County of Brunswick

3954 Clearwell Dr NE
Leland, NC 28451

Northwest Plant

Leland, NC
Samples Received: 4-12-19

Analytical Report
(0419-718)

Isotope Dilution Method

PFAS

Enthalpy Analytical, LLC – Ultratrace

Phone: (910) 212-5858 / www.enthalpy.com
2714 Exchange Drive, Wilmington, NC 28405

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: Bryan A. Vining

Report Issued Date: 26 APR 19

ENTHALPY ANALYTICAL

Summary of Results

Summary of Results: PFAS

Enthalpy Ultratrace Batch # 10290

PFAS

Analyte	Method Blank ng/L	041219-S01 ng/L	041219-E01 ng/L
Acids			
PFBA	0.269	4.62	3.04
PFPeA	0.0662 JL	4.71	5.44
PFHxA	0.0962 JL	6.29	6.70
PFHpA	ND U	4.86	5.46
PFOA	0.0436 JL	4.92	4.76
PFNA	ND U	0.944	0.836
PFDA	0.0581 JL	0.542	0.416 B
PFUnA	0.0246 JL	0.223 B	0.124 JB
PFDoA	0.0182 JL	0.0557 JB	0.0331 JBL
PFTrA	ND U	ND U	ND U
PFTA	ND U	ND U	ND U
Sulfonates			
L-PFBS	ND U	1.83	2.01
PFPeS	ND U	0.958	0.678
PFHxS	ND U	2.82	3.50
PFHpS	ND U	ND U	ND U
PFOS	ND U	10.4	9.43
PFNS	ND U	ND U	ND U
PFDS	ND U	ND U	ND U
4:2 FTS	ND U	ND U	ND U
6:2 FTS	ND U	0.218	0.357
8:2 FTS	ND U	ND U	ND U
Other			
PFOSA	0.0628 JL	0.188 JBL	0.0955 JBL
N-MeFOSAA	ND U	ND U	ND U
N-EtFOSAA	ND U	ND U	0.0167 JL
HFPO-DA (Gen-X)	ND U	ND U	ND U
Lab Sample ID	MB_10290	0419-718_10290_001	0419-718_10290_002

Narrative Summary

Company	County of Brunswick
Job#	0419-718 PFAS
Client Project #	n/a

Custody	Hunter Allen of Enthalpy Analytical Wilmington received the samples (via client courier) on 04/12/19 on ice at 5.4°C in good condition. Prior to, during, and after analysis, the samples were stored in the laboratory with access only by authorized personnel of Enthalpy Analytical, LLC.
Analysis	The samples were analyzed by isotope dilution method for PFAS using Waters Acquity UPLC equipped with Xevo TQ MS (LC/MS/MS "Fili"). For aqueous samples, ~250mL aliquot was weighed 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 200 µL of Injection Standard (JS/IS), prior to analysis.
Calibration	The analytes and labeled standards of interest in the initial calibration exhibited RSDs less than 50%. All analytes passed the R^2 coefficient correlation criteria. The continuing calibration met the ±30% criteria for native analytes of interest, ±50% criteria for ES recoveries and JS area count values.

QC Notes	The QC injection met the ±50% criteria for ES recoveries and IS Area with the exception of the following: M5PFPeA, M3HFPO-DA, M5PFHxA, M2-8:2 FTS, and M8FOSA for ES recoveries and M2PFOA and MPFOS for IS Area. Analysis of the sample was conducted per isotope dilution method; therefore, data is not biased high or low as would be the case if analysis were conducted via other methods. Additionally, only M8FOSA was also recovered outside of QC limits for the analysis of the submitted samples. The LCS/OPR demonstrates that the M8FOSA recovery being outside QC limits does not impact the accuracy of the native analyte data. The ES compounds recovered outside of QC limits are reported with a "V" qualifier A few analytes were detected in the method blank (MB) below the MDL. Those analytes also found in the samples are notated with a B qualifier when the amount in the sample is less than 10 times the amount in the MB. The MB met the ±50% criteria for ES recoveries and JS Area with the exception of the following: M2-8:2 FTS and M8FOSA for ES recoveries. As the recovery for M2-8:2 FTS was high, there is no concern of a false negative. FOSA was detected in the MB, and, therefore, the low recovery for that standard does not indicate a possible false negative. Further, no bias would be expected given that the analysis was conducted using isotope dilution. These compounds are reported with a "V" qualifier. The samples were extracted within the 14-day from collection holding time Extracts were analyzed within the 28-days from extraction to analysis holding time required by the method.
Reporting Notes	The isotopically labeled standard PFBA was observed in the method blank as well as all samples. It was determined to be found in the standard provided the manufacturer used in preparation of the IS. Results may be biased high for this analyte. ES recoveries fell outside the QC limits for various analytes. As the analysis was conducted using isotope dilution, no bias of the data are introduced by poor recoveries. However, the uncertainty of measurement is increased by poor recoveries, so this factor should be considered in any decision-making that takes place using the data. These analyses met the requirements of the TNI Standard. Any deviations from the requirements of the reference method or TNI Standard have been stated above.

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

The samples, calibrations and standards for the data presented in this report were analyzed at 2714 Exchange Drive, Wilmington, NC 28405.

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.
- C – 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 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).
- 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.
- J – Indicates that an analyte has a concentration below the reporting limit (lowest point of the calibration curve).
- L - Indicates that an analyte has a concentration below the Minimum Detection Limit (MDL).
- ND – Indicates a non-detect.
- NR – Indicates a value that is not reportable.
- 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 Estimated Detection Limit (EDL) may be reported for this analyte.
- V – The labeled standard recovery was found to be outside of the method control limits.

DRBC/TMDL Specific Data Qualifiers / Data Attributes

- J – The reported result is an estimate. The value is less than the minimum calibration level but greater than the Estimated Detection Limit (EDL).
- U – The analyte was not detected in the sample at the Estimated Detection Limit (EDL).

- E – The reported concentration is an estimate. The value exceeds the upper calibration range (upper point of the calibration curve).
- D – Dilution Data. Result was obtained from the analysis of a dilution.
- B – Analyte found in the sample and associated method blank.
- Cxx – Co-elutes with the indicated congener, data is reported under the lowest IUPAC congener. 'xx' denotes the IUPAC number with the lowest numerical designated congener.
- NR – Analyte is not reportable because of problems in sample preparation or analysis.
- V – Labeled standard recovery is not within method control limits.
- X – Results from re-injection/repeat/second-column analysis.
- EMPC – Estimated Maximum Possible Concentration. Indicates that a peak is identified but did not meet the method specified ion-abundance ratio.

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.
- D – Indicates a dilution of the sample extract. 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.

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
PFUnDA	Perfluoroundecanoic acid
PFDoDA (PFTDoA)	Perfluorododecanoic acid
PFTrDA (PFTrA)	Perfluorotridecanoic acid
PFTeDA (PFTA)	Perfluorotetradecanoic acid
PFBS	Perfluorobutane sulfonate
PFPeS	Perfluoropentane sulfonate
PFHxS	Perfluorohexane sulfonate
PFHpS	Perfluoroheptane sulfonate
PFOS	Perfluorooctane sulfonate
PFNS	Perfluorononane sulfonate
PFDS	Perfluorodecane sulfonate
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	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	
M3PFBA	Perfluoro-n-[2,3,4-13C3]butanoic acid
M5PFPeA	Perfluoro-n-[13C5]pentanoic acid
M3PFBS	Sodium perfluoro-1-[2,3,4-13C3]-butanesulfonate
M2-4:2 FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonate
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]-hexanesulfonate
M2-6:2 FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonate
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M8PFOS	Sodium perfluoro-1-[13C8]-octanesulfonate
M2-8:2 FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonate
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	
MPFBA	Perfluoro-n-[13C4]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]-octanesulfonate

Sample Custody

0419-718

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: N.W. 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	ERA 537 + GENX		Notes:
041219-S01	4/12/19	1005AM	250mL	G	NW	2													✓		
041219-E01	4/12/19	1005AM	250mL	G	DW	2													✓		

Relinquished By:	Date:	Received By:	Date:	Time:	Sample Temperature Upon Receipt:
	4/12/19		4/12/19	1:38PM	☑ Iced ☐ Ambient °C 5.4
					☐ Iced ☐ Ambient °C_____
					☐ Iced ☐ Ambient °C_____

1 cooler by courier NO seals good condition on ice thermometer used: T5 HA 4/12/19

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