County of Brunswick

3954 Clearwell Dr NE
Leland, NC 28451

Northwest Plant Lab

Leland, NC
Samples Received: 01/30/2020

Analytical Report
0120-767

Isotope Dilution Method

PFAS – NPW Legacy 24, Gen-X, PFMOAA

EPA Method 537.1

PFAS

Enthalpy Analytical, LLC – Ultratrace

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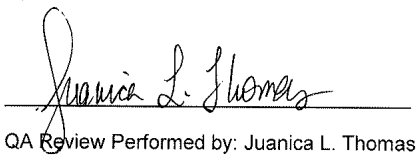
I certify that to the best of my knowledge all analytical data presented in this report:

- 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: 02/14/20

ENTHALPY ANALYTICAL

Summary of Results

Enthalpy Analytical

Job No.: 0120-767 Line 1 - PFAS by Isotope Dilution (non-potable water)

County of Brunswick NW Plant Lab

Summary

	Compound	CAS	Method Blank ng/L	013020 S01 NPW ng/L	013020 E01 NPW ng/L
Acids	PFBA	375-22-4	ND U	ND U	ND U
	PFPeA	2706-90-3	ND U	ND U	5.94
	PFHxA	307-24-4	ND U	4.71	6.47
	PFHpA	375-85-9	ND U	2.80	3.78
	PFOA	335-67-1	ND U	2.93 IR	2.70 IR
	PFNA	375-95-1	ND U	0.660	0.420 IR
	PFDA	335-76-2	ND U	0.318 IR	0.191 J-IR
	PFUnDA	2058-94-8	ND U	0.164 J	0.0571 J
	PFDoDA	307-55-1	ND U	0.0804 J	0.0156 L
	PFTrDA	72629-94-8	ND U	ND U	0.0442 L-IR
	PFTeDA	376-06-7	ND U	ND U	ND U
Sulfonates	PFBS	375-73-5	ND U	1.60 IR	1.69 IR
	PFPeS	2706-91-4	ND U	0.349	0.215 IR
	PFHxS	355-46-4	ND U	1.83	1.63
	PFHpS	375-92-8	ND U	ND U	ND U
	PFOS	1763-23-1	ND U	5.35 IR	2.93 IR
	PFNS	68259-12-1	ND U	ND U	ND U
	PFDS	335-77-3	ND U	ND U	ND U
	4:2 FTS	757124-72-4	ND U	ND U	ND U
	6:2 FTS	27619-97-2	ND U	0.415 IR	0.409
	8:2 FTS	39108-34-4	ND U	ND U	ND U
Other	PFOSA	754-91-6	ND U	ND U	ND U
	N-MeFOSAA	2355-31-9	ND U	ND U	0.0693 J-IR
	N-EtFOSAA	2991-50-6	ND U	ND U	0.0725 J
	HFPO-DA	13252-13-6	ND U	5.09 J	2.75 L
	PFMOAA	674-13-5	ND U	18.4	13.5
Lab ID			MB-10663-PFAS	0120-767-001-1	0120-767-002-1

Enthalpy Analytical

Job No.: 0120-767 Line 2 - EPA Method 537.1 (Drinking Water)

County of Brunswick NW Plant Lab

Summary

	Compound	CAS	Method Blank ng/L	013020 S01 537.1 ng/L
Acids	PFHxA	307-24-4	ND	5.32
	PFHpA	375-85-9	ND	3.87
	PFOA	335-67-1	ND	3.17
	PFNA	375-95-1	ND	0.855 J
	PFDA	335-76-2	ND	0.606 L
	PFDoA	307-55-1	ND	0.597 J
	PFTrDA	72629-94-8	ND	0.595 L
	PFTeDA	376-06-7	0.251	0.649 J
Sulfonates	PFBS	375-73-5	ND	ND U
	PFHxS	355-46-4	ND	2.85
	PFOS	1763-23-1	ND	7.43
Other	N-MeFOSAA	2355-31-9	ND	0.311 L
	N-EtFOSAA	2991-50-6	ND	0.133 L
	HFPO-DA	13252-13-6	ND	4.90
	ADONA	919005-14-4	ND	0.146 L
	9Cl-PF3ONS	756426-58-1	ND	0.326 J
	11CL-PF3OUdS	763051-92-9	0.0261	0.422 L
	PFUdA	2058-94-8	ND	0.383 L
Lab ID			MB-PFASDW	0120-767-003

Narrative Summary

Enthalpy Analytical Narrative Summary

Company	County of Brunswick
Job No.	0120-767 PFAS by Isotope Dilution (non-potable water & Drinking water)
Client ID.	N/A

1. Custody

Bryna Vining received the samples on 01-30-20 at 2.4°C on ice 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
0120-767-002-1	013020 E01 NPW	Aqueous
0120-767-001-1	013020 S01 NPW	Aqueous
0120-767-003-1, 0120-767-003-2	013020 S01 537.1	Aqueous

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. The following methods were used for sample preparation:

Table 3 - Methods and Analytes

EU Method	Analytes	Cleanup Method
SOP EU047	Full List	N/A
EPA 537.1	537.1 List	N/A

3. Analysis

The samples were analyzed for PFAS (Legacy 24 + HFPO-DA (Gen-X) and PFMOAA) and EPA 537 using Waters Acquity UPLC equipped with Xevo TQ MS (LC/MS/MS "Kili").

For aqueous samples, a 250mL nominal sample volume was confirmed 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 400µL of Injection Standard (IS) for NPW and 500uL of IS for DW, prior to analysis.

4. Calibration

Except where noted below, in the initial calibration, the analytes met the R^2 coefficient correlation criterion. The continuing calibration (concal) and Internal Calibration Verification (ICV) met the 30% criterion for native analytes.

Enthalpy Analytical Narrative Summary

Company	County of Brunswick
Job No.	0120-767 PFAS by Isotope Dilution (non-potable water & Drinking water)
Client ID.	N/A

5. **QC Notes**

Except where noted below, the QC sample analyses passed all method criteria.

NPW QC samples that did not meet method acceptance criteria were:
MB-10663-PFAS M3HFPO-DA

DW QC samples that did not meet method acceptance criteria were:
MB-10671-PFASDW d3-N-MeFOSAA

PFTeDA was detected in the method blank (MB) below the Reporting Limit (RL) with values more than 1/10 the sample amount. Any analytes detected in the samples affected by MB amount were notated with a B qualifier.

The samples were extracted within the 14-day from collection holding time and analyzed within the 28-day from extraction to analysis holding time required by the method.

6. **Reporting Notes**

There was a DW OPR failure for analyte ADONA in the initial extraction. The retain for sample 013020 S01 537.1 was re-extracted. The summary contains the combined results for both extractions.

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. Gen-X and PFMOAA are not accredited under TNI. 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.

General Reporting Notes – Data Qualifiers

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

General Data Qualifiers / Data Attributes

- 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) and is considered an estimate.
- EMPC – Represents an estimated maximum possible concentration. EMPCs arise in cases where the signal/noise ratio is not sufficient for peak identification (the determined ion-abundance ratio is outside the allowed theoretical range), or where there is a co-eluting interference. Indicates that a peak is identified but did not meet the method specified ion-abundance ratio.
- J – Indicates that an analyte has a concentration below the reporting limit (lowest point of the calibration curve). The value is less than the minimum calibration level but greater than the Reporting Limit (RL) or Estimated Detection Limit (EDL).
- 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 value may have a S/N less than 3.
- ND – Indicates a non-detect.
- NR – Indicates a value that is not reportable due to issues observed in sample preparation or analysis.
- PR – Due to interference, the associated congener is poorly resolved.
- DI – Indicates the presence of a quantitative interference.
- 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. The Minimum Detection Limit (MDL) or Estimated Detection Limit (EDL) may be reported for this analyte.
- V – The labeled standard recovery is not within method control limits.

- Q – 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 5.3 Table B-15.

DRBC/TMDL Specific Data Qualifiers / Data Attributes

- D – Dilution Data. Result was obtained from the analysis of a dilution. The number that follows the "D" indicates the dilution factor.
- X – Results from re-injection/repeat/second-column analysis.

Lab Identifiers

- 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.
- 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.

PFAS Compound Acronym List	
Acronym	**Compound Name**
Target Analytes	
PFBA	Perfluorobutanoic Acid
PFPeA	Perfluoropentanoic Acid
PFHxA	Perfluorohexanoic Acid
PFHpA	Perfluoroheptanoic Acid
PFOA	Perfluorooctanoic Acid
PFNA	Perfluorononanoic Acid
PFDA	Perfluorodecanoic acid
PFUnA (PFUnDA)	Perfluoroundecanoic acid
PFDoA (PFDoDA)	Perfluorododecanoic acid
PFTrDA (PFTriA)	Perfluorotridecanoic acid
PFTeDA (PFTA)	Perfluorotetradecanoic acid
PFBS	Perfluorobutane sulfonic acid
PFPeS	Perfluoropentane sulfonic acid
PFHxS	Perfluorohexane sulfonic acid
PFHpS	Perfluoroheptane sulfonic acid
PFOS	Perfluorooctane sulfonic acid
PFNS	Perfluorononane sulfonic acid
PFDS	Perfluorodecane sulfonic acid
4:2 FTS	4:2 fluorotelomer sulfonic acid
6:2 FTS	6:2 fluorotelomer sulfonic acid
8:2 FTS	8:2 fluorotelomer sulfonic acid
PFOSA (FOSA)	Perfluorooctane sulfonamide
N-MeFOSAA	N-methyl perfluorooctane sulfonamido acetic acid
N-EtFOSAA	N-ethyl perfluorooctane sulfonamido acetic acid
HFPO-DA	2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid (Gen-X)
Extraction Standards	
MPFBA	Perfluoro-n-[13C4]butanoic acid
M5PFPeA	Perfluoro-n-[13C5]pentanoic acid
M3PFBS	Sodium perfluoro-1-[2,3,4-13C3]-butanesulfonic acid
M2-4:2 FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
M3HFPO-DA	2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-13C3-propanoic acid
M4PFHpA	Perfluoro-n-[1,2,3,4-13C4]heptanoic acid
M3PFHxS	Sodium perfluoro-1-[1,2,3-13C3]-hexanesulfonic acid
M2-6:2 FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M8PFOS	Sodium perfluoro-1-[13C8]-octanesulfonic acid
M2-8:2 FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid
M8FOSA	Perfluoro-1-[13C8]octanesulfonamide
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
d3-N-MeFOSAA	N-methyl-d3-perfluoro-1-octanesulfonamide
d5-N-EtFOSAA	N-ethyl-d5-perfluoro-1-octanesulfonamide
M7PFUnDA (M7PFUdA)	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoA	Perfluoro-n-[1,2-13C2]dodecanoic acid
M2PFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid

Injection Standards	
M3PFBA	Perfluoro-n-[2,3,4-13C3]butanoic acid
M2PFOA	Perfluoro-n-[1,2-13C2]octanoic acid
MPFDA	Perfluoro-n-[1,2-13C2]decanoic acid
MPFOS	Sodium perfluoro-1-[1,2,3,4-13C4]-octanesulfonic acid

Sample Custody

Chain of Custody Record

0120-767

ENTHALPY

Enthalpy Ultratrace Job#: _____ COC Page 1 of 1

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	EPA 537.1 Genx PFMOAA	EPA 531.1	Notes:
013020 S01	1-30-20	0800	250mL	G	NW	2										✓		
013020 E01	1-30-20	0800	250mL	G	DW	2										✓		
013020 S01	1-30-20	0800	250mL	G	NW	2											✓	

Relinquished By:	Date:	Received By:	Date:	Time:	Sample Temperature Upon Receipt:
Phillip McCulloch	1-30-20		1/30/20	1334	☒ Iced ☐ Ambient °C 2.4 (TS)
					☐ Iced ☐ Ambient °C _____
					☐ Iced ☐ Ambient °C _____

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Courier, on ice, good condition

This Is The Last Page Of This Report.

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