

County of Brunswick

3954 Clearwell Dr NE
Leland, NC 28451

Northwest Plant

Leland, NC
Samples Received: 1-3-19

Analytical Report (0119-701)

Isotope Dilution 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 _____ pages.

Report Issued Date: _____



010319-S01
Detailed Results - PFAS
Client Details
Client Sample ID: 010319-S01

Client Name: Brunswick County

Client Project ID: N/A

Sample Collection Date: 03-Jan-19

Lab/Sample Details

Lab Job #:	0119-701	Matrix:	Aqueous	Date Received:	27-Dec-18
Lab Sample ID:	0119-701_10185_001	Wt./Vol.	34.2	Date Extracted:	07-Jan-19
QC Batch #:	10185	Date Low Analyzed:	09-Jan-19	Date High Analy:	08-Jan-19
Final Volume (mL)	0.2	Time Low Analyzed:	16:11:55	Time High Analy	22:28:16



Analyte	Conc. (ng/L)	EDL (ng/L)	MDL (ng/L)	RL (ng/L)	Qualifiers	Standard	ES Recoveries	Qualifiers
Acids						M3PFBA	111%	
PFBA	3.53	0.695	1.15	1.46	JB	M5PFPeA	162%	V
PFPeA	ND	0.345	0.656	1.46	U	M3PFBS	191%	V
PFHxA	ND	0.0888	1.15	1.46	U	M2-4:2 FTS	136%	
PFHpA	2.93	0.145	0.508	1.46	J	M5PFHxA	82.9%	
PFOA	4.09	0.0148	0.581	1.46	J	M3HFPO-DA	225%	V
PFNA	ND	0.0662	0.372	1.46	U	M4PFHpA	100%	
PFDA	0.280	0.150	0.913	1.46	J	M3PFHxS	102%	
PFUnA	ND	0.0379	0.352	1.46	U	M2-6:2 FTS	103%	
PFDoA	ND	0.0123	0.347	1.46	U	M8PFOA	97.7%	
PFTTrA	ND	0.00749	0.544	1.46	U	M9PFNA	73.1%	
PFTA	ND	0.0471	0.607	1.46	U	M8PFOS	92.0%	
						M2-8:2 FTS	85.0%	
Sulfonates						M8FOSA	5.00%	
L-PFBS	ND	0.359	0.607	1.46	U	M6PFDA	75.6%	
PFPeS	0.243	0.125	0.723	1.46	J	d3-N-MeFOSAA	51.7%	
PFHxS	2.37	0.0131	0.604	1.46	J	d5-N-EtFOSAA	64.0%	
PFHpS	ND	0.225	0.569	1.46	U	M7PFUdA	74.2%	
PFOS	9.27	0.110	0.344	1.46	J	MPFDoA	55.1%	
PFNS	ND	0.0653	0.478	1.46	U	M2PFTeDA	45.7%	V
PFDS	ND	0.0505	0.987	1.46	U			
4:2 FTS	ND	0.0115	0.123	1.46	U			
6:2 FTS	ND	0.00683	0.528	1.46	U	JS Standard	JS Area	Qualifiers
8:2 FTS	ND	0.00424	0.416	1.46	U	MPFBA	26914	V
						M2PFOA	79667	
Other						MPFDA	131231	
PFOSA	0.121	0.0796	2.67	1.46	JB	MPFOS	19962	
N-MeFOSAA	ND	0.00471	0.398	1.46	U			
N-EtFOSAA	ND	0.0119	0.476	1.46	U			
HFPO-DA (Gen-X)	ND	2.28	24.3	51.2	U			

010319-E01					Detailed Results - PFAS				
Client Details									
Client Sample ID: 010319-E01			Client Name: Brunswick County						
Client Project ID: N/A			Sample Collection Date: 03-Jan-19						
Lab/Sample Details									
Lab Job #:		0119-701	Matrix:		Aqueous		Date Received:		27-Dec-18
Lab Sample ID:		0119-701_10185_002	Wt./Vol.		34.9		Date Extracted:		07-Jan-19
QC Batch #:		10185	Date Low Analyzed		09-Jan-19		Date High Analy		08-Jan-19
Final Volume (mL)		0.2	Time Low Analyzed		16:20:32		Time High Analy		22:36:52
									
Analyte	Conc. (ng/L)	EDL (ng/L)	MDL (ng/L)	RL (ng/L)	Qualifiers	Standard	ES Recoveries	Qualifiers	
Acids									
PFBA	3.03	0.496	1.13	1.43	JB	M3PFBA	108%		
PFPeA	4.30	0.914	0.644	1.43	JB	M5PFPeA	146%		
PFHxA	4.33	0.0801	1.13	1.43	JB	M3PFBS	162%	V	
PFHpA	2.66	0.131	0.498	1.43	J	M2-4:2 FTS	121%		
PFOA	4.01	0.0954	0.570	1.43	J	M5PFHxA	83.8%		
PFNA	0.901	0.0367	0.365	1.43	J	M3HFPO-DA	203%	V	
PFDA	0.299	0.137	0.896	1.43	JB	M4PFHpA	110%		
PFUnA	0.116	0.0345	0.345	1.43	J	M3PFHxS	98.1%		
PFDoA	ND	0.00940	0.341	1.43	JB	M2-6:2 FTS	96.8%		
PFTra	ND	0.0385	0.534	1.43	U	M8PFOA	108%		
PFTA	ND	0.0244	0.595	1.43	U	M9PFNA	85.3%		
						M8PFOS	89.2%		
						M2-8:2 FTS	87.8%		
Sulfonates									
L-PFBS	1.31	0.300	0.595	1.43	J	M8FOA	4.80%	V	
PFPeS	ND	0.0942	0.710	1.43	U	M6PFDA	81.5%		
PFHxS	2.29	0.0737	0.593	1.43	U	d3-N-MeFOSAA	49.6%	V	
PFHpS	ND	0.0688	0.559	1.43	J	d5-N-EtFOSAA	78.3%		
PFOS	6.17	0.0693	0.338	1.43	U	M7PFUdA	83.2%		
PFNS	ND	0.0544	0.469	1.43	J	MPFDoA	58.1%		
PFDS	0.944	0.0458	0.968	1.43	U	M2PFTeDA	40.5%	V	
4:2 FTS	ND	0.0128	0.120	1.43	JB				
6:2 FTS	0.522	0.00237	0.519	1.43	U				
8:2 FTS	ND	0.00339	0.408	1.43	JB	JS Standard	JS Area	Qualifiers	
					U	MPFBA	31656	V	
						M2PFOA	84239		
Other									
						MPFDA	132621		
PFOSA	0.166	0.0214	2.62	1.43	JB	MPFOS	21465		
N-MeFOSAA	ND	0.00266	0.390	1.43	U				
N-EtFOSAA	ND	0.00220	0.467	1.43	U				
HFPO-DA (Gen-X)	ND	1.90	23.9	50.2	U				

Continuing Calibration

PFAS

	CS5(High)/CS8(Low)	
HighConcentration (ng/μL)	20000	
Low Concentration (ng/μL)	125000	
High Standard ID	SID AE48	
High Acquisition Date	08-Jan-19	
High Acquisition Time	22:45:27	
Low Standard ID	SID AE58	
Low Acquisition Date	09-Jan-19	
Low Acquisition Time	18:30:02	

Analyte	Concentration (ng/μL)	PD (v. ICAL)	Limit	Acceptable	
Acids					
PFBA	116686.6	-6.7%	30%	Yes	
PFPeA	120906.4	-3.3%	30%	Yes	
PFHxA	125729.1	0.6%	30%	Yes	
PFHpA	113596.0	-9.1%	30%	Yes	
PFOA	115943.0	-7.2%	30%	Yes	
PFNA	116930.5	-6.5%	30%	Yes	
PFDA	20559.4	2.8%	30%	Yes	
PFUnA	20497.5	2.5%	30%	Yes	
PFDoA	20290.2	1.5%	30%	Yes	
PFTrA	20976.9	4.9%	30%	Yes	
PFTA	18652.6	-6.7%	30%	Yes	
Sulfonates					
L-PFBS	121265.0	-3.0%	30%	Yes	
PFPeS	134523.2	7.6%	30%	Yes	
PFHxS	119580.9	-4.3%	30%	Yes	
PFHpS	107740.7	-13.8%	30%	Yes	
PFOS	116514.2	-6.8%	30%	Yes	
PFNS	18645.0	-6.8%	30%	Yes	
PFDS	16913.1	-15.4%	30%	Yes	
4:2 FTS	125944.2	0.8%	30%	Yes	
6:2 FTS	124271.5	-0.6%	30%	Yes	
8:2 FTS	112596.2	-9.9%	30%	Yes	
Other					
PFOSA	20016.6	0.1%	30%	Yes	
N-MeFOSAA	20394.0	2.0%	30%	Yes	
N-EtFOSAA	20167.9	0.8%	30%	Yes	
HFPO-DA (Gen-X)	4331568.5	-1.0%	30%	Yes	

Continuing Calibration

PFAS

	CS5(High)/CS8(Low)	
High Concentration (ng/μL)	20000	
Low Concentration (ng/μL)	125000	
High Standard ID	SID AE48	
High Acquisition Date	08-Jan-19	
High Acquisition Time	22:45:27	
Low Standard ID	SID AE58	
Low Acquisition Date	09-Jan-19	
Low Acquisition Time	18:30:02	

Analyte	RRF	PD (v. ICAL)	Limit	Acceptable	
M3PFBA	2.31	-7.80	30	Yes	
M5PFPeA	1.75	-11.20	30	Yes	
M3PFBS	1.05	-13.80	30	Yes	
M2-4:2 FTS	1.13	-6.80	30	Yes	
M5PFHxA	1.84	-6.40	30	Yes	
M3HFPO-DA	1.48	-15.90	30	Yes	
M4PFHpA	7.81	-85.80	30	No	
M3PFHxS	2.15	6.10	30	Yes	
M2-6:2 FTS	4.61	43.50	30	No	
M8PFOA	3.50	9.90	30	Yes	
M9PFNA	1.97	-2.40	30	Yes	
M8PFOS	2.11	2.00	30	Yes	
M2-8:2 FTS	2.96	46.60	30	No	
MPFBA	6974	-59.5%			
M2PFOA	9169	-84.3%			
MPFDA	103675	9.1%			
MPFOS	2388	-85.7%			

Method Blank	Detailed Results - PFAS
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Lab/Sample Details

		Matrix:	Aqueous	Date Received:	N/A
Lab Sample ID:	Blank	Wt./Vol.	25.0	Date Extracted:	07-Jan-19
QC Batch #:	10185	Date Low Analyzed	09-Jan-19	Date High Analyzed:	08-Jan-19
Final Volume (mL)	0.2	Time Low Analyzed	15:46:03	Time High Analyzed:	22:02:29



Analyte	Conc. (ng/L)	EDL (ng/L)	MDL (ng/L)	RL (ng/L)	Qualifiers	Standard	ES Recoveries	Qualifiers
Acids						M3PFBA	105%	
PFBA	1.88	0.113	1.57	2000	J	M5PFPeA	120%	
PFPeA	0.937	0.0647	0.898	2000	J	M3PFBS	107%	
PFHxA	1.29	0.109	1.58	2000	J	M2-4:2 FTS	119%	
PFHpA	0.373	0.00288	0.695	2000	J	M5PFHxA	92.6%	
PFOA	0.574	0.0111	0.795	2000	J	M3HFPO-DA	137%	
PFNA	0.374	0.0782	0.509	2000	J	M4PFHpA	122%	
PFDA	ND	0.0150	1.25	2000	U	M3PFHxS	106%	
PFUnA	0.0613	0.00198	0.481	2000	J	M2-6:2 FTS	104%	
PFDoA	ND	0.0123	0.475	2000	U	M8PFOA	138%	
PFTra	ND	0.0465	0.745	2000	U	M9PFNA	93.3%	
PFTA	0.976	0.0185	0.830	2000	J	M8PFOS	91.4%	
						M2-8:2 FTS	92.9%	
Sulfonates						M8FOSA	13.9%	
L-PFBS	ND	0.0288	0.830	2000	U	M6PFDA	93.2%	
PFPeS	ND	0.0149	0.990	2000	U	d3-N-MeFOSAA	78.6%	
PFHxS	ND	0.00886	0.827	2000	U	d5-N-EtFOSAA	96.4%	
PFHpS	ND	0.0187	0.779	2000	U	M7PFUdA	100%	
PFOS	ND	0.0904	0.471	2000	U	MPFDoA	81.9%	
PFNS	0.236	0.00337	0.654	2000	J	M2PFTeDA	71.0%	
PFDS	1.34	0.0103	1.35	2000	J			
4:2 FTS	ND	0.0279	0.168	2000	U			
6:2 FTS	0.240	0.0453	0.723	2000	J	JS Standard	JS Area	Qualifiers
8:2 FTS	0.150	0.00536	0.569	2000	J	MPFBA	47271	V
						M2PFOA	83127	
Other						MPFDA	131235	
PFOSA	0.0600	0.0160	3.65	2000	J	MPFOS	17930	
N-MeFOSAA	ND	0.00963	0.544	2000	U			
N-EtFOSAA	ND	0.00281	0.651	2000	U			
HFPO-DA (Gen-X)	ND	0.157	33.3	70000	U			

LCS	Detailed Results - PFAS
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Lab/Sample Details

		Matrix:	Aqueous	Date Received:	N/A	
Lab Sample ID:	OPR_10185_PFC	Wt./Vol.	200	Date Extracted:	07-Jan-19	
QC Batch #:	10185	Date Low Analyzed:	09-Jan-19	Date High Analyzed:	08-Jan-19	
Final Volume (mL)	0.2	Time Low Analyzed:	15:28:51	Time High Analyzed:	21:45:19	

Analyte	Conc. (ng/L)	EDL (ng/L)	MDL (ng/L)	RL (ng/L)	Qualifiers	Standard	ES Recoveries	Qualifiers
Acids						M3PFBA	107%	
PFBA	54.3	0.00795	0.197	250	J	M5PFPeA	110%	
PFPeA	55.0	0.00969	0.112	250	J	M3PFBS	111%	
PFHxA	54.8	0.0131	0.197	250	J	M2-4:2 FTS	92.8%	
PFHpA	54.1	0.00366	0.0869	250	J	M5PFHxA	92.6%	
PFnOA	55.3	0.00684	0.0993	250	J	M3HFPO-DA	101%	
PFNA	55.5	0.0108	0.0636	250	J	M4PFHpA	105%	
PFDA	54.8	0.00853	0.156	250	J	M3PFHxS	92.5%	
PFUnA	56.1	0.00135	0.0601	250	J	M2-6:2 FTS	96.2%	
PFDoA	55.6	0.00711	0.0594	250	J	M8PFOA	98.4%	
PFTTrA	66.3	0.00915	0.0931	250	J	M9PFNA	99.5%	
PFTA	53.9	0.00963	0.104	250	J	M8PFOS	92.0%	
						M2-8:2 FTS	93.1%	
Sulfonates						M8FOSA	11.7%	
L-PFBS	53.5	0.000664	0.104	250	J	M6PFDA	92.8%	
PFPeS	56.3	0.00623	0.124	250	J	d3-N-MeFOSAA	85.2%	
PFHxS	57.3	0.00421	0.103	250	J	d5-N-EtFOSAA	96.2%	
PFHpS	56.3	0.0214	0.0974	250	J	M7PFUDa	99.0%	
PFOS	54.0	0.00586	0.0589	250	J	MPFDoA	94.5%	
PFNS	52.5	0.00271	0.0818	250	J	M2PFTeDA	79.2%	
PFDS	47.3	0.00379	0.169	250	J			
4:2 FTS	53.4	0.0145	0.0210	250	J			
6:2 FTS	52.5	0.0226	0.0904	250	J	JS Standard	JS Area	Qualifiers
8:2 FTS	55.9	0.00353	0.0711	250	J	MPFBA	43460	V
						M2PFOA	74326	
Other						MPFDA	108144	
PFOSA	56.2	0.0114	0.456	250	J	MPFOS	22153	
N-MeFOSAA	54.2	0.00208	0.0680	250	J			
N-EtFOSAA	55.5	0.00524	0.0814	250	J			
HFPO-DA (Gen-X)	1830	0.481	4.16	8750	J			

LCS Evaluation

Batch ID#: 10185

Analyte	Conc. (pg)	Lower Limit	Upper Limit	Acceptable?
Acids				
PFBA	54.3	42	78	Y
PFPeA	55.0	42	78	Y
PFHxA	54.8	42	78	Y
PFHpA	54.1	42	78	Y
PFOA	55.3	42	78	Y
PFNA	55.5	42	78	Y
PFDA	54.8	42	78	Y
PFUnA	56.1	42	78	Y
PFDoA	55.6	42	78	Y
PFTTrA	66.3	42	78	Y
PFTA	53.9	42	78	Y
Sulfonates				
L-PFBS	53.5	42	78	Y
PFPeS	56.3	42	78	Y
PFHxS	57.3	42	78	Y
PFHpS	56.3	42	78	Y
PFOS	54.0	42	78	Y
PFNS	52.5	42	78	Y
PFDS	47.3	42	78	Y
4:2 FTS	53.4	42	78	Y
6:2 FTS	52.5	42	78	Y
8:2 FTS	55.9	42	78	Y
Other				
PFOSA	56.2	42	78	Y
N-MeFOSAA	54.2	42	78	Y
N-EtFOSAA	55.5	42	78	Y
HFPO-DA (Gen-X)	1830	1470	2730	Y

Enthalpy Analytical Narrative Summary

Company	County of Brunswick	Client #	N/A
Analyst	H. Allen	Job #	0119-701
Parameters	PFAS	# Samples	2

Custody	Enthalpy Analytical Wilmington received the samples (via client courier) received by Bryan Vining on 1/3/2019. The samples were received on ice at 3.3°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 for PFAS via LC/MS/MS. The analysis was completed using the following instrumentation: Waters Acquity UPLC equipped with Xevo TQ MS (Kili). The sample is spiked with ES, mixed well and centrifuged. An aliquot of supernatant is added to a measured volume of water and extracted via SPE. The elute is condensed, reconstituted with IS and analyzed.
Calibration	The analytes and labeled standards in the initial calibration exhibited RSDs less than 30% for all analytes. All analytes passed the R² coefficient correlation criteria. The ICV met the ±30% criteria for analytes. The CCV met the ±30% criteria for analytes and labeled standards, except for M2-8:2 FTS, which is because the CS6 was used for the Low analysis, and the native contribution caused a high bias in the result.
QC Notes	The QC injections passed method criteria. 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. Some analytes were detected in the method blank. Analytes detected in the samples that were found to be more than 1/10 the sample concentration in the method blank were notated with a B qualifier.
Reporting Notes	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. Any deviations from the requirements of the reference method or TNI Standard have been stated above.

Enthalpy Analytical Narrative Summary

(continued)

Reporting Notes (cont.)

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).
- 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).

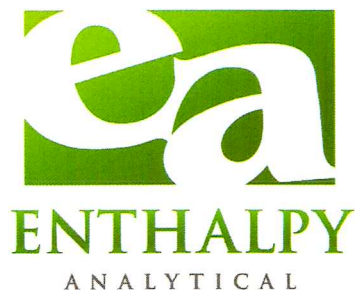


General Reporting Notes – Data Qualifiers

- 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.



Job 0119-701 report due Thursday Jan 17 2019

To	Glenn Walker	From	Lindsay Boone
Company	County of Brunswick	Customer PO	
Site		Sales Order	SO1033016
Customer Phone	910-612-5618	Date Due QA	Tuesday, January 15, 2019
Customer Email	glenn.walker@brunswickcountync.gov	Results Due	Thursday, January 17, 2019
Customer Project		Report Due	Thursday, January 17, 2019

Line	Method	Analytes	Quant	Dept	Objective	Status
1	WM-026 PFAS by Isotope Dilution (non-potable water) report:	Legacy 24/Gen X	2	Wilmington		Sampled 01-03-19 09:50 (local time) Received 01-03-19 11:30 ReceivedTemp 3.3 StorageTemp 4 StorageLocation R1

Chain of Custody Record

**This Is The Last Page
Of This Report.**