County of Brunswick

3954 Clearwell Dr NE
Leland, NC 28451

Northwest Plant Lab

Leland, NC
Samples Received: 05/21/2020

Analytical Report
0520-743

Isotope Dilution Method

PFAS

Enthalpy Analytical, LLC – Ultratrace

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I certify that to the best of my knowledge all analytical data presented in this report:

- Have been checked for completeness
- Are accurate, error-free, and legible
- Have been conducted in accordance with approved protocol, and that all deviations and analytical problems are summarized in the appropriate narrative(s)

This analytical report was prepared in Portable Document Format (.PDF) and contains 15 pages.

QA Review Performed by: Juanica L. Thomas

Report Issued Date: 06/05/2020

ENTHALPY ANALYTICAL

Summary of Results

Enthalpy Analytical

Job No.: 0520-743 PFAS by Isotope Dilution (non-potable water)

County of Brunswick Site: NW Plant Lab Leland,NC

Summary

	Compound	CAS	52120S01 ng/L	52120E01 ng/L
Acids	PFBA	375-22-4	8.26	ND U
	PFPeA	2706-90-3	11.4	11.3
	PFHxA	307-24-4	11.4	12.3
	PFHpA	375-85-9	6.69	7.04
	PFOA	335-67-1	6.87	7.06
	PFNA	375-95-1	0.959	0.938
	PFDA	335-76-2	0.645	0.699
	PFUnDA	2058-94-8	0.192 J	0.0976 J
	PFDoDA	307-55-1	0.0456 L	ND U
	PFTrDA	72629-94-8	ND U	ND U
	PFTeDA	376-06-7	ND U	ND U
Sulfonates	PFBS	375-73-5	ND U	ND U
	PFPeS	2706-91-4	0.932	0.766
	PFHxS	355-46-4	5.39	4.87
	PFHpS	375-92-8	0.415	0.386
	PFOS	1763-23-1	10.8	10.8
	PFNS	68259-12-1	ND U	ND U
	PFDS	335-77-3	ND U	ND U
	4:2 FTS	757124-72-4	ND U	ND U
	6:2 FTS	27619-97-2	0.191 J	0.346
	8:2 FTS	39108-34-4	ND U	ND U
Other	PFOSA	754-91-6	ND U	ND U
	N-MeFOSAA	2355-31-9	ND U	ND U
	N-EtFOSAA	2991-50-6	ND U	ND U
	HFPO-DA	13252-13-6	16.9	16.8
	PFMOAA	674-13-5	54.4	53.3
	PFMOPrA	377-73-1	ND U	ND U
	PFO2HxA	39492-88-1	13.7	14.2
	PFO3OA	39492-89-2	0.0273	0.0348
	PFO4DA	39492-90-5	ND U	ND U
	Nafion Byproduct 1	29311-67-9	0.225	0.741
	ADONA	919005-14-4	ND U	ND U
	9Cl-PF3ONS	756426-58-1	ND U	ND U
	11Cl-PF3OUdS	763051-92-9	ND U	ND U
	Nafion Byproduct 2	749836-20-2	1.59	0.917
	NFDHA	151772-58-6	ND U	ND U
	PEPA		0.0413	0.0418
	PFEESA	113507-82-7	ND U	ND U
	PFMOBA	863090-89-5	ND U	ND U
	PFO5DA	39492-91-6	ND U	ND U
	PMPA	13140-29-9	0.0613	0.0660

QC Data

Enthalpy Analytical

Job No.: 0520-743-1 PFAS by Isotope Dilution (non-potable water)

County of Brunswick NW Plant Lab Leland,NC

Enthalpy ID	MB-10896-PFAS	Prep Batch	EU10896	Sample Vol (mL)	250
Sample Name	MB-10896-PFAS	Prep Date	2020-05-22	Extract Vol (mL)	0.4
Matrix		Analysis Date	2020-05-22	Dilution Factor	1
Sampling Date					

	Compound	CAS	Extract Concentration ng/L	Sample Concentration ng/L	Formatted Result ng/L	LOD ng/L	LOQ ng/L	Recovery	Flags
Acids	PFBA	375-22-4	ND	ND	ND	0.157	0.240		U
	PFPeA	2706-90-3	ND	ND	ND	0.0898	0.240		U
	PFHxA	307-24-4	ND	ND	ND	0.158	0.240		U
	PFHpA	375-85-9	ND	ND	ND	0.0695	0.240		U
	PFOA	335-67-1	ND	ND	ND	0.0795	0.240		U
	PFNA	375-95-1	ND	ND	ND	0.0509	0.240		U
	PFDA	335-76-2	ND	ND	ND	0.125	0.240		U
	PFUnDA	2058-94-8	ND	ND	ND	0.0481	0.240		U
	PFDoDA	307-55-1	ND	ND	ND	0.0475	0.240		U
	PFTrDA	72629-94-8	ND	ND	ND	0.0745	0.240		U
	PFTeDA	376-06-7	ND	ND	ND	0.0830	0.240		U
Sulfonates	PFBS	375-73-5	ND	ND	ND	0.0830	0.240		U
	PFPeS	2706-91-4	ND	ND	ND	0.0990	0.240		U
	PFHxS	355-46-4	ND	ND	ND	0.0827	0.240		U
	PFHpS	375-92-8	ND	ND	ND	0.0779	0.240		U
	PFOS	1763-23-1	ND	ND	ND	0.0471	0.240		U
	PFNS	68259-12-1	ND	ND	ND	0.0654	0.240		U
	PFDS	335-77-3	ND	ND	ND	0.135	0.240		U
	4:2 FTS	757124-72-4	ND	ND	ND	0.0646	0.240		U
	6:2 FTS	27619-97-2	ND	ND	ND	0.0723	0.240		U
	8:2 FTS	39108-34-4	ND	ND	ND	0.0569	0.240		U
Other	PFOSA	754-91-6	ND	ND	ND	0.365	0.366		U
	N-MeFOSAA	2355-31-9	ND	ND	ND	0.0544	0.240		U
	N-EtFOSAA	2991-50-6	ND	ND	ND	0.0651	0.240		U
	HFPO-DA	13252-13-6	ND	ND	ND	0.0951	0.240		U
	ADONA	919005-14-4	ND	ND	ND	0.120	0.240		U
	9Cl-PF3ONS	756426-58-1	ND	ND	ND	0.120	0.240		U
	11Cl-PF3OUdS	763051-92-9	ND	ND	ND	0.120	0.240		U
ES	MPFBA		4455.13	7.13				75.6%	
	M5PFPeA		3824.02	6.12				66.1%	
	M3PFBS		4182.26	6.69				67.5%	
	M2-4:2 FTS		3740.59	5.98				73.5%	
	M5PFHxA		4197.35	6.72				70.4%	
	M3HFPO-DA		5788.91	9.26				95.5%	
	M4PFHpA		4199.59	6.72				68.0%	
	M3PFHxS		4287.23	6.86				74.2%	
	M2-6:2 FTS		3964.01	6.34				75.0%	
	M8PFOA		4239.93	6.78				70.7%	
	M9PFNA		3921.38	6.27				65.0%	
	M8PFOS		4181.61	6.69				69.4%	
	M2-8:2 FTS		3667.70	5.87				62.7%	
	M8FOSA-I		2519.79	4.03				43.0%	
	M6PFDA		4091.14	6.55				56.0%	
	d3-N-MeFOSAA		3434.10	5.49				59.1%	
	d5-N-EtFOSAA		3169.82	5.07				52.3%	
	M7PFUdA		3558.52	5.69				50.9%	
	MPFDoA		2762.95	4.42				40.5%	
	M2PFTeDA		1426.89	2.28				20.6%	

Narrative Summary

Enthalpy Analytical Narrative Summary

Company	County of Brunswick
Job No.	0520-743-1 PFAS by Isotope Dilution (non-potable water)
Client ID.	Site: NW Plant Lab: Leland,NC

1. Custody

Naomi Harka received the samples on 05/21/20 at 2.3°C after being relinquished by County of Brunswick. The samples were received in good condition.

Prior to, during, and after analysis, the samples were kept under lock with access only to authorized personnel by Enthalpy Analytical, LLC.

Table 1 - Sample Inventory

EU Lab Sample ID	Client Sample ID	Matrix
0520-743-002-1	52120E01	AQ
0520-743-001-1	52120S01	AQ

2. Methods and analytes

A list of analytes of interest and corresponding methods of analysis is shown in Table 3. Abbreviations are defined in the listed Appendices.

Table 3 - Methods and Analytes

EU Method	Analytes	Cleanup Method
EU-047	All PFAS	ENVI-Carb

3. Analysis

The samples were analyzed using Waters Acquity UPLC equipped with Xevo TQ MS (LC/MS/MS "Kili").

For aqueous samples, the sample volume was measured gravimetrically by the laboratory, and spiked with Extraction Standard (ES). The sample was then mixed well and centrifuged.

Cleanup procedures were performed on the supernatant and then extracted via SPE. Each final sample extract was transferred to an autosampler vial and spiked with 80µL of Injection Standard (IS), prior to analysis.

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Enthalpy Analytical Narrative Summary

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4. Calibration

In the initial calibration, the analytes exhibited R^2 of ≥ 0.99. The calibration standard analytes, continuing calibration (concal) and Initial Calibration Verification (ICV) met the 30% criterion for native analytes.

5. QC Notes

QC sample analyses passed all method criteria.

The samples were extracted within the 28-day from collection holding time and analyzed within the 28-day from extraction to analysis holding time required by the method.

6. Reporting Notes

Some labeled standards in the samples fell outside the limits for ES recoveries. The target analytes are quantified based on their ratio to the labeled standards, therefore, undergo the same losses as the labeled standards. As a result, low or high recoveries do not cause any change to ratios or contribute any additional error in the measurement of the target analytes. Therefore, the data are considered acceptable.

The results presented in this report are representative of the samples as provided to the laboratory.

These analyses met the requirements of the TNI Standard. Analytes in excess of Legacy 24 compounds are not accredited under the TNI standard. Any deviations from the requirements of the reference method or TNI Standard have been stated above.

Enthalpy Analytical, LLC in Wilmington NC is accredited by the Louisiana Department of Environmental Quality to the 2009 TNI Standard under certificate number 05075.

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General Reporting Notes – Data Qualifiers

The following are general reporting notes that are applicable to all Enthalpy Analytical, LLC - Wilmington, NC data reports, unless specifically noted otherwise.

General Data Qualifiers

- B – The analyte was found in the method blank, at a concentration that was at least 10% of the concentration in the sample.
- Cxx – Two or more congeners co-elute. In EDDs, C denotes the lowest IUPAC congener in a co-elution group and additional co-eluters for the group ('xx') are shown with the number of the lowest IUPAC co-eluter**.**
- E – The reported concentration exceeds the calibration range (upper point of the calibration curve). For HRMS data, this condition does not imply additional measurement uncertainty. For LC-MS/MS data, these values should be considered as having measurement uncertainty higher than values within the calibration range.
- EDL – Estimated Detection Level. Specific to Dioxin/Furan tests and equivalent to MDL
- EMPC – Estimated Maximum Possible Concentration Specific to Dioxin/Furan tests to indicate the signal/noise ratio wass not sufficient for peak identification (the determined ion-abundance ratio was outside the allowed theoretical range), or where there was a co-eluting interference. Indicates that a peak was identified but did not meet the method specified ion-abundance ratio.
- IR – The ion ratio between the primary and secondary ions was observed to be outside the method criteria therefore the actual analyte concentration cannot be accurately determined as defined by DoD QSM Table B-15.
- J – The analyte has a concentration below the minimum calibration level (LOQ value) but greater than the LOD. These values should be considered as having measurement uncertainty higher than values within the calibration range
- L - Indicates that an analyte has a concentration below the Minimum Detection Limit (MDL). The reported concentration is not recommended for regulatory use as the analyte signal may have a signal-to-noise ratio less than the criteria deemed necessary to be considered a detected analyte.
- LOD – Limit of Detection: For reports conforming to the DOD ELAP QSM, this is the QSM-defined LOD. For reports conforming to TNI requirements (but not DOD ELAP QSM requirements), this value is the minimum detection limit (MDL). The LOD is adjusted for sample weight or volume.
- LOQ – Limit of Quantiation: For reports conforming to the DOD ELAP QSM, this is the QSM-defined LOQ. For reports conforming to TNI requirements (but not DOD ELAP QSM requirements), this value is the reporting limit (RL). The LOD is adjusted for sample weight or volume.
- <LOD() – Analyte was not found at a concentration high enough to be reported as detected. It is reported as less than the LOD, and the LOD is given in the parentheses.

- ND – Indicates a non-detect.
- NR – Indicates a value that is not reportable due to issues observed in sample preparation or analysis.
- PR – The associated congener(s) is(are) poorly resolved.
- QI – Indicates the presence of a quantitative interference.
- RL – Reporting Limit. Lowest reportable value. The level is higher than the MDL.
- SI – Denotes "Single Ion Mode" and is utilized for PCBs where the secondary ion trace has a significantly elevated noise level due to background PFK. Responses for such peaks are calculated using an EMPC approach based solely on the primary ion area(s) and may be considered estimates.
- U – The analyte was not detected.
- V – The labeled standard recovery is not within method control limits.
- X – Results from re-injection/repeat/second-column analysis.

Lab Identifiers/ Data Attributes

- AR – Indicates use of the archived portion of the sample extract.
- CU – Indicates a sample that required additional clean-up prior to HRMS injection/processing.
- D – Dilution Data. Result was obtained from the analysis of a dilution. The number that follows the "D" indicates the dilution factor.
- DE – Indicates a dilution performed with the addition of ES (Extraction Standard) solution.
- DUP – Designation for a duplicate sample.
- MS – Designation for a matrix spike.
- MSD – Designation for a matrix spike duplicate.
- RJ – Indicates a reinjection of the sample extract.
- S – Indicates a sample split. The number that follows the "S" indicates the split factor.
- R – Indicates a re-extraction of the sample.

Analyte	CAS #
Perfluoro(2-ethoxyethane)sulphonic acid (PFEESA)	113507-82-7
Hexafluoropropylene Oxide Dimer Acid (HFPOA-DA/Gen X)	13252-13-6(b)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	151772-58-6
Perfluorooctanesulfonate (PFOS)	1763-23-1
Perfluoroundecanoic acid (PFUdA)	2058-94-8
N-methylperfluoro-1-octanesulfonamidoacetic acid (N-MeFOSAA)	2355-31-9
Perfluoropentanoic acid (PFPeA)	2706-90-3
Perfluoropentanesulfonate (PFPeS)	2706-91-4
Fluorotelomer sulfonate 6:2 (6:2 FTS)	27619-97-2
Perfluorodecanesulfonate (PFDS)	2806-15-7
Nafion Byproduct 1	29311-67-9
N-ethylperfluoro-1-octanesulfonamidoacetic acid (N-EtFOSAA)	2991-50-6
Perfluorohexanoic acid (PFHxA)	307-24-4
Perfluorododecanoic acid (PFDoA)	307-55-1
Perfluorooctanoic acid (PFOA)	335-67-1
Perfluorodecanoic acid (PFDA)	335-76-2
Perfluorohexanesulfonate (PFHxS)	355-46-4
Perfluorobutyric acid (PFBA)	375-22-4
Perfluorobutanesulfonate (PFBS)	375-73-5
Perfluoroheptanoic acid (PFHpA)	375-85-9
Perfluoroheptanesulfonate (PFHpS)	375-92-8
Perfluorononanoic acid (PFNA)	375-95-1
Perfluorotetradecanoic acid (PFTeDA)	376-06-7
Perfluoro-3-methoxypropanoic acid (PFMOPrA)	377-73-1
Fluorotelomer sulfonate 8:2 (8:2 FTS)	39108-34-4
Perfluoro(3,5-dioxahexanoic) acid (PFO2HxA)	39492-88-1
Perfluoro(3,5,7-trioxaoctanoic) acid (PFO3OA)	39492-89-2
Perfluoro(3,5,7,9-tetraoxadecanoic) acid (PFO4DA)	39492-90-5
Perfluoro(3,5,7,9,11-pentaoxadodecanoic) acid (PFO5DA)	39492-91-6
Perfluorononanesulfonate (PFNS)	474511-07-4
Perfluoro-2-methoxyacetic acid (PFMOAA)	674-13-5
Perfluorotridecanoic acid (PFTrDA)	72629-94-8
Nafion Byproduct 2	749836-20-2
Perfluorooctanesulfonamide (PFOSA)	754-91-6
9-chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3PONS)	756426-58-1 (d)
Fluorotelomer sulfonate 4:2 (4:2 FTS)	757124-72-4
11-chloroeicosafluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OUdS)	763051-92-9 (c)
Perfluoro-4-methoxybutanic acid (PFMOBA)	863090-89-5
Sodium dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	919005-14-4(e)

Sample Custody

0520-743

Chain of Custody Record

ENTHALPY analytical

Enthalpy Ultratrace Job#: _____ **COC Page**____**of**____

Special Handling:
- ☐ Standard Turn Around Time
- ☐ Rush Turn Around Time -- Date Needed_____
- All Fast TATs Subject to Approval by Enthalpy Analytical, Inc.
- All Samples Disposed of After 6 months Unless Otherwise Instructed.

Enthalpy Analytical-Wilmington, NC has added enhancements to standard methods to improve accuracy, precision and permit an assessment of laboratory performance in the context of your specific data needs. For more information email Cindy.James@enthalpy.com.

Client Name: Brunswick County Water
Project Manager: Glenn Walker
Report To: same

Project Number:
Site Name: NW Plant Lab
Location: Leland

PO#:
Telephone#:
Email:

This Chain of Custody is applicable to Non-Air samples. Standard TAT differ per analysis and are provided by request.

Client Special Instructions:

Matrix: GW-Groundwater, WW-Wastewater, NW-Non-Potable Water, DW-Drinking Water, S-Soil, SL-Sludge, BT-Biological Tissue, O-Other

Type: G=Grab C=Composite Q=Quality Control

Sample ID	Date	Time	Sample Volume	Type	Matrix	Sample Containers: # of Bottles	# of Jars	# of Bags	# Other	Analyses: Method 1613	Method 8290	Method 1668A/B/C PCB	PFAS by LC/MS/MS	PAHs by HRGC/HRMS	Sample on Hold	ALL PFAS	Notes:
52120S01	5-21-20	0815	250mL	G	NW	2										✓	
52120E01	5-21-20	0815	250mL	G	DW	2										✓	

Relinquished By:	Date:	Received By:	Date:	Time:	Sample Temperature Upon Receipt:
Phillip McCullock	5-21-20	Naomi Harris	5/21/20	2:30	☑ Iced ☐ Ambient °C 2.3, T5
					☐ Iced ☐ Ambient °C_____
					☐ Iced ☐ Ambient °C_____

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courier, cooler, iced, No seal, good condition, 2.3°C, T5 NH 5/21/20

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