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Rapid High-Quality Testing of 56 PFAS in Non-Potable Waters by ASTM D8421

ALS offers a tiered suite of testing options for per- and polyfluoroalkyl substances (PFAS) to meet the varied data quality objectives and requirements of any type of monitoring or remediation project. Our capabilities now include ASTM D8421,[1] providing rapid, high-quality, isotope dilution testing of PFAS in wastewater, surface water, and groundwater, for applications where the ultra-trace detection limits of EPA Method 1633 are not required, and where more cost-effective testing is preferred. This method uses a sample size of only 5 mL, and has the option of an extended analyte list reporting 56 PFAS, including the standard 40 compounds from EPA Method 1633 plus 16 additional environmentally relevant PFAS.

Method Overview

ASTM D8421 is an international reference method for the analysis of PFAS in non-potable water samples, using co-solvation and LC-MS/MS analysis. The method has been validated by ASTM international for a wide variety of aqueous sample types including wastewater, landfill leachate, pulp and paper effluent, groundwater, and surface water. The method uses 1:1 co-solvation with methanol to ensure solubility of all PFAS analytes and to fully desorb PFAS with lower water solubility from sample container walls. The ALS application of ASTM D8421 incorporates many of the same best practices for PFAS analysis as EPA Method 1633, including:

- LC-MS/MS analysis with isotope dilution or extracted internal standard quantification
- Whole bottle analysis
- Quantification of linear and branched PFAS isotopes

ASTM D8421 is a performance-based method. ALS has introduced minor modifications to improve performance and data quality, such as adopting all QC and instrumental analysis requirements from EPA Method 1633 and miniaturizing the sample container to simplify field sampling logistics.

This method is rapidly gaining recognition from regulators and stakeholders. The US EPA has proposed to formally approve ASTM D8421 for wastewater testing under NPDES permits (National Pollutant Discharge Elimination System) as part of their proposed Methods Update Rule, MUR 22.

Benefits of Method D8421

Most other PFAS water methods rely on Solid Phase Extraction (SPE) to concentrate sample analytes, which facilitates detection at ultra-trace levels, but also increases sources of error and risk of carryover in the lab due to complex sample preparation procedures. In contrast, because ASTM D8421 targets detection limits suitable for contaminated sites, wastewaters, and other non-potable water applications, it employs a simpler procedure using methanol co-solvation to facilitate effective whole bottle analysis. This reduces handling and complex sample preparation steps in the laboratory without compromising data quality or accuracy. Although this method is not currently applicable to drinking waters, the ALS testing options cover all 25 PFAS analytes included in Health Canada's Drinking Water Objective for Total PFAS (routine and extended lists).

Limits of Reporting (LORs) are sufficient to meet all current Canadian Federal and Provincial guidelines and regulations

for waters, with the exception of the Health Canada Drinking Water Objective and the Québec Surface Water Quality Criteria for PFOS (non-enforceable guidance adopted from Michigan). Apart from the Québec criteria, this method can meet all Canadian guidelines for non-potable waters, even with a 10x sample dilution (if needed for high-level samples or highly complex matrices). Please refer to Table 3 for a summary of current Canadian PFAS guidelines and standards for environmental waters.

The ASTM D8421 method offers several key advantages:

- **Industry-Leading Turnaround Time** – Streamlined lab preparation steps enable a standard 5-day turnaround for this method. Faster rush analyses are available by request to support urgent testing needs.
- **High-Quality Results** – Incorporates isotope dilution (where labeled PFAS isotopes are available) to ensure optimal accuracy and precision. Our method validation data for this new method showed significantly better precision versus EPA Method 1633 due to reduced sample preparation complexity.
- **Small Samples / Efficient Sampling** – Requires only two vials of 5 mL water per sample, reducing field sampling time and shipping costs, and supporting low-flow sampling techniques (e.g., for low-recharge monitoring wells).
- **Reduced Risk of Contamination** – Minimal sample handling in the laboratory lowers risk of cross-contamination from high-level samples.
- **Sustainability** – In addition to reduced shipping weight, this method also reduces usage of solvents and consumables in the laboratory to support sustainability objectives.

Extended PFAS List including 6:2 FTAB

Our extended analyte list includes sixteen PFAS of emerging environmental relevance and concern, including newer alternative PFAS from aqueous film forming foams (AFFFs) and consumer products, common degradation products and precursors, and specialty PFAS used in aviation hydraulic oils (PFECHS) and lithium battery electrolytes (TFSI). There is growing concern for 6:2 FTAB, a common component of AFFFs, used as an alternative to PFOS. Numerous recent studies have detected 6:2 FTAB in surface water, groundwater, effluent, and tap water, sometimes as very significant components of total PFAS detections.[2,3] The UK Drinking Water Inspectorate (DWI) added 6:2 FTAB

Table 1: Relevance & Usage of Extended List PFAS

Short Name	CAS #	Relevance / Usage
PFECHS	646-83-3	used in aviation hydraulic oils
PFUnS	749786-16-1	long chain PFAS (C11); high risk for bioaccumulation & persistence
PFTrDS	791563-89-8	long chain PFAS (C13); high risk for bioaccumulation & persistence
PFPrA	422-64-0	degradation product; short chain PFAS (C3); less toxic & bioaccumulative than long chain PFAS, but highly water soluble and mobile
PFBSA	30334-69-1	widespread use (AFFFs, surface treatments), precursor to PFBS, short chain (C4)
PFHxSA	41997-13-1	widespread use (AFFFs, surface treatments), similar to PFOS, but shorter chain (C6)
10:2 FTS	120226-60-0	widespread use (AFFFs, surface treatments), alternative to PFOS, precursor to PFDA, PFNA
6:2 FTUCA	70887-88-6	degradation product; precursor to 6:2 FTCA & PFHxA
8:2 FTUCA	70887-84-2	degradation product; precursor to 8:2 FTCA & PFOA
10:2 FTUCA	70887-94-4	degradation product; precursor to 10:2 FTCA & PFCA
6:2 FTCA	53826-12-3	degradation product; precursor to PFHxA
8:2 FTCA	27854-31-5	degradation product; precursor to PFOA
10:2 FTCA	53826-13-4	degradation product; precursor to PFCA
TFSI	82113-65-3	used as lithium battery electrolytes
6:2 FTAB	34455-29-3	common AFFF component (PFOS alternative); persistent, mobile, precursor to 6:2 FTS, PFHxA
6:2 diPAP	57677-95-9	widely used in consumer products, textiles, packaging (water/oil/grease repellent); degrades to 6:2 FTUCA and PFHxA

to its target list of PFAS in January 2025. Table 1 summarizes the relevance and common usage of the additional sixteen PFAS analytes from our extended list, beyond the 40 compounds from EPA 1633.

Sampling Guidance

Table 2 provides sampling guidance for the ASTM D8421 method. Two polypropylene vials each containing ~5 mL of non-potable water are required per sample. Vials should be filled to approximately the fill line indicated on the label. Samples will be weighed at the laboratory to determine exact sample volumes collected.

Samples should be protected from light and shipped with sufficient ice to maintain temperature at 0-6°C. For cooling of PFAS samples, ALS recommends double bagged regular ice in sealed poly bags (e.g., Ziploc®) or HDPE bottles filled with water and frozen. Chemical or "blue" ice should be avoided (most brands are untested for PFAS). Avoid exposure of samples to Teflon (e.g., cap liners from other sample bottles).

To avoid cross-contamination, special precautions are important for the collection of samples for PFAS testing. Due to the prevalence of perfluorinated substances in consumer products such as waterproof clothing and fabrics, sunscreens, lotions and cleansers, grease-proof and waterproof food packaging, cleaning products, fabric softeners, and cosmetics, care should be taken to avoid potential transfer from such items. Field blanks and equipment blanks are recommended to monitor for potential background contaminants (request PFAS-free water with your bottle orders).

Our PFAS drinking water method (EPA 533 - modified) should be requested for drinking waters as lower LORs and preservation are required. EPA Method 1633 should be requested for non-potable waters where ultra-trace LORs are required. Please identify samples expected to contain high levels of PFAS on Chains of Custody (COCs).

Accreditation Status

In Canada, ALS offers ISO 17025 accredited testing by the ASTM D8421 method at our Waterloo location. Please refer to the CALA scope of accreditation of our laboratory in Waterloo for current status.

Please contact your ALS Project Manager for more information or to request sampling supplies.

Table 2. Sampling Details

Method Reference	ASTM D8421 (modified)
ALS Canada Test Codes	E745R (routine list) E745RX (extended list)
Sample Container	2 x 5 mL Polypropylene Vials
Preservation and Storage	≤ 6°C (protect from light)
Hold time	28 days

References

[1] Standard Test Method for Determination of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous Matrices by Co-solvation followed by Liquid Chromatography Tandem Mass Spectrometry, ASTM International, D8421-25.

[2] PFAS contamination in tap water: Target and suspect screening of zwitterionic, cationic, and anionic species across Canada and beyond, Teymoorian, T. et al., Environment Internatonal, Vol. 195, Jan 2025, https://doi.org/10.1016/j.envint.2025.109250.

[3] Target and Suspect Screening Reveal PFAS Exceeding European Union Guideline in Various Water Sources South of Lyon, France, Teymoorian, T. et al., Environmental Science & Technology Letters, 2025 12 (3), 327-333, https://doi.org/10.1021/acs.estlett.4c01126.

Table 3: Canadian PFAS Standards & Guidelines for Environmental Waters (Aug 2025)

ALS Canada PFAS Analyte Suite (ASTM D8421)			Routine List	Extended List	Canadian PFAS Regulatory Criteria (Environmental Waters)						
			E745R Limit of Reporting	E745RX Limit of Reporting	CCME Ground-water Quality Guideline (lowest)	ECCC Surface Water Quality Guideline	BC CSR (lowest)	Alberta Tier 1 (lowest)	Atlantic RBCA & NS CSR Non-Potable GW / SW (lowest)	Atlantic RBCA & NS CSR Potable GW	Québec Surface Water Quality Criteria** (lowest)
Perfluoroalkyl Sulfonic Acids											
Perfluorobutanesulfonic acid	PFBS	375-73-5	20	20			80,000			15,000	
Perfluoropentanesulfonic acid	PFPeS	2706-91-4	20	20							
Perfluorohexanesulfonic acid	PFHxS	355-46-4	20	20						600	
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	20	20							
Perfluorooctanesulfonic acid	PFOS	1763-23-1	20	20	600	6,800	300	600*	6,800	600	11
Perfluorononanesulfonic acid	PFNS	68259-12-1	20	20							
Perfluorodecanesulfonic acid	PFDS	335-77-3	40	40							
Perfluoroundecanesulfonic acid	PFUnS	749786-16-1	-	40							
Perfluorododecanesulfonic acid	PFDoS	79780-39-5	40	40							
Perfluorotridecanesulfonic acid	PFTrDS	791563-89-8	-	400							
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	8	8							
Perfluoroethylcyclohexanesulfonic acid	PFECHS	646-83-3	-	8							
Perfluoroalkyl Carboxylic Acids											
Perfluoropropanoic acid	PFPrA	422-64-0	-	40							
Perfluorobutanoic acid	PFBA	375-22-4	60	60						30,000	
Perfluoropentanoic acid	PFPeA	2706-90-3	20	20						200	
Perfluorohexanoic acid	PFHxA	307-24-4	20	20						200	
Perfluoroheptanoic acid	PFHpA	375-85-9	20	20						200	
Perfluorooctanoic acid	PFOA	335-67-1	20	20			200	200*		200	66
Perfluorononanoic acid	PFNA	375-95-1	20	20						20	
Perfluorodecanoic acid	PFDA	335-76-2	20	20							
Perfluoroundecanoic acid	PFUnA	2058-94-8	20	20							
Perfluorododecanoic acid	PFDoA	307-55-1	20	20							
Perfluorotridecanoic acid	PFTrDA	72629-94-8	20	20							
Perfluorotetradecanoic acid	PFTeDA	376-06-7	20	20							
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	8	8							
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	8	8							
Hexafluoropropylene oxide dimer acid	HFPO-DA (GenX)	13252-13-6	100	100							
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	80	80							
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	4	4							
Perfluoroalkane Sulfonamides/Sulfonamidoacetic Acids											
Perfluorobutanesulfonamide	PFBSA	30334-69-1	-	40							
Perfluorohexanesulfonamide	PFHxSA	41997-13-1	-	40							
Perfluorooctanesulfonamide	PFOSA	754-91-6	40	40							
N-methyl perfluorooctanesulfonamide	NMeFOSA	31506-32-8	20	20							
N-ethyl perfluorooctanesulfonamide	NEtFOSA	4151-50-2	20	20							
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7	20	20							
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2	20	20							
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	40	40							
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	40	40							
(n:2) Fluorotelomer Sulfonic Acids											
4:2 Fluorotelomer sulfonic acid	4:2 FTS	757124-72-4	50	50							
6:2 Fluorotelomer sulfonic acid	6:2 FTS	27619-97-2	60	60							
8:2 Fluorotelomer sulfonic acid	8:2 FTS	39108-34-4	50	50							
10:2 Fluorotelomer sulfonic acid	10:2 FTS	120226-60-0	-	100							
Unsaturated Fluorotelomer Acids											
6:2 Fluorotelomer unsaturated carboxylic acid	6:2 FTUCA	70887-88-6	-	40							
8:2 Fluorotelomer unsaturated carboxylic acid	8:2 FTUCA	70887-84-2	-	40							
10:2 Fluorotelomer unsaturated carboxylic acid	10:2 FTUCA	70887-94-4	-	40							
Fluorotelomer Carboxylic Acids											
6:2 Fluorotelomer carboxylic acid	6:2 FTCA	53826-12-3	-	400							
7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4	40	40							
8:2 Fluorotelomer carboxylic acid	8:2 FTCA	27854-31-5	-	400							
10:2 Fluorotelomer carboxylic acid	10:2 FTCA	53826-13-4	-	800							
3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5	100	100							
5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3	40	40							
Chlorinated Perfluoroalkyl Sulfonic Acids											
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9CL-PF3ONS	756426-58-1	20	20							
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11CL-PF3OUdS	763051-92-9	20	20							
Other Important PFAS											
Bis(trifluoromethane)sulfonimide	TFSI	82113-65-3	-	8							
Fluorotelomer sulfonamide alkylbetaine	6:2 FTAB	34455-29-3	-	200							
Polyfluoroalkyl phosphate diester, 6:2	6:2 diPAP	57677-95-9	-	100							

* ABT1 PFOS & PFOA limits are additive; sum of ratios of detected concentrations to corresponding limits should not exceed 1.

** Québec Surface Water Quality Criteria are guidelines that are not legally enforceable.

CCME = Canadian Council of Ministers of the Environment
ECCC = Environment and Climate Change Canada

BC CSR = BC Contaminated Sites Regulation
Alberta Tier 1 Soil and Groundwater Remediation Guidelines
RBCA = Atlantic Canada Risk-Based Corrective Action Environmental Quality Standards
NS CSR = Nova Scotia Contaminated Sites Regulations Environmental Quality Standards
GW = Groundwater
SW = Surface Water