances Control Act (40 C.F.R. § 705.3), EPA adopted a structural definition that generally captures substances containing at least two fluorinated carbon atom, including both linear and branched configurations:

- R–(CF_2)–CF(R') R", where both the CF_2 and CF moieties are saturated carbons;
- R–CF_2–O–CF_2–R', where R and R' may be fluorine, oxygen, or saturated carbon atoms; and
- CF_3–C(CF_3)–R'R", where R' and R" may be fluorine or saturated carbon atoms.

For other regulatory programs—such as the PFAS National Primary Drinking Water Regulation, Toxics Release Inventory (TRI) reporting, and the proposed CERCLA hazardous substance designations—EPA does not apply a class-based definition. Instead, the Agency either identifies specific PFAS or uses structural descriptors (e.g., "perfluoroalkyl" or "polyfluoroalkyl" substances) tied to defined carbon–fluorine patterns.

European Chemicals Agency (ECHA)

Within the EU chemicals regulatory framework, PFAS has been defined as a class. In the context of a broad PFAS restriction proposal under REACH Annex XV, PFAS are defined as:

> Any substance that contains at least one fully fluorinated methyl (–CF_3) or methylene (–CF_2–) carbon atom, without any hydrogen (H), chlorine (Cl), bromine (Br), or iodine (I) attached.

This expansive definition captures a very large class of substances, including both polymeric and non-polymeric PFAS.

Organization for Economic Co-operation and Development (OECD)

While not a regulatory agency per se, the OECD is an international organization that plays a significant role in shaping policies and regulatory standards. In 2021, the OECD adopted a broad structural definition of PFAS:

> PFASs are defined as fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e. with a few noted exceptions, any chemical with at least a perfluorinated methyl group (–CF3) or a perfluorinated methylene group (–CF2–) is a PFAS.

The OECD definition serves as a foundational reference for international chemical inventories, data-sharing initiatives, and harmonization efforts, and it has influenced regulatory approaches adopted by multiple jurisdictions, including several U.S. states. For example, New Mexico and Minnesota have enacted PFAS laws that are structurally aligned with the OECD approach, focusing on the presence of at least one fully fluorinated carbon atom.

> **For a detailed summary of OECD recommendations on how to structurally define and characterize PFAS, consult this report:**
>
> OECD, Reconciling Terminology of the Universe of Per-and Polyfluoroalkyl Substances: Recommendations and Practical Guidance, Series on Risk Management No. 61 (2021).

Section 2: Regulatory Overview

The lubricants industry is facing growing regulatory scrutiny as environmental and human health concerns over PFAS pollution intensifies worldwide. In the United States, regulatory efforts are emerging at both the national and state levels, with increasing momentum to gather information about applications, establish pollution controls, restrict products, and impose clean-up mandates. For instance, the Environmental Protection Agency (EPA) has taken several regulatory actions to establish a robust reporting regime for hundreds of PFAS, while some states have enacted laws to restrict or phase-out products containing intentionally added PFAS. Abroad, the European Union and Canada are seeking to regulate PFAS as a class, covering thousands of compounds.

These actions, while still evolving, signal a shift toward stricter compliance expectations and a need for proactive risk management within the industry. This chapter provides a high-level overview of the evolving regulatory landscape to help stakeholders understand the direction of PFAS-related policies.

a. Federal Landscape

Reporting Requirements

The Toxic Substances Control Act (TSCA) and the Emergency Planning and Community Right-to-Know Act (EPCRA) are federal statutes with provisions that require covered entities to report information on chemicals to better understand and manage public health and environmental risks. Together, these authorities have created a complex and evolving PFAS reporting landscape, driven by Congressional mandates and ongoing agency implementation.

To gather information about the manufacture, use, and disposal of PFAS, Congress amended Section 8 of TSCA and Section 313 of EPCRA to impose reporting obligations in the 2020 National Defense Authorization Act (2020 NDAA). The legislation seeks to inform regulatory approaches under pollution control and remediation statutes. The requirements apply across industries, including lubricants and specialty chemical sectors, for triggering activities.

TSCA Section 8 Reporting

The PFAS reporting program under TSCA stems from amendments enacted in the 2020 NDAA, which directed EPA to establish a one-time reporting rule requiring manufacturers and importers of PFAS to submit extensive historical information to the agency. Congress mandated that EPA collect data on PFAS manufactured or imported in the United States since January 1, 2011, including volumes, uses, disposal practices, exposures, and hazards. Facilities who have solely processed, distributed in commerce, used, and/or disposed of PFAS are not required to report under the statutory scheme.

The statutory provision requires EPA to promulgate a rule under TSCA Section 8(a)(7) and broadly defines PFAS using a structural definition rather than a fixed list of chemicals, significantly expanding the scope of potentially reportable substances.

EPA has a *database* with a non-exhaustive list of thousands of reportable PFAS:

OECD, Reconciling Terminology of the Universe of Per-and Polyfluoroalkyl Substances: Recommendations and Practical Guidance, Series on Risk Management No. 61 (2021).

EPA sought to implement the mandate through a final rule issued in October 2023. Notably, the final rule included PFAS contained in articles and did not establish a production-volume threshold. In addition, the rule did not contain major exemptions regarding covered manufacturing activities, such as byproduct or impurities exemptions.

However, in November 2025, the agency proposed amendments to the rule to "incorporate certain exemptions and other modifications to the scope of the reporting regulation." *See 90 Fed. Reg. 50923 (RIN: 2070-AL29)*. According to the 2026 Unified Regulatory Agenda, the agency expects to finalize the changes to the scope of the rule by Summer 2026.

NOTE:

EPA is considering incorporating the following exemptions to the scope of reportable manufacturing activities: (1) imported articles, (2) de minimis exemption of 0.1%, (3) byproducts, (4) impurities, (5) research and development, and (6) non-isolated intermediates. The agency also solicited comments on whether to add a production volume threshold below which reporting on a given PFAS would not be required.

Relatedly, given the ongoing nature of this rulemaking, EPA established a new submission period: the reporting window will begin on **January 31, 2027**, or 60 days following the effective date of a forthcoming final rule on the substantive requirements of the PFAS Reporting Rule — whichever is earlier.

Under the statutory regime, companies must report all **"known or reasonably ascertainable"** information across a broad set of data points, including substance identity, production volumes, industrial/commercial uses, worker exposure, disposal methods, and environmental releases.

In guidance documents, EPA has explained that the scope of the "known or reasonably ascertainable by" standard includes information that a "reasonable person similarly situated may be expected to possess, control, or know," including information in possession or control of that site as well as its subsidiaries or general partnerships and their relevant employees.

EPCRA Reporting: Toxics Release Inventory

The Toxics Release Inventory (TRI), established under Section 313 of EPCRA, is a national reporting program that requires certain industrial facilities to disclose their use, management, and disposal of listed chemicals. Covered facilities—generally those in specific sectors with 10 or more full-time employees—must report annually if they manufacture, process, or otherwise use listed chemicals above applicable thresholds.

These reports are due each **July 1** for the prior calendar year and are publicly accessible to support environmental transparency and informed community decision-making.

A facility's TRI reporting obligation is triggered when a listed chemical is **known to be present** and handled above threshold levels. Accordingly, the TRI program does not impose a duty to investigate, but reasonable steps to identify reportable chemicals must be taken (e.g., reviewing safety data sheets, procurement records, supplier chemical composition information). This regulation covers manufacturers, importers, processors, and otherwise users.

To address challenges in downstream awareness, EPA also implements **Supplier Notification Requirements (SNRs)**. These require suppliers (facilities that manufacture, process, sell, or distribute) of mixtures or trade name products to notify downstream recipients (TRI-covered facilities or any facility that may sell or distribute that mixture or trade name product to TRI-covered facilities) if the product contains a listed TRI chemical. This helps ensure accurate tracking and disclosure throughout the supply chain.

Exemptions exist (e.g., for consumer products, articles, and laboratory uses), but the requirements broadly apply across industries, including lubricants, base oil suppliers, and specialty chemical sectors.

EPA has taken incremental steps to build a PFAS-specific framework within the TRI program. Initially, only a handful of PFAS were subject to TRI reporting. However, in recent years, EPA has significantly expanded the list—196 PFAS were subject to TRI reporting for Reporting Year 2024 and **205 PFAS are reportable for Reporting Year 2025** (reports were due July 1, 2026). For Reporting Year 2026 (reports due July 1, 2027), EPA automatically added one additional compound in October 2025, increasing the total amount of reportable PFAS to 206. The EPA's 2026 Unified Regulatory Agenda notes that the agency is expecting to finalize a rulemaking to add more PFAS to the TRI by Summer 2026. *See* 89 FR 81776 (RIN: 2070-AL03).

> **NOTE:**
> *Further additions are possible as EPA implements automatic triggers. Consult EPA's website to stay up to date: https://www.epa.gov/toxics-release-inventory-tri-program/addition-certain-pfas-tri-national-defense-authorization-act*

Lubricant manufacturers may be subject to reporting requirements as manufacturers, processors, or otherwise users.

> "Manufacture" means to produce, prepare, import, or compound a toxic chemical. Manufacture also applies to a toxic chemical that is produced coincidentally during the manufacture, processing, use, or disposal of another chemical or mixture of chemicals, including a toxic chemical that is separated from that other chemical or mixture of chemicals as a byproduct, and a toxic chemical that remains in that other chemical or mixture of chemicals as an impurity.
>
> "Process" refers to the preparation of a listed chemical, after its manufacture, for distribution in commerce. This involves the incorporation of the substance into a product or using it in a way that changes its form, shape, or chemical composition, either as part of a mixture, formulation, or other end-use product.
>
> "Otherwise use" functions as a catch-all category referring to any use of the listed chemical—including a listed chemical contained in a mixture, product, or waste—not covered by the definitions of "manufacture" or "processing."

NOTE:

EPA has published guidance stating that suppressing a fire with a listed PFAS-containing foam constitutes an otherwise use of a TRI-listed chemical.

The TRI-listed PFAS threshold has been set at 100 pounds by the 2020 NDAA. For threshold determination, calculation, and reporting, EPA has proposed a categorical approach. **Category reporting** would require covered facilities to submit only one form per category, accounting for each threshold activity and quantities associated with all member chemicals.

NOTE:

It is important to monitor whether EPA finalizes or withdraws the category approach to address PFAS compound categories (89 FR 81776) (RIN: 2070-AL03)

Additionally, EPA classified PFAS as **"chemicals of special concern,"** meaning they are now excluded from the ***de minimis* exemption** and must be reported even at very low concentrations in mixtures. Additionally, due to this classification, supplier notifications are now required for PFAS-containing mixtures, which may be critical for downstream lubricant manufacturers who rely on chemical suppliers for product content disclosures. Facilities must take steps to ensure they are receiving proper notifications and evaluating their formulations accordingly. EPA may also reconsider the "chemicals of special concern" classification as it lacks an explicit legislative mandate.

Product Restrictions

While there is ongoing debate on Capitol Hill regarding broad restrictions on PFAS-containing products, no comprehensive federal legislation has succeeded to date. Bills such as the Forever Chemical Regulation and Accountability Act of 2026 have been introduced seeking to phase out "nonessential" uses of PFAS in consumer products, but these initiatives appear unlikely to advance in the near term. They nonetheless signal sustained congressional concern and reflect growing political momentum toward a comprehensive federal product restriction framework.

For now, the most salient product restriction effort at the federal level concerns the packaging of chemical and industrial products. Packaging plays a fundamental role in the lubricants supply chain. Commonly used in packaging for its durability and chemical resistance, fluorinated plastic containers have come under scrutiny by the EPA due to the potential byproduct formation of PFAS during the fluorination process and leaching to stored products afterwards.

TSCA Section 6 Regulation: HDPE Containers

After an unsuccessful attempt to ban the fluorination of **High-Density Polyethylene (HDPE)** containers under Section 5 of TSCA, the EPA started a rulemaking to mitigate PFAS risks in the fluorination of HDPE containers under Section 6 of TSCA. The agency started collecting data on the uses of fluorinated containers and alternatives to fluorinated barriers to evaluate regulatory options—not committing itself to prohibiting the practice and, ultimately, restricting the product.

However, there is ongoing litigation on whether EPA is legally required to ban fluorinated containers altogether, rather than imposing less stringent requirements to manage risk. EPA has maintained that the agency is not compelled to prohibit fluorination under Section 6 and is currently assessing its regulatory approach.

Waste Management

Waste management is a critical compliance area for lubricant manufacturers and blenders, given the industry's generation of oily waste, spent solvents, and wastewater. Federal and state regulations governing the handling, treatment, and disposal of these materials are rooted primarily in the **Resource Conservation and Recovery Act (RCRA)** and the **Clean Water Act (CWA)**. Understanding whether a waste stream is classified as hazardous, how used oil must be managed, and when discharges to publicly owned treatment works (POTWs) or surface waters require permitting is essential to environmental compliance and risk mitigation. With increased regulatory scrutiny of PFAS, facilities should consider how these substances may be present in waste streams and its risk implications.

Resource Conservation and Recovery Act

Under RCRA, the EPA regulates solid waste according to its hazards. RCRA Subtitle C governs the management of solid hazardous waste from "cradle-to-grave" (covering generation, transportation, treatment, storage, and disposal). Facilities that generate and transport hazardous waste must comply with tracking, labeling, containment, handling, and disposal requirements. At the back end of the waste stream, facilities that treat, store, or dispose of hazardous waste are required to secure permits and meet operational obligations such as design requirements, recordkeeping, and training. RCRA Subtitle D covers non-hazardous solid waste, providing a more flexible framework for the disposal of these wastes in municipal or industrial facilities.

Used oil, if recycled or burned for energy recovery, is generally regulated under a specialized set of management standards that avoid full Subtitle C regulation—provided the oil is not mixed with hazardous waste. As regulatory frameworks evolve, the presence of PFAS in waste streams may affect how materials are classified and handled under RCRA.

In 2024, EPA proposed the listing of nine PFAS as RCRA **hazardous constituents under 40 C.F.R. Part 261 Appendix VIII**. *See* 89 FR 8606. If finalized, this listing is a pre-requisite for the designation of these PFAS as RCRA hazardous wastes under Subtitle C's cradle-to-grave scheme. Additionally, the listing would place these nine PFAS into the regulatory reach of RCRA's Corrective Action Program. Accordingly, EPA would gain the authority to investigate and cleanup contamination at permitted hazardous waste treatment, storage, and disposal facilities (TSDFs). These entities could face mandatory cleanup obligations for PFAS releases, even if the substances were legally used or disposed of at the time—thus TSDFs would have every incentive to scrutinize and restrict waste streams that may contain listed PFAS. EPA also proposed to **expand the RCRA Corrective Action Program** to address emerging contaminants, including non-listed PFAS, at TSDFs. However, in May 2026, EPA withdrew the proposal arguing that it exceeded its statutory authority. *See* 91 FR 25266.

Clean Water Act

The Clean Water Act (CWA) regulates the discharge of pollutants into U.S. waters and requires facilities to obtain permits under the **National Pollutant Discharge Elimination System (NPDES)** for direct discharges or meet **pretreatment standards** if discharging into a POTW. Facilities must characterize their wastewater to determine pollutant concentrations and comply with effluent limits.

Generally, lubricant manufacturers discharge into POTWs and, thus, are subject to pretreatment standards. As state and federal agencies begin incorporating PFAS into water quality monitoring and permitting frameworks, lubricant formulators and blenders must assess the potential for PFAS-containing wastewater and prepare for new monitoring or treatment obligations.

The EPA's approach to wastewater has emphasized pretreatment and discharge limits through sector-specific rulemaking. For instance, the agency is developing or updating Effluent Limitations Guidelines for the electroplating and metal finishing industry. While these operations may not rely directly on lubricants, such as metalworking fluids, facilities often conduct other metalworking processes that do. As a result, ELGs in the electroplating and metal finishing industry could increase scrutiny of all inputs to these facilities—including metalworking fluids—potentially leading to enhanced documentation and verification requirements from lubricant suppliers.

Additionally, EPA has taken steps to leverage the NPDES permit system to incorporate PFAS requirements, focusing on best management practices that include monitoring, controls, and pollution minimization. POTWs that adopt these practices could elevate scrutiny on receiving wastewater from industrial sources, including lubricant manufacturers.

In summary, waste management policies are creating incentives for manufacturers to proactively assess their wastewater streams and implement pollution prevention strategies to minimize risks.

Water Quality

A key component in water quality regulation involves the establishment of national standards for levels of contaminants under the Safe Drinking Water Act (SDWA). Pursuant to the SDWA, the EPA regulates public drinking water systems to ensure an adequate level of safety for water consumption. Lubricant manufacturers could have exposure from incoming water sources and ancillary fluid use.

Safe Drinking Water Act: Occurrence Data

First, the SDWA requires the agency to identify contaminants in drinking water which may have an adverse effect on human health. To do so, the EPA must promulgate a monitoring rule to collect data on unregulated contaminants of concern every five years. Unregulated Contaminant Monitoring Rules (UCMRs) generally apply to public water systems serving more than 10,000 people, as well as a statistically selected sample of smaller systems. The purpose of UCMRs is to gather occurrence data to support future regulatory determinations, including whether to promulgate National Primary Drinking Water Regulations. PFAS testing requirements have been imposed under UCMR 3 (2013-2015) and UCMR 5 (2023-2025). Thus, the agency has already a public database with the presence of dozens of PFAS in public water systems. Lubricant manufacturers that rely on public water for formulation and other processes can consult with UCMRs data to assess a potential exposure pathway.

Safe Drinking Water Act: National Primary Drinking Water Regulation

The heart of the SDWA regulatory scheme involves establishing enforceable Maximum Contaminant Levels (MCLs) for public water systems which regularly supply water to 15 or more connections or to 25 individuals at least 60 days a year. An MCL is the maximum level allowed of a contaminant in water which is delivered to any user of a public water system. Water systems that exceed MCLs will need to install advanced PFAS treatment technologies, such as granular activated carbon (GAC), ion exchange, or reverse osmosis. These technologies are effective not only for the regulated compounds but for broader PFAS removal—offering incidental benefits for industrial users of municipal water, including lubricant manufacturers.

In April 2024, EPA finalized its first-ever enforceable drinking water standards for PFAS under the SDWA. The rule established MCLs for six PFAS compounds in public water systems, including PFOA and PFOS, applicable to all community and non-transient non-community water systems. In sum, the regulation requires these systems to monitor PFAS and act when levels exceed regulatory thresholds. The rule took effect in June 2024. Under the 2024 rule, initial monitoring was set for 2027, and full compliance was set for 2029.

However, in May 2026, **EPA proposed to rescind** the MCLs for PFHxS, PFNA, HFPO-DA, and PFBS and extend the PFOS and PFOA compliance deadline to 2031. Importantly, however, the agency indicated that it would maintain the 4 ppt regulatory threshold for PFOA and PFOS.

Remediation Liability

Comprehensive Environmental Response, Compensation and Liability Act

Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund law, the EPA can order parties responsible for contamination from hazardous substances to clean up the site or to recover funds expended by the agency in cleaning up the site itself. Additionally, reporting obligations attach for substances deemed hazardous under the statute. A hazardous substance is primarily defined in reference to other environmental statutes, but the EPA is authorized to designate substances based on their potential to cause substantial danger to public health, welfare, or the environment.

In May 2024, the EPA promulgated rule to designate PFOA and PFOS, two of the most widely studied PFAS compounds, as hazardous substances under the Superfund program. This action authorizes regulators to require cleanup of PFOA and PFOS contamination and seek cost recovery from potentially responsible parties (PRPs).

Recognizing the broad scope and unintended consequences of the rule, the EPA issued a CERCLA enforcement discretion policy in April 2024 stating it would focus enforcement on major contributors, such as chemical manufacturers and federal facilities, and not pursue certain community-oriented entities (e.g., municipalities, water utilities, landfills) for cleanup costs. Notably, the enforcement policy did not cover industrial passive receivers that may have been unintentionally engaged with these substances. Also, this policy is non-binding and does not shield parties from third-party contribution claims, leading to legal uncertainty.

The U.S. Chamber of Commerce is challenging EPA's designation of PFOA and PFOS as hazardous substances under CERCLA. On January 20, 2026, the D.C. Circuit heard oral arguments. Subsequently, the parties have submitted post-argument letters. This case is important to monitor to understand the remediation liability landscape.

b. State Trends

As federal PFAS regulations continue to develop, states have advanced their own diverse and often more aggressive regulatory measures to address PFAS contamination across environmental media. These actions are increasingly relevant to lubricant manufacturers, as PFAS-related standards now affect a wide array of products, water discharges, waste streams, and remediation responsibilities. According to a report conducted by Multistate US, "nearly 100 state PFAS bills have been introduced across 17 states, with an additional 280 bills carried over from 2025." This growing patchwork underscores the importance of monitoring state-level PFAS initiatives as part of a comprehensive risk strategy.

Product Restrictions / Labeling / Reporting

Several states have enacted legislation to impose a comprehensive ban on the use of intentionally added PFAS in consumer and commercial products. Maine was the first state to establish a strict product restriction framework. Minnesota and New Mexico have also led the charge on such broad prohibitions. The schemes in Minnesota and New Mexico also involve burdensome labeling and/or reporting requirements.

New Mexico

New Mexico enacted legislation regulating products that contain intentionally added PFAS. The state environmental agency finalized implementing regulations that took effect July 1, 2026. The law requires a phase-out of PFAS, as well as labeling standards and reporting.

The statute (HB 212) broadly defines PFAS as "a substance in a class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom." Thus, fluorinated agents used in the manufacture of certain lubricants or automotive fluids fall within this definition. For example, fluorinated silicon anti-foaming agents in automotive products meet this statutory definition.

The law applies to manufacturers, distributors and retailers that sell, offer for sale or distribute products containing intentionally added PFAS in the state, whether directly or through intermediaries. "Intentionally added" refers to any PFAS deliberately incorporated during manufacturing where its continued presence in the product or one of its components is expected or desired. While some specific statutory exemptions exist, none apply to lubricants.

The law establishes a phased approach to prohibiting products containing intentionally added PFAS. The ban applies to certain consumer products beginning Jan. 1, 2027, and expands to more products in 2028. Starting **Jan. 1, 2032**, all remaining products not otherwise exempted will be prohibited unless the manufacturer obtains a currently unavoidable use (CUU) determination, which allows continued use if PFAS is essential for product performance, health, safety or societal functioning.

For lubricant manufacturers, the key takeaway is that while lubricant products and fluids are not immediately subject to the prohibition, any PFAS-containing products will be effectively banned after 2032 unless a CUU application is approved. For CUU proposals, the requester must submit the required information no later than 12 months prior to the applicable prohibition.

Additionally, manufacturers will be required to submit detailed reporting information to the New Mexico Environment Department (NMED) starting Jan. 1, 2027. This includes product identifiers such as UPC or SKU, the purpose and quantity of PFAS used (by CAS number), and manufacturers' contact information. In parallel, products manufactured after Jan 1, 2027, containing intentionally added PFAS may not be sold or distributed in New Mexico unless labeled in accordance with New Mexico standards or in a manner consistent with comparable PFAS labeling requirements adopted by another state.

Minnesota

Minnesota has adopted comprehensive reporting requirements for products containing intentionally added per- and polyfluoroalkyl substances (PFAS). The Minnesota Pollution Control Agency (MPCA) issued final rules establishing how manufacturers must report PFAS in products that are sold, offered for sale, or distributed in the state.

The reporting requirement applies to manufacturers, or groups of manufacturers, whose products contain intentionally added PFAS and are sold in Minnesota, including products sold through online channels. “Intentionally added” generally refers to PFAS deliberately incorporated during the manufacturing process where the continued presence of the chemical in the final product or its components is desired for a specific function.

Manufacturers must submit detailed information about each product or product component containing intentionally added PFAS. The reporting mandate only applies to products manufactured after July 1, 2023. Required data elements include a description of the product or product category, the PFAS chemicals present in the product (including their function), and the concentration of PFAS within the product or within homogeneous materials that make up the product. Companies must also provide manufacturer identification information and contact details for an authorized representative responsible for the submission, along with an alternative contact if necessary.

Reports must be submitted through the state’s PFAS Reporting and Information System for Manufacturers (PRISM), an online reporting platform managed by the MPCA. Initial PFAS reports are due by September 15, 2026. Subsequent reports are due each year on February 1. All information except trade secrets will become publicly available.

Firefighting Foam Regulations

Aqueous film-forming foam (AFFF) firefighting systems are highly effective for suppressing fires in facilities handling flammable and petroleum-based materials. By forming a thin, aqueous film that spreads across the surface of flammable substances, AFFF suppresses flames and prevents ignition. Accordingly, for many years, it has been the go-to emergency response solution in petroleum industrial settings. However, PFAS product restrictions at the state level have largely centered on **AFFF**, a known source of persistent pollution. As regulatory oversight and risk of litigation have intensified in this context, lubricant manufacturers are incentivized to explore alternative formulations and adopt best practices to transition to PFAS-free foams.

As of 2025, **22 states** have enacted legislation to restrict or ban the manufacture, sale, and use of AFFF. These restrictions often include mandatory labeling, phaseout dates, and disposal as hazardous waste. In tandem, **19 states** have implemented **AFFF takeback programs**, which include coordinated efforts to collect, transport, and properly dispose of legacy stocks. These programs often promote the transition to **fluorine-free foams (F3)** and are accompanied by public funding or industry support. Below are examples of state laws that highlight various approaches to the regulation of AFFF.

California

Effective Jan. 1, 2022, California prohibited manufacturers, importers, and distributors from selling or distributing PFAS-containing AFFF for non-exempt uses. Exceptions include federally mandated applications and specific petroleum related activities. Until January 2024, entities were allowed to use these foams in fixed suppression systems for flammable liquid fires, such as oil, grease, and gasoline related fires. For terminals and oil refineries, PFAS-containing foams can still be used on fuel in depth pools and storage tanks with a surface area of 120 square meters or more, provided containment or other safety measures are in place. This exemption expires Jan. 1, 2028. Noncompliance requires manufacturers to recall the products.

Illinois

Since Jan. 1, 2022, Illinois banned the use of AFFF containing PFAS for training or testing purposes unless facilities can demonstrate readiness to employ proper containment, treatment, and disposal measures. Further, manufacturers are barred from producing, selling, or distributing PFAS-containing AFFF except when required or authorized under federal law or local fire and building codes. Certain facilities—including refineries, chemical and ethanol plants, and manufacturing sites with fixed foam systems—may request extensions until Jan. 1, 2027.

Connecticut

Connecticut broadly prohibits the use of AFFF with intentionally added PFAS for training, testing, and nonflammable liquid fires. PFAS-containing foam is only permitted for flammable liquid fires if the state's commissioner of Energy and Environmental Protection has not identified viable alternatives.

Massachusetts

In 2018, the Massachusetts Department of Environmental Protection (MassDEP), in coordination with the Massachusetts Department of Fire Services, launched a statewide take-back program to collect and dispose of legacy firefighting foams containing PFAS. The initiative targeted AFFF manufactured prior to 2003, when manufacturers phased out certain long-chain PFAS compounds, including PFOS and PFOA.

The program was designed to prevent the environmental release of PFAS from aging stockpiles stored by municipal fire departments and public safety agencies. MassDEP funded the removal and disposal of legacy foam through its Bureau of Waste Site Cleanup capital program, while participating fire departments were responsible for replacing the removed foam with safer alternatives. MassDEP contracted a hazardous materials cleanup firm to collect and transport the foam from local departments, after determining that container integrity concerns made self-transport impractical.

Collected foam was transported to a fuel-blending facility and ultimately destroyed at refuse-derived fuel incinerators located outside Massachusetts. Over a five-month period, 105 fire departments and public safety entities participated in the program. A total of approximately 149,000 pounds (17,500 gallons) of legacy foam were collected and destroyed, with the majority originating from large regional foam caches or major facilities.

In parallel with the take-back effort, state agencies issued guidance advising fire departments to discontinue use of legacy PFAS-containing foams and limit the use of newer formulations to situations where life safety is at risk. The state has also encouraged the transition to fluorine-free foams and continues to evaluate safer alternatives for Class B firefighting applications.

Water Quality Standards

States are playing a leading role in setting enforceable **drinking water and groundwater standards** for PFAS. Many have adopted their own MCLs. For example, New Jersey, Michigan, Massachusetts, and Wisconsin have adopted MCLs for compounds such as PFOA, PFOS, PFNA, and PFHxS. Other states have set **health-based advisory levels** or screening values for PFAS in drinking water supplies. In total, thirty states have at least guidance for one or more PFAS in drinking water. These standards are frequently mirrored in **groundwater protection rules**, particularly in states where groundwater is a major source of drinking water and where private wells also play a prominent role in the supply of drinking water.

Regarding **surface water, 11 states** are adopting or considering EPA's Final **Aquatic Life Criteria** under the Clean Water Act (effective September 2024). These criteria are based on toxicological data and apply to both freshwater and saltwater ecosystems. States use them to support NPDES permitting decisions and to assess the health of aquatic ecosystems impacted by PFAS discharges. States are also integrating PFAS considerations into NPDES permits for industrial facilities and POTWs.

Remediation Liability

Many states are also establishing **remediation and disposal rules** to manage PFAS-contaminated soil, sludge, and industrial waste. Some have adopted definitions of PFAS as "hazardous substances" under state cleanup laws, triggering remediation obligations at contaminated sites or requiring notices to regulators during property transfers or permit modifications.

Several states are also issuing guidance on PFAS testing in landfills, industrial waste characterization, and acceptance criteria. Lubricant manufacturers should evaluate how state-level waste classification could create cleanup obligations downstream, even if the waste is legally disposed of under federal rules.

Wisconsin

PFAS cleanup obligations arise primarily under the state's long-standing Spills Law (Wis. Stat. ch. 292), which functions similarly to a state Superfund program. The law requires any person who causes, possesses, or controls a hazardous substance that has been discharged into the environment to immediately report the release to the Wisconsin Department of Natural Resources (DNR) and undertake remediation to restore the environment and minimize harm. For several years, the scope of this authority as applied to PFAS was heavily litigated. Lower courts initially held that the DNR could not require investigation or cleanup of PFAS contamination unless the agency first promulgated formal rules identifying PFAS as hazardous substances and establishing regulatory thresholds.

In June 2025, the Wisconsin Supreme Court held that the DNR has broad statutory authority under the Spills Law to address "emerging contaminants," including PFAS, without first promulgating rules designating each chemical as hazardous. As a result, the agency may require responsible parties to investigate contamination, report discharges, and perform cleanup actions for PFAS on a case-by-case basis even in the absence of rulemaking formally making hazardous designations and establishing numeric standards.

c. International Developments

As PFAS regulation accelerates globally, lubricant manufacturers operating in international markets or supplying customers with cross-border distribution must be aware of divergent and evolving requirements outside the U.S. While regulatory frameworks vary, there is a shared global momentum toward regulating PFAS in products and emissions, often with implications for manufacturers, importers, and downstream users alike.

European Union

The EU is advancing one of the most comprehensive PFAS regulatory frameworks globally, largely under two mechanisms: (1) The **Persistent Organic Pollutants (POPs) Regulation**, which already bans certain legacy PFAS compounds; and (2) **Annex XVII of the REACH Regulation**, where sweeping PFAS restrictions are currently under review.

In 2023, national authorities from Denmark, Germany, Netherlands, Norway, and Sweden submitted a joint proposal to universally restrict PFAS. The proposed restriction would apply to thousands of PFAS substances across sectors, including lubricants. The **Committee for Risk Assessment (RAC)** and **Socio-Economic Analysis Committee (SEAC)** are conducting sector-by-sector evaluations.

Both committees have addressed the lubricants sector directly, and the findings are significant. The final RAC evaluation identified high PFAS volumes and emissions in lubricants — estimated at approximately 800 metric tons per year — and concluded that those emissions are not adequately controlled and must be minimized. RAC evaluated a full ban (RO1) and a ban with broad derogations (RO2). While RAC found RO1 effective, it concluded that RO2 would result in an estimated 16,825 additional metric tons of PFAS emissions over 30 years and characterized the associated risk as uncontrolled. If RO2 is adopted, RAC recommends comprehensive lifecycle risk management measures to reduce emissions, including labeling requirements.

SEAC's preliminary findings offer a more nuanced picture. On substitution, SEAC concluded that for industrial and professional lubricant uses — applications requiring performance under harsh conditions — substitution potential is low and technically feasible alternatives are generally not available. SEAC also flagged that a broad ban would have cascading effects across downstream sectors including automotive, aerospace, nuclear, medical devices, and industrial machinery, and acknowledged that downstream costs are likely underestimated. On that basis, SEAC concluded that a full ban (RO1) would likely not be proportionate for the lubricants sector. While SEAC could not reach a definitive conclusion on the proportionality of RO2, citing cost uncertainty and reduced environmental benefits, it indicated that a 12-year derogation for industrial and professional uses may be justified given current evidence.

Final evaluations are expected by **the end of 2026**, with potential final restriction regulations not likely implemented before 2029 with a phased-out or sell off period. ILMA members with a European market presence — or those supplying customers who do — can face significant exposure if this regulatory control regime advances. Given the broad class-based scope, any formulation incorporating PFAS-based or fluorinated components may be affected, and substitution strategies will require careful technical and regulatory analysis. Proactive supply chain mapping and early engagement will be essential.

Canada and Mexico

Canada has taken concrete regulatory steps under the *Canadian Environmental Protection Act, 1999 (CEPA)*. The *Prohibition of Certain Toxic Substances Regulations, 2012*—amended in 2016—prohibit the manufacture, use, sale, offer for sale, and import of **PFOA and long-chain perfluorocarboxylic acids (LC-PFCAs)**, including their salts and precursors. Additionally, Canada is preparing one of the most sweeping PFAS regulatory programs in North America. In April 2024, Environment and Climate Change Canada (ECCC) and Health Canada released the *State of PFAS Report* and a proposed *Risk Management Approach*, outlining a three-phase strategy to phase out PFAS wherever feasible.

While binding regulations have not yet been issued, the agencies propose listing PFAS—excluding fluoropolymers—as a class of **toxic substances** under *CEPA*. This would mark the first time Canada regulates an entire chemical class under this law, signaling a commitment to avoid regrettable substitution and address the entire lifecycle of PFAS risks. Once listed, PFAS could be subject to broad restrictions via future CEPA regulations. The agencies expect to propose a regulation by 2027.

Mexico outlined emerging policy goals through its **Programa Frontera 2025**, which includes PFAS-specific actions focused on monitoring and risk assessments, training, regulatory alignment, and cross-border collaboration. While regulations are not likely to appear in the immediacy, the foundation for regulation is starting to form and is worth monitoring.

Section 3: Litigation Overview

In tandem with growing regulatory scrutiny, litigation is becoming an additional vector of legal exposure, driven by claims of environmental contamination and associated health risks. PFAS-related lawsuits are being brought across multiple legal theories and jurisdictions, targeting manufacturers, formulators, and downstream users for alleged releases, product design choices, and failure-to-warn practices. These cases increasingly involve complex scientific evidence, long exposure timelines, and significant potential liabilities tied to remediation, damages, and injunctive relief.

While the factual circumstances and legal claims vary, PFAS litigation reflects a broader trend toward holding entities liable for historical and current uses of fluorinated chemistries, often based on emerging science and evolving regulatory benchmarks. This chapter provides a high-level overview of the main categories of PFAS-related litigation, with illustrative examples, to help lubricant manufacturers understand key risk drivers and consider proactive mitigation strategies.

For the lubricants industry, these cases highlight the importance of proactive risk management, including understanding PFAS content in raw materials, maintaining robust supplier communications, implementing sound waste-handling and disposal practices, and monitoring evolving regulatory and scientific developments. Early attention to these issues can help reduce litigation risk, support compliance efforts, and position companies to respond effectively as PFAS scrutiny continues to intensify.

a. Personal Injury – Toxic Tort

Personal injury or toxic-tort claims allege that exposure to PFAS caused bodily harm and are typically brought under negligence and strict liability theories. Defendants are most often PFAS manufacturers, though downstream users may also be named as co-defendants depending on the alleged source of exposure.

The seminal litigation in this area is the *DuPont C8 case*.

DuPont, a PFAS manufacturer, used and released perfluorooctanoic acid (PFOA or C8) from its Washington Works facility, where Teflon was produced, resulting in contamination of drinking water supplies in Ohio and West Virginia. DuPont faced multiple class action lawsuits, with several cases proceeding to jury verdict. Plaintiffs alleged that DuPont knew C8 posed health risks, failed to disclose those risks to regulators and the public, and continued discharges despite knowledge of potential harm.

Following a class settlement that established the independent “C8 Science Panel,” individual personal injury claims proceeded to trial, resulting in multiple multimillion-dollar jury verdicts. Many remaining cases were subsequently resolved through settlements.

b. Property Damage and Diminution of Value

Property damage claims allege that PFAS contamination of groundwater, soil, or private wells diminished property values or interfered with the use and enjoyment of property. In these cases, downstream PFAS users are frequently named as defendants, sometimes alongside manufacturers.

The *Wolverine World Wide litigation* in Michigan illustrates this category of claims. Wolverine, a downstream user of PFAS-containing products such as 3M’s Scotchgard, allegedly disposed of PFAS-containing materials at multiple sites near its Rockford facilities, including landfills and dumping areas, resulting in contamination of private wells and the regional water supply. Plaintiffs asserted claims for loss of use, diminution of property value, inconvenience, and emotional distress associated with contaminated drinking water.

Wolverine entered a settlement in 2020, followed by a subsequent settlement with 3M in 2023. These settlements required, among other measures, the extension of municipal water lines and the installation of water treatment and filtration systems.

c. Natural Resource Damages

Natural resource damages (NRD) actions are brought by states acting as trustees for public resources, seeking compensation for alleged injury to groundwater, surface water, and other natural resources. Defendants typically include PFAS manufacturers and large industrial users.

A leading example is *State of Minnesota v. 3M*, in which Minnesota alleged that 3M's disposal of PFAS contaminated groundwater, rivers, and other natural resources in the East Metropolitan Area of the Twin Cities. The state sought damages to fund environmental restoration and long-term water protection. The case was resolved through a court-approved settlement of $850 million.

A more recent case of relevance to the lubricants and metalworking sectors is the *City of Fresno PFAS* lawsuit. Fresno has sued more than 40 companies, including numerous metal plating facilities, alleging that PFAS contamination of the city's groundwater requires extensive treatment to comply with EPA drinking water standards. The city seeks damages for cleanup costs, remediation, and other relief, including punitive damages.

d. Products Liability and Deceptive Advertising

Products liability and deceptive advertising claims allege that PFAS-containing products were defectively designed, lacked adequate warnings, or were marketed in a misleading manner that obscured PFAS-related risks.

The *Aqueous Film-Forming Foam (AFFF) multidistrict litigation (MDL)*, pending in the District of South Carolina, exemplifies this category. Plaintiffs allege that PFAS manufacturers designed and sold firefighting foam containing PFAS without adequate warnings, and that downstream users—including military installations and airports—contributed to environmental contamination through use of the products. The MDL remains active, with discovery, bellwether proceedings, and partial settlements ongoing.

In *McDowell v. McDonald's Corp.*, plaintiffs allege that food packaging used for products such as Big Macs contains PFAS and is therefore unsafe for human consumption. The complaint asserts that McDonald's falsely marketed its products as "safe" and "sustainable," and that consumers would not have purchased the products had they known PFAS were present in the packaging.

e. Failure to Disclose

Failure-to-disclose claims arise under statutes that independently require warnings for exposure to certain chemicals, most notably California's Proposition 65. Defendants are typically product manufacturers or brand owners.

In *Ecological Alliance, LLC v. Edgewell Personal Care Brands LLC*, an environmental group alleged that Edgewell's Carefree menstrual liners contained PFOA and lacked required Proposition 65 warnings. The plaintiff sought injunctive relief and civil penalties. The case was voluntarily dismissed.

Section 4: Insurance Considerations

As the lubricants industry faces intensifying regulatory oversight and growing public concern over PFAS contamination, risk management strategies must extend beyond regulatory compliance. A critical, and often overlooked, component of any effective PFAS risk management program is a clear understanding of the insurance landscape and how evolving PFAS-related liabilities may affect coverage.

This chapter outlines the key insurance dynamics associated with PFAS, including litigation trends, exclusions, underwriting developments, and the strategic role of insurance brokers. As PFAS regulations evolve and the cost of remediation and liability continues to rise, manufacturers that proactively address insurance considerations will be better positioned to manage long-term risk and maintain insurability.

a. Factors Impacting Insurance Risks

A major driver of the rapidly evolving nature of the insurance landscape concerns heightened regulatory scrutiny, enforcement actions, and increasing litigation. As detailed in previous chapters, state, federal, and international governments are tightening PFAS regulations—including enforcement for clean-up responsibility—in response to environmental and health concerns. Further, PFAS-related litigation is rapidly increasing, with private party or mass tort claims emerging from contaminated groundwater, occupational exposures, and product liability.

Insurers, in response, are applying pollution exclusions more aggressively, tightening underwriting standards, and introducing PFAS-specific exclusions. For lubricant manufacturers, this implicates a shrinking window for obtaining or maintaining sufficient coverage under commercial general liability (CGL), property, products pollution, and pollution legal liability (PLL) policies. Moreover, the long-tail nature of PFAS risks makes

historical policies—particularly pre-1984/pre-1986 policies without pollution exclusions—potentially valuable assets for manufacturers with legacy exposure.

Understanding how to identify and leverage such policies, while also engaging environmental brokers skilled in PFAS-related underwriting, can be essential to preserving financial resilience.

b. Key PFAS Coverage Dynamics

From an environmental insurance perspective, PFAS-related risks are reshaping coverage dynamics for the lubricants industry. Key considerations include:

Pollution Exclusions in Commercial General Liability Policies

Commercial general liability (CGL) policies are often sought for bodily injury and property damage, but coverage depends on policy terms and exclusions. Insurers are increasingly applying pollution exclusions to deny PFAS-related claims, arguing that PFAS constitute environmental pollutants. However, courts have ruled variably—some claims, such as direct exposure to PFAS-containing products, may fall outside "traditional environmental pollution," potentially preserving coverage. Insurers may also invoke knowledge-based defenses (e.g., known loss or expected damages), complicating recovery.

Legacy CGL Policies

Since PFAS have been used since the 1940s, older CGL policies (pre-1984, pre-1986 pollution exclusions) may offer broader coverage for "occurrence-based" claims, where exposure occurred decades ago. Identifying and leveraging these legacy policies is critical for manufacturers facing PFAS liabilities. Investing time and effort in locating these policies can prevent major issues later if historical claims are levied against a business.

Shrinking Pollution Legal Liability Policies

Pollution legal liability (PLL) policies can cover cleanup costs and third-party claims, but availability is shrinking as insurers reassess PFAS risks. Environmental risk transfer solutions, such as remediation cost cap and liability buyouts, may help manage long-tail liabilities but require robust exposure data.

Stricter Underwriting

Due to PFAS's ubiquity and high cleanup costs, insurers are tightening underwriting standards. Underwriters are requesting more detailed disclosures regarding PFAS usage, discharge controls, supply chain risks, and waste management practices. Many are adding PFAS-specific exclusions to casualty and pollution policies or restricting coverage for high-risk clients.

c. Role of Brokers in Navigating PFAS Challenges

Insurance brokers play a critical role in helping lubricant manufacturers navigate the complex and evolving PFAS insurance landscape. As regulatory scrutiny and litigation risks increase, a knowledgeable environmental insurance broker can be an essential partner in securing coverage, managing liabilities, and strengthening an organization's overall PFAS risk management strategy. Key functions include:

Strategic Risk Communication

Brokers serve as intermediaries between the insured and the underwriting community, articulating the company's PFAS risk profile, operational controls, and commitment to compliance. By presenting detailed exposure information, such as chemical inventories, product formulations, and waste management practices, brokers can improve the client's insurability and negotiate more favorable policy terms.

Gap Identification

Brokers can help clients identify coverage gaps across their existing commercial general liability (CGL), pollution legal liability (PLL), property, and umbrella policies. This includes analyzing the applicability of pollution exclusions, evaluating the language of PFAS-specific exclusions, and investigating the availability of legacy CGL policies that may provide coverage for historical exposures.

Coverage Negotiation

In an environment where many insurers are adopting blanket PFAS exclusions, brokers can advocate for tailored coverage solutions. This may involve challenging overly broad exclusionary language, negotiating limited PFAS carve-outs, or structuring alternative environmental insurance programs to fill critical gaps. Brokers may also assist clients in pursuing specialty markets or captives where traditional insurance is unavailable or unaffordable.

Regulatory Adaptation

An effective broker stays abreast of regulatory developments and understands their implications for liability and insurability. Brokers leverage this regulatory insight to provide clients with early warnings, advise on risk mitigation, and adjust insurance strategies accordingly. Brokers can collaborate with environmental consultants and counsel to support and adapt to the evolving legal landscape.

d. Aligning Risk Management with Insurance Strategy

As PFAS regulations continue to evolve and litigation expands across jurisdictions, lubricant manufacturers face a uniquely challenging liability landscape. Insurance is no longer a passive backstop—it must be an integrated component of a proactive PFAS risk management program. From assessing chemical use to reviewing policy portfolios, each step in a company's response to PFAS carries implications for insurability, claim defensibility, and long-term financial resilience.

ILMA members that take deliberate, forward-looking steps—by auditing exposures, investing in safer alternatives, enhancing regulatory compliance, and engaging qualified brokers—will be better positioned to navigate tightening insurance markets. The goal is to not only secure coverage, but to demonstrate to insurers a clear and credible commitment towards risk mitigation. In doing so, lubricant manufacturers can reduce their exposure to potentially costly PFAS liabilities.

ILMA
Independent Lubricant Manufacturers Association

Section 5: PFAS in the Lubricants Supply Chain

Certain PFAS chemistries have attracted interest in lubricant applications due to their capacity to maintain performance under severe mechanical and thermal stress. The combination of oil and water repellency with high-temperature stability has positioned these substances as useful contributors to friction reduction and resistance to material degradation in engineered systems.

Polytetrafluoroethylene (PTFE) is a well-known example — incorporated into both surface treatments and lubricant formulations for its ability to lower friction, withstand elevated operating temperatures, and resist chemical interaction with other substances. In automotive and industrial contexts, select PFAS have found their way into engine oils and hydraulic fluids, where they support functions including wear protection, corrosion inhibition, and foam suppression.

Understanding the role of PFAS in tribological applications can support mapping exercises and risk management endeavors.

> **For an in-depth account of the role of PFAS in tribological applications, consult the following resources:**
>
> Darrius Dias et al., Forever Chemicals, Per-and Polyfluoroalkyl Substances (PFAS), in Lubrication (2024).
>
> OECD, Per-and Polyfluoroalkyl Substances (PFAS) and alternatives in hydraulic oils and lubricants: Report on commercial availability and current uses, OECD Series on Risk Management of Chemicals (2025).

a. Legacy Contamination

Legacy contamination refers to the presence of PFAS in soil, groundwater, or infrastructure as a result of historical industrial, commercial, or municipal practices—often dating back decades. PFAS have been manufactured and widely used in countless applications due to their chemical stability and resistance. Over time, routine activities such as chemical handling, equipment cleaning, spills, or disposal led to PFAS releases into the environment, where they persist and migrate due to their resistance to natural degradation. Addressing legacy contamination is essential to understanding a site's total PFAS risk profile—even when current operations no longer involve PFAS.

Common sources of PFAS contamination include the historical use of firefighting foams, surface treatments, landfills, and various manufacturing processes. In the lubricant manufacturing context, legacy risks may be hidden in areas where PFAS-containing materials or products were used, stored, or disposed of. As detailed below, the formulation process itself has involved PFAS through the use of PFPE base oils, PTFE lubricant additives, and certain processing aids and equipment.

Additionally, bulk product transfer zones—where lubricants are loaded into or offloaded from railcars, tank trucks, totes, and drums—could be suspect given that they are among the highest-risk locations for historical spills and leaks at a time when secondary containment standards lacked. These areas typically include loading docks, fill stations, pump pads, and tanker hose connections.

Prioritizing site knowledge and methodical documentation lays the foundation for proper risk assessment and management with respect to legacy contamination.

b. Environmental Contributors

Environmental contributors refer to nearby facilities, land uses, or infrastructure that may be a source of PFAS contamination, even if they are unrelated to a company's own operations. Because some PFAS are highly mobile in groundwater and can persist in the environment for decades, historical or ongoing activities in the surrounding area—such as airports, military bases, landfills, wastewater treatment plants, or industrial operations that used or disposed of PFAS-containing materials—can result in off-site migration. Identifying these contributors is a best practice for contextualizing a site's PFAS risk and determining whether contamination is attributable to on-site or external sources. A thorough review of publicly available environmental records, regulatory databases, and adjacent land use history can help identify such potential contributors early in the risk assessment process.

c. Formulation

PFAS contamination in lubricants can occur even when these substances are not intentionally added as ingredients. After all, PFAS may enter the supply chain through base fluids, additives, and water supplies used during formulation—either as active performance-enhancing components or as impurities. Therefore, companies must treat formulation inputs as a key risk vector.

Base Oils

All lubricants are built on a base oil, which may be mineral, synthetic, or plant derived. While traditional mineral oils are not associated with PFAS content, certain classes of **synthetic base oils** are made up of fluorinated chemistries. These high-performance base oils are used in specialized applications that require extreme thermal stability, chemical resistance, or lubrication under high pressure and temperature conditions. Key examples of PFAS-based base fluids include:

- **Perfluoropolyether oils (PFPEs)** are synthetic fluorinated polymers used directly as lubricants or as base fluids for greases. They are prized for their oxidation resistance, thermal stability, non-flammability, and anti-corrosion features.
- **Polychlorotrifluoroethylene (PCTFE)** are oligomeric fluids that can be used as lubricants, base oils in greases, and process fluids in a variety of applications, including metalworking fluids and vacuum pump fluids.

> **NOTE:**
>
> *PCTFE oligomeric fluids are intentionally engineered low-molecular weight oligomers designed to remain in liquids, greases, or waxes. The degree of polymerization is a key attribute. PCTFE oligomeric fluids should not be confused with high-molecular weight PCTFE fluoropolymers.*

- **Fluorosilicone oils**, used to produce fluorosilicone lubricants are suitable for high-speed bearings, valves, gears, and mechanical pumps operating in harsh chemical environments. These components are commonly found in the aerospace, automotive, and petrochemical industries, where they require lubrication to resist fuels, oils, solvents, and extreme temperatures.

Additives

Additives are incorporated into base lubricating oils to enhance their inherent properties or impart new properties for better performance. Their functions vary depending on the type of lubricant and its end-use application, but commonly include friction reduction, corrosion inhibition, emulsion stability, extreme pressure protection, and lubricity, among others. The following additive functions are of particular interest in the context of potential PFAS engagement:

Extreme Pressure additives are used in higher performance pressing and drawing lubricants to protect metal surfaces in machinery or operations in high temperature processes. PTFE particles are widely used in EP additives for greases, gear oils, and engine oils. These particles create a low-friction protective film between metal surfaces during high-load operations, reducing wear and mechanical failure risks.

Surfactants and emulsifiers help stabilize mixtures of oil and water, reduce surface tension, and promote uniform dispersion of other components. They are commonly employed in metalworking fluids and other water-based lubricants. These additives can rely on fluorotelomer chemistry for reducing surface tension.

Defoamers suppress or eliminate foam formation during lubricant use, particularly relevant to engine oils, gear oils, hydraulic oils, turbine oils, and compressor oils. These additives may contain fluoro-surfactants.

Anti-wear agents form a protective layer on metal surfaces to reduce friction and wear under load. Some historic formulations used PFAS-based compounds (PTFE) for high thermal resistance.

PVDF Nanoparticles is a performance enhancer that forms a lubricating film on contact surfaces, reducing friction and wear. PVDF is a fluoropolymer.

Water Supplies

In water-based metalworking fluids, cutting fluids, and coolants, municipal or private water is frequently used as a formulation component. When sourced from contaminated water systems, this becomes an additional—and often overlooked—vector for PFAS engagement. Since PFAS compounds are highly water-soluble and stable, even low-level contamination in process water can lead to product-level PFAS introduction.

d. Equipment

Processing aids and equipment represent one of the most overlooked—but potentially high-risk—sources of PFAS contamination in lubricant manufacturing. Particularly in older facilities or shared production lines, the legacy use of fluorinated greases, PTFE-lined hoses, and aqueous film-forming foam (AFFF) systems can create often difficult to detect contamination pathways.

Manufacturers should understand that even equipment perceived as "clean" may retain micro-residues capable of migrating into new product batches. Without a proactive and systematic approach to identifying, sampling, and either decontaminating or replacing high-risk components, companies face the ongoing risk of inadvertently introducing PFAS into finished lubricants.

Tank, Kettles, Molds, Hoses and Seals

Equipment may contain fluorotelomer-based anti-stick coatings, such as kettles, mixers, molds, and tanks. There is a risk for PFAS leaching, especially during high heat or aggressive formulation. Equipment may also contain PTFE-linings, including hoses and seals.

AFFF Fire Suppression Systems

PFAS-based or fluorinated foam systems developed as highly valuable commercially because they could quickly extinguish hydrocarbon fires. The molecules form a protective film on the fuel that blocks air, while their water solubility makes them easy to apply and highly effective in firefighting.

PFAS-enhanced firefighting foams were developed by the military in the late 1960s. Aqueous film-forming foams (AFFF) were subsequently broadly adopted by aviation, industrial, and firefighting in the 1970s, as they outperformed traditional water and earlier foams in fighting hydrocarbon fires such as oil and petroleum-based lubricant and oil fires by creating a thin film that suppresses vapors and cools the fuel surface.

AFFF, used in fire suppression systems and emergency drills, can lead to floor drain, sump, and tank infiltration with PFAS. Equipment that was retrofitted or repurposed without thorough decontamination may retain hidden reservoirs of PFAS. Over time, these materials can leach PFAS into new batches of products, creating a pathway for unintentional contamination.

e. Packaging

Fluorinated packaging used in the lubricant industry—from small bottles to large drums and totes—due to its enhanced barrier properties and chemical resistance can be a source of PFAS. Most fluorinated containers are made of high-density polyethylene (HDPE) or polypropylene (PP) that undergo surface treatment via direct fluorination. This process strengthens the container against paneling, cracking, and chemical attack, allowing for lighter, thinner-walled packaging that maintains structural integrity over time.

However, direct fluorination can inadvertently generate PFAS as a byproduct when oxygen is present during treatment. These PFAS can then leach into lubricant formulations or enter the environment through disposal or recycling pathways. Among the various fluorination techniques, only **in-mold fluorination (IMF)** has been shown by one study thus far to produce containers that are effectively PFAS-free.

> **For the IMF study, consult the following resource:**
>
> *Rock J. Vitale et. al., An Assessment of the potential for leaching of per-and polyfluoroalkyl substances from fluorinated and non-fluorinated high-density polyethylene containers, Environmental Advances Vol. 9 (Oct. 2022).*

Where the benefits of fluorinated packaging are essential, lubricant manufacturers should understand fluorination methods to assess and manage risks.

ILMA
Independent Lubricant Manufacturers Association

Section 6: Tools for PFAS Risk Assessment

a. Intro to Risk Assessment

For lubricant manufacturers seeking to manage PFAS-related risk, the first and most important step is assessment. Without a clear understanding of where and how PFAS may be present in raw materials, packaging, or manufacturing environments, companies cannot develop meaningful strategies to mitigate exposure or respond to emerging regulatory and customer demands. A well-structured assessment allows companies to triage risk, allocate resources efficiently, and engage knowledgeably with suppliers, regulators, and customers.

Assessment begins by identifying potential sources of PFAS within the supply chain or product lifecycle—whether intentional use, cross-contamination, or leaching from packaging. However, detection of PFAS is complex: the substances occur at extremely low concentrations, and analytical methods are still evolving. Lubricant manufacturers may decide not to conduct testing directly but should be familiar with the tools available and understand their relevance, limitations, and implications for defensible risk management.

Reporting Compliance Considerations

Understanding applicable reporting obligations under TSCA and the TRI program is a critical consideration when assessing a company's engagement with PFAS. After all, these programs can transform technical findings into regulatory exposure if not managed deliberately. Under TRI, PFAS that are listed chemicals may trigger reporting when they are manufactured, processed, or otherwise used above applicable thresholds. Separately, TSCA PFAS reporting requires companies to look retrospectively across their operations and supply chains to identify PFAS that were manufactured or imported.

> **TIPS:**
>
> *Align PFAS reporting threshold determinations with a centralized inventory of materials, suppliers, and waste streams to support consistent and defensible reporting positions*
>
> *New PFAS chemicals continue to be added to the Toxic Release Inventory each year as regulations are updated and amended. The current list of reportable chemicals should be reviewed frequently to ensure reporting methodologies are up to date. Consult EPA website:* ***https://www.epa.gov/toxics-release-inventory-tri-program/addition-certain-pfas-tri-national-defense-authorization-act***

By integrating TRI and TSCA considerations into PFAS risk assessment planning, lubricant manufacturers can reduce regulatory uncertainty, avoid unplanned disclosures, and help to ensure that mitigation actions support long-term risk management objectives.

b. Intro to PFAS Detection Methods

Understanding the available sampling tools and their relevance to lubricant environments is important when evaluating compliance and insurance risks, responding to customer inquiries, and engaging with third-party labs. Several methods have been developed to detect PFAS across water, soil, biosolids, and waste.

The **EPA's Method 537** and its updates (537.1) remain the foundational tools for detecting PFAS in drinking water, targeting commonly known compounds such as PFOA and PFOS. **Method 537.1** now can effectively measure 29 PFAS, expanding its scope to include newer substances like GenX chemicals. Further, the method has been adapted by researchers to test PFAS in high-density polyethylene (HDPE) containers—a relevant material in lubricant packaging. See more about this HDPE test method in subsection F.

The **EPA's Method 1633** broadens applicability to media beyond drinking water, covering wastewater, surface water, groundwater, soil, sediment, and tissue samples. This method has emerged as the go-to tool to monitor PFAS concentrations for purposes of Clean Water Act compliance, targeting nine classes of compounds covering a total of 40 PFAS, including the most high-profile compounds (PFOS, PFOA, PFHxS, PFNA, PFBA, PFBS).

The **EPA ACB Project B21-02**, discussed further in subsection F, can detect and quantify 28 specific PFAS in oily matrices, such as pesticide products formulated in oil, petroleum distillates, or mineral oils. This method could potentially be adapted to petroleum-based lubricants, allowing manufacturers to detect PFAS in formulations or containers, especially where PFAS use is unintentional or residual. To date, it has not been adapted to do so.

Finally, **ASTM International** has issued two guides, **E3302-25 and F3700-25**, that outline current analytical methods and provide a framework for selecting appropriate techniques based on project-specific goals. The guides cover the strengths, limitations, and emerging trends in PFAS testing, while also highlighting the importance of involving qualified laboratories and experienced professionals when planning and interpreting PFAS data, especially given the evolving nature of detection capabilities and regulatory expectations. Coupled with **E3439-25** and **E3511-26**—additional guides on data evaluation and sampling of environmental media for PFAS—these four guides provide a comprehensive overview of available methodology, sampling techniques and data evaluation for PFAS and assist in understanding analytical testing within a broader risk assessment and management strategy.

c. Legacy Contamination & Environmental Contributors

Assessing legacy PFAS contamination starts with a thorough and well-documented preliminary investigation. For lubricant manufacturers—especially those operating before 2010—legacy risk often lies beneath the surface: soil, groundwater, drains. Understanding past operational practices such as hydraulic oils, metalworking fluids, and plating chemicals generates great context for a due diligence review.

The approach involves conducting a tailored Phase I Environmental Site Assessment (ESA) with a focus on PFAS-associated operations, followed by targeted Phase II testing only in high-probability zones such as transfer areas, dry wells, AFFF discharge sites, and old waste pits.

ESA Phase I is a document-based investigation designed to identify potential or existing environmental contamination liabilities at a property. It's typically conducted during property transfers, refinancing, or acquisitions as part of a due diligence process

> **TIP:**
>
> *The Phase I ESA should be completed in accordance with ASTM E1527-21 Standard, which now includes PFAS considerations, especially in the context of acquisitions to benefit from landowner liability protections.*

Scoping the geographical area of your site can also be a complementary step to your ESA Phase I review, as it may unveil nearby facilities, land uses, or infrastructure that may be a source of PFAS contamination, even if they are unrelated to your company's own operations. Identifying these contributors is important for contextualizing a site's PFAS risk and determining whether contamination is attributable to on-site or external sources.

TIPS:

Develop a map identifying potential sources of PFAS near your lubricant plant—such as AFFF manufacturers, PFAS producers, industries scrutinized under EPA's Effluent Guidelines Program (e.g., electroplating facilities), landfills, and airports.

*Review PFAS data using EPA's PFAS Analytic Tools at **echo.epa.gov/trends/pfas-tools** to identify known contamination and usage near your lubricant plant.*

Utilize a quality environmental consulting firm with a track record of conducting Phase I ESAs compliant with the ASTM standard.

ESA Phase II involves collecting environmental samples to determine if contamination is present. Collecting PFAS samples requires a special degree of care and procedures to minimize cross contamination risks. Before proceeding with this next step, however, it's crucial to consider whether Phase II activities can trigger any contractual obligation, insurance risk, or regulatory requirement. For instance, TRI reporting applies to listed chemicals "known to be present." Because internal documentation (e.g., Safety Data Sheets, procurement records) may not identify PFAS compounds, sampling can implicate heightened threshold calculation and reporting requirements under the TRI.

TIP:

Before initiating a Phase II ESA, consult with an environmental attorney to develop a risk matrix and protect certain information.

A risk matrix can help companies make informed decisions about when a proactive Phase II is strategically and legally appropriate. The framework should weigh:

- **Insurance considerations** – whether sampling results could affect current or future coverage, exclusions, or claims;
- **Regulatory implications** – whether detection of PFAS could trigger mandatory reporting, remediation, or agency oversight; and
- **Contractual obligations** – including disclosure duties or representations under purchase, lease, or financing agreements.

In summary, a methodical assessment of legacy contamination through the ESA process can be a valuable tool for gaining a clearer understanding of your company's historical engagement with PFAS.

d. Formulation

PFAS may enter the supply chain through raw materials or water sources used during formulation, making proactive assessment of these inputs essential for effective risk management.

For assessing your company's level of engagement with **PFAS via raw materials**, it is important to get familiar with PFAS chemistry in relation to your procurement orders. A general understanding of PFAS structures, naming conventions, and groupings is necessary to assess whether base oils or additives used for formulation can introduce PFAS into your finished lubricants.

Equally important is for formulators to watch for inputs known or reasonably anticipated to interact with these compounds. In the case of base oils, pay special attention to synthetic oils that may intentionally rely on fluorinated chemistries to impart high-performance characteristics to lubricant products. Similarly, flag classes of additives that commonly involve fluorinated chemistries or fluoropolymers: PTFE and other solid fluoropolymers (EP/anti-wear), fluoro-surfactants (emulsifiers, defoamers), PVDF nanoparticles, and any specialty heat- or chemical-resistant polymers.

A structured approach to identifying PFAS in raw materials involves:

- Administrative
  - Develop a centralized log to inventory suspect PFAS ingredients and maintain supplier documentation.
  - Understand reporting implications under TSCA and TRI.
  - Establish a strategic framework for interactions with customers if PFAS presence is unveiled.

> **TIP:**
>
> *Organizing the inventory of raw materials by supplier, region, and CAS number can be particularly helpful.*

- Ingredient Risk Assessment
  - Review product formulations and corresponding documentation like SDSs.
  - Cross-check inventory against known PFAS CAS numbers (EPA, OECD), using specific search terms such as “fluoro-”, “telomer”, “perfluoro-”.
- Supplier Inquiries
  - Review TSCA and TRI data using your supplier’s facility identification.
  - Request PFAS certifications for functional additives and synthetic base oils.

> **TIPS:**
>
> *In some cases, non-disclosure agreements can be valuable tools when proprietary or trade-secret information poses barriers to effective communication.*
>
> *Evaluate whether and how information should be protected through in-house or external counsel to maintain confidentiality and privilege.*
>
> *Consider the definitional variance of the term “PFAS” when communicating with your supplier; cite a specific program or naming convention to the governing definition.*
>
> *Specify whether it only covers intentionally added PFAS.*
>
> *Request the factual basis for the representation, including whether it rests on formulation knowledge, upstream supplier information, analytical testing, or some combination of those sources.*

PFAS may also enter formulations through water used in processing, cleaning, or as part of the mixture. Proactive assessment of water sources can help companies identify potential exposure, verify quality, and, ultimately, support risk management decisions. With respect to assessing **PFAS in water supplies**, there are a few actions to take:

- Identify all water intake points: municipal water, private wells, and surface water sources.
- Review existing water quality data from local, state, and federal agencies.

TIP:

*Consult with EPA databases from the Unregulated Contaminant Monitoring Rules (UCMR 3 and UCMR 5) to review sampling results from public water systems for more than 30 PFAS. Visit **epa.gov/dwucmr***

- Consider testing water supplies using appropriate analytical methods and, where appropriate, establish a regular sampling cadence to ensure ongoing monitoring and quality assurance.

e. Equipment

AFFF fire suppression systems are widely recognized as a potential source of PFAS contamination in industrial facilities, including lubricant plants. Assessing the presence of PFAS in AFFF systems and evaluating potential risk is therefore an indispensable part of the risk mitigation plan. The risk drivers presented by AFFF systems are:

- PFAS releases into the environment with associated human health impacts;
- costly environmental remediation and regulatory penalties;

NOTE:

A recent US Chamber of Commerce study (2022) estimates clean-up costs for existing PFOS and PFOA contaminated sites at over $17.4 billion, with an individual site costing between $15 to $20 million to remediate.

- potential legal liability;
- reputational harm

The risk of a release is exacerbated by the fact that some automatic AFFF firefighting system designs are significantly more prone to accidental discharge than to discharge in response to a fire event. In a 2022 study of foam deluge systems in hangars conducted by the University of Maryland, it was found that foam deluge systems more frequently discharge accidentally than in response to a fuel fire due to human action or electrical malfunctions in the initiating buttons, valves, or panels. The UMD study found that over an 18-year period from 2004 to 2021, over 80% of foam releases in hangars were the result of accidental discharges with no fire present (Milke and Poole, 2022). Using the data published in the UMD report, a conservative estimate of the probability of an accidental release of foam is about 5×10^{-2} per year. This is approximately 10,000 times more likely than an actual pool fire from a fuel spill.

TIPS:

To identify potential PFAS presence in your system, check product literature (such as tank or container labels) for key terms including: AFFF, fluoroprotein foam, fluorosurfactant, "fluoro" prefixes, PFOS/PFOA.

If product literature does not confirm or rule out PFAS presence, consult your NFPA 11 maintenance service provider as a first step (they are required to document foam concentrate in use). Contact the manufacturer directly if further clarification is needed.

f. Packaging

Fluorinated packaging can be used in the lubricant industry—from small bottles to large drums and totes—to enhance barriers and impart chemical resistance properties. Most fluorinated containers are made of high-density polyethylene (HDPE) or polypropylene (PP) that undergo surface treatment via direct fluorination, which strengthens the container against cracking, chemical attack, and long-term degradation.

While these properties improve product performance, recent studies have shown that direct fluorination can inadvertently generate PFAS as a byproduct, particularly when oxygen is present during treatment. These PFAS may leach into lubricant formulations or enter the environment through disposal, recycling, or incidental release. For example, in 2021, EPA's Analytical Chemistry Branch (ACB) reported on testing of methanol rinsates from the interiors of 2.5-gallon, 30-gallon, and 55-gallon drums, and also from the exterior of a used and an unused 2.5-gallon drum that had been subjected to a fluorination process. ACB found concentrations of a variety of perfluoroaliphatic acids ranging from C4 to C11, with individual PFOA results from one container exceeding 30 ppb and total PFOA amounts ranging up to almost 60 ppb. Non-fluorinated containers, when subjected to the same analyses, showed only a few ppt PFOA.

EPA's Analytical Chemistry Branch (ACB) developed and validated a method for analysis of twenty-eight PFAS compounds extracted from oily matrices. This method, ACB Project B21-02, was published internally by the Agency but became publicly available.

> **For an in-depth review of the studies, consult the following resources:**
>
> EPA, Nguyen, *Rinses from Selected Fluorinated and Non-Fluorinated HDPE Containers* (March 21, 2021).
>
> EPA, Nguyen, *Analytical Chemistry Method for the Analysis of PFAS in Oily Matrix*, ACB Project B21-02 (Sept. 28, 2021).
>
> Steven Lasee et. al., *Targeted analysis and Total Oxidizable Precursor assay of several insecticides for PFAS*, J. Haz. Materials, 3 (2024).

A 2020 study by Vitale et al. evaluated the potential for PFAS leaching from containers manufactured using different fluorination technologies, including advanced in-mold fluorination, post-mold fluorination, and post-mold plasma fluorination. Using extended methanol soak tests and analyzing 19 target PFAS compounds, the researchers found no detectable PFAS (above instrument LOQs) in containers produced using advanced in-mold fluorination. By contrast, measurable levels of PFAS—ranging from 11 to 9,700 ng/L—were consistently detected in containers using post-mold and plasma fluorination methods.

These findings highlight important differences in PFAS risk depending on the fluorination process used and underscore the value of method-specific testing for packaging materials.

Tools to assess risk in this context include:

- Review all packaging materials used to identify potential sources.
- Communicate with suppliers and document relevant information, including any reported changes in production methods.
- Develop and maintain a comprehensive inventory of all fluorinated packaging, organized by container type, size, fluorination method, and the type of product stored.
- Determine the type of fluorination process applied to each container for risk triage.

> **TIP:**
>
> *A 2022 study showed that the risk of by-product PFAS creation is significantly reduced through advanced in-mold fluorination (IMF). See **Rock J. Vitale et. al., An Assessment of the potential for leaching of per-and polyfluoroalkyl substances from fluorinated and non-fluorinated high-density polyethylene containers, Environmental Advances Vol. 9 (Oct. 2022)**.*

Section 7: Risk Management Considerations

a. Intro to PFAS Risk Mitigation

For lubricant manufacturers that have identified a potential PFAS risk from past/current operations or property conditions, the next step is mitigation—translating assessment findings into practical, defensible actions.

PFAS risk mitigation is not a single solution, but a spectrum of controls that can be applied strategically based on risk magnitude, regulatory exposure, and business constraints. A useful framework for approaching mitigation is the hierarchy of controls, which prioritizes eliminating hazards where feasible, followed by substitution, engineering controls, and administrative measures. Additionally, proactively addressing risks associated with previous operations on-site or nearby environmental contributors can prove cost-effective in the long run.

In the PFAS context, elimination or substitution may involve reformulating products, replacing fluorinated additives, or transitioning away from fluorinated packaging where alternatives are viable. Engineering controls can reduce exposure through closed systems, improved containment, or enhanced wastewater treatment. Administrative controls—such as procurement policies, supplier requirements, and waste-handling procedures—often play a central role where elimination is not immediately achievable. In the context of historical PFAS contamination of soil or groundwater, there are risk management strategies to mitigate impacts and liabilities.

An effective mitigation strategy balances these controls and strategies to reduce PFAS risk over time while maintaining product performance, operational continuity, and regulatory compliance.

Risk Governance and Oversight

Effective PFAS risk mitigation requires more than technical controls; it depends on clear governance and disciplined decision making. For lubricant manufacturers, PFAS determinations increasingly function as enterprise level risk decisions, with implications that extend beyond EHS into legal exposure, supply chain continuity, insurance coverage, customer relationships, and corporate transactions. As a result, it is critical to establish clear ownership, escalation pathways, and documentation practices for PFAS- related- decisions.

A sound governance framework begins by identifying who owns PFAS risk within the organization. While Environmental, Health, and Safety teams often lead technical evaluations, mitigation decisions should be coordinated with Legal, Procurement, Product Stewardship, and, where applicable, ESG or enterprise risk management functions. This cross functional- structure helps ensure that tradeoffs are evaluated consistently and with full visibility into downstream consequences.

Documentation plays a central role in governance. Companies should clearly record the rationale for key decisions centered around PFAS risk mitigation. Tying PFAS evaluations into existing governance mechanisms—such as EHS committees, product approval gates, or capital project reviews—helps demonstrate consistency across sites and over time.

b. Intro to PFAS Treatment Methods

Understanding how PFAS-containing waste streams are treated is an important component of PFAS risk mitigation for lubricant manufacturers, particularly where assessment activities indicate potential PFAS presence in wastewater, spent oils, sludges, or residual materials. Unlike many conventional contaminants, PFAS are highly resistant to chemical, biological, and thermal degradation, meaning most treatment approaches focus first on separation and concentration, with true destruction occurring only under limited conditions.

> **TIP:**
>
> *Establish a routine audit process to evaluate waste management practices involving PFAS-impacted materials against currently applicable regulatory guidance — and maintain thorough documentation of those practices. Given the pace of regulatory change in this area, records demonstrating that materials were handled, treated, and disposed of in compliance with the guidance in effect at the time may prove consequential.*

Currently, the most widely implemented PFAS treatment technologies for liquid waste streams include **Granular Activated Carbon (GAC)**, **Ion Exchange (IX) resins**, and **Foam Fractionation,** all of which remove PFAS through adsorption or ion exchange rather than destruction. These technologies are commonly used for treating industrial wastewater, process water, and landfill leachate. However, these methods generate secondary PFAS-laden media that must themselves be managed as waste.

For solids, sludges, spent sorbents, and concentrated PFAS wastes, high-temperature incineration remains the most established destruction pathway, provided that sufficiently high temperatures and residence times are achieved to avoid incomplete destruction and by-product formation. Regulatory scrutiny and capacity limitations, however, have increased interest in alternative destruction technologies. Landfilling also remains an approach that could be viable for these waste streams, but landfills are becoming increasingly concerned with PFAS waste streams and potential future liability.

Emerging PFAS treatment and destruction methods include supercritical water oxidation (SCWO), electrochemical oxidation, and plasma-based technologies, all of which aim to break the carbon–fluorine bond and achieve mineralization rather than sequestration. While several of these approaches have demonstrated promising results at pilot or early commercial scale, most remain costly, operationally complex, or limited to specific waste types.

> **TIP:**
>
> *Lubricant manufacturers should view treatment selection as an evolving landscape, informed by waste-stream characteristics, disposal pathways, regulatory expectations, and long-term liability considerations rather than as a one-size-fits-all solution.*

c. Legacy Contamination & Environmental Contributors

When PFAS are identified or reasonably suspected during a Phase I or Phase II Environmental Site Assessment, mitigation should focus on controlling exposure, managing liability, and preserving flexibility—rather than defaulting immediately to expansive remediation. For lubricant manufacturers, legacy PFAS risk often stems from historical operations, past chemical use, legacy fire suppression systems, or environmental conditions that predate current ownership or practices. An effective mitigation strategy begins with distinguishing between historical contamination and ongoing sources, then tailoring controls accordingly.

The first step is to stabilize the situation and refine the conceptual site model (CSM). This includes confirming the media affected (soil, groundwater, wastewater, or infrastructure), evaluating whether contamination is migrating, and assessing potential exposure pathways. Where PFAS appear attributable to historical practices or offsite contributors, mitigation may focus on containment, monitoring, and documentation rather than immediate removal. In many cases, preventing further migration—through source isolation, improved drainage controls, or operational changes—can significantly reduce risk while -longer term- strategies are evaluated.

> **TIP:**
>
> *Focus early mitigation efforts on stopping or limiting ongoing releases; eliminating an active source often reduces risk more effectively than aggressive cleanup of legacy impacts.*

Where Phase II data indicate elevated PFAS concentrations, companies should carefully evaluate regulatory and contractual implications before initiating further investigation or remediation. Sample results can strengthen technical understanding but may also trigger reporting obligations, permit modifications, or disclosure requirements. Mitigation strategies may therefore include targeted monitoring programs, institutional controls, and adequate consideration of liability protections.

> **TIP:**
>
> *Use experienced environmental consultants and attorneys to support data evaluation, risk assessment, and mitigation steps.*

Environmental contributors beyond the facility boundary should also be addressed as part of mitigation planning. Nearby airports, landfills, industrial users, or historical AFFF deployment can complicate source attribution. Documenting these contributors and integrating them into the CSM can help support defenses against sole source- liability and inform discussions with regulators or third parties.

> **TIP:**
>
> *Maintain clear documentation distinguishing onsite operations from external PFAS contributors to support cost recovery or third-party attribution strategies.*

Finally, legacy PFAS mitigation should be integrated with broader business objectives, including insurance strategy, property transactions, and stakeholder communications. A reasoned, well documented- mitigation approach positions lubricant manufacturers to manage legacy PFAS exposure responsibly while avoiding unnecessary regulatory, financial, or reputational consequences.

d. Formulation

Mitigation in formulation is most effective when it moves beyond reactive compliance and toward structural risk reduction — eliminating non-essential PFAS, preventing reintroduction through procurement controls, and embedding oversight into product development. This approach reduces regulatory exposure, litigation vulnerability, and supply chain disruption while preserving performance and customer trust.

- **Develop a substitution framework considering performance, regulatory outlook, supply stability, and downstream customer exposure and satisfaction**

TIPS:

Establish a PFAS Team to develop a substitution decision-making framework.

Consider strategic reformulation to remove non-essential PFAS-containing raw materials, prioritizing elimination in products sold into jurisdictions with current or anticipated PFAS restrictions.

Consult publicly available information on alternatives, such as OECD, Per-and Polyfluoroalkyl Substances (PFAS) and alternatives in hydraulic oils and lubricants: Report on commercial availability and current uses, OECD Series on Risk Management of Chemicals (2025).

- **Tighten procurement controls to more closely monitor PFAS engagement**

TIP:

Require updated PFAS-free certifications from suppliers on a recurring basis — providing a clear delineation of the definition of "PFAS"

- **Apply feasible engineering and process controls**

In cases where PFAS sources cannot be eliminated, evaluate the use of engineering and process controls to minimize exposure and environmental release. For example, consider whether it's feasible to isolate PFAS-containing formulations to dedicated equipment.

TIP:

Implement enhanced PFAS cleaning protocols to prevent cross-contamination

Additionally, examine whether waste segregation is a needed risk mitigation measure to ensure that PFAS-containing waste is adequately managed.

TIP:

Consider enhancing on-site wastewater treatment systems to target PFAS removal before discharge. If water source is contaminated, consider point-of-use treatments (e.g., granular activated carbon or reverse osmosis) or switching to alternative water sources.

- **Develop a communications plan for customers and downstream users, prioritizing high-risk markets**
- **Formalize a PFAS review screening in new product development processes**

e. Processing Aids and Equipment

Managing PFAS risks in processing aids and equipment begins with a practical, tiered approach that balances cost with risk. While a full forensic investigation of all equipment might appear burdensome, the reality is that low-cost, high-impact actions—like inventories, supplier declarations, rinse testing, and prioritizing replacement of obvious PFAS-containing components—can significantly reduce risk exposure early.

Supplier questionnaires and PFAS content declarations allow companies to assess the upstream risk posed by raw materials, additives, and maintenance chemicals. Asking suppliers to disclose:

- Whether PFAS are intentionally used.
- If fluorinated processing aids or surfactants are part of the product.

- Whether PFAS-free third-party certification or testing has been performed.

These can flag high-risk inputs and help prioritize reformulation or substitution. These documents also serve as key due diligence artifacts that demonstrate proactive effort in the event of customer concerns or regulatory audits.

Early and detailed documentation can build confidence with downstream users and regulators. Avoiding costly product recalls or contamination incidents starts with knowing exactly how and where your equipment could be an unintentional PFAS source.

Potential risk mitigation measures include:

- **Conducting an inventory of all processing equipment, including legacy components and any fluorinated materials**
- **Testing surfaces and rinse water for PFAS indicators**

> **TIP:**
>
> *Consult with your testing laboratory for sample methods and collection procedures for rinse water analysis. Clear objectives and proper planning are essential when considering PFAS sampling.*

- **Develop a decision-making method for replacement or decontamination of suspect materials**
- **Train personnel to recognize high-risk materials and conduct proper cleaning procedures**

AFFF fire suppression systems are widely recognized as a potential source of PFAS contamination in industrial facilities, including lubricant plants. There are several ways to manage this risk depending on the current situation at a given facility. Broadly speaking, AFFF risks can be mitigated by:

- **Removing or modifying an existing AFFF system and replacing it with a different code compliant fire suppression system.**

If a facility has an existing AFFF system, the first risk management consideration is to transition the system away from AFFF to a non-fluorinated foam (NFF) or in specific situations, to a water-only system. While this may be a costly alternative, there are many risk factors that may support this approach.

Often, the transition does not require extensive demolition of the existing system, depending on the specific types, quantities, and storage arrangement of the material to be protected, the history of past discharges, and the existing system design. There are now several options for UL and/or FM listed NFF products. In some cases, all that is required is the removal of the existing AFFF tanks, piping to the proportioner, and the proportioner, and changing out the discharge devices (i.e., sprinkler heads and/or nozzles) to ones listed for use with the NFF selected. Additional considerations include the need for flushing of existing piping if adsorbed PFAS compounds may be present in concentrations sufficient to result in discharge of regulated quantities of PFAS compounds should the system discharge.

Any foam system will still need to meet the requirements of NFPA 11 in effect in the jurisdiction, as it governs the design, installation, operation, testing, and maintenance of low-, medium-, and high-expansion foam systems regardless of the foam's chemical composition. NFPA 11 requires proper proportioning, discharge testing, and compatibility verification for foam concentrates and systems. Transition to NFF must maintain compliance with system performance criteria, including application density, expansion ratios, and discharge device compatibility.

In some unique cases, it may be possible to transition to a water-only system. This is an increasing option for airplane hangars. This approach may be an option for other storage facilities depending on the specific types, quantities, and storage arrangement of the material to be protected.

> **TIP:**
>
> *Assess risk comprehensively focusing on state laws or legislative bills that ban or phase out the sale of products containing added PFAS.*

- **Adding additional containment to an existing system to reduce or eliminate PFAS containing foam or foam/water from entering the environment**

The most serious consequences of an AFFF release occur when the foam is released into the environment. When a sprinkler system discharges, hundreds to thousands of gallons of foam/water mixture are discharged per minute, and foam system design requires enough foam for 10-minutes of discharge. As a result, a large volume of PFAS contaminated water is released. To avoid this escaping into the environment, additional containment and capture to allow treatment and disposal of the contaminated water without it being allowed to escape into the environment can significantly reduce risk. The appropriate transport and disposal of this waste can be expensive and is still heavily regulated. Even if contained, once an AFFF system discharges, the inability to refill the system due to the laws and policies discussed above banning PFAS materials may still result in the need to transition the system away from AFFF.

- **Hardening an existing AFFF system to reduce risk of an accidental discharge.**

If it is determined that system removal and/or transition to NFF is not currently feasible, it is still possible to reduce risks associated with an AFFF release. Depending on the type of system, it can be "hardened," which means adding controls that can significantly reduce the probability of an accidental discharge.

> **TIPS:**
>
> *Assess and consider modifying activation protocols. For example, if the current system is automatically activated electronically by a single device, such as by a heat or flame detector, the system can be re-programmed to not activate unless there are two (2) independent initiation signals. This means that should one detector be tripped accidentally due to an electrical short circuit, the system would not discharge unless an independent, second initiating device is also activated.*
>
> *Depending on the system type and industrial operation, it may be possible to move away from deluge application of foam to discharge through a closed-head sprinkler system to reduce probability of accidental release.*

- **If installing a new system, avoid installation of an AFFF system.**

A company building a new facility must consider a risk mitigation approach that avoids installing a PFAS-containing AFFF system. While this sounds obvious and straightforward, it is not simple or easy. Until very recently, the model codes developed by the International Code Council (ICC), and standards published by National Fire Protection Association (NFPA), which serve as the basis of the vast majority of state building and fire codes, required foam (typically AFFF) in locations with flammable and combustible liquids (aka "ignitable liquids"). Fire Mutual (FM) Global standards similarly called for foam fire protection systems. In the past three (3) to five (5) years however, these organizations have started to recognize alternative methods of protection for ignitable liquid.

However, because state legislatures must approve updates to the editions of model codes upon which most state building and fire codes are based, we are often in a position where state laws may mandate installation of foam systems in instances where quantities of hydrocarbon liquids are stored and/or used. This is complicating the process of getting approval for non-AFFF fire suppression systems, but Fire Marshals across the country who can approve systems from more recent standards or with alternative methods are generally supporting elimination of PFAS foam where feasible.

> **TIP:**
>
> *Work closely with the Fire Marshal to explore non-foam, or at least non-AFFF, fire suppression design options and proactively follow the procedure to obtain waivers from code requirements if needed.*

f. Packaging

To mitigate PFAS risk associated with fluorinated HDPE and PP packaging, lubricant manufacturers should adopt a structured approach focused on supply chain transparency, risk prioritization, substitution analysis, and due-diligence documentation.

- **Strengthen Supplier Oversight**

> **TIPS:**
>
> *Obtain written disclosure of fluorination methods used by your supplier (post-mold fluorination, in-mold fluorination, or post-mold plasma fluorination).*
>
> *Require notification of method changes and, if necessary, regulatory compliance certifications.*

- **Evaluate and Implement Alternatives**

> **TIPS:**
>
> *Assess the functionality and feasibility of transitioning to non-fluorinated packaging technologies, such as barrier additives and multilayer structures. Prioritize elimination where fluorinated functionality is not essential*
>
> *Where fluorination is necessary, consider limiting packaging options to advance in-mold fluorination (IMF) processes.*

- **If feasible, map disposal and recycling pathways for potential PFAS release and legal exposure**