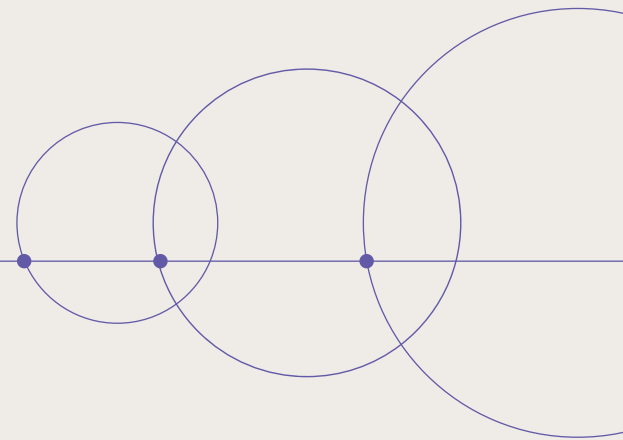




INDEPENDENT LABORATORY TESTING OF CHROMASOLV™ LC-MS SOLVENTS FOR PFAS ANALYSIS

**Demonstrating suitability for use in EPA 1633A and
ASTM D7979 regulatory methods**

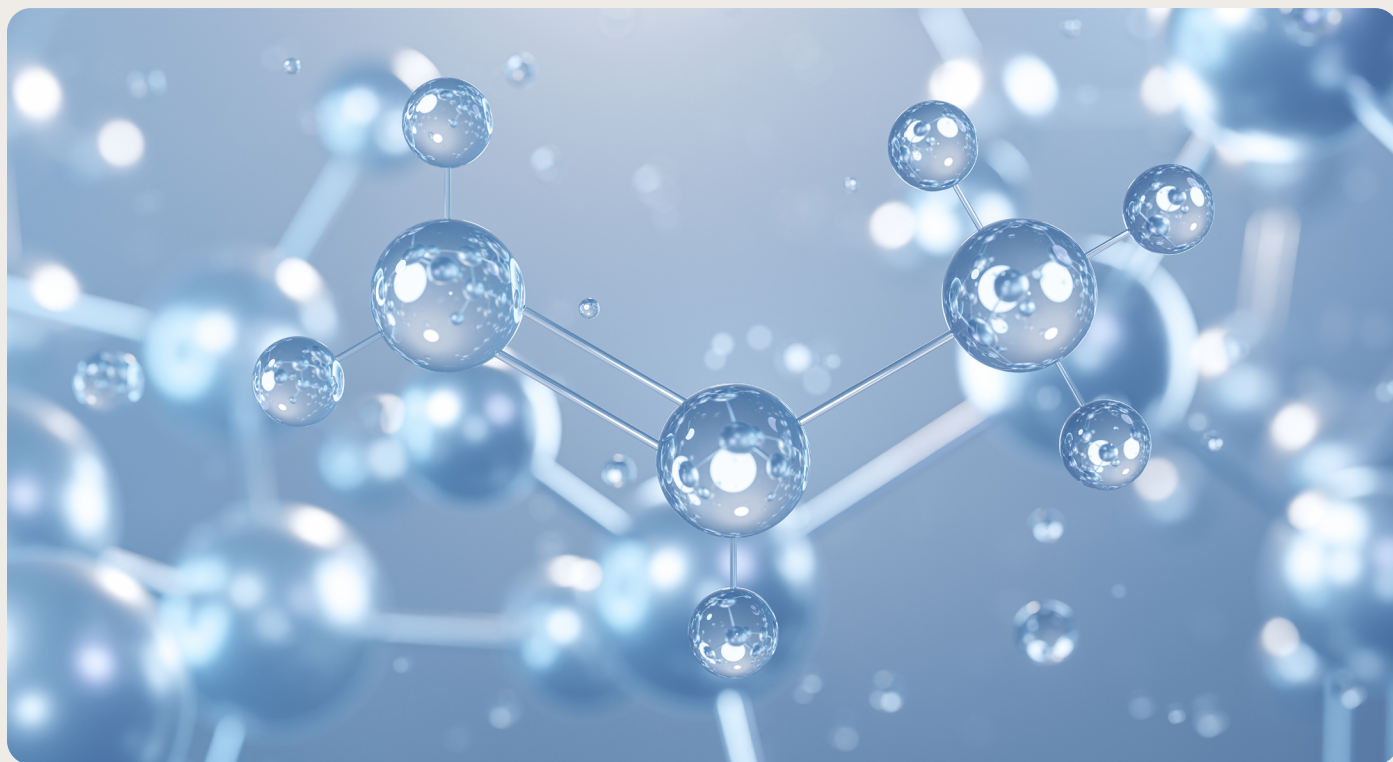


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EXECUTIVE SUMMARY

The analysis of per- and polyfluoroalkyl substances (PFAS) at ultra-low levels presents significant analytical challenges due to evolving regulations. Reliable PFAS quantification requires not only advanced instrumentation but also exceptional control over laboratory contamination sources, particularly solvents used in extraction and mobile phases.

This study evaluates PFAS background in Chromasolv LC-MS grade water, methanol, and acetonitrile and assesses their suitability for trace-level PFAS analysis using EPA method 1633A and a modified ASTM D7979 workflow.



These findings confirm that the solvents provide a viable analytical foundation, supporting high-confidence low-level detection of PFAS analytes.

This paper refers to the term “PFAS” specifically in the context of solvent products for laboratory analyses utilizing EPA1633A and ASTM D7979 regulatory methods.

KEY FINDINGS:

Suitability for use in PFAS analysis:

- All PFAS analytes evaluated (40 compounds for water and 29 for acetonitrile and methanol, details in Appendix A) were below reporting limits for EPA 1633A and ASTM D7979 across all solvents and production lots

Successful validation of method detection limits (MDLs):

- Water (EPA Method 1633A):
 - MDL range: 0.04–1.62 ng/L depending on analyte
- Methanol (ASTM D7979 MOD):
 - MDL range: 0.78–63.08 ng/L depending on analyte
- Acetonitrile (ASTM D7979 MOD):
 - MDL range: 0.64 – 27.51 ng/L depending on analyte
- MDL details are in Appendix B (pages 9 and 10)
- Consistent analyte-specific behavior observed across all lots
- MDL elevation was not attributable to solvent background

Analytical Performance:

- All analytes met method acceptance criteria for initial precision and recovery (IPR) performance. IPR details are in Appendix B (page 11)
- Surrogate recovery ranges were within method-defined acceptance ranges

Chromasolv LC-MS solvents for PFAS analysis enable accurate PFAS quantification at regulatory-relevant levels.

INTRODUCTION

The term PFAS encompasses thousands of chemically distinct compounds that vary in structure, properties and environmental behavior. PFAS have become a major focus of environmental and regulatory scrutiny. Analytical methods such as EPA Method 1633A have been developed to quantify specific PFAS analytes at low ng/L (ppt) levels. At low detection limits even small sources of contamination from the laboratory environment can impact results.

One of the most critical, yet often overlooked, sources of contamination is the solvent system. Even trace PFAS contamination in solvents can:

- Elevate background signal
- Increase MDLs and reporting limits
- Compromise quantitation accuracy
- Result in false positives that can overstate PFAS levels in a sample

Given these risks, laboratories require solvents that are demonstrably suitable for use in regulatory test methods.

This study was completed by a third-party laboratory, Paragon Laboratories, Inc. Paragon Laboratories is compliant with ISO/IEC 17025:2017 and is certified by the Michigan Department of



Environment, Great Lakes, and Energy to analyze drinking water (EGLE Lab No. 9901). The study was designed to quantify PFAS background levels in Chromasolv LC-MS water, methanol, and acetonitrile for PFAS analysis, validate their compatibility with EPA Method 1633A and ASTM D7979, and assess reproducibility across multiple production lots and solvent types. Individual laboratories must validate performance within their own methods and quality systems.

METHODS AND EXPERIMENTAL DESIGN

Two PFAS analytical methods were applied:

- EPA Method 1633A (aqueous matrices)
- ASTM D7979 MOD (organic matrices)

Water samples were prepared according to EPA Method 1633A without modification. EPA Method 1633A could not be applied to methanol and acetonitrile matrices due to interference with the solid-phase extraction (SPE) cartridge elution process. Therefore, methanol and acetonitrile samples were prepared and analyzed using a modified ASTM D7979 method (ASTM D7979-MOD).

No changes were made to the underlying analytical method outlined in ASTM D7979. The methanol and acetonitrile analyses were conducted using a modified analyte panel, as listed in Appendix A (page 7). This analyte panel was selected based on the PFAS compound list requirements published by the State of Michigan in 2018 and differs from the analyte panel specified in ASTM D7979.

The published ASTM D7979 method includes 21 PFAS compounds. For this study, the modified analyte panel included 15 PFAS compounds from the ASTM D7979 list and 14 additional PFAS compounds, for a total of 29 PFAS compounds. For comparison, the original ASTM D7979 analyte list is provided in Appendix A.

Analyses were performed by Paragon Laboratories Inc., using a Shimadzu LCMS-8060 triple quadrupole LC-MS/MS in a dedicated PFAS laboratory environment. Certified reference materials (ISO 17034) and polypropylene labware were used to minimize contamination.

Validation followed established regulatory guidance in 40 CFR Part 136 Appendix B and included evaluation of MDL and IPR across multiple lots. Method Detection Limits (MDL) were determined using seven replicate blanks and seven spiked samples to ensure analytical sensitivity meets regulatory expectations. Initial Precision and Recovery (IPR) evaluated method accuracy and reproducibility and assessed variability across four replicate spiked samples per solvent. This design ensured that both analytical performance and manufacturing consistency are assessed.

SOLVENTS FOR PFAS ANALYSIS: BACKGROUND EVALUATION RESULTS

Across all solvents and production lots:

- All PFAS analytes were reported as below reporting limits
- All analytes were below method reporting thresholds
- Any contribution to baseline noise was below the method's limit of detection (LOD)

The analyte panel included PFOA, PFOS, PFBA, PFBS, HFPO DA (GenX), ADONA, and other sulfonates, carboxylates, and fluorotelomers.



REPORTING LIMITS

The achieved reporting limits shown in Table 1 demonstrate strong analytical sensitivity.

Solvent	Method	Matrix Type	Reporting Limit
Water	EPA Method 1633A	Aqueous	2.0–5.0 ng/L
Methanol	ASTM D7979 MOD	Organic	2.0–100 ng/L
Acetonitrile	ASTM D7979 MOD	Organic	2.0–100 ng/L

Table 1. Reporting Limits by Solvent
Reporting limits were analyte-specific and varied by target compound and analytical method. A detailed list of reporting limits for all analytes is provided in Appendix B.

Water analyzed via EPA Method 1633A achieves lower reporting limits due to Solid-Phase Extraction (SPE) based preconcentration, while methanol and acetonitrile analyzed via ASTM D7979 MOD maintain reliable detection capability at higher but still sensitive ranges.

Importantly, all measured values remained below these thresholds, confirming that solvent background did not contribute to signal noise or detection interference. The achieved reporting limits demonstrate strong analytical sensitivity across both aqueous and organic matrices.

METHOD DETECTION LIMITS (MDL)

Methanol MDL range was 0.78–63.08 ng/L, acetonitrile MDL range was 0.64–27.51 ng/L, and water MDL range was 0.04–1.62 ng/L. MDL details are included in Appendix B. These MDLs characterize the analytical sensitivity of the respective methods and provide supporting method-performance information for the solvent background evaluation.

Key observations:

- These MDLs characterize the analytical sensitivity of the respective methods and provide supporting method-performance information for the solvent background evaluation.
- Negligible contribution from solvent blanks.

PRECISION AND RECOVERY

Initial Precision and Recovery (IPR) results demonstrated that the solvents support accurate quantitation without introducing variability.

- All analytes met method acceptance criteria
- Relative standard deviation (%RSD) values for all four aliquots tested per solvent were below the established acceptance criterion. Detailed %RSD results are provided in Appendix B (page 11)
- Stable performance across the three lots tested

SURROGATE RECOVERY

Surrogate recovery is a key indicator of analytical integrity. Observed recoveries for methanol, acetonitrile and water all fell within method-defined control limits, demonstrating efficient extraction, minimal matrix interference, and strong analytical reliability as shown in Table 2.



Solvent	Surrogate Recovery Range	Acceptance Criteria	Performance
Methanol	81–128%	70–130%	Pass
Acetonitrile	81–125%	70–130%	Pass
Water	41–106%	10–200%	Pass

Table 2. Surrogate Recovery Results Across All Solvents

LOT-TO-LOT CONSISTENCY

Each solvent was evaluated across multiple production lots with duplicate samples:

- Methanol: 3 lots
- Acetonitrile: 3 lots
- Water: 3 lots

Results across all lots tested showed stable analytical performance and no target PFAS analytes were detected above the applicable reporting limits under the conditions tested.

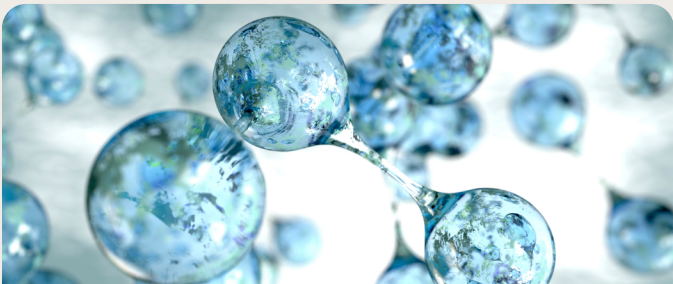
CONCLUSIONS

The testing completed by Paragon Laboratories Inc. confirms that Chromasolv LC-MS solvents for PFAS analysis solvents minimize baseline signal and carryover risk, support achievement of low MDLs and reporting limits, and improve reproducibility and analytical confidence.

For laboratories operating under evolving regulatory limits, solvent purity directly influences data defensibility, false positive risk reduction, and long-term method robustness. The tested solvent grade enables laboratories to operate at the sensitivity achieved in this study without compromising data quality.

This validation study demonstrates that the solvents:

- Exhibited negligible background PFAS contamination, with analytes in unspiked solvent samples below detection limits or below the reported MDLs
- Met validation criteria consistent with EPA Method 1633A and ASTM D7979 requirements
- Supported sensitive PFAS analysis with MDLs ranging from sub-ng/L to low ng/L concentrations



This study establishes Chromasolv LC-MS solvents for PFAS analysis as a trusted solution for PFAS analytical workflows requiring both sensitivity and regulatory alignment.

Adopting solvents specifically evaluated for suitability in PFAS analytical workflows can enable laboratories to reduce contamination risk, improve reproducibility, and meet evolving regulatory expectations.

Ultimately, solvent purity becomes a strategic enabler of analytical excellence in PFAS testing and a reliable foundation for trace PFAS analysis where contamination control is critical.

APPENDIX A – PFAS TARGET ANALYTE LIST

ASTM D7979 MOD ANALYTES

Target Analyte Name	Analyte Abbreviation	CAS Number
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
1H,1H,2H,2H-Perfluorohexane sulfonic acid	4:2 FTS	757124-72-4
1H,1H,2H,2H-Perfluorooctane sulfonic acid	6:2 FTS	27619-97-2
1H,1H,2H,2H-Perfluorodecane sulfonic acid	8:2 FTS	39108-34-4
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
Perfluoroethylcyclohexanesulfonic acid	PFecHS	646-83-3

EPA METHOD 1633A ANALYTES

Target Analyte Name	Analyte Abbreviation	CAS Number
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5
1H,1H,2H,2H-Perfluorohexane sulfonic acid	4:2 FTS	757124-72-4
1H,1H,2H,2H-Perfluorooctane sulfonic acid	6:2 FTS	27619-97-2
1H,1H,2H,2H-Perfluorodecane sulfonic acid	8:2 FTS	39108-34-4
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methyl perfluorooctanesulfonamide	NMeFOSA	31506-32-8
N-ethyl perfluorooctanesulfonamide	NEtFOSA	4151-50-2
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Perfluoro-3-methoxypropanoic acid	PFMBA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMPA	863090-89-5
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
3-Perfluoropropyl propanoic acid	3:3 FTCA	356-02-5
2H,2H,3H,3H-Perfluorooctanoic acid	5:3 FTCA	914637-49-3
3-Perfluoroheptyl propanoic acid	7:3 FTCA	812-70-4

ASTM D7979 ANALYTES (FOR REFERENCE ONLY)

Target Analyte Name	Analyte Abbreviation	CAS Number
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluoroethylcyclohexanesulfonic acid	PFecHS	646-83-3
2-Perfluorohexyl ethanoic acid	FHEA; 6:2 FTCA	53826-12-3
8:2 Fluorotelomer carboxylic acid; 2H,2H-Perfluorodecanoic acid	FOEA; 8:2 FTA	27854-31-5
2-Perfluorodecyl ethanoic acid	FDEA; 10:2 FTA	53826-13-4
2H-Perfluoro-2-decenoic Acid	FOUEA; 8:2 FTUCA	70887-84-2
2H,2H,3H,3H-Perfluorodecanoic acid	FHpPA; 7:3 FTCA	812-70-4
2H-Perfluoro-2-octenoic acid	FHUEA	70887-88-6



APPENDIX B – QUANTITATIVE PERFORMANCE SUMMARY

B1. METHOD DETECTION LIMITS (MDLS) DERIVED FROM SPIKED SOLVENTS

B1.1 ORGANIC SOLVENTS (METHANOL & ACETONITRILE – ASTM D7979 MOD)

Target Analyte Name	Analyte Abbreviation	Reporting Limit (ng/L)	Acetonitrile MDL (ng/L)	Methanol MDL (ng/L)
Perfluorobutanoic acid	PFBA	2	0.92	0.93
Perfluoropentanoic acid	PFPeA	5	0.64	2.32
Perfluorohexanoic acid	PFHxA	5	1.16	2.34
Perfluoroheptanoic acid	PFHpA	5	0.92	1.9
Perfluorooctanoic acid	PFOA	2	1.27	0.78
Perfluorononanoic acid	PFNA	5	0.95	1.33
Perfluorodecanoic acid	PFDA	5	2.21	1.84
Perfluoroundecanoic acid	PFUnA	5	2.14	1.04
Perfluorododecanoic acid	PFDoA	5	1.6	2.1
Perfluorotridecanoic acid	PFTTrDA	10	1.87	4.42
Perfluorotetradecanoic acid	PFTeDA	10	3.47	2.06
Perfluorobutanesulfonic acid	PFBS	5	2.81	2.7
Perfluoropentanesulfonic acid	PFPeS	10	4.69	4.46
Perfluorohexanesulfonic acid	PFHxS	5	2.65	2.64
Perfluoroheptanesulfonic acid	PFHpS	10	2.66	4.77
Perfluorooctanesulfonic acid	PFOS	2	1.93	0.79
Perfluorononanesulfonic acid	PFNS	10	2.75	5.22
Perfluorodecane sulfonic acid	PFDS	10	3.27	5.62
4:2 Fluorotelomer sulfonic acid	4:2 FTS	50	19.43	28.96
6:2 Fluorotelomer sulfonic acid	6:2 FTS	50	17.54	13.01
8:2 Fluorotelomer sulfonic acid	8:2 FTS	50	19.59	24.25
Perfluorooctane sulfonamide	PFOSA	5	1.7	2.4
N-Methyl perfluorooctane sulfonamidoacetic acid	NMeFOSAA	50	13.83	15.19
N-Ethyl perfluorooctane sulfonamidoacetic acid	NEtFOSAA	50	12.98	24.71
Hexafluoropropylene oxide dimer acid	HFPO-DA	100	27.51	63.08
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	50	15.04	23.72
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	50	11.3	21.35
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUDS	21.68	21.68	17.76
Perfluoroethylcyclohexanesulfonic acid	PFEcHS	5	2.16	2.9

KEY OBSERVATIONS:

- Lowest MDLs achieved for legacy PFAS (PFOA, PFNA)
- Higher MDLs observed for ether/novel PFAS (e.g., HFPO-DA)
- MDL elevation was not attributable to solvent background
- All analytes reported as below reporting limit across all samples and lots.



B1.2 WATER (EPA METHOD 1633A) – DETAILED ANALYTE-SPECIFIC MDLS

Target Analyte Name	Analyte Abbreviation	Reporting Limit (ng/L)	Water MDL (ng/L)
Perfluorobutanoic acid	PFBA	2.00	0.226
Perfluoropentanoic acid	PFPeA	2.00	0.151
Perfluorohexanoic acid	PFHxA	2.00	0.064
Perfluoroheptanoic acid	PFHpA	2.00	0.063
Perfluorooctanoic acid	PFOA	2.00	0.095
Perfluorononanoic acid	PFNA	2.00	0.089
Perfluorodecanoic acid	PFDA	2.00	0.089
Perfluoroundecanoic acid	PFUnA	2.00	0.07
Perfluorododecanoic acid	PFDaA	2.00	0.06
Perfluorotridecanoic acid	PFTrDA	2.00	0.043
Perfluorotetradecanoic acid	PFTeDA	2.00	0.068
Perfluorobutanesulfonic acid	PFBS	2.00	0.044
Perfluoropentanesulfonic acid	PFPeS	2.00	0.094
Perfluorohexanesulfonic acid	PFHxS	2.00	0.089
Perfluoroheptanesulfonic acid	PFHpS	2.00	0.101
Perfluorooctanesulfonic acid	PFOS	2.00	0.095
Perfluorooctanesulfonic acid	PFNS	2.00	0.19
Perfluorodecane sulfonic acid	PFDS	2.00	0.227
Perfluorododecanesulfonic acid	PFDoS	2.00	0.235
4:2 Fluorotelomer sulfonic acid	4:2 FTS	2.00	0.379
6:2 Fluorotelomer sulfonic acid	6:2 FTS	2.00	0.367
8:2 Fluorotelomer sulfonic acid	8:2 FTS	2.00	0.444
Perfluorooctane sulfonamide	PFOSA	2.00	0.075
N-Methyl perfluorooctane sulfonamide	NMeFOSA	2.00	0.29
N-Ethyl perfluorooctane sulfonamide	NEtFOSA	2.00	0.161
N-Methyl perfluorooctane sulfonamidoacetic acid	NMeFOSAA	2.00	0.212
N-Ethyl perfluorooctane sulfonamidoacetic acid	NEtFOSAA	2.00	0.089
N-Methyl perfluorooctane sulfonamidoethanol	NMeFOSE	2.00	0.94
Perfluorodecane sulfonic acid	PFDS	2.00	0.227
N-Ethyl perfluorooctane sulfonamidoethanol	NEtFOSE	5.00	1.618
Hexafluoropropylene oxide dimer acid	HFPO-DA	2.00	0.154
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	5.00	0.177
Perfluoro-3-methoxybutanoic acid	PFMBA	2.00	0.101
Perfluoro-3-methoxypropanoic acid	PFMPA	5.00	0.165
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	2.00	0.091
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	2.00	0.189
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	2.00	0.166
3:3 Fluorotelomer carboxylic acid	3:3 FTCA	2.00	0.263
5:3 Fluorotelomer carboxylic acid	5:3 FTCA	2.00	1.261
7:3 Fluorotelomer carboxylic acid	7:3 FTCA	5.00	1.445

B2. PRECISION AND RECOVERY PERFORMANCE

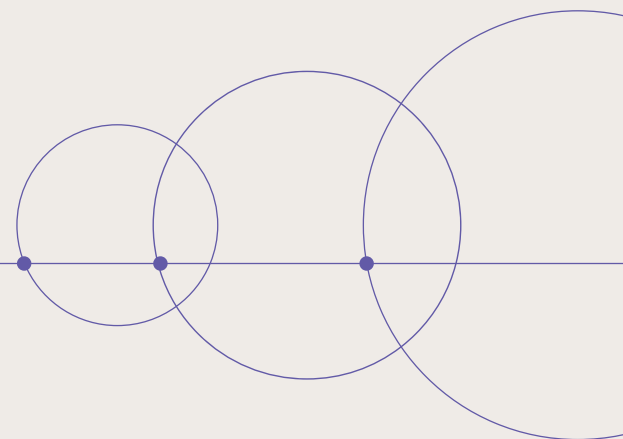
ASTM D7979-MODPFAS IPD - Acetonitrile														
Analytes	IPR1 (ng/L)	IPR2 (ng/L)	IPR3 (ng/L)	IPR4 (ng/L)	Mean (ng/L)	Std.Dev	%RSD	Acceptance %RSD	PASS / FAIL	Calculated IPR %R	Spike Level (ng/L)	IPR %R Limits		PASS / FAIL
												Low	High	
PFBS	90.92	92.68	96.85	90.57	92.76	2.88	3.11	30	PASS	92.76%	100	70%	130%	PASS
PFHxA	104.61	106.39	111.16	112.89	108.76	3.9	3.59	30	PASS	108.76%	100	50%	130%	PASS
PFHpA	105.55	108.45	115.84	110.35	110.35	4.41	3.99	30	PASS	110.35%	100	50%	130%	PASS
PFHxS	101.86	102.31	101.59	97.13	100.72	2.41	2.4	30	PASS	100.72%	100	70%	130%	PASS
PFOA	105.38	114.36	111.27	109.27	110.07	3.76	3.42	30	PASS	110.07%	100	70%	130%	PASS
PFOS	91.96	93.12	93.91	99.72	94.68	3.46	3.65	30	PASS	94.68%	100	70%	130%	PASS
PFNA	103.14	101.32	108.06	101.48	103.5	3.15	3.04	30	PASS	103.50%	100	70%	130%	PASS
PFDA	105.57	103.55	106.26	100.6	104	2.54	2.44	30	PASS	104.00%	100	70%	130%	PASS
NMeFOSAA	1055.1	1036.44	975.07	1030.17	1024.2	34.42	3.36	30	PASS	102.42%	1000	70%	130%	PASS
PFUnDA	106.96	102.81	109.56	106.43	106.44	2.78	2.61	30	PASS	106.44%	100	70%	130%	PASS
NEtFOSAA	970.96	946.4	881.62	971.07	942.51	42.22	4.48	30	PASS	94.25%	1000	70%	130%	PASS
PFDoA	89.52	98.15	97.79	91.99	94.36	4.29	4.54	30	PASS	94.36%	100	70%	130%	PASS
PFTrDA	89.83	87.14	94.52	101.05	93.14	6.09	6.54	30	PASS	93.14%	100	70%	130%	PASS
PFTeDA	85.37	75.21	91.33	83.05	83.74	6.67	7.97	30	PASS	83.74%	100	70%	130%	PASS
PFBA	106.86	104.43	97.26	98.39	101.74	4.65	4.57	30	PASS	101.74%	100	50%	130%	PASS
PFPeA	110.25	102.75	103.7	106.99	105.92	3.41	3.22	30	PASS	105.92%	100	70%	130%	PASS
4:2 FTSA	1011.92	1047.1	1064.09	940.36	1015.87	54.83	5.4	30	PASS	101.59%	1000	70%	130%	PASS
PFPeS	104.81	109.51	103.46	100.72	104.63	3.67	3.51	30	PASS	104.63%	100	70%	130%	PASS
6:2 FTSA	983.62	1035.85	951.71	903.53	968.68	55.58	5.74	30	PASS	96.87%	1000	70%	130%	PASS
PFHpS	98.62	97.12	110.77	112.43	104.74	7.98	7.62	30	PASS	104.74%	100	70%	130%	PASS
8:2 FTSA	933.3	972.37	921.03	923.03	934.68	26.76	2.86	30	PASS	93.48%	1000	70%	130%	PASS
PFNS	89.3	95.59	103.63	114.97	100.87	11.08	10.98	30	PASS	100.87%	100	70%	130%	PASS
PFDS	82.95	85.42	86.38	88.47	85.81	2.29	2.67	30	PASS	85.81%	100	70%	130%	PASS
PFOSA	96.8	95.54	111	119.39	105.68	11.52	10.9	30	PASS	105.68%	100	70%	130%	PASS
HFPO-DA	1088.29	1061.5	1242.17	1053.82	1111.45	88.39	7.95	30	PASS	111.14%	1000	70%	130%	PASS
11Cl- PF3OUdS	985.48	947.1	956.39	929.76	954.7	23.3	2.44	30	PASS	95.47%	1000	70%	130%	PASS
9Cl- PF3ONS	1023.29	976.41	1020.5	1002.21	1005.6	21.59	2.15	30	PASS	100.56%	1000	70%	130%	PASS
ADONA	1011.13	986.23	1000.84	992	997.55	10.87	1.09	30	PASS	99.76%	1000	70%	130%	PASS
PFecHS	92.96	90.57	90.07	97.23	92.71	3.27	3.53	30	PASS	92.71%	100	70%	130%	PASS

ASTM D7979-MODPFAS IPD – Methanol														
Analytes	IPR1 (ng/L)	IPR2 (ng/L)	IPR3 (ng/L)	IPR4 (ng/L)	Mean (ng/L)	Std.Dev	%RSD	Acceptance %RSD	PASS / FAIL	Calculated IPR %R	Spike Level (ng/L)	IPR %R Limits		PASS / FAIL
												Low	High	
PFBS	103.11	98.68	100.78	95.63	99.55	3.18	3.19	30	PASS	99.55%	100	70%	130%	PASS
PFHxA	99.28	89.19	93.79	106.36	97.16	7.39	7.61	30	PASS	97.16%	100	50%	130%	PASS
PFHpA	99.64	103.13	89.73	100.83	97.83	6.89	7.04	30	PASS	97.83%	100	50%	130%	PASS
PFHxS	94.55	100.36	104.81	104.22	100.99	4.72	4.68	30	PASS	100.99%	100	70%	130%	PASS
PFOA	100.9	97.68	86.43	99.76	96.19	6.64	6.91	30	PASS	96.19%	100	70%	130%	PASS
PFOS	99.21	115.26	90.58	98.96	101	10.32	10.21	30	PASS	101.00%	100	70%	130%	PASS
PFNA	97.33	92.38	90.75	108.58	97.26	8.05	8.28	30	PASS	97.26%	100	70%	130%	PASS
PFDA	98.22	94.71	85.33	96.31	93.64	5.72	6.11	30	PASS	93.64%	100	70%	130%	PASS
NMeFOSAA	976.12	1022.23	978.7	1034.75	1002.95	29.95	2.99	30	PASS	100.30%	1000	70%	130%	PASS
PFUnDA	96.26	100.59	95.28	100.43	98.14	2.77	2.82	30	PASS	98.14%	100	70%	130%	PASS
NEtFOSAA	886.02	934.72	861.32	939.1	905.29	37.92	4.19	30	PASS	90.53%	1000	70%	130%	PASS
PFDoA	86.6	83.15	85.28	85.03	85.02	1.42	1.67	30	PASS	85.02%	100	70%	130%	PASS
PFTTrDA	104.65	99.39	91.34	77.07	93.11	12.9	12.91	30	PASS	93.11%	100	50%	130%	PASS
PFTeDA	86.45	80.73	74.43	71.83	78.36	6.56	8.37	30	PASS	78.36%	100	50%	130%	PASS
PFBA	113.1	79.63	108.32	109.3	102.59	15.44	15.05	30	PASS	102.59%	100	50%	130%	PASS
PFPeA	109.58	104.89	96.06	103.34	103.47	5.61	5.42	30	PASS	103.47%	100	70%	130%	PASS
4:2 FTSA	1134.8	1151.09	1113.07	1348.6	1186.89	108.93	9.18	30	PASS	118.69%	1000	70%	130%	PASS
PFPeS	106.36	90.61	103.93	99.26	101.04	4.16	4.12	30	PASS	101.04%	100	70%	130%	PASS
6:2 FTSA	1157.73	1155.33	1005.87	1385.87	1176.2	156.79	13.33	30	PASS	117.62%	1000	70%	130%	PASS
PFHpS	90.43	93.08	98.78	108.55	97.21	8	8.23	30	PASS	97.21%	100	70%	130%	PASS
8:2 FTSA	1307.94	1137.33	1054.15	1275.89	1193.83	118.96	9.96	30	PASS	119.38%	1000	70%	130%	PASS
PFNS	94.01	105.44	94.54	95.62	97.4	5.4	5.54	30	PASS	97.40%	100	70%	130%	PASS
PFDS	88.86	94.07	79.03	84.24	86.55	6.42	7.42	30	PASS	86.55%	100	70%	130%	PASS
PFOSA	78.96	63.85	67.97	74.39	71.29	6.7	9.4	30	PASS	71.29%	100	70%	130%	PASS
*HFPO-DA	993.3	892.7	791.72	897.37	893.77	82.33	9.21	30	PASS	89.38%	1000	70%	130%	PASS
*11CI- PF3OUds	950.25	1090.68	1077.58	1127.27	1061.45	77.05	7.26	30	PASS	106.14%	1000	70%	130%	PASS
*9CI- PF3ONS	928.49	1074.71	1011.91	1054.07	1017.3	64.72	6.36	30	PASS	101.73%	1000	70%	130%	PASS
*ADONA	1037.6	980.15	956.64	884.17	964.64	63.52	6.58	30	PASS	96.46%	1000	70%	130%	PASS
*PFecHS	93.5	104.23	98.08	121.51	104.33	12.27	11.76	30	PASS	104.33%	100	70%	130%	PASS

**ASTM D7979-MOD PFAS IPR Methanol- initial IPR study 10.25.2018 – last 5 analytes
pulled from LCS data [5/28-6/23/20 & 12/5/20-1/22/21]*

ASTM D7979-MODPFAS IPD – Methanol

Analytes	IPR1 (ng/L)	IPR2 (ng/L)	IPR3 (ng/L)	IPR4 (ng/L)	Mean (ng/L)	Std.Dev	%RSD	Acceptance %RSD	PASS / FAIL	Calculated IPR %R	Spike Level (ng/L)	IPR %R Limits		PASS / FAIL
												Low	High	
PFBA	39.83	39.84	40.97	39.98	40.15	0.55	1.36	20	PASS	100.38%	40	60%	147%	PASS
PFMPA	20.68	21.06	20.52	19.29	20.39	0.77	3.75	20	PASS	101.93%	20	55%	141%	PASS
3:3FTCA	37.59	38.87	40.91	35.78	38.29	2.16	5.65	20	PASS	95.72%	40	66%	126%	PASS
PFPeA	20.53	20.14	20.73	20.9	20.57	0.33	1.58	20	PASS	102.87%	20	56%	150%	PASS
PFMBA	20.15	20.16	20.15	18.32	19.69	0.92	4.66	20	PASS	98.47%	20	59%	145%	PASS
4:2FTS	35.34	34.27	37.02	35.58	35.55	1.13	3.18	20	PASS	94.81%	37.5	77%	135%	PASS
NFDHA	20.15	20.31	20.14	20.47	20.27	0.15	0.76	35	PASS	101.34%	20	63%	146%	PASS
PFBS	8.63	8.43	8.92	8.91	8.72	0.23	2.69	20	PASS	98.35%	8.87	66%	141%	PASS
PFHxA	10.12	10.35	10.95	10.05	10.37	0.41	3.95	25	PASS	103.70%	10	59%	148%	PASS
HFPO-DA	19.2	19.26	18.59	19.05	19.01	0.3	1.59	25	PASS	95.06%	20	72%	135%	PASS
5:3FTCA	198.08	199.84	215.64	191.2	201.19	10.33	5.13	25	PASS	100.59%	200	68%	130%	PASS
PFEESA	17.88	17.78	19.2	17.16	18.01	0.85	4.75	20	PASS	101.15%	17.8	57%	149%	PASS
PFHpA	9.74	9.87	10.37	10.26	10.06	0.3	2.99	20	PASS	100.59%	10	60%	149%	PASS
PFPeS	9.51	9.66	10.05	9.52	9.68	0.25	2.61	25	PASS	102.58%	9.44	66%	144%	PASS
ADONA	20.65	20.56	23.67	22.01	21.72	1.46	6.72	20	PASS	114.94%	18.9	75%	138%	PASS
6:2FTS	37.21	39.83	40.23	35.58	38.21	2.21	5.77	30	PASS	100.56%	38	75%	137%	PASS
PFOA	9.97	10.31	10.19	9.96	10.11	0.17	1.69	25	PASS	101.08%	10	55%	158%	PASS
PFHxS	8.61	8.37	9.23	8.71	8.73	0.36	4.15	25	PASS	95.54%	9.14	62%	141%	PASS
7:3FTCA	204.09	208.27	212.16	196.69	205.3	6.62	3.22	20	PASS	102.65%	200	55%	133%	PASS
PFNA	10.81	10.76	11.35	10.6	10.88	0.33	3	20	PASS	108.81%	10	64%	144%	PASS
PFHpS	8.63	8.62	8.99	9	8.81	0.21	2.41	25	PASS	92.47%	9.53	59%	148%	PASS
8:2FTS	37.32	37.32	40.05	36.45	37.78	1.57	4.15	30	PASS	98.39%	38.4	79%	136%	PASS
PFDA	9.85	10.06	9.95	9.52	9.85	0.23	2.34	20	PASS	98.47%	10	57%	142%	PASS
NMeFOSAA	10.43	10.16	11.51	11.2	10.82	0.64	5.88	20	PASS	108.24%	10	65%	140%	PASS
PFOS	8.63	8.22	8.8	8.85	8.63	0.29	3.32	20	PASS	92.17%	10	61%	145%	PASS
NEtFOSAA	10.33	9.94	10.54	10.53	10.34	0.28	2.73	20	PASS	103.36%	10	65%	140%	PASS
PFUnDA	9.83	10.13	10.12	10.07	10.04	0.16	1.61	20	PASS	100.72%	10	54%	140%	PASS
9Cl- PF3ONS	20.1	20.09	22.09	20.95	20.81	0.95	4.55	30	PASS	111.27%	18.7	72%	140%	PASS
PFNS	9.58	9.42	9.52	9.56	9.52	0.07	0.76	20	PASS	98.97%	9.62	57%	143%	PASS
PFDoA	10.91	10.81	10.98	10.95	10.95	0.12	1.05	25	PASS	109.45%	10	73%	133%	PASS
PFOSA	9.58	9.61	9.94	10	9.78	0.18	1.86	20	PASS	96.74%	10	64%	144%	PASS
PFDS	9.69	9.64	10	9.95	9.85	0.22	2.26	20	PASS	98.47%	10	56%	142%	PASS
PFTrDA	11.03	10.39	11.13	10.88	10.86	0.33	3.02	20	PASS	108.58%	10	52%	145%	PASS
11Cl- PF3OUds	18.77	19.9	21.51	20.66	20.21	1.16	5.75	35	PASS	106.92%	18.9	61%	145%	PASS
PFTeDA	11.03	10.76	11.26	11.06	11.03	0.21	1.89	20	PASS	110.27%	10	49%	158%	PASS
PFDoS	8.81	8.43	9.22	8.77	8.81	0.32	3.64	30	PASS	90.78%	9.7	41%	140%	PASS
NMeFOSE	107.04	106.49	107.94	107.3	107.19	0.6	0.56	20	PASS	107.19%	100	79%	129%	PASS
NMeFOSA	10.57	11.03	11.45	11.68	11.18	0.49	4.39	25	PASS	111.81%	10	76%	132%	PASS
NEtFOSE	104.51	110.26	109.95	96.21	105.23	6.57	6.24	25	PASS	105.23%	100	79%	126%	PASS
NEtFOSA	10.66	11.27	11.61	12.52	11.52	0.78	6.75	25	PASS	115.16%	10	75%	129%	PASS



REFERENCES

- EPA Method 1633A – PFAS by LC-MS/MS
- ASTM D7979 – LC-MS/MS PFAS determination
- 40 CFR Part 136 Appendix B (MDL procedures)
- Paragon Laboratories Validation Reports



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