PFAS Roadmap

Tackle testing projects of any size and scope.

Per- and polyfluoroalkyl substances (PFAS) — the "forever chemicals" — have become a primary emerging contaminant of concern because the carbon-fluorine bond is extremely strong and stable, making PFAS difficult to break down. These man-made toxic chemicals cause widespread contamination of water, soil and air and have a harmful impact on public health. PFAS are found in raw materials and a number of products from firefighting foams to non-stick cookware to personal care products. Thermo Fisher Scientific offers scalable and robust solutions, enabling institutions to test projects of any size and scope from objective evidence gathering to ongoing research in line with global environmental agency requirements.

HISTORY OF PFAS

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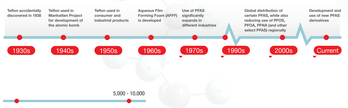
The scientific community continues to evolve its understanding of the environment and health impacts associated with the use of PFAS. Certain PFAS, most notably some of the perfluoroalkyl acids (PFAAs) such as perfluorooctanoate (PFOA) and perfluoro octane sulfonate (PFOS), are mobile, persistent, bioaccumulative and are not known to degrade in the environment; finding their way into food and water sources. These fluorinated organic chemicals have been produced since the mid-20th century and are estimated to include approximately **5,000 to 10,000 compounds** used globally.



Estimated number of fluorinated organic compounds produced globally 1950-current.

IMPACT ON PUBLIC HEALTH

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PFAS has become so prevalent that, according to the Centers for Disease Control (CDC), 95-100% of the population have these chemicals in their blood. Though manufacturers have agreed to stop using PFOS and PFOA, these molecules don't break down easily, and can persist in the human body and the environment for decades, which is why they continue to cause concerns today.

Manufacturing

PFAS environmental release mechanisms associated with primary and secondary manufacturing uses may result in their release through air emission and dispersion, spills and disposal of manufacturing wastes and wastewater.

Firefighting

Firefighting foams are released into the environment through a variety of practices and mechanisms; including during equipment storage and calibration, apparatus testing, firefighter training, and actual firefighting; suppression and prevention.

Solid Waste Disposal

Leachate from municipal solid waste landfill disposal is a source of PFAS environmental contamination due to consumer goods treated with hydrophobic, stain-resistant coatings. The leachate treatment by wastewater treatment plants is common prior to surface water discharge or other uses but ineffective in removing PFAS.

Wastewater Treatment

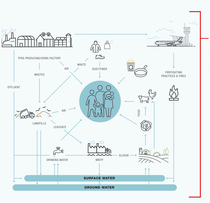
Sources of PFAS include consumer and industrial discharge. Treatment methods can't efficiently remove PFASs from water and sludge. More than 50% of domestic sludge is applied to agricultural land as a soil amendment, with uptake by plants and soil organisms.

Household Products

PFASs are widely used in household applications and products. Studies have shown physical degradation of consumer products such as clothing, non-stick cookware, cleaning agents, personal care products textiles and carpets may be a high source of PFAS in households and later from adsorption related to solid waste disposal.

Commercial Products

Resistant to thermal, chemical, and biological degradation, PFAS are used to produce paper and packaging, outdoor textiles and sporting equipment, ski and snowboard waxes, waxes, pesticides, hydraulic fluids, windshield wipers, paints, varnishes, dyes and inks, adhesives, and medical products.



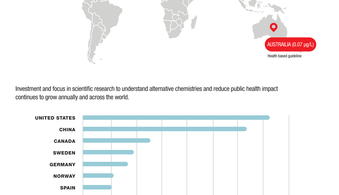
PFAS Environmental Cycle and Human Exposure

PFAS chemicals cycle through the environment daily in air, water, soil and sediments. Through this cycle, they accumulate in fish, wildlife and humans. Most people are exposed to PFAS from drinking water and eating food that contain these chemicals. According to the CDC, and the World Health Organization exposure to PFAS can increase cholesterol and cancer risks, as well as interfere with hormones and thyroid performance.

GLOBAL PFAS HEALTH ADVISORIES

3

Health Advisories (HAs) continually provide information on contaminants causing human health effects and those known or anticipated to occur in drinking water. HAs may be non-enforceable and used primarily to provide technical information to local agencies and other public health officials on health effects, analytical methodologies and treatment technologies associated with drinking water contamination, but also serve as start point for local regulatory changes.



Investment and focus in scientific research to understand alternative chemistries and reduce public health impact continues to grow annually and across the world.

Total number of documents published by top 10 countries concerning PFAS from 2000 to 2020 (data extracted from Scopus, October 2020).

STRATEGIES FOR REDUCING PFAS

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Investigational Studies

Laboratory studies using animals and epidemiological studies of human populations show that exposure to some PFAS may be associated with a wide range of adverse human health effects. Since the early 2000s, the ability to identify PFAS and document in samples is feasible.

Public Awareness and Regulations

Environmental agencies are increasing oversight and enforcement to better identify and address PFAS releases by conducting inspections. At times, they may require parties responsible to characterize the nature and extent of the PFAS contamination.

Replacement Chemistries

Due to concerns about potential health and environmental impact, long-chain PFAS have been phased out globally in manufacturing and use. Global regulatory pressure has manufacturers reformulating, substituting chemicals or looking for alternate technologies altogether.

Voluntary Stewardship Programs

Regulatory oversight can take time to develop, finalize and implement. Agencies are looking to leverage voluntary stewardship programs, challenging industry to reduce overall releases of PFAS and go beyond existing regulatory compliance limits.

TACKLING TESTING PROJECTS OF ANY SIZE AND SCOPE

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Whether lab operations need to address increasing sample requests to meet regulatory standards, enable objective investigations on unknown samples (including environmental, chemical, packaging materials and more), or support ongoing public health research, we can help you tackle PFAS projects of any size and scope.

Scale operations and improve lab efficiency for routine sample requests
Ensure inertness and prevent PFAS cross-contamination and address matrix complexity while improving limits of detection.

Scale and optimize water and soil sample extraction

Improve recovery and reproducibility

Significantly reduce risk of background PFAS detected by LC-MS

Ultimate sensitivity and robustness with ease

Ultrafast analysis time

PFC free UHPLC

Triple quadrupole MS/MS

Integrated suite of data analysis software tools

Complimentary myCloud spectral library for PFAS

Quick-start solutions for easy set up and use

EXPAND INVESTIGATIONAL CAPABILITIES

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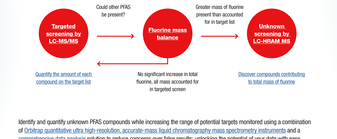
Incorporate analysis of adsorbable organically-bound fluorine by combustion ion chromatography to determine if other PFAS not on the target list may be present in samples.



Identify and quantify unknown PFAS compounds while increasing the range of potential targets monitored using a combination of Orbitrap quantitative ultra high-resolution, accurate-mass liquid chromatography mass spectrometry instruments and a comprehensive data analysis solution to reduce concerns over false results; unlocking the potential of your data with ease.

Find out more at thermofisher.com/pfas-testing