Per- and Polyfluoroalkyl Substances (PFAS)

Frequently Asked Questions

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What are PFAS?

Per- and Polyfluoroalkyl Substances (PFAS) are groupings of thousands of fluorine-containing chemicals that are resistant to heat, water, and petroleum products. These attributes make products that are stain and water resistant and fire retardant. For decades, PFAS have been used in industrial applications and consumer products. Examples include:

- firefighting and the use of fire-suppressant foam (e.g., aqueous Class B, film-forming foam, AFFF)
- chemical manufacturing
- surface finishing and treatment of metals, paper, textiles, or durable goods (e.g., leather)
- mist suppressant in metal plating baths, especially chromium plating processes
- paints and adhesives
- waxes and surfactants (detergents)
- food-grade non-stick coatings (i.e., Teflon™)
- personal care products (e.g., cosmetics, soaps, shampoos)
- fluorocarbon-based synthetic rubber (e.g., gaskets, O-rings, hoses)
- points of transfer (e.g., rail yards) and disposal (e.g., landfills, wastewater treatment facilities, composting facilities, biosolids disposal or land application areas)

Based on the nature of emerging contaminants, it is likely that additional uses will be identified.

How do PFAS interact with the environment?

Due to the presence of carbon-fluorine bonds, one of the strongest bond types in nature, PFAS are persistent, which means that they do not break down in the environment easily. Similarly, studies of half-lives in humans suggest that the human body has difficulty excreting PFAS as they absorb to proteins and bio-accumulate, with small amounts building up over time in blood and organs.

How can PFAS affect human health?

Some studies suggest that certain PFAS may affect different systems in the body. The National Center for Environmental Health (NCEH)/Agency for Toxic Substances and Disease Registry (ATSDR) is working with various partners to better understand how exposure to PFAS might affect human health. Although more research is needed, some studies in humans have shown that certain PFAS may:

- affect growth, learning, and behavior of infants and older children
- lower a woman's chance of getting pregnant
- interfere with the body's natural hormones
- increase cholesterol levels
- affect the immune system
- increase the risk of certain types of cancer

Have cleanup criteria been established?

The EPA has set a lifetime health advisory (LTHA) level for two PFAS in drinking water: perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). The LTHA level is 70 parts per trillion (ppt) for PFOA and PFOS combined. The LTHA is the level, or amount, below which no harm is expected from these chemicals. These extremely low action levels are the result of the human body's inability to excrete these chemicals using natural processes and uncertainty associated with their toxicity. A summary of current recognized actions levels in New England as of January 2019 is provided below:

State	Drinking Water Action Level	Soil Action Level(s)
Connecticut	70 ppt (Sum of 5)	Residential Direct Exposure Criteria 1.35 mg/kg GA Pollutant Mobility Criteria: 1.4 ug/kg
Massachusetts *	70 ppt (Sum of 5)	None Proposed
New Hampshire *	70 ppt (Sum of 2)	None Proposed
Vermont	20 ppt (Sum of 5)	None Proposed
Rhode Island	70 ppt (Sum of 2)	None Proposed
Maine	70 ppt (Sum of 2)	None Proposed

** New values are being proposed*

Additional studies are being conducted; it is likely that action levels will change in the future.

Are special procedures required for PFAS sampling?

PFAS present significant challenges relative to environmental assessment. PFAS-containing chemicals were used in a wide variety of industries, and are present in consumer products, clothing, and a host of other applications, contributing to a relatively high potential for cross-contamination. Health advisory action levels require extremely sensitive analysis using a modified drinking water analysis; therefore, low levels of field or laboratory cross-contamination can invalidate data sets. Special care needs to be taken during sampling to address these challenges. Furthermore, laboratory analysis costs are higher that other common constituents of concern based on the sensitive analysis required.

COMMON PFAS ABBREVIATIONS

PFAS Regulated by All New England States (January 2019)

PFOA - Perfluorooctanoic Acid

PFOS - Perfluorooctanesulfonic Acid

Connecticut, Massachusetts, and Vermont Additions (January 2019)

PFHxS - Perfluorohexanesulfonic Acid

PFHpA - Perfluoroheptanoic Acid

PFNA - Perfluorononanoic Acid

Others

PFBA - Perfluorobutanoic Acid

PFPeA - Perfluoropentanoic Acid

PFHxA - Perfluorohexanoic Acid

PFDA - Perfluorodecanoic Acid

PFUnA - Perfluoroundecanoic Acid

PFDoA - Perfluorododecanoic Acid

PFTriA - Perfluorotridecanoic Acid

PFTeA - Perfluorotetradecanoic Acid

PFBS - Perfluorobutanesulfonic Acid

PFHpS - Perfluoroheptanesulfonic Acid

PFDS - Perfluorodecanesulfonic Acid

FOSA - Perfluorooctanesulfonamide

NMeFOSAA- N-methylperfluorooctanesulfonamidoacetic Acid

NEtFOSAA - N-ethylperfluorooctanesulfonamidoacetic Acid

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Has Fuss & O'Neill sampled for PFAS?

Fuss & O'Neill has collected both soil and groundwater samples for PFAS analysis at multiple sites, including a landfill, specialty coating manufacturer, former paper/box manufacturing facility, former car wash, and a fire training school. General observations from these sampling events are provided below:

Site	Number of Samples	Samples with No Detections	Drinking Water Action Level Exceeded
Fire Training School	5 Groundwater 23 Soil 3 Potable Water	Yes	Yes
Car Wash	6 Wash Water 3 Groundwater	No	Yes 2 Locations
Specialty Coating Manufacturer	57 Soil 19 Groundwater	Yes	No
Paper/Box Manufacturer	5 Groundwater	Yes	No
Landfill	3 Groundwater	Yes	No

- Although the parts per trillion detection limits required are extremely low, PFAS compounds were not detected in some samples and equipment blanks. This demonstrates that, if care is taken, "non-detect" conditions can be found at parts per trillion concentrations, even though there is a high potential for cross-contamination.
- The highest concentrations detected (up to 48,100 ng/L) were at a fire training school at two locations where firefighting foams were routinely applied during training exercises. PFOS was the primary PFAS detected.
- At a former car wash, PFAS were detected in each of six samples collected from a large wash-water oil water separator and in groundwater. Total PFAS were detected in two monitoring wells at elevated concentration ranging up to 1,287 ng/L. PFOS was the primary PFAS detected.
- At the remaining manufacturing facilities and landfill, including a site where extensive sampling was conducted, no location was identified with PFAS at concentrations exceeding applicable action levels.

Additional studies are being conducted at each of these locations. These preliminary results suggest that PFAS are not ubiquitously present in the environment and will, primarily, be a concern where large volumes of firefighting foams or detergents were used routinely.

If PFAS are found, how can they be addressed?

To date, PFAS found in potable supply wells and manufacturing production wells have been removed using granular activated carbon and/or chemically-engineered resin filtration systems, with the latter being more efficient. Oxidation has been considered; however, due to the potential for byproducts that are more difficult to treat, this technology has not seen widespread use.

With regard to filtration treatment systems, pilot testing is recommended because the specific PFAS, as well as the nature of other constituents present in the groundwater, can have significant impact on the success of the treatment technology. Groundwater plumes have been addressed using pump and treat technology, primarily to control the migration of plumes.

The only options currently available for impacted soil or other solid media from filter systems are incineration (which is expensive) or landfilling.

What can I do?

Fuss & O'Neill recommends that organizations review their current processes to determine the potential for PFAS use, and if identified, prepare an Operations & Maintenance program to develop best management practices and/or engineered solutions to reduce risk to PFAS exposure. Fuss & O'Neill has extensive experience developing such programs for lead paint, ACMs, PCBs, polluted groundwater and can assist you with an evaluation of PFAS in your organization.

Should I sample for PFAS?

There are some instances where you will be required by regulations or permit to sample. In Connecticut, the application for a permit for the discharge polluted groundwater requires analysis for emerging contaminants, including PFAS. In New Hampshire, sampling for PFAS compounds is required at certain parcels of land that are in regulated programs. In Rhode Island, Vermont, Massachusetts, and Maine, there are no current regulatory requirements to sample; however, sampling may be requested by regulators, or by insurance and financial institutions, as part of obtaining coverage or financing. If a requirement to sample for PFAS does not exist and you know of activities that may have resulted in releases of PFAS, sampling would be prudent if:

- there is the potential for impact to a nearby private or public water supply
- investigation results will support future regulatory program closure
- a complete understanding of site conditions is required as part of investigations supporting a transfer in ownership of a property

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