County of Brunswick

3954 Clearwell Dr NE
Leland, NC 28451

Northwest Plant

Leland, NC
Samples Received: 5-3-19

Analytical Report
(0519-700 R1)

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: 13 APR 19

ENTHALPY ANALYTICAL

Summary of Results

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Summary of Results: PFAS

Enthalpy Ultratrace Job

0519-700 (Reanalysis)

PFAS

Analyte	Method Blank ng/L	050319-S01 ng/L	050319-E01 ng/L
Acids			
PFBA	1.08	8.39 B	6.28 B
PFPeA	0.0430 JL	9.41	9.02
PFHxA	0.0380 JL	11.4	10.6
PFHpA	ND U	9.24	7.16
PFOA	ND U	9.39	8.85
PFNA	ND U	1.40	1.29
PFDA	ND U	0.837	0.794
PFUnA	ND U	0.236	0.282
PFDoA	0.0421 JL	ND U	ND U
PFTrA	ND U	ND U	ND U
PFTA	0.0725 JL	ND U	0.0613 JBL
Sulfonates			
L-PFBS	ND U	3.61	3.50
PFPeS	ND U	1.04	1.18
PFHxS	0.0520 JL	4.95	4.49
PFHpS	0.0331 JL	0.665	0.547
PFOS	0.0681 J	20.5	19.3
PFNS	ND U	0.133 J	ND U
PFDS	ND U	ND U	ND U
4:2 FTS	ND U	ND U	ND U
6:2 FTS	0.0218 JL	0.299	0.288
8:2 FTS	ND U	ND U	ND U
Other			
PFOSA	0.130 JL	0.0992 JBL	0.104 JBL
N-MeFOSAA	0.000528 JL	ND U	0.0430 JL
N-EtFOSAA	0.000979 JL	ND U	ND U
HFPO-DA (Gen-X)	0.137 JL	1.66 JL	1.38 JL
Lab Sample ID	MB1_10307_PFAS	0519-700_10307_001	0519-700_10307_002

ENTHALPY ANALYTICAL

Summary of Results: PFAS

Enthalpy Ultratrace Job

0519-700 (Original Analysis)

PFAS

Analyte	Method Blank ng/L	050319-S01 ng/L	050319-E01 ng/L
Acids			
PFBA	1.60	15.9	4.69 B
PFPeA	0.0182 JL	8.50	7.39
PFHxA	1.24	11.2 B	9.71 B
PFHpA	0.0486 JL	8.59	6.97
PFOA	ND U	9.11	8.42
PFNA	ND U	1.30	1.19
PFDA	ND U	0.727	0.665
PFUnA	ND U	0.128 J	0.308
PFDoA	ND U	ND U	0.0784 J
PFTrA	ND U	ND U	ND U
PFTA	ND U	ND U	ND U
Sulfonates			
L-PFBS	ND U	2.76	3.46
PFPeS	ND U	1.02	1.01
PFHxS	0.0151 JL	5.29	4.14
PFHpS	ND U	0.661	0.459
PFOS	0.0480 J	17.9	17.7
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	0.279	0.248
8:2 FTS	ND U	ND U	0.00140 JL
Other			
PFOSA	ND U	ND U	ND U
N-MeFOSAA	0.0151 JL	0.0827 JB	0.0576 JB
N-EtFOSAA	ND U	ND U	0.00563 JL
HFPO-DA (Gen-X)	0.957 JL	3.88 JB	3.23 JB
Lab Sample ID	MB1_10305_PFAS	0519-700_10305_001	0519-700_10305_002

Narrative Summary

Enthalpy Analytical Narrative Summary

Company	County of Brunswick
Job#	0519-700 PFAS
Client Project #	n/a

Custody

Juanica Thomas of Enthalpy Analytical Wilmington received the samples (via client courier) on 05/03/19 on ice at 3.1°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 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 LCS met the acceptance criteria with the exception of the following: Gen-X and PFPeS were both recovered slightly above the QC limit, while M2-6:2 FTS was recovered below the QC limits. These failures appear to be due to a spiking error that was unique to the LCS. ES recoveries indicate proper spiking of the field samples, which, in combination with the use of isotope dilution ensures the data are accurate.

PFBA was detected in the method blank (MB) above the MDL. It is notated with a B qualifier when the amount in the MB is 10 times that in the sample.

Two ES recoveries fell above QC acceptance limits, which appears to be due to a matrix interference that affected the JS differently than the ES. Since isotope dilution was applicable to all detected analytes, the matrix interference has no effect on the accuracy of the data. Two ES recoveries fell below the QC acceptance limits. As these labeled standards still had adequate signal-to-noise (>20:1), the low recovery does not negatively impact the accuracy of the data, although the uncertainty of measurement is increased. However, neither of the corresponding native analytes was detected above the MDL, and, therefore, there is no significant effect of this QC failure.

Reporting Notes	The samples were reextracted and reanalyzed because the initial analysis (Batch 10305) was inadvertently processed incorrectly, showing unusually high results compared to historical results. After reviewing the results of the re-extraction, it was determined that both sets of data matched historical trends. The raw data was inadvertently overwritten requiring the data to be reprocessed. Both sets of results are presented in this report. 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. 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.

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

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.

Sample Custody

0519-700

ENTHALPY analytical, inc.

Chain of Custody Record

Enthalpy Ultratrace Job#: __________ COC Page____of____

Special Handling:
☑ Standard Turn Around Time (21 calendar days)
☐ 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
Location: LELAND

PO#:
Telephone#:
Email:

This Chain of Custody is applicable to Flue Gas and Ambient Air samples. Please note that standard TAT of 21 calendar days applies to PCDD/PCDF analysis only.

Client Special Instructions:

Client Sample ID	Collection Date	Collection Time	# of XAD Traps	# of PUF (TO-9A only)	# of Filters	# FH/BH rinse (Ace/DCM)	# FH/BH rinse-Toluene	FH/BH Rinse Combined?	# Other	Method 23	Method 0023A	Method TO-9A	Sample on Hold	EPA537+GENX				Notes:
050319-S01	5/3/19	10 20/AM						Y / N		☐	☐	☐	☐	✓				
050319-E01	5/3/19	10 20/Am						Y / N		☐	☐	☐	☐	✓				
								Y / N		☐	☐	☐	☐					
								Y / N		☐	☐	☐	☐					
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								Y / N		☐	☐	☐	☐					
								Y / N		☐	☐	☐	☐					

Relinquished By:	Date:	Received By:	Date:	Time:	Sample Temperatures Upon Receipt:
[signature]	5/3/19	[signature]	5/3/19	11:47	XAD/PUFs & Filters: ☐ Iced ☐ Ambient °C____ Solvents/Impingers: ☐ Iced ☐ Ambient °C
					XAD/PUFs & Filters: ☐ Iced ☐ Ambient °C____ Solvents/Impingers: ☐ Iced ☐ Ambient °C
					XAD/PUFs & Filters: ☐ Iced ☐ Ambient °C____ Solvents/Impingers: ☐ Iced ☐ Ambient °C

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Brunswick Courier, condition: Good, on Ice, cooler, no seal, Temp.=5.5
Therm. # = T9 . [initials] 5.3.19

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