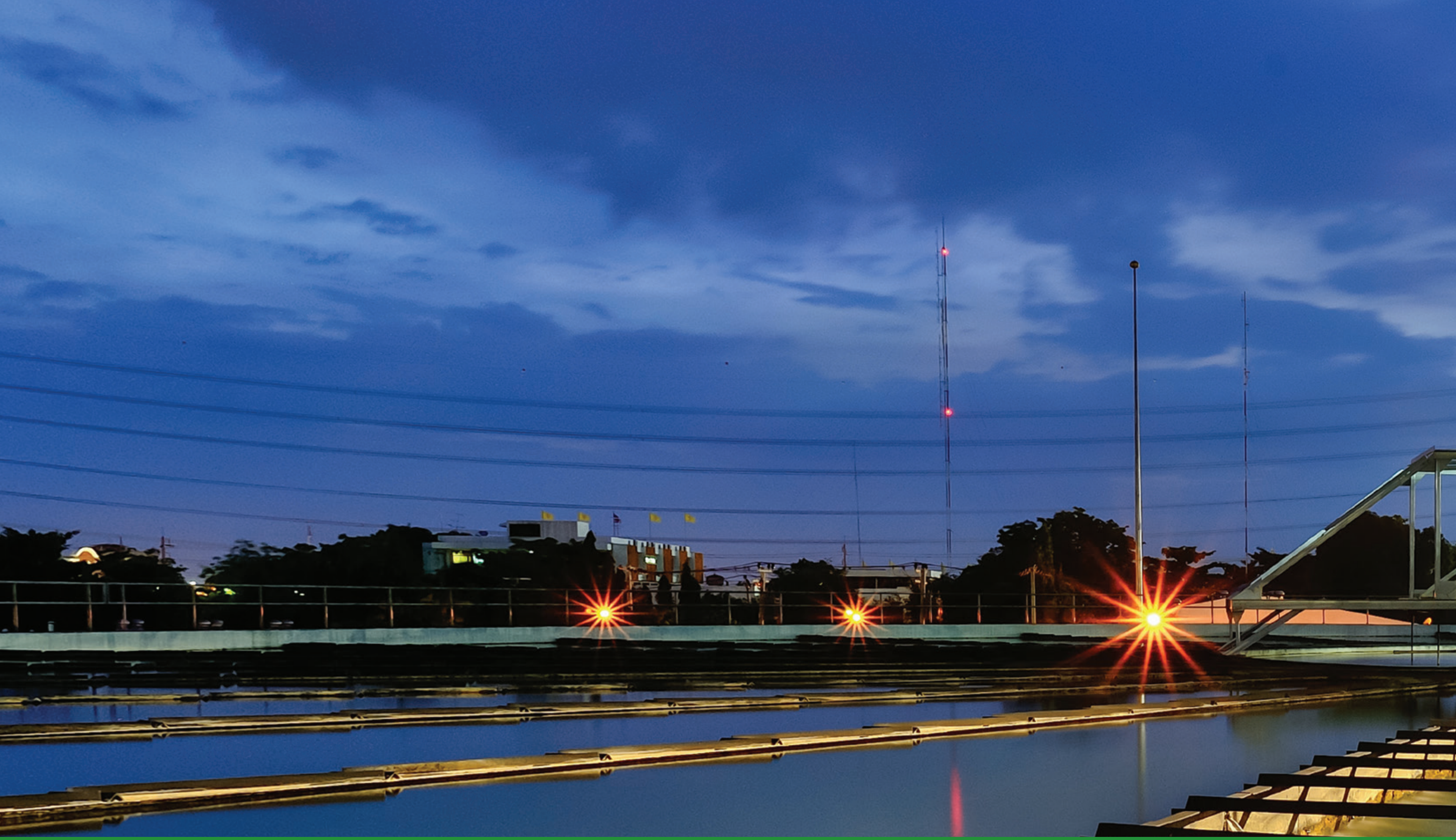


PFAS: KEEPING UP WITH TRENDS, DETECTION METHODS AND REGULATORY MEASURES

Per- and polyfluoroalkyl substances (PFAS) are man-made chemicals that have been widely used over the past 60 years in commercial and industrial products and have been considered pollutants for decades. These chemicals are persistent and can easily build up in the environment–causing concern for human and wildlife health.

In 2016, the U.S. Environmental Protection Agency (EPA) issued a health advisory guideline for levels of two major PFAS—PFOS and PFOA in drinking water. These limits are not enforceable federal standards. Now, as more information about PFAS and research on their effects is available, several states in the U.S., such as Massachusetts, New Hampshire and New Jersey, have taken action to create enforceable regulatory standards to ensure safe drinking water. Thus, public drinking water suppliers must perform analysis to detect and determine PFAS levels and to correct them if they are too high.

Beyond human health concerns, environmental concerns also exist. A release of any non-natural contaminant can cause disruptions to already fragile ecosystems, based on their inherent, strong chemical bond and structure, and resistance to degradation;
PFAS are persistent organic pollutants and bio accumulative. Currently, many wastewater treatment plants do not have technologies in place to adequately treat and remove PFAS. Indeed, PFAS can be released after incomplete treatment through wastewater into surface waters. Some of PFAS remain in sewage and if the sludge is used as a fertiliser in agriculture, PFASs can seep into groundwater.

Consequently, some wastewater treatment plant effluent is redistributing PFAS into natural water systems and regulatory authorities such as U.S. EPA have established detection methods for non-drinking water matrices. The European commission with the new Drinking Water Directive (Directive EU 2020/2184) has established more stringed parametric value for sum of PFAS (Annex I) and total PFAS as total (Annex III).

SW-846 Method 83271: For the analysis of PFAS in four non-potable aqueous matrices (reagent water, groundwater, surface water, and wastewater effluent) using external standard calibration and liquid chromatography/tandem mass spectrometry (LC-MS/MS). There are additional proposed methods for the determination of PFAS in non-drinking water matrices; it is expected that U.S. EPA will finalize non-drinking water matrices as they advance their efforts in Federal PFAS Regulatory Actions program.

Figure 1:Engineers sampling water at waste treatment plant

Testing for PFAS in Water

Although change is not new to the environmental analysis market, the speed of that change is. Emerging contaminants such as PFAS, new methods, and lower detection limits: all these factors make it challenging to keep pace. At the same time, scientists performing environmental testing are facing an increasing number of samples—and the expectation that they must deliver ever-higher productivity with fewer resources.

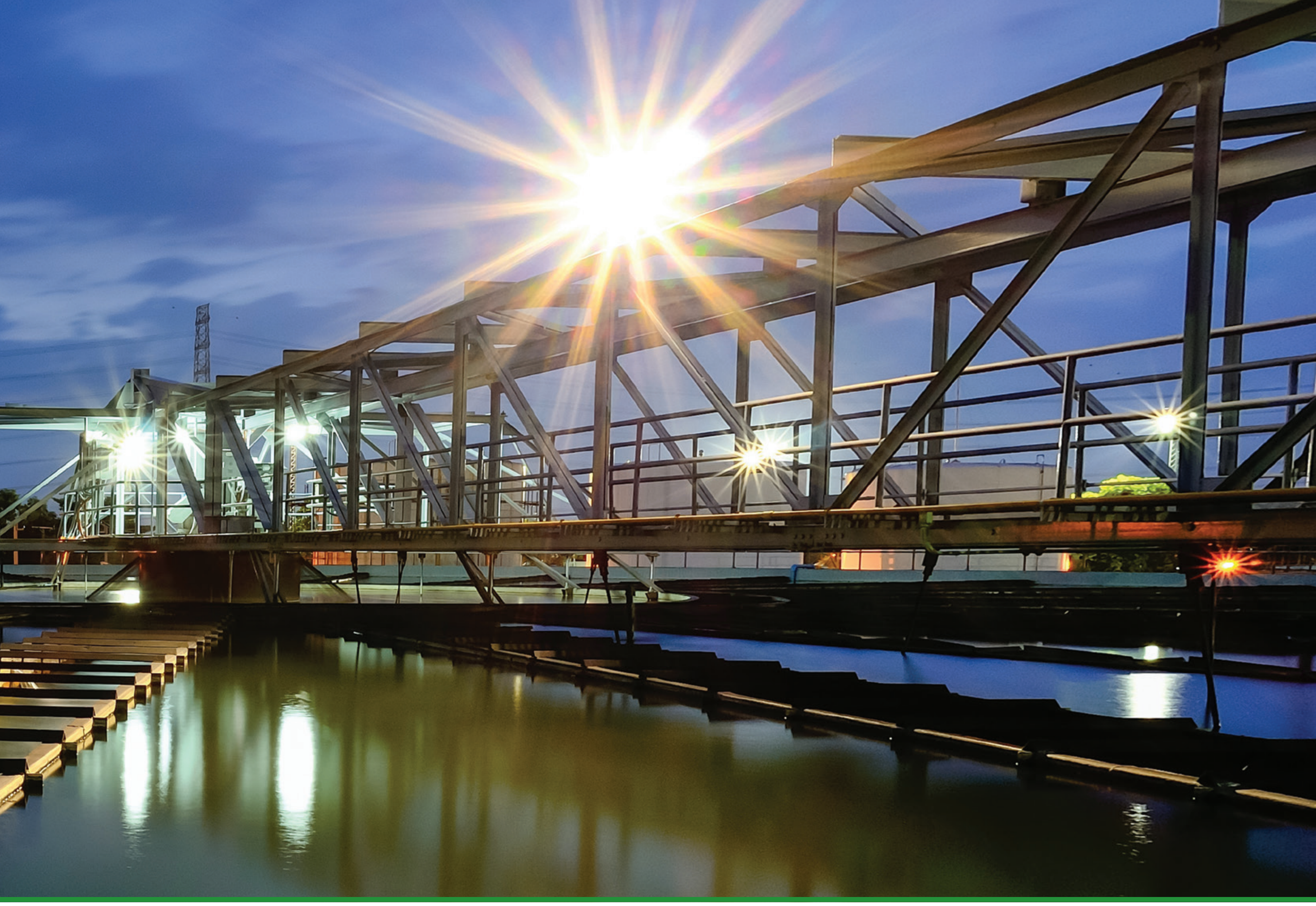
The development of a fast and robust method for the analysis of all analytes listed in proposed EPA Method 8327 is necessary so testing facilities and scientists can quickly adapt to ever-changing standards.

One such method uses the **PerkinElmer QSight LX50 ultra high-performance liquid chromatography (UHPLC) system** coupled with the **PerkinElmer QSight 220 triple quadrupole mass spectrometer**.

The validation results demonstrate that all 24 PFAS analytes listed in EPA Method 8327 can be determined reliably by the QSight 220 LC/MS/MS system, with good recovery and precision at low limits of quantification in reagent water, wastewater, downstream, and upstream surface water samples.

Analytical samples represented four diverse water types (reagent water, wastewater, upstream, and downstream effluent water) with varying PFAS concentrations in order to evaluate the recovery and reproducibility of the analytical method.

The results shown in this article represent a subset of analytical results and how this method can be performed successfully and within the requirements of the proposed EPA Method 8327. Full results can be found in our Application Note: **Analysis of Perfluoroalkyl and Polyfluoroalkyl Substances by EPA Method 8327 Using the QSight 220 UHPLC/MS/MS.**



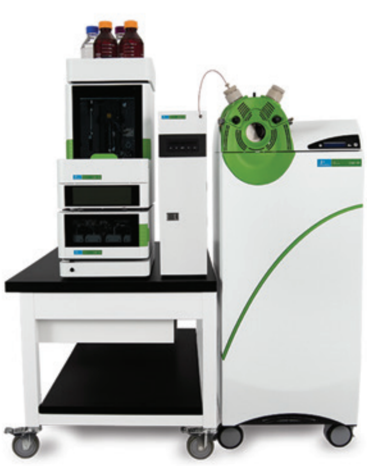


Figure 2: PerkinElmer LX50-QSight Triple Quadrupole LC-MS/MS

A critical challenge to the analysis of PFAS in environmental matrices is the possible contamination from a variety of sources in the analytical blanks that are used in the preparation and analysis of the samples. With this analytical method, multiple precautions and steps were incorporated to remove interference and contamination sources, including placing a delay column between the mobile phase mixer and the autosampler injection valve so that the PFAS compounds in the sample are well separated from the PFAS contaminants from the mobile phase solvent lines. To ensure absence of PFAS interference in samples, a laboratory reagent blank (LRB) was prepared each day of analysis, testing for potential interference and contamination from reagents, glassware, and materials used for the method and sample preparation process

This proven workflow can save time in method development and sample preparation to ensure your results are accurate and reliable and meet or deliver better sensitivity in accordance with the EPA guidelines.

	Wastewater 160 ng/L			Downstream Surface Water 160 ng/L			Upstream Surface Water 160 ng/L		
Analyte	Average Concentration (ng/L)	%RSD	% Average Recovery	Average Concentration (ng/L)	%RSD	% Average Recovery	Average Concentration (ng/L)	%RSD	% Average Recovery
MPFBA	155.24	0	97	154.74	3	97	151.18	2	94
M5PFPeA	154.35	2	96	152.68	2	95	151.26	2	95
M3PFBS	152.02	3	95	155.83	2	97	150.10	2	94
M2-4:2 FTS	161.66	4	101	164.29	6	103	161.59	5	101
M5PFHxA	166.43	3	104	155.96	8	97	147.78	8	92
M4PFHpA	151.75	4	95	147.16	3	92	142.78	4	89
M3PFHxS	150.83	5	94	151.42	4	95	152.16	3	95
M2-6:2 FTS	154.60	7	97	148.48	2	93	147.82	2	92
M8PFOA	158.37	3	99	150.61	3	94	144.67	3	90
M8PFOS	152.85	3	96	153.23	2	96	152.65	3	95
M9PFNA	158.92	3	99	148.72	4	93	140.38	4	88
M6PFDA	148.20	3	93	147.51	5	92	145.52	8	91
M2-8:2 FTS	158.33	6	99	151.90	6	95	153.40	5	96
d3-N-MeFOSAA	164.51	10	103	157.85	8	99	161.48	7	101
M7PFUdA	160.20	8	100	154.82	8	97	142.13	8	89
d5-N-EtFOSAA	131.97	10	82	140.66	10	88	150.12	7	94
MPFDoA	150.35	5	94	146.64	4	92	147.61	5	92
M2PFTeDA	157.42	9	98	163.30	8	102	149.84	8	94

Looking Forward

With many countries and individual states in the U.S., Europe and across the globe recognising the importance of testing for numerous PFAS compounds, it is only a matter of time when more environmental and public health agencies enact legal standards requiring testing. Staying up to date on the latest research and technologies can help laboratories remain current and agile. Large sample volumes and staff turnover only add to current widespread laboratory challenges, and these easy-to-use, cost-effective solutions suit any workload – large numbers of everyday samples, quick turnarounds and emergencies, even testing in the field and on the fly. Having an already established and validated workflow in place will help ensure there's no time lost while scrambling to put one in place in time.

For more information on PerkinElmer's PFAS capabilities or to get a product quote, visit www.perkinelmer.com.

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