

What Labs Need to Know About PFAS And Ultrapure Water Quality

May, 2026 | Content supplied by Sartorius AG

What is PFAS, and why is it a hot topic?

PFAS (per and polyfluoroalkyl substances) are a large group of over 4,700 synthetic chemicals that have been widely used since the mid 20th century in industrial and consumer products, such as non stick cookware, waterproof textiles, food packaging, and firefighting foams. Their popularity stems from their unique properties, including resistance to heat, water, and chemical degradation.

PFAS have become a hot topic due to growing concerns about their environmental persistence and potential adverse health effects. Because of their strong carbon-fluorine bonds, PFAS do not readily break down in nature and can accumulate in soil, water, wildlife, and the human body over long periods of time. They have been detected in drinking water sources worldwide, raising public health concerns.

Human exposure to PFAS can occur through contaminated food and water, inhalation of dust or air, and contact with PFAS containing products. Increasing evidence linking PFAS exposure to health risks, combined with their widespread environmental distribution and difficulty of removal, has led to heightened scientific, regulatory, and public attention, making PFAS a major environmental issue today.





Dr. Kunal Kureja is a Scientist and Product Manager at Sartorius AG, specializing in laboratory water technologies and analytical applications. He earned his PhD in Analytical and Preparative Chemistry from the University of Kassel and has worked across academic, startup, and industrial settings. His expertise includes application development, technical communication, and cross-functional project leadership, with a particular focus on PFAS-related analytical challenges and contamination risks in laboratory workflows.



What makes PFAS so difficult to remove from the environment?

What makes PFAS particularly difficult to remove from the environment is a combination of their chemical stability, environmental mobility, and widespread use. The carbon-fluorine bond, which is one of the strongest bonds in organic chemistry, makes PFAS highly resistant to chemical, biological, and thermal degradation. As a result, they persist in water, soil, and living organisms for decades.

In addition, many PFAS are highly soluble in water and can easily spread through rivers, groundwater, oceans, and the atmosphere. This mobility allows them to circulate globally, as seen in their presence in remote marine and Arctic environments. Once released, PFAS are not confined to a single location, making containment and removal extremely challenging.

Another difficulty arises from the sheer number of PFAS compounds, which differ in chain length, structure, and behavior. Short-chain PFAS, for example, are even harder to remove from water using conventional treatment methods. Furthermore, PFAS often occur at very low concentrations, complicating detection, monitoring, and remediation efforts. Together, their chemical persistence, global transport, and resistance to conventional treatment technologies make PFAS exceptionally difficult to remove from the environment.

Why is ASTM Type I ultrapure water essential for PFAS-sensitive analyses?

When we work with PFAS, we are often measuring concentrations in single-digit parts per trillion (ppt) or sub-ppt levels. At that level, even trace contamination from lab water or any other equipment and reagent can have a significant impact on the chromatography results. ASTM Type I ultrapure water provides the highest level of purity, with an extremely low organic and ionic background. This is essential to achieve reliable detection limits, avoid false positives, and ensure confidence in PFAS measurements, especially in LCMS based analyses.

How do reverse osmosis, activated carbon, and ion exchange work together to reduce PFAS?

PFAS removal requires a multi barrier approach, as no single technology is sufficient on its own.

- Reverse osmosis (RO) acts as the first major barrier, physically rejecting a broad range of PFAS molecules based on size and charge, significantly reducing the overall PFAS load.
- Activated carbon adsorbs PFAS via hydrophobic and electrostatic interactions and is particularly effective for long chain PFAS.
- Ion exchange resins provide targeted removal, especially for short chain and more mobile PFAS, which are not efficiently captured by activated carbon.

Together, these technologies complement each other, achieving a much higher and more consistent PFAS reduction than any single treatment step.

Why did you use both LCMS and combustion ion chromatography total organic fluorine (CIC-TOF) analysis for this study?

We used both techniques to combine ultra high sensitivity with comprehensive coverage. LCMS is essential for targeted PFAS analysis because it can detect and quantify individual PFAS compounds at single digit ppt or even sub ppt levels, which is critical for regulatory compliance and high confidence quantification.

However, LCMS is inherently limited to the PFAS compounds included in the analytical method. To address this, we complemented LCMS with CIC-TOF analysis. While CIC TOF typically operates at ppb level sensitivity, it captures the entire pool of organofluorine compounds, including unknown or emerging PFAS that are not part of targeted LCMS methods.

By combining the extreme sensitivity of LCMS with the broader fluorine mass balance perspective provided by CIC TOF, we obtained a much more robust understanding of PFAS presence. This dual technique approach increases confidence in PFAS removal performance and helps ensure that no significant fluorinated contamination is overlooked

How important are ultrapure water storage conditions in preventing secondary PFAS contamination?

Water storage conditions are critical when it comes to preventing secondary PFAS contamination. Even water that initially meets the highest purity standards can become contaminated during storage through contact with unsuitable materials such as plastics, tubing, caps, or seals,

as well as through prolonged storage times. Because PFAS analyses are often performed at single-digit ppt or sub ppt levels, even trace amounts of PFAS introduced during storage can lead to elevated background levels or false positive results. In practice, contamination frequently occurs downstream of the purification process rather than during water production itself.

For this reason, we strongly recommend avoiding ultrapure water storage whenever possible. Instead, laboratories should produce ultrapure water on demand and use it immediately at the point of use. Fresh, on demand water production minimizes contact time with materials, reduces contamination risk, and provides the highest level of confidence for PFAS sensitive analyses. Proper control of storage conditions is therefore a key element of reliable and reproducible PFAS analytics.

How does an in-house lab water system compare with bottled LCMS-grade water for PFAS work?

In house water purification systems offer laboratories greater control, consistency, and confidence. Producing ultrapure water on demand eliminates risks associated with bottling, transport, and long term storage, all of which can introduce PFAS contamination. In addition, in house systems enable continuous quality monitoring and traceability, key advantages for laboratories operating under increasing regulatory and quality expectations. For routine PFAS analysis, in house systems provide both performance and operational efficiency.

What should labs look for in a future-ready PFAS water purification system?

Laboratories should look for a multi stage purification solution, tailored to their daily ultrapure water demand and feed water quality, that is proven to deliver water suitable for PFAS analysis. Importantly, this performance should be supported by water analyses or certificates demonstrating that PFAS concentrations in the product water are below the analytical detection threshold, as even trace PFAS contamination can lead to false positive results in ultra trace analyses.

Sartorius' Arium® lab water systems are designed to meet these exact requirements. By utilizing advanced multi stage treatment technologies, Arium® systems reduce PFAS to undetectable levels, ensuring water quality that meets the stringent demands of PFAS sensitive applications. Independent water analyses following DIN 38407-42 or EPA 1633 have confirmed that Arium® product water is PFAS-free and suitable for PFAS analysis, providing laboratories with confidence in their results.

At Sartorius, we also emphasize the importance of real time water quality and data monitoring, and simple, contamination safe point of use dispensing. As detection limits continue to decrease and PFAS regulations evolve, a lab water system capable of consistently producing PFAS-free water is essential. Such systems ensure that laboratories are protected against background contamination and are prepared not only for today's analytical challenges, but also for future regulatory and sensitivity requirements.

Germany

Sartorius Lab Instruments
GmbH & Co. KG
Otto-Brenner-Strasse 20
37079 Goettingen
Phone +49 551 308 0

USA

Sartorius Corporation
3874 Research Park Drive
Ann Arbor, MI 48108
Phone +1 734 769 1600

 **For further information, visit**
[sartorius.com](https://www.sartorius.com)