

Qualifications for Battelle's Accredited PFAS Lab

Per- and polyfluoroalkyl substances (PFAS) are commonly used in firefighting foams as well as water-repellent materials, non-stick cookware and takeout containers. Due to their possible impacts on human health, they are now emerging as an environmental contaminant of concern, particularly in industrial sites and on military bases. Research is urgently needed to better understand the fate and transport of PFAS compounds and how contaminated sites can best be remediated to minimize environmental and human health concerns.



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LEADING THE WAY

Battelle is leading new discoveries that will help assess, destroy or degrade PFAS. We have a specific mission to bring scientific solutions to government and industry for the benefit of society and have a robust internal research and development program that is focused on solving today's environmental challenges.

We apply rigorous quality controls to accurately measure even trace levels of PFAS compounds in sediments, soils, water and biological tissues. Our lab in Norwell, Massachusetts provides high-quality, defensible data with very low limits, as well as new method development and optimization.

PFAS METHOD DESCRIPTIONS

PFAS IN DRINKING WATER (EPA METHOD 537.1)

Drinking water samples are extracted per the requirements of EPA Method 537.1 (November 2018). All samples are collected in polypropylene bottles, pre-preserved with Trizma. Samples are fortified with labeled surrogates in the original sample containers from the field. The drinking water samples are extracted using an solid phase extraction (SPE) cartridge and eluted from the SPE with an methanol solution. Extracts are concentrated to dryness under nitrogen in a water bath set between 60 °C and 65 °C, reconstituted with 96:4 methanol/ water (V/V), and fortified with internal standard. Extracts are then transferred for liquid chromatography tandem mass spectrometry (LC/MS/MS) analysis. Samples extracts are quantified using internal standard methods. Results are reported on a ng/L basis.

PFAS IN DRINKING WATER (EPA METHOD 533)

Drinking water samples are extracted per the requirements of EPA Method 533 (November 2019). All samples are collected in polypropylene bottles, pre-preserved with ammonium acetate. Samples are fortified with labeled surrogates in the original sample containers from the field. The drinking water samples are extracted using an solid phase extraction (SPE) cartridge and eluted from the SPE with a25 NH3OH in methanol solution. Extracts are concentrated to dryness under nitrogen in a water bath set between 55 °C and 60 °C, reconstituted with 80:20 methanol/ water (V/V), and fortified with internal standard. Extracts are then transferred for liquid chromatography tandem mass spectrometry (LC/MS/MS) analysis. Samples extracts are quantified using internal standard methods. Results are reported on a ng/L basis.

PFAS BY LC/MS/MS (COMPLIANT WITH DOD QSM 5.3 TABLE B-15)

Non-Potable Water Extraction: All non-potable water samples are pre-screened prior to SPE. For SPE, water samples are fortified with isotopically labeled surrogates (extracted internal standards) in the original sample container from the field. The water samples are

extracted using SPE and eluted from the SPE with solvent. Extracts are concentrated, reconstituted, fortified with isotopically labeled internal standards, and transferred for LC-MS/MS analysis. Results are reported on an ng/L basis.

Solid and Tissue Extraction: A well homogenized subsample of soil, sediment, or tissue sample is weighed into a non-Teflon centrifuge tube and fortified with isotopically labeled surrogates. Samples are extracted in solvent using a Geno/Grinder. An aliquot from the extract is reconstituted in PFAS free water and refined using SPE, post SPE, the extract is then treated with dispersive carbon to remove other potential matrix interferences. The refined extracts are concentrated, reconstituted, fortified with isotopically labeled internal standards, and transferred for LC/MS/MS analysis. Results are reported in ng/g on a dry weight basis for soil and sediment and ng/g on a wet weight basis for tissues.

Isotope Dilution Analysis: PFAS are measured by LC-MS/MS in the multiple reaction monitoring (MRM) mode. For most analytes, two transitions are monitored, one for quantitation and the other for confirmation, and the ion ratios are monitored for all analytes. An initial calibration including target analytes, surrogates, and internal standards is analyzed prior to analysis of samples to demonstrate the linear range of instrument. Target PFAS are quantified using the isotope dilution method following QSM 5.3 Table B-15 quality criteria.

TOTAL OXIDIZABLE PRECURSOR (TOP) ASSAY

TOP Assay is performed on a sub-sample of a non-potable water sample or on an unfortified extract of a solid or tissue sample, following methods similar to those described by Houtz and Sedlak 2012. Samples are to convert oxidizable precursors into perfluoroalkyl acids. All samples are analyzed before the oxidation following the extraction and analysis methods described above and again post oxidation to compare the changes in concentrations of perfluoroalkyl acids.

PFAS ANALYTES COVERED BY ELAP/NELAP ACCREDITATION

Analyte	CAS No.	EPA DW Method		QSM 5.3 Table B-15		Analyte	CAS No.	EPA DW Method		QSM 5.3 Table B-15	
		537.1	533	NPW	S/T			537.1	533	NPW	S/T
NFDHA	151772-58-6	—	Ö	P	P	NEtFOSE	1691-99-2	—	—	P	P
PFEESA	113507-82-7	—	Ö	P	P	PFOSA	754-91-6	—	—	P	Ö
PFMPA	377-73-1	—	Ö	P	P	PFBS	375-73-5	Ö	Ö	Ö	Ö
PFMBA	863090-89-5	—	Ö	P	P	PFPeS	2706-91-4	—	Ö	Ö	Ö
PFBA	375-22-4	—	Ö	Ö	Ö	PFHxS	355-46-4	Ö	Ö	Ö	Ö
PFPeA	2706-90-3	—	Ö	Ö	Ö	PFHpS	375-92-8	—	Ö	Ö	Ö
PFHxA	307-24-4	Ö	Ö	Ö	Ö	PFOS	1763-23-1	Ö	Ö	Ö	Ö
PFHpA	375-85-9	Ö	Ö	Ö	Ö	PFNS	68259-12-1	—	—	Ö	Ö
PFOA	335-67-1	Ö	Ö	Ö	Ö	PFDS	335-77-3	—	—	Ö	Ö
PFNA	375-95-1	Ö	Ö	Ö	Ö	PFDoS	79780-39-5	—	—	P	P
PFDA	335-76-2	Ö	Ö	Ö	Ö	4:2FTS	757124-72-4	—	Ö	Ö	Ö
PFUnA	2058-94-8	Ö	Ö	Ö	Ö	6:2FTS	27619-97-2	—	Ö	Ö	Ö
PFDoA	307-55-1	Ö	Ö	Ö	Ö	8:2FTS	39108-34-4	—	Ö	Ö	Ö
PFTrDA	72629-94-8	Ö	—	Ö	Ö	10:2FTS	108026-35-3	—	—	P	P
PFTeDA	376-06-7	Ö	—	Ö	Ö	3:3 FTCA	356-02-5	—	—	P	Ö
PFHxDA	67905-19-5	—	—	P	P	5:3 FTCA	914637-49-3	—	—	P	Ö
PFODA	16517-11-6	—	—	P	P	7:3 FTCA	812-70-4	—	—	P	Ö
NMeFOSAA	2355-31-9	Ö	—	Ö	Ö	HFPO-DA	13252-13-6	Ö	Ö	Ö	Ö
NEtFOSAA	2991-50-6	Ö	—	Ö	Ö	Adona	919005-14-4	Ö	Ö	Ö	Ö
NMeFOSA	31506-32-8	—	—	P	P	11Cl-PF3OUdS	763051-92-9	Ö	Ö	Ö	Ö
NEtFOSA	4151-50-2	—	—	P	P	9Cl-PF3ONS	756426-58-1	Ö	Ö	Ö	Ö
NMeFOSE	24448-09-7	—	—	P	P						

DW – Drinking water NPW – Non-potable water S – solid, sediment, soil T - Tissue Ö Analyte on both ELAP and NELAP scope of accreditation
 — Analyte not in method P – Analyte pending accreditation

COMPLETE ACCREDITATION

	EPA DW Method		QSM 5.3 Table B-15				EPA DW Method		QSM 5.3 Table B-15		
	537.1	533	NPW	S	T		537.1	533	NPW	S	T
DoD ELAP / ISO 17025	91667	91667	91667	91667	91667	Montana (MT)	Ø	Ø	‡	‡	‡
Alabama (AL)	‡	‡	‡	‡	‡	Nebraska (NE)	Ø	Ø	‡	‡	‡
Alaska (AK)	19-005	19-005	19-005	19-005	‡	Nevada (NV)	‡	‡	‡	‡	‡
Arizona (AZ)	Ø	Ø	‡	‡	‡	New Hampshire (NH) ^{TNI}	2137	Ø	‡	‡	‡
Arkansas (AR)	‡	‡	‡	‡	‡	New Jersey (NJ)	Ø	Ø	‡	‡	‡
California (CA)	P	‡	P	P	‡	New Mexico (NM)	Ø	Ø	‡	‡	‡
Colorado (CO)	‡	‡	‡	‡	‡	New York (NY) ^{TNI}	12105	‡	‡	‡	‡
Connecticut (CT)	‡	‡	‡	‡	‡	North Carolina (NC)	‡	‡	‡	‡	‡
Delaware (DE) ^{TNI}	‡	‡	‡	‡	‡	North Dakota (ND)	‡	‡	‡	‡	‡
Florida (FL) ^{TNI}	E87856	Ø	E87856	E87856	E87856	Ohio (OH)	‡	‡	‡	‡	‡
Georgia (GA)	‡	‡	‡	‡	‡	Oklahoma (OK) ^{TNI}	‡	‡	‡	‡	‡
Hawaii (HI)	Ø	Ø	‡	‡	‡	Oregon (OR)	‡	‡	‡	‡	‡
Idaho (ID)	‡	‡	‡	‡	‡	Pennsylvania (PA) ^{TNI}	68-05687	Ø	68-05687	68-05687	‡
Illinois (IL) ^{TNI}	‡	‡	‡	‡	‡	Rhode Island (RI)	E87856	‡	‡	‡	‡
Indiana (IN)	‡	‡	‡	‡	‡	South Carolina (SC)	‡	‡	‡	‡	‡
Iowa (IA)	‡	‡	‡	‡	‡	South Dakota (SD)	‡	‡	‡	‡	‡
Kansas (KS) ^{TNI}	‡	‡	‡	‡	‡	Tennessee (TN)	‡	‡	‡	‡	‡
Kentucky (KY)	‡	‡	‡	‡	‡	Texas (TX) ^{TNI}	‡	‡	‡	‡	‡
Louisiana (LA) ^{TNI}	Ø	Ø	Ø	Ø	‡	Utah (UT) ^{TNI}	‡	‡	‡	‡	‡
Maine (ME)	MA00056	Ø	‡	‡	‡	Vermont (VT)	VT-87856	Ø	‡	‡	‡
Maryland (MD)	‡	‡	‡	‡	‡	Virginia (VA) ^{TNI}	‡	‡	‡	‡	‡
Massachusetts (MA)	P	‡	P	P	‡	Washington (WA)	C1050	Ø	C1050	C1050	‡
Michigan (MI)	‡	‡	‡	‡	‡	West Virginia (WV)	‡	‡	‡	‡	‡
Minnesota (MN) ^{TNI}	‡	‡	‡	‡	‡	Wisconsin (WI)	‡	‡	‡	‡	‡
Mississippi (MS)	Ø	Ø	‡	‡	‡	Wyoming (WY)	‡	‡	‡	‡	‡
Missouri (MO)	‡	‡	‡	‡	‡						

DW – drinking water NPW – Non-potable water S – solid, sediment, soil T – Tissue TNI – NELAC States Lab number inserted for current accreditations P – Accreditation pending
 ‡ – Accreditation currently not offered at the State level Ø – offered, but not currently accredited in this state

DETECTION LIMIT RANGES

Matrix	Method	Units	MDL	LOD	LOQ (MRL)
Drinking water	EPA 537.1	ng/L	0.0863 – 0.234	0.4 – 0.5	2.5
Drinking water	EPA 533	ng/L	0.22 – 1.04	0.8 – 2.1	2.5
Non-potable water	PFAS by LC-MS/MS compliant with QSM 5.3 Table B-15	ng/L	0.112 – 1.59	0.4 – 2.0	5.0
Solids (soil/sediment)		ng/g	0.237 – 1.44	0.5 – 2.5	5.0
Tissues		ng/g	0.206 – 1.64	0.5 – 3.5	5.0

Analyte specific detection limits available upon request

SAMPLING

Cross-contamination is a significant concern when it comes to collecting field samples for PFAS analysis. The EPA health advisory limits for PFOA and PFOS are 70 parts per trillion, with many states setting limits below the EPA health advisory levels, requiring analytical methods with trace low detection limits.

Other PFAS compounds may also have health or environmental impacts at very low levels. With such low detection limits, cross-contamination by even trace levels of PFASs from other sources will have a large impact on the accuracy and validity of the analytical results.

There are several precautions that field personnel can take to minimize the potential for cross-contamination, including avoiding certain items during sampling events and using the appropriate sample containers.

Items to avoid when sampling for PFAS:

- Teflon bottles, Teflon lined jars, or any sampling items containing Teflon
- LDPE or polypropylene materials (with the exception of polypropylene bottles used for drinking water samples)
- Chemical (blue) ice packs
- Decontamination soaps that contain fluorinated surfactants, like Decon 90
- PFAS free water must be used for trip blanks, field blanks, and equipment blanks. PFAS free water can also be provided for decontamination processes by the laboratory.
- Waterproof and/or stain resistant clothing or shoes that have been treated, such as Gore-Tex and Tyvek

PFAS SAMPLE CONTAINERS AND HOLDING TIMES

Matrix	Containers, minimum sample size requirements	Preservation		Holding time	
		Other	Temperature	Extraction	Analysis
Drinking water (537.1) ¹	2 X 250 mL PP bottle, 250 mL sample	Trizma (5 g/L)	Cool <6°C ³	14 Days	28 Days
Drinking water (533) ²	2 X 250 mL PP bottle, 250 mL sample	AMAC ⁴ (1 g/L)	Cool <6°C ³	28 Days	28 Days
Non-potable water	2 X 250 mL HDPE bottle, 250 mL sample	N/A	Cool <6°C ³	14 Days	28 Days
Soil / Sediment	8 oz. HDPE jar, 1 container, minimum of 20 grams	N/A	Cool <6°C ³	14 Days	28 Days
Tissue	8 oz. HDPE jar, 1 container, minimum of 20 grams	N/A	< -20 °C	1 Year	28 Days
TOP (non-potable water)	2 x 125 mL HDPE (in addition to the sample collected for routine analysis)	N/A	< -20 °C	1 Year	28 Days
TOP (soil, sediment, tissue)	No additional sample needed	N/A	N/A	N/A	28 Days

¹Sampling instructions are included in EPA method 537.1 and can be provided by the laboratory upon request.

²Sampling instructions are included in EPA method 533 and can be provided by the laboratory upon request.

³Samples stored cool should be above freezing (0 °C).

⁴AMAC – Ammonium acetate.

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