PFAS FAQ

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WHAT ARE PFAS?

PFAS, or Per- and Polyfluoroalkyl Substances, are a diverse group of chemicals resistant to heat, oil, water, and grease. They have numerous other beneficial characteristics as well. For decades, these compounds have been used in numerous industrial applications and the production of countless consumer products, including carpeting, apparel, non-stick cookware, food packaging, plastic containers, firefighting foams, ski wax, cosmetics, and more. While some PFAS have been phased out in the United States, notably PFOA and PFOS, hundreds if not thousands of PFAS remain in use.

HOW TOXIC ARE PFAS?

Much remains unknown about the toxicity of PFAS as a class of compounds, but the U.S. EPA (EPA) has either completed toxicity assessments or has assessments underway for a small handful of compounds of concern. These assessments can be found on the U.S. EPA's **Integrated Risk Information System (IRIS) database**. The data from these assessments are used to inform federal and state regulatory efforts, such as the National Primary Drinking Water Regulations (NPDWR) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund). One trait that all PFAS seem to share is their ability to build up in the bloodstream and tissues of plants and animals. Some of the more studied PFAS have also been linked to numerous health concerns such as certain types of cancers, low birth weight, and cognitive development issues.

HOW ARE PEOPLE EXPOSED TO PFAS?

The most well-studied pathway for human exposure is through drinking water; however, the FDA is currently conducting studies to determine the level of PFAS in the foods we eat. PFAS may enter the food supply through plant and animal uptake of PFAS in the environment. This is of growing concern as PFAS-contaminated wastewater treatment plant sludge that is land-applied as biosolids for fertilizer is a well-known pathway for PFAS to enter our food supply. Thanks to their oil, grease, and water-resistant properties, PFAS has also been a component of food packaging for decades. Other researchers are also looking at PFAS uptake from consumer products such as apparel and cosmetics.

HOW IS EXPOSURE TO PFAS CONTROLLED?

In April of 2024, the EPA announced the first-ever National Primary Drinking Water Regulations (NPDWR) limits on six PFAS in the nation's public drinking water systems. Unlike previously issued health advisories, NPDWR limits are legally enforceable. PFOA, PFOS, PFNA, PFHxS, and HFPO-DA (GenX) have individual Maximum Contaminant Limits (MCLs). In addition, PFNA, PFBS, PFHxS, and GenX are assessed using a Hazard Index (HI) calculation that considers the relative toxicities of the various compounds and their combined concentration.

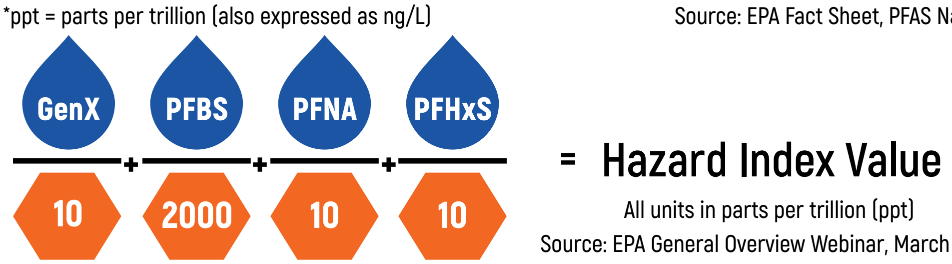
In the graphic below, the water drop represents the concentration of each PFAS in the sample. If the total of all the fractions is equal to or greater than one, the water system exceeds the Hazard Index limit. To be considered in violation, the running average of all samples taken in the past twelve months must also be equal to or greater than one. States are free to also set limits on these and other PFAS in drinking water, provided allowable levels do not exceed levels set by the NPDWR.

Chemical	Maximum Contaminant Level Goal (MCLG)	Maximum Contaminant Level (MCL)
PFOA	**0**	**4.0 ppt**
PFOS	**0**	**4.0 ppt**
PFNA	**10 ppt**	**10 ppt**
PFHxS	**10 ppt**	**10 ppt**
HFPO-DA (GenX chemicals)	**10 ppt**	**10 ppt**
Mixture of two or more: PFNA, PFHxS, HFPO-DA, and PFBS	**Hazard Index of 1**	**Hazard Index of 1**
Maximum Contaminant Level Goal (MCLG): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.		

The Hazard Index is a tool used to evaluate potential health risks from exposure to chemical mixtures.

*ppt = parts per trillion (also expressed as ng/L)

Source: EPA Fact Sheet, PFAS National Primary Drinking Water Regulation



All units in parts per trillion (ppt)

Source: EPA General Overview Webinar, March 2023

In May of 2025, **the U.S. EPA announced plans** to rescind the use of the Hazard Index and the individual limits on all PFAS except PFOA and PFOS. In addition, the agency proposed to extend the deadline for compliance with PFOA and PFOS MCLs from 2029 to 2031. The revised rule is expected to be published in late 2025, with finalization anticipated in the spring of 2026. Until then, the regulations and requirements enacted in 2024 remain in effect.

Effluent Limitation Guidelines (ELGs) are regulations established by the U.S. EPA, limiting the level of pollutants allowed in discharge into surface water and to Publicly Owned Treatment Works (POTWs). According to the EPA, "ELGs are intended to represent the greatest pollutant reductions that are economically achievable for an industry." The most current finalized plan is ELG Plan 15. In this plan, the agency determined that limits were warranted for **landfills**, but has yet to define those limits. The EPA also proposed an **Information Collection Rule (ICR)** to study PFAS in wastewater influent, effluent, and biosolids. As written, this rule impacts the country's 400 largest Publicly Owned Treatment Works (POTWs).

In December 2024, the EPA published Preliminary Plan 16 and opened it up for public comment. This plan expands the study of PFAS in wastewater discharge and announces the agency's intention to issue an Advanced Notice of Proposed Rulemaking (ANPRM) for effluent guidelines in the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) industry. Once ELGs are established, they are enforced under **National Pollutant Discharge Elimination System (NPDES)** permitting.

NPDES permitting regulates the discharge of pollutants into the waters of the U.S. (WOTUS). States can petition the U.S. EPA to administer their own NPDES program. Four states, NH, NM, MD, and MA, as well as most U.S. territories and Tribal Lands continue to rely on the EPA for NPDES permitting. Under guidance from the EPA, many states have already begun including PFAS in NPDES permits.

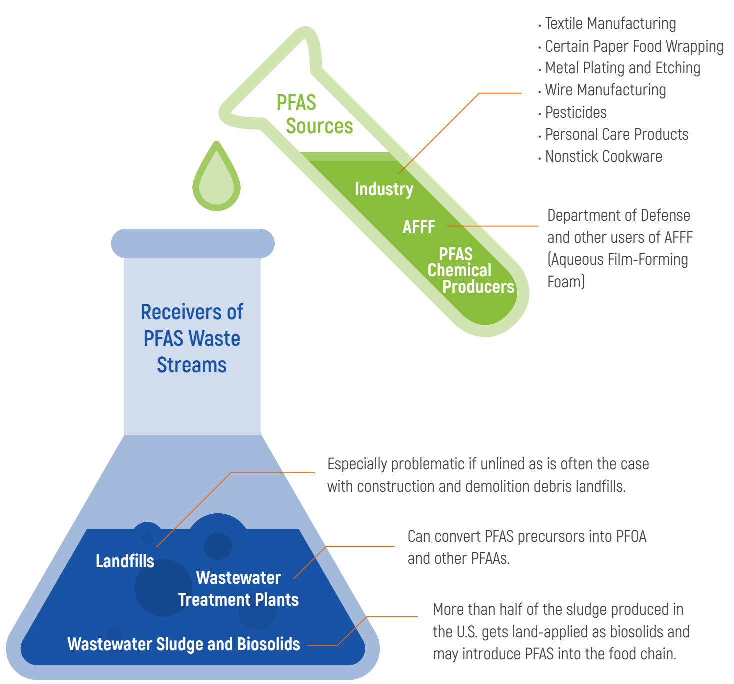
In 2024, PFOA and PFOS were declared "hazardous substances" under the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**. This gives the U.S. EPA the authority to respond directly to PFAS contamination in the event of a release of these two compounds. CERCLA also grants the EPA the power to address existing contamination under the Superfund program. The EPA has also proposed designating certain PFAS (PFOA, PFOS, PFBS, HFPO-DA (GenX), PFNA, PFHxS, PFDA, PFHxA, and PFBA) "hazardous constituents" under the **Resource Conservation and Recovery Act (RCRA)**, allowing much greater control over the entire lifecycle of PFAS: manufacturing, transportation, treatment, storage, and disposal. For instance, once finalized, hazardous waste facilities may be required to conduct enhanced monitoring of PFAS concentrations in solid and liquid waste, including landfill leachate.

Finally, some states are starting to monitor and, in some cases, set limits on PFAS in other matrices, such as groundwater, surface water, soil, and biosolids. **Biosolids**, in particular, are receiving quite a bit of attention as they are often land-applied as soil amendments or disposed of in municipal landfills. Several states have enacted laws requiring biosolids to be tested before they can be sold as a soil amendment, while others have restricted the use of biosolids in agriculture.

WHAT IS UCMR 5?

The EPA's Unregulated Contaminant Monitoring Rule (UCMR) is designed to collect data on 30 contaminants that are suspected to be present in drinking water but do not have health-based standards set under the Safe Drinking Water Act (SDWA). A revised list of 30 contaminants is selected every five years. The UCMR 5 contaminants list includes 29 PFAS plus the metal lithium (Li). Both EPA Test Methods 537.1 and 533 are required to analyze for the 29 PFAS, and EPA Test Method 200.7 is required to analyze for lithium. Pace® is UCMR 5 approved for all three test methods.

Under **UCMR 5**, all public water systems serving 3300 people or more and a randomly selected set of 800 smaller systems are required to comply with UCMR 5. This more than doubles the number of public water systems required to participate in previous UCMR sampling rounds. Sampling is expected to be complete by the end of 2025. A summary of the data collected may be found on the **EPA's website**.



WHAT ARE SOME COMMON SOURCES OF PFAS?

PFAS in drinking water and other environmental matrices can come from a variety of sources:

Local industry – Chemical manufacturers of PFAS are an obvious source of PFAS, but other types of businesses, such as metal finishing and textile manufacturers, can also be a significant source of PFAS contamination.

Stormwater – Runoff from industrial sites where PFAS is manufactured or used is cause for concern, but there are other sources to consider. Farmland may have been treated with pesticides containing PFAS (which can leach from fluorinated plastic storage containers) or fertilized with biosolids contaminated by PFAS. Runoff from these fields can contaminate local drinking water sources.

Airports and military sites – AFFF (Aqueous Film-Forming Foam), the foam traditionally used to fight Class-B chemical fires, often contains PFAS. Although Fluorine Free Foams (FFF) have been approved for firefighting, not all municipalities have switched, and the use of AFFF can contaminate a site for years. Drainage from sites where this foam has been used, either in an emergency or during a training exercise, can be transported by stormwater runoff. This stormwater runoff can contaminate adjacent soil and leach into groundwater or enter the storm sewer system where it can enter a receiving body of water (surface water). Soil and groundwater beneath the training area have also frequently been found to be contaminated.

Landfill leachate – As liquid (rain, condensation, liquid waste) passes through a landfill, it can leach PFAS from solid waste. This contaminated leachate is frequently discharged to the local wastewater treatment facility.

WHICH TEST METHODS SHOULD WE USE?

For drinking water compliance, only two test methods are allowable: EPA Test Methods 533 and 537.1. For more complex matrices or where compliance reporting isn't required, several additional methods are now available.

EPA Test Method 537.1

Matrix: Drinking Water

An EPA-validated method, Method 537.1 was developed to replace Method 537 and is commonly used for drinking water compliance. In addition to analyzing for the 14 compounds covered by Method 537, Method 537.1 also analyzes for four replacement PFAS*, including 11Cl-PF3OUdS, 9Cl-PF3ONS, ADONA, and HFPO-DA (GenX).

*Replacement PFAS are typically shorter-chain, PFAS compounds used to replace PFAS with known toxicity, such as PFOA and PFOS.

EPA Test Method 533

Matrix: Drinking Water

EPA 533 expanded the number of PFAS compounds that can be analyzed in drinking water samples. Unlike the 537 series, this method utilizes isotope dilution, providing additional quality control for accuracy of reporting, especially at ppt (parts per trillion) levels. EPA 533 does not replace EPA 537.1, but together, the tests can be used to analyze for 29 PFAS compounds. EPA 533 is also commonly used for drinking water compliance, and both EPA 533 and EPA 537.1 are required for UCMR 5 compliance.

For testing non-potable liquids, solids, and other matrices, a variety of test methods are available:

EPA 1633

Matrices: Wastewater, Surface Water, Groundwater, Soil and Sediment, Biosolids, Biological Tissues, Landfill Leachate, AFFF

Method 1633 closely resembles PFAS by Isotope Dilution/"537M" SOPs and can quantitate 40 compounds across a wide range of solid and aqueous matrices, and additional compounds can be added to this method. EPA 1633 will play a vital role in the EPA's efforts to study, monitor, and regulate PFAS in nearly all matrices and regulatory programs except drinking water. Pace® participated in the multi-lab validation of this method. This method will be adopted into SW-846 for the RCRA program and will soon be promulgated in 40 CFR Part 136.

EPA 1621

Matrix: Aqueous

AOF/EPA 1621 measures adsorbable organic fluorine in non-potable water. Similar to other organofluorine-based methods, EPA 1621 utilizes Combustion Ion Chromatography (CIC) instrumentation. The EPA intends EPA 1621 to be utilized as a screening tool to assess organic fluorine concentrations in non-potable water, which often contains many PFAS compounds not detectable by targeted methods such as EPA 1633. The EPA Office of Water describes EPA 1621 as a "Screening Method for the Determination of Adsorbable Organic Fluorine (AOF) in Aqueous Matrices by Combustion Ion Chromatography (CIC)." Its reporting limit is in the single-digit parts-per-billion range. Pace® was chosen to perform the single-laboratory validation for EPA 1621.

ASTM D8421/ASTM D8535/EPA 8327

Matrices: Ground & Surface Waters, Wastewater, Landfill Leachate, Biosolids, Soil & Sediment

ASTM D8421 and D8535 are PFAS methods developed by the American Society for Testing and Materials (ASTM) to provide a quick, easy, and robust method for PFAS analyses in aqueous and solid matrices, respectively. ASTM D8421/D8535 utilizes Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), with optional uses of Isotope Dilution (ID) to minimize the impacts of sample matrix interference on quantification and thus improve data quality. Technically similar to EPA 8327, Pace® can cite either EPA 8327 or ASTM D8421/D8535. Along with EPA 1633, the DOD utilizes ASTM methods to expedite base-wide remedial investigations across the country. EPA CWA personnel are reviewing the validation study data of D8421 to potentially include it in 40 CFR Part 136 as an NPDES-approved test method.

ASTM D8421/D8535 and EPA 8327 offer several advantages over other methods. Turnaround time (TAT) is faster than other published methods that are more procedurally challenging. With optimized procedural requirements, ASTM D8421/D8535/EPA 8327 can also be delivered at a lower price point than other PFAS methods. Finally, ASTM D8421/EPA 8327 only requires 15 mL (5 mL in triplicate) of water volume to be collected. This saves significant field collection time and shipping costs compared to other methods, such as EPA 1633, which require higher sample volumes.

PFAS by Isotope Dilution

Matrices: Ground & Surface Waters, Wastewater, Landfill Leachate, Wastewater Sludge & Biosolids, Soil & Other Solids, Biota

Like many commercial labs, Pace® developed and validated an isotope dilution method based on EPA 537 to apply for non-drinking water matrices such as non-potable water, solids, biota, and biosolids. Able to quantitate 40 PFAS compounds, this method is widely applicable to both DOD and commercial/industrial applications. Furthermore, Pace® has been audited and certified to the accreditation standards of DOD, TNI NELAC, and state accreditation bodies for this method.

TOP Assay

Matrices: Aqueous and Solids

PFAS precursors, both known and unknown, are a class of PFAS compounds that can degrade to terminal PFAS compounds (i.e., perfluoroalkyl substances) under the right environmental circumstances. TOP Assay oxidizes PFAS precursors, most of which are compounds not currently measured by targeted techniques, converting them into their terminal PFAS compounds that can then be measured. The increase in PFAS measured after the TOP Assay oxidation relative to pre-oxidation levels is a gross estimate of the total concentration of PFAS precursors present in a sample. PFAS analysis by TOP Assay is particularly useful in forensic studies designed to identify the source of elevated PFAS levels in all matrices. TOP Assay is commonly used on complex sample matrices such as landfill leachate, wastewater, biosolids, and AFFF.

Total Fluorine

Matrices: Solids

Two tests are commonly used for analyzing total fluorine in a wide range of solids, such as cosmetics, personal care products, textiles, etc. Cryomilling combined with CIC provides a complete profile of organic and inorganic fluorine content in a sample.

Consumer and Industrial Products

Matrices: Fluoropolymers, Textiles, Food Contact Materials, And Many Other Consumer and Industrial Products

PFAS is often an ingredient in fluoropolymers and other materials used for packaging and in many commercial and industrial applications. It is also a concern in the container industry and chemical formulation. Pace® utilizes EPA Method 1633 with cryomilling to analyze for 40 common PFAS compounds in consumer and industrial products. We also offer Total Fluorine testing for these products.

ARE LAB CERTIFICATIONS FOR PFAS TESTING REQUIRED?

US EPA approval is required for a laboratory to participate in the UCMR 5 program. Many states also have lab certification programs for drinking water compliance, and those that do not are in the process of adding it now that the PFAS NPDWR is final. Pace® has multiple laboratories that are UCMR 5 approved, and we maintain accreditations in every state that requires them for PFAS testing.

DOD ELAP accreditation is required for DOD projects that fall under the Installation Restoration program. Pace® was the first DOD-accredited lab to obtain DOD certification for four critical PFAS test methods for non-potable liquids and solids: EPA 1633, ASTM D8421, ASTM D8535, and EPA 8327.

HOW DO I KNOW WHICH PFAS COMPOUND(S) TO TEST FOR?

EPA programs, such as UCMR 5, and state sampling requirements are very specific about which compounds are included. When compliance reporting isn't required, several other methods are available, many of which can analyze for additional compounds or for total fluorine. (See test methods) Pace® can help you determine the appropriate methods and compound lists to use for your project.

DO WE NEED TO TEST INFLUENT, SLUDGE/BIOSOLIDS AS WELL AS EFFLUENT AT OUR WASTEWATER TREATMENT PLANT (WWTP)?

When working with municipal clients, Pace® often provides influent, sludge, biosolids, and effluent testing. Effluent (treated wastewater) testing is important since these waters are discharged directly into the environment (receiving bodies of water). Testing influent (untreated wastewater) can help identify the PFAS compounds (concentrations) of PFAS that are entering the wastewater treatment plant (WWTP). Since PFAS have an affinity to solids, testing the sludge/biosolids can help to identify the PFAS are being adsorbed to the to these matrices. While these types of tests are frequently done to assess potential liabilities, many states are starting to require PFAS in NPDES wastewater and stormwater permitting.

DO WE NEED TO WORRY ABOUT PFAS FROM THE LOCAL LANDFILL?

When a liquid (rain, condensation, liquid waste) passes through solid waste, the liquid byproduct is called "leachate." If liquid passes through and from waste that contains PFAS, it is likely that the leachate will contain PFAS too. Most municipal landfills are lined and have leachate collection systems, so they are unlikely to contaminate local groundwater and drinking water sources directly. However, leachate is frequently sent to municipal WWTPs.

Since traditional wastewater treatment does not remove PFAS, landfill leachate can contribute to PFAS discharged through the WWTP effluent and could impact drinking water sources indirectly. In addition, private construction and demolition (C&D) landfills and some industrial landfills are unlined and do not have a leachate collection system. These C&D landfills have the potential to receive large amounts of PFAS waste from building materials. The PFAS in these landfills can leach into the soil, and from there, into the local groundwater.

OUR SMALL COMMUNITY IS SURROUNDED BY FARMLAND, AND WE DON'T HAVE MUCH INDUSTRY. DO WE NEED TO BE CONCERNED ABOUT PFAS CONTAMINATION?

More than half of the biosolids (sludge) produced by wastewater treatment are land applied to agricultural fields as a soil amendment. If the wastewater contains elevated levels of PFAS, these biosolids are likely to as well, and researchers are showing that certain types of plants can accumulate PFAS in higher concentrations than other plants. In addition, many small municipalities are also supported by local airports. The AFFF used to extinguish oil-based fires is a primary source of contamination. Even if there has not been an actual incident at the airport, firefighting equipment needs to be tested frequently, which often involves the release of AFFF. The runoff from a release of AFFF can contaminate local groundwater. Drinking water can also be contaminated if runoff from the airport is treated by the municipal water treatment facility. Lastly, PFAS can also migrate into the local environment from nearby military installations. Since these sites are often located in rural areas, they can be a source of elevated PFAS detections in water systems serving small communities as well as private wells.

WHAT LEAD OR TURN-AROUND-TIMES (TAT) ARE TYPICAL FOR PFAS TESTING?

Typical turn-around times [TATs]] are two weeks at Pace®, with Rush TAT also available. Actual TATs depend on the lab capacity, matrix issues, and various method requirements. Pace® can provide an estimate based on the parameters of your project and available lab capacity.

ARE THERE EMERGENCY SERVICE OPTIONS AVAILABLE?

In the event of a chemical spill or other emergency, our Rapid Response (877-859-7778) team can be up and running within hours and provide around-the-clock services by leveraging resources across the Pace® laboratory network.

HOW DO YOU TEST PLANT AND ANIMAL TISSUE FOR PFAS?

With the growing awareness of elevated levels of PFAS in wildlife, particularly game and fish, this question is being asked more often. When testing biota, sample prep is more complicated than it is for other matrices. For instance, you need to decide whether you need to analyze the entire organism or just a portion. Then, since an animal is far less homogenous than even challenging matrices like wastewater, there's the matter of prepping the sample in a way that yields a reliable result.

Pace® was one of the first commercial labs to analyze biota for PFAS and other emerging contaminants. In late 2024, we conducted a webinar sharing the processes we use for sample prep and analysis. This webinar is now available on demand: **Navigating The Complexities of Testing for PFAS in Plant and Animal Tissue.**

HOW CAN PFAS CONTAMINATION BE ADDRESSED?

The EPA has identified several **Best Available Technologies (BAT)** for removing or reducing PFAS contaminants from drinking water. In particular, activated carbon filtration, ion exchange resins, and high-pressure membranes like nanofiltration or reverse osmosis are widely recognized as effective at reducing the concentration of PFAS to safe levels as recommended or required by health advisories and regulatory standards.

Although each of these methods can be effective, results may vary based on several factors. In addition, PFAS remediation is often costly to implement, so assessing the efficacy of a particular approach through pilot studies is critical. We conducted a webinar with one of our consulting partners, showcasing our collective experience with PFAS remediation studies in drinking water. The recording is now available on demand: **Navigating PFAS in Drinking Water: Treatability Insights and Analytical Overview.**

PFAS remediation in more complex matrices like wastewater can be challenging, but many new technologies have been introduced, and more are under development. Read **our case study** for one such project using plasma vortex technology to destroy PFAS in wastewater.

The Pace® PFAS Treatability Studies Center of Excellence (COE) assists clients in evaluating and optimizing technologies and strategies for PFAS removal, remediation, and destruction. Our focus is on supporting the analytical needs associated with treatability studies, utilizing the full PFAS analytical toolbox ranging from EPA methods to non-routine analyses like TOP Assay and AOF. The PFAS Treatability Studies COE encompasses all wet chemistry tests associated with these studies as well.

The PFAS Treatability Studies COE team includes PFAS subject matter experts, project managers, and PFAS analysts familiar with these project and the importance of timely and accurate data. We have experience in a wide array of matrices associated with these studies, from drinking water to landfill leachate and foamate. Our experts support the entire PFAS remediation lifecycle, including bench scale testing, such as Rapid Small Scale Column Test (RSSCT), on-site pilot projects, and ongoing monitoring.

Learn more about PFAS Treatability Studies

LEARN MORE ABOUT PACE®

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