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Technical Memorandum

To:	Ms. Demaree Collier – Remedial Project Manager USEPA Region 5 77 West Jackson Boulevard Chicago, IL 60604
From:	Kristopher D. Krause, P.E. Senior Project Manager
Subject:	Evaluation of Per- and Poly-Fluoroalkyl Substances (PFAS) at the Lemberger Landfill Sites
Date:	November 19, 2021
CC:	B.J. LeRoy – WDNR Brian Potts – Perkins Coie, LLP Kristin Jones – Newell Rubbermaid Troy Adams – Manitowoc Public Utilities Scott Karbon – Manitowoc Public Utilities James Wallner – Red Arrow Products James Cook – Manitowoc Cranes Kathleen McDaniel – City of Manitowoc David Dougherty – Subterranean Research, Inc. John Lang – EHS Support, LLC Tom Sullivan – EHS Support, LLC
Project No.:	419607.0000 phase 7

On behalf of the Lemberger Site Remediation Group (LSRG), and in accordance with the PFAS Evaluation Work Plan, Revision 1 ("Work Plan"; September 2021), TRC Environmental Corporation (TRC) has prepared this technical memorandum to present results of the recent PFAS groundwater sampling event, an evaluation of the significance of PFAS at the site, and recommendations based on the results of the evaluation.

Introduction

The USEPA completed the fifth Five-Year Review Report for the Lemberger Sites in July 2020 (USEPA, 2020). The report concluded that the USEPA should proceed with a revision to the groundwater cleanup standards (to the Wisconsin NR140 Enforcement Standard [ES]) and to incorporate a Monitored Natural Attenuation (MNA) remedy for volatile organic compounds (VOCs) into an amendment of the 1991 and 1994 Records of Decision (ROD) for the Sites. The Five-Year Review Report also identified that the emerging contaminant group per-and poly-

fluoroalkyl substances (PFAS) had not been evaluated at the Lemberger Sites. Based on the presence of these compounds at other landfill sites with VOC contamination, the USEPA recommended that groundwater samples should be collected and analyzed for PFAS. These recommendations were incorporated into the January 2021 ROD Amendment (USEPA, 2021).

In order to determine if PFAS are constituents of concern (COCs) at the Lemberger Sites, TRC prepared the PFAS Evaluation Work Plan (TRC, 2021) to collect groundwater samples for PFAS analysis from various site monitoring wells in conjunction with a routine groundwater monitoring event. The PFAS evaluation program included four monitoring wells representative of different portions of the chlorinated VOC (CVOC) plume, ranging from upgradient of the site, to the Lemberger Transport and Recycling Landfill (LTR) former source area, to more distal downgradient locations (Figure 1). The data from these four wells was evaluated to determine if these compounds are present, and if they are present, if the detections are sufficiently significant to make PFAS COCs at the landfills.

Work Performed

On September 22, 2021, TRC and Brooks Services, LLC (Brooks Services) collected groundwater samples from monitoring wells RM-102D (upgradient of Site), RM-007D (LTR source area), RM-401XD (immediately downgradient of the Lemberger Landfill [LL] and downgradient of the LTR), and RM-204D (downgradient of both the LTR and LL) for PFAS analysis. In addition, one duplicate sample was collected at RM-007D; a field equipment blank was collected from the portable QED Sample Pro® bladder pump (including pump body, bladder, and HDPE tubing); and one ambient air (poured) blank was collected at the field site. All work was performed in accordance with the Work Plan. The samples were packed on ice in a cooler and shipped to the Test America Laboratory in Sacramento, California for analysis by modified EPA Method 537 (WI-33 list).

Analytical Results

The analytical results for PFAS are summarized in Table 1 and shown on Figure 1. The data validation report and laboratory data sheets for the PFAS samples are included in Attachment 1. The field and laboratory data will be submitted as an electronic data deliverable (EDD) in a subsequent Data Transmittal document once the remainder of the third quarter analytical data have been received from the laboratory and validated.

Low concentrations of only four PFAS (perfluorobutanoic acid [PFBA], perfluorooctanoic acid [PFOA], perfluorobutanesulfonic acid [PFBS], and perfluorooctanesulfonamide [FOSA]) were reported in the groundwater samples, at individual concentrations ranging up to 4.5 ng/L. The maximum total PFAS concentration in any of the samples was < 9 ng/L. Only one result, PFOA at RM-007D (4 ng/L) exceeded the recommended Preventive Action Limit (PAL) of 2 ng/L for that compound. None of the results exceeded a recommended Enforcement Standard (ES).

No PFAS were detected in either the field equipment blank (FB-101), or in the atmospheric (poured) blank (ATM-001).

Evaluation of Results

Three of the four PFAS detected are terminal perfluorinated carboxylic acids (PFBA and PFOA) or perfluorinated sulfonic acids (PFBS). FOSA, detected only at downgradient location RM-204D, is a transient intermediate compound. No precursor fluorotelomers (e.g., 6:2 FTS or 8:2 FTS) were detected in the groundwater samples.

PFBA was detected only at source area well RM-007D (4.3 ng/L; 4.5 ng/L in the duplicate sample). PFOA was detected in groundwater from the source area well (RM-007D, 4.0 ng/L), as well as both downgradient locations, at concentrations decreasing with distance from the LTR (1.6 ng/L at RM-401XD, and 0.75 ng/L at RM-204D). The concentrations present do not pose an ecological or human health risk. PFBA concentrations are two orders of magnitude below the PAL; and PFOA concentrations are an order of magnitude below the ES even within the former source area. Source control measures implemented at the LTR in the mid-1990s, including the removal of potential source materials (drums, jars, gas cylinders), placement of a soil cover, and operation of leachate/groundwater extraction and treatment systems through the 1990s and early 2000s have likely eliminated the LTR as a potential PFAS source. The source control is confirmed through evaluation of historical concentrations of the primary site COCs, CVOCs. CVOC concentrations at the site show site-wide stable to decreasing trends (TRC, 2019).

PFBS was detected at concentrations just above the detection limit in groundwater from three of the four wells, including upgradient location RM-102D (0.21 ng/L). The apparent ubiquitous distribution of this compound in groundwater (but not in the field blanks) suggests its presence is not the result of sample contamination and is also not related to the Landfills. Concentrations of PFBS (maximum of 0.33 ng/L) are well below the recommended PAL (90,000 ng/L).

Conclusions and Recommendations

Based on our analysis of the PFAS data collected from groundwater at the Lemberger site, TRC concludes the following:

- There were no detections of PFAS compounds at concentrations above the recommended ESs.
- The very low concentrations of PFAS present in the groundwater do not currently pose a risk to human health or the environment.
- Source control measures taken at the LTR in the 1990s and the lack of precursor fluorotelomers in the groundwater indicate that PFAS at the site will not pose a risk to human health or the environment in the future.

These results indicate that PFAS are not constituents of concern at the Lemberger sites. TRC recommends that no further action is necessary with respect to PFAS at the site.

References

TRC. 2019. Monitored Natural Attenuation Report, Lemberger Transport and Recycling, Inc. (LTR) and Lemberger Landfill (LL) Superfund Sites, Groundwater Operable Unit OU-1, Town of Franklin, Manitowoc County, Wisconsin. April 2019.

TRC. 2021. PFAS Evaluation Work Plan, Lemberger Landfill Sites, Town of Franklin, Wisconsin. Revision 1. September 1, 2021.

USEPA. 2020. Fifth Five-Year Review Report for Lemberger Landfill, Inc. and Lemberger Transport and Recycling Superfund Sites, Manitowoc County, Wisconsin. July 20, 2020.

USEPA. 2021. Amendment to the 1991 and 1994 Records of Decision for the Lemberger Landfill, Inc. and Lemberger Transport and Recycling Superfund Sites, Town of Franklin, Wisconsin. January 2021.

Attachments: Table 1 – Water Analytical Data
Figure 1 – PFAS Sampling Locations and Results
Attachment 1 - The Data Validation Report and Laboratory Data Sheets

Table 1: Water Analytical Data
Summary of Analyzed Constituents
Lemberger PFAS Sampling

PFAS Compound (WI-33 List)	CAS Number	Recommended PAL (ng/L)	Recommended ES (ng/L)	RM-007D 09/22/2021	RM-007D DUP 09/22/2021	RM-102D 09/22/2021	RM-204D 09/22/2021	RM-401XD 09/22/2021	AMB-001 09/22/2021	FB-101 09/22/2021
Results in (ng/L)										
Perfluorobutanoic acid (PFBA)	375-22-4	2000	10000	**4.3 J**	**4.5 J**	< 2.0	< 2.1	< 2.3	< 2.2	< 2.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	NR	NR	< 0.44	< 0.45	< 0.41	< 0.43	< 0.46	< 0.44	< 0.44
Perfluorohexanoic acid (PFHxA)	307-24-4	30000	150000	< 0.52	< 0.54	< 0.48	< 0.51	< 0.55	< 0.52	< 0.52
Perfluoroheptanoic acid (PFHpA)	375-85-9	NR	NR	< 0.22	< 0.23	< 0.21	< 0.22	< 0.24	< 0.23	< 0.22
Perfluorooctanoic acid (PFOA)	335-67-1	2	20 (i)(ii)	**4.0**	**4.0**	< 0.71	**0.75 J**	**1.6 J**	< 0.77	< 0.76
Perfluorononanoic acid (PFNA)	375-95-1	3	30	< 0.24	< 0.25	< 0.23	< 0.24	< 0.26	< 0.24	< 0.24
Perfluorodecanoic acid (PFDA)	335-76-2	60	300	< 0.28	< 0.29	< 0.26	< 0.27	< 0.29	< 0.28	< 0.28
Perfluoroundecanoic acid (PFUnA)	2058-94-8	600	3000	< 0.99	< 1.0	< 0.92	< 0.97	< 1.0	< 0.99	< 0.98
Perfluorododecanoic acid (PFDoA)	307-55-1	100	500	< 0.49	< 0.51	< 0.46	< 0.48	< 0.52	< 0.50	< 0.49
Perfluorotridecanoic acid (PFTriA)	72629-94-8	NR	NR	< 1.2	< 1.2	< 1.1	< 1.1	< 1.2	< 1.2	< 1.2
Perfluorotetradecanoic acid (PFTeA)	376-06-7	2000	10000	< 0.66	< 0.68	< 0.61	< 0.64	< 0.69	< 0.66	< 0.65
Perfluorobutanesulfonic acid (PFBS)	375-73-5	90000	450000	**0.28 J**	**0.33 J**	**0.21 J**	< 0.18	**0.19 J**	< 0.18	< 0.18
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	NR	NR	< 0.27	< 0.28	< 0.25	< 0.26	< 0.28	< 0.27	< 0.27
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	4	40	< 0.51	< 0.53	< 0.48	< 0.50	< 0.54	< 0.51	< 0.51
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NR	NR	< 0.17	< 0.18	< 0.16	< 0.17	< 0.18	< 0.17	< 0.17
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	2	20 (i)(ii)	< 0.48	< 0.50	< 0.45	< 0.47	< 0.51	< 0.49	< 0.48
Perfluorononanesulfonic acid (PFNS)	68259-12-1	NR	NR	< 0.33	< 0.34	< 0.31	< 0.33	< 0.35	< 0.33	< 0.33
Perfluorodecanesulfonic acid (PFDS)	335-77-3	NR	NR	< 0.29	< 0.30	< 0.27	< 0.28	< 0.30	< 0.29	< 0.29
Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	NR	NR	< 0.87	< 0.90	< 0.81	< 0.85	< 0.92	< 0.87	< 0.87
Perfluorooctanesulfonamide (FOSA)	754-91-6	2	20 (i)	< 0.88	< 0.91	< 0.82	**1.0 J**	< 0.93	< 0.88	< 0.88
NEtFOSA	4151-50-2	2	20 (i)	< 0.78	< 0.81	< 0.73	< 0.76	< 0.82	< 0.78	< 0.78
NMeFOSA	31506-32-8	NR	NR	< 0.39	< 0.40	< 0.36	< 0.38	< 0.41	< 0.39	< 0.38
NMeFOSAA	2355-31-9	NR	NR	< 1.1	< 1.1	< 1.0	< 1.1	< 1.1	< 1.1	< 1.1
NEtFOSAA	2991-50-6	2	20 (i)	< 1.2	< 1.2	< 1.1	< 1.1	< 1.2	< 1.2	< 1.2
NMeFOSE	24448-09-7	NR	NR	< 1.3	< 1.3	< 1.2	< 1.2	< 1.3	< 1.3	< 1.3
NEtFOSE	1691-99-2	2	20 (i)	< 0.76	< 0.79	< 0.71	< 0.75	< 0.81	< 0.77	< 0.76
4:2 FTS	757124-72-4	NR	NR	< 0.22	< 0.22	< 0.20	< 0.21	< 0.23	< 0.22	< 0.21
6:2 FTS	27619-97-2	NR	NR	< 2.2	< 2.3	< 2.1	< 2.2	< 2.4	< 2.3	< 2.2
8:2 FTS	39108-34-4	NR	NR	< 0.41	< 0.43	< 0.38	< 0.40	< 0.44	< 0.41	< 0.41
DONA	919005-14-4	600	3000	< 0.36	< 0.37	< 0.33	< 0.35	< 0.38	< 0.36	< 0.36
HFPO-DA (GenX)	13252-13-6	30	300	< 1.3	< 1.4	< 1.3	< 1.3	< 1.4	< 1.4	< 1.3
F-53B Major	756426-58-1	NR	NR	< 0.22	< 0.22	< 0.20	< 0.21	< 0.23	< 0.22	< 0.21
F-53B Minor	763051-92-9	NR	NR	< 0.29	< 0.30	< 0.27	< 0.28	< 0.30	< 0.29	< 0.29

Notes:

Bold text indicates the compound was reported at a concentration above the method detection limit (MDL).

= value exceeds a recommended PAL.

< = Less than the detection limit.

J = Result is less than the reporting limit (RL) but greater than or equal to the method detection limit (MDL) and the concentration is an approximate value.

(i) DHS recommends a combined enforcement standard of 20 ng/L for FOSA, NEtFOSE, NEtFOSA, NEtFOSAA, PFOS, and PFOA.

(ii) USEPA recommended Lifetime Drinking Water Health Advisory (HAS) of 70 parts per trillion (ppt) (0.07 ng/L) for PFOA and PFOS combined or individually.

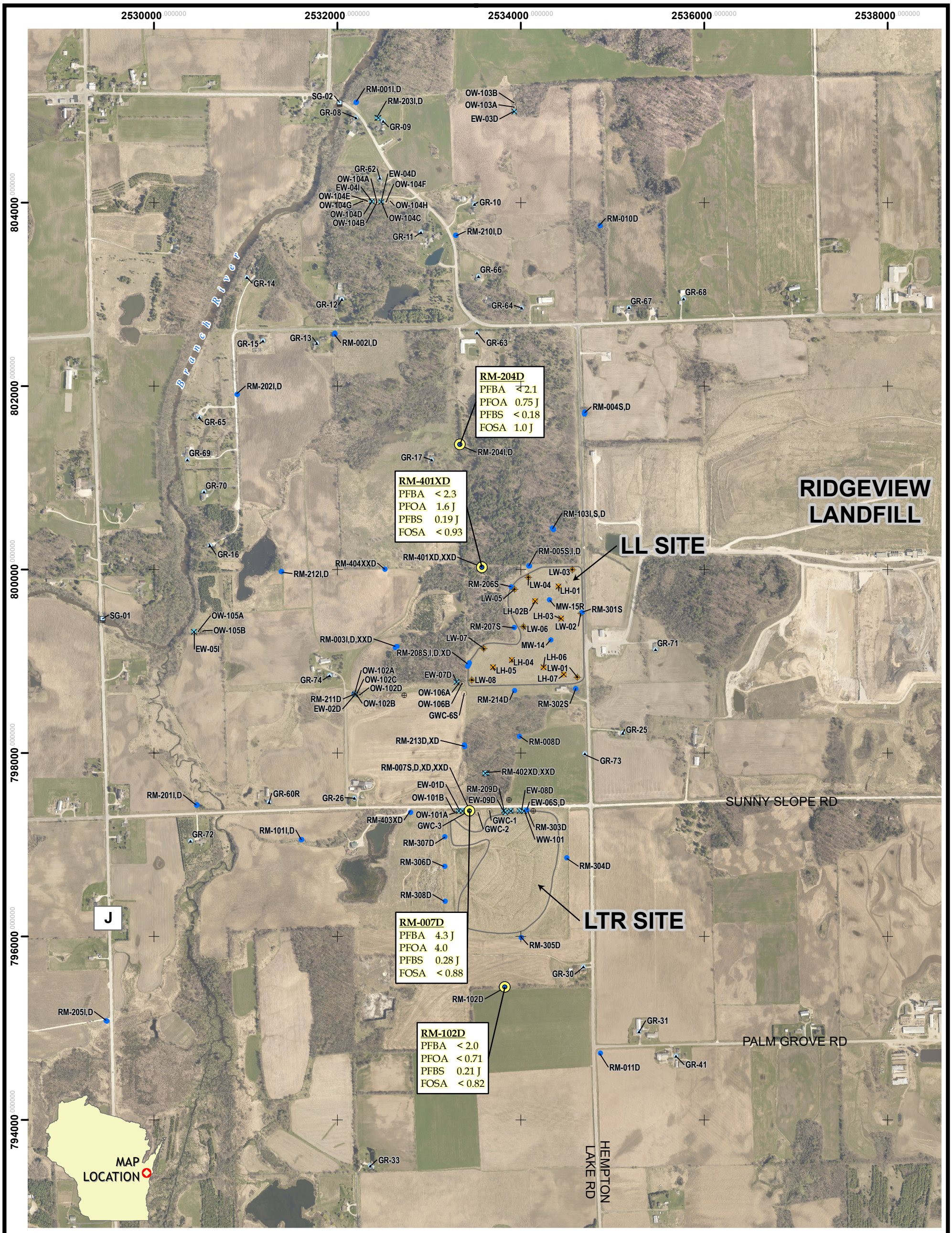
PAL = Wisconsin Administrative Code (WAC) Chapter NR140 Preventive Action Limit.

ES = WAC Chapter NR140 Enforcement Standard.

NR = No recommended standard yet from Cycles 10 or 11.

FB = field equipment blank.

AMB = ambient air (poured) blank.



LEGEND

SAMPLE AND MONITORING LOCATIONS

- Bedrock boring
- GW Collection Sump (GWC)
- GW Extraction Well (EW)
- GW Observation Well (OW)
- Leachate Head Well (LH)
- Leachate Withdrawl Well (LW)
- Monitoring Well (RM)
- Residential Well (GR)
- Staff Gauge (SG)
- LANDFILL AREA

WELLS SAMPLED FOR PFAS EVALUATION

NOTES

1. AERIAL IMAGERY FROM MANITOWOC COUNTY, 2017.
2. MAP COORDINATES ARE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.

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1 " = 1,000 ' 1:12,000

N

PROJECT:

LEMBERGER SITES
TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE:

PFAS SAMPLING LOCATIONS AND RESULTS

DRAWN BY:	A. HORRIE	SCALE:	PROJ. NO. 419607
CHECKED BY:	M. WESTOVER	AS NOTED	FILE NO. 419607-001.mxd
APPROVED BY:	K. KRAUSE	DATE PRINTED:	**FIGURE 1**
DATE:	OCTOBER 2021		

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Attachment 1

The Data Validation Report and Laboratory Data Sheets

Memorandum

To: Meredith Westover

From: Kristen Morin (Data Reviewer)
Liz Denly (Peer Reviewer)

Date: October 13, 2021

Subject: Data Validation Report
PFAS Groundwater Samples: 3rd Quarter 2021
Lemberger Landfill and Lemberger Transport and Recycling/Franklin, Wisconsin
Laboratory Job Number 320-79406-1

SUMMARY

Limited validation (level III) was performed on the data for four groundwater samples, one field duplicate, one field blank, and one ambient conditions blank collected at the Lemberger Landfill and Lemberger Transport and Recycling Site in Franklin, Wisconsin. The samples were collected on September 22, 2021. Samples were submitted to Eurofins-Test America in West Sacramento, California for analysis. The samples were analyzed for per- and poly-fluoroalkyl substances (PFAS) based on EPA Method 537.1 (modified). The laboratory reported the results under laboratory job number 320-79406-1.

The sample results were assessed using the following guidance, modified for the methodology used:

- USEPA National Functional Guidelines for Organic Superfund Methods Data Review (EPA-540-R-20-005), November 2020
- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review (EPA-542-R-20-007), November 2020
- USEPA Data Review and Validation Guidelines for PFAS Analyzed Using EPA Method 537 (EPA 910-R-18-001), November 2018
- The project-specific quality assurance project plan (QAPP), dated September 2011, Revision 1 and PFAS Evaluation Work Plan, dated September 2021, Revision 1.

In general, the data are valid as reported and may be used for decision-making purposes. The following issue was noted which have a minor impact on the data usability:

- Select results were reported which were below the lowest calibration standard and quantitation limit (QL); these results were qualified as estimated (J).

SAMPLES

Samples included in this review are listed below:

- RM-007D
- RM-102D
- RM-204D
- RM-401XD
- AMB-001
- FB-101
- FDUP-002 (Field duplicate of RM-007D)

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Data completeness
- Holding times and sample preservation
- Initial and continuing calibrations
- Blanks
- Isotopically Labeled Surrogate Results
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results
- Internal standard performance
- Field duplicate results
- QLs and sample results

DISCUSSION

Agreement of Analyses Conducted with Chain-of-Custody Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the COC. No issues were noted.

Data Completeness

The data package was found to be complete as received from the laboratory.

Holding Times and Sample Preservation

All samples were analyzed within the method-specified holding time. All samples were received by the laboratory on ice and were properly preserved.

Note that samples were not received by the laboratory until two days after collection. As indicated by the field sampler in previous rounds of sampling, when not shipped to the laboratory on the day of collection, samples are stored in coolers, on ice, in a locked former treatment building at the site until delivery to the laboratory. No validation actions were required on this basis since the samples were kept on ice prior to shipment to the laboratory and were received on ice and at an acceptable cooler temperature by the laboratory.

Initial and Continuing Calibrations

The percent relative standard deviations were within the laboratory acceptance criteria in the initial calibrations. The percent differences met the laboratory acceptance criteria in the continuing calibration standards associated with the samples in this data set.

Blanks

Target compounds were not detected in the associated method blank, field blank, and ambient conditions blank.

Isotopically Labeled Surrogate Results

Twenty-five (25) isotopically labeled surrogates were spiked into the samples prior to extraction for isotope dilution quantitation. The percent recoveries (%Rs) were within the laboratory acceptance criteria.

MS/MSD Results

MS/MSD analyses were not performed on a sample in this data set.

LCS/LCSD Results

An LCS and LCSD were performed with each extraction batch. The %Rs and relative percent differences (RPDs) were within the laboratory acceptance criteria.

Internal Standard Performance

The isotopically labeled internal standard 13C2-PFOA was added to each sample prior to injection to monitor for ion suppression/enhancement at the instrument level. The %Rs met the laboratory limits of 50-150% in the PFAS analyses.

Field Duplicate Results

Samples RM-007D and FDUP-002 were submitted as the field duplicate pair with this data set. The following table summarizes the absolute differences (AbsDs) of the detected PFAS results in the field duplicate pair and the validation actions.

Criteria:

- When both results are ≥ 5x the QL, RPDs must be ≤ 35%.
- When one or both results are < 5x the QL, AbsD must be < the QL.
- When one result is nondetect, the AbsD is not calculable (NC); the positive result must be < 2× the QL.

Analyte	QLs (ng/L)	RM-007D (ng/L)	FDUP-002 (ng/L)	AbsD (ng/L)	Validation Action
PFBA	4.5/4.6	4.3 J	4.5 J	0.2	None; all criteria were met.
PFOA	1.8/1.9	4.0	4.0	0	
PFBS	1.8/1.9	0.28 J	0.33 J	0.05	

Quantitation Limits and Sample Results

Select results were reported which were below the lowest calibration standard level and QL (or limit of quantitation [LOQ]). These results were qualified as estimated (J) by the laboratory.

There were no dilutions performed on the samples in this data set.

The laboratory's method detection limits for all PFAS were below both of the project action limits specified in the PFAS Evaluation Work Plan (proposed Wisconsin Department of National Resources

Cycle 10 and 11 standards: Wisconsin Administrative Code [WAC] Chapter NR 140 Preventive Action Limit and WAC Chapter NR 140 Enforcement Standard).

QUALIFIED FORM 1s

Client Sample ID: RM-007D

Date Collected: 09/22/21 17:58
Date Received: 09/24/21 09:40

Lab Sample ID: 320-79406-1

Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	**4.3**	**J**	4.5	2.2	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluoropentanoic acid (PFPeA)	<0.44		1.8	0.44	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorohexanoic acid (PFHxA)	<0.52		1.8	0.52	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluoroheptanoic acid (PFHpA)	<0.22		1.8	0.22	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorooctanoic acid (PFOA)	**4.0**		1.8	0.76	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorononanoic acid (PFNA)	<0.24		1.8	0.24	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorodecanoic acid (PFDA)	<0.28		1.8	0.28	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluoroundecanoic acid (PFUnA)	<0.99		1.8	0.99	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorododecanoic acid (PFDoA)	<0.49		1.8	0.49	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorotridecanoic acid (PFTrDA)	<1.2		1.8	1.2	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorotetradecanoic acid (PFTeA)	<0.66		1.8	0.66	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorobutanesulfonic acid (PFBS)	**0.28**	**J**	1.8	0.18	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluoropentanesulfonic acid (PFPeS)	<0.27		1.8	0.27	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorohexanesulfonic acid (PFHxS)	<0.51		1.8	0.51	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluoroheptanesulfonic Acid (PFHpS)	<0.17		1.8	0.17	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorooctanesulfonic acid (PFOS)	<0.48		1.8	0.48	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorononanesulfonic acid (PFNS)	<0.33		1.8	0.33	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorodecanesulfonic acid (PFDS)	<0.29		1.8	0.29	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorododecanesulfonic acid (PFDoS)	<0.87		1.8	0.87	ng/L		09/28/21 11:45	09/29/21 21:47	1
Perfluorooctanesulfonamide (FOSA)	<0.88		1.8	0.88	ng/L		09/28/21 11:45	09/29/21 21:47	1
NEtFOSA	<0.78		1.8	0.78	ng/L		09/28/21 11:45	09/29/21 21:47	1
NMeFOSA	<0.39		1.8	0.39	ng/L		09/28/21 11:45	09/29/21 21:47	1
NMeFOSAA	<1.1		4.5	1.1	ng/L		09/28/21 11:45	09/29/21 21:47	1
NEtFOSAA	<1.2		4.5	1.2	ng/L		09/28/21 11:45	09/29/21 21:47	1
NMeFOSE	<1.3		3.6	1.3	ng/L		09/28/21 11:45	09/29/21 21:47	1
NEtFOSE	<0.76		1.8	0.76	ng/L		09/28/21 11:45	09/29/21 21:47	1
4:2 FTS	<0.22		1.8	0.22	ng/L		09/28/21 11:45	09/29/21 21:47	1
6:2 FTS	<2.2		4.5	2.2	ng/L		09/28/21 11:45	09/29/21 21:47	1
8:2 FTS	<0.41		1.8	0.41	ng/L		09/28/21 11:45	09/29/21 21:47	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<0.36		1.8	0.36	ng/L		09/28/21 11:45	09/29/21 21:47	1
HFPO-DA (GenX)	<1.3		3.6	1.3	ng/L		09/28/21 11:45	09/29/21 21:47	1
9Cl-PF3ONS	<0.22		1.8	0.22	ng/L		09/28/21 11:45	09/29/21 21:47	1
11Cl-PF3OUdS	<0.29		1.8	0.29	ng/L		09/28/21 11:45	09/29/21 21:47	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*77*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C5 PFPeA	*91*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C2 PFHxA	*97*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C4 PFHpA	*92*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C4 PFOA	*96*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C5 PFNA	*95*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C2 PFDA	*95*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C2 PFUnA	*88*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C2 PFDoA	*85*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C2 PFTeDA	*79*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*
13C3 PFBS	*92*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:47*	*1*

Client Sample ID: RM-102D
Date Collected: 09/22/21 10:50
Date Received: 09/24/21 09:40

Lab Sample ID: 320-79406-2
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	<2.0		4.2	2.0	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluoropentanoic acid (PFPeA)	<0.41		1.7	0.41	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorohexanoic acid (PFHxA)	<0.48		1.7	0.48	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluoroheptanoic acid (PFHpA)	<0.21		1.7	0.21	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorooctanoic acid (PFOA)	<0.71		1.7	0.71	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorononanoic acid (PFNA)	<0.23		1.7	0.23	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorodecanoic acid (PFDA)	<0.26		1.7	0.26	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluoroundecanoic acid (PFUnA)	<0.92		1.7	0.92	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorododecanoic acid (PFDoA)	<0.46		1.7	0.46	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorotridecanoic acid (PFTrDA)	<1.1		1.7	1.1	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorotetradecanoic acid (PFTeA)	<0.61		1.7	0.61	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorobutanesulfonic acid (PFBS)	**0.21**	**J**	1.7	0.17	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluoropentanesulfonic acid (PFPeS)	<0.25		1.7	0.25	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorohexanesulfonic acid (PFHxS)	<0.48		1.7	0.48	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluoroheptanesulfonic Acid (PFHpS)	<0.16		1.7	0.16	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorooctanesulfonic acid (PFOS)	<0.45		1.7	0.45	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorononanesulfonic acid (PFNS)	<0.31		1.7	0.31	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorodecanesulfonic acid (PFDS)	<0.27		1.7	0.27	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorododecanesulfonic acid (PFDoS)	<0.81		1.7	0.81	ng/L		09/28/21 11:45	09/29/21 21:56	1
Perfluorooctanesulfonamide (FOSA)	<0.82		1.7	0.82	ng/L		09/28/21 11:45	09/29/21 21:56	1
NEtFOSA	<0.73		1.7	0.73	ng/L		09/28/21 11:45	09/29/21 21:56	1
NMeFOSA	<0.36		1.7	0.36	ng/L		09/28/21 11:45	09/29/21 21:56	1
NMeFOSAA	<1.0		4.2	1.0	ng/L		09/28/21 11:45	09/29/21 21:56	1
NEtFOSAA	<1.1		4.2	1.1	ng/L		09/28/21 11:45	09/29/21 21:56	1
NMeFOSE	<1.2		3.3	1.2	ng/L		09/28/21 11:45	09/29/21 21:56	1
NEtFOSE	<0.71		1.7	0.71	ng/L		09/28/21 11:45	09/29/21 21:56	1
4:2 FTS	<0.20		1.7	0.20	ng/L		09/28/21 11:45	09/29/21 21:56	1
6:2 FTS	<2.1		4.2	2.1	ng/L		09/28/21 11:45	09/29/21 21:56	1
8:2 FTS	<0.38		1.7	0.38	ng/L		09/28/21 11:45	09/29/21 21:56	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<0.33		1.7	0.33	ng/L		09/28/21 11:45	09/29/21 21:56	1
HFPO-DA (GenX)	<1.3		3.3	1.3	ng/L		09/28/21 11:45	09/29/21 21:56	1
9Cl-PF3ONS	<0.20		1.7	0.20	ng/L		09/28/21 11:45	09/29/21 21:56	1
11Cl-PF3OUdS	<0.27		1.7	0.27	ng/L		09/28/21 11:45	09/29/21 21:56	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*84*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C5 PFPeA	*91*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C2 PFHxA	*91*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C4 PFHpA	*85*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C4 PFOA	*91*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C5 PFNA	*87*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C2 PFDA	*86*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C2 PFUnA	*82*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C2 PFDoA	*77*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C2 PFTeDA	*72*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*
13C3 PFBS	*87*		*25 - 150*	*09/28/21 11:45*	*09/29/21 21:56*	*1*

Client Sample ID: RM-204D

Date Collected: 09/22/21 13:26
Date Received: 09/24/21 09:40

Lab Sample ID: 320-79406-3

Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	<2.1		4.4	2.1	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluoropentanoic acid (PFPeA)	<0.43		1.8	0.43	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorohexanoic acid (PFHxA)	<0.51		1.8	0.51	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluoroheptanoic acid (PFHpA)	<0.22		1.8	0.22	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorooctanoic acid (PFOA)	**0.75**	**J**	1.8	0.75	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorononanoic acid (PFNA)	<0.24		1.8	0.24	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorodecanoic acid (PFDA)	<0.27		1.8	0.27	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluoroundecanoic acid (PFUnA)	<0.97		1.8	0.97	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorododecanoic acid (PFDoA)	<0.48		1.8	0.48	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorotridecanoic acid (PFTrDA)	<1.1		1.8	1.1	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorotetradecanoic acid (PFTeA)	<0.64		1.8	0.64	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorobutanesulfonic acid (PFBS)	<0.18		1.8	0.18	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluoropentanesulfonic acid (PFPeS)	<0.26		1.8	0.26	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorohexanesulfonic acid (PFHxS)	<0.50		1.8	0.50	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluoroheptanesulfonic Acid (PFHpS)	<0.17		1.8	0.17	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorooctanesulfonic acid (PFOS)	<0.47		1.8	0.47	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorononanesulfonic acid (PFNS)	<0.33		1.8	0.33	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorodecanesulfonic acid (PFDS)	<0.28		1.8	0.28	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorododecanesulfonic acid (PFDoS)	<0.85		1.8	0.85	ng/L		09/28/21 11:45	09/29/21 22:05	1
Perfluorooctanesulfonamide (FOSA)	**1.0**	**J**	1.8	0.86	ng/L		09/28/21 11:45	09/29/21 22:05	1
NEtFOSA	<0.76		1.8	0.76	ng/L		09/28/21 11:45	09/29/21 22:05	1
NMeFOSA	<0.38		1.8	0.38	ng/L		09/28/21 11:45	09/29/21 22:05	1
NMeFOSAA	<1.1		4.4	1.1	ng/L		09/28/21 11:45	09/29/21 22:05	1
NEtFOSAA	<1.1		4.4	1.1	ng/L		09/28/21 11:45	09/29/21 22:05	1
NMeFOSE	<1.2		3.5	1.2	ng/L		09/28/21 11:45	09/29/21 22:05	1
NEtFOSE	<0.75		1.8	0.75	ng/L		09/28/21 11:45	09/29/21 22:05	1
4:2 FTS	<0.21		1.8	0.21	ng/L		09/28/21 11:45	09/29/21 22:05	1
6:2 FTS	<2.2		4.4	2.2	ng/L		09/28/21 11:45	09/29/21 22:05	1
8:2 FTS	<0.40		1.8	0.40	ng/L		09/28/21 11:45	09/29/21 22:05	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<0.35		1.8	0.35	ng/L		09/28/21 11:45	09/29/21 22:05	1
HFPO-DA (GenX)	<1.3		3.5	1.3	ng/L		09/28/21 11:45	09/29/21 22:05	1
9Cl-PF3ONS	<0.21		1.8	0.21	ng/L		09/28/21 11:45	09/29/21 22:05	1
11Cl-PF3OUdS	<0.28		1.8	0.28	ng/L		09/28/21 11:45	09/29/21 22:05	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*100*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C5 PFPeA	*104*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C2 PFHxA	*101*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C4 PFHpA	*102*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C4 PFOA	*106*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C5 PFNA	*104*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C2 PFDA	*102*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C2 PFUnA	*101*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C2 PFDoA	*99*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C2 PFTeDA	*91*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*
13C3 PFBS	*98*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:05*	*1*

Client Sample ID: RM-401XD

Date Collected: 09/22/21 15:57
Date Received: 09/24/21 09:40

Lab Sample ID: 320-79406-4

Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	<2.3		4.7	2.3	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluoropentanoic acid (PFPeA)	<0.46		1.9	0.46	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorohexanoic acid (PFHxA)	<0.55		1.9	0.55	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluoroheptanoic acid (PFHpA)	<0.24		1.9	0.24	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorooctanoic acid (PFOA)	**1.6**	**J**	1.9	0.81	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorononanoic acid (PFNA)	<0.26		1.9	0.26	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorodecanoic acid (PFDA)	<0.29		1.9	0.29	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluoroundecanoic acid (PFUnA)	<1.0		1.9	1.0	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorododecanoic acid (PFDoA)	<0.52		1.9	0.52	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorotridecanoic acid (PFTrDA)	<1.2		1.9	1.2	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorotetradecanoic acid (PFTeA)	<0.69		1.9	0.69	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorobutanesulfonic acid (PFBS)	**0.19**	**J**	1.9	0.19	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluoropentanesulfonic acid (PFPeS)	<0.28		1.9	0.28	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorohexanesulfonic acid (PFHxS)	<0.54		1.9	0.54	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluoroheptanesulfonic Acid (PFHpS)	<0.18		1.9	0.18	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorooctanesulfonic acid (PFOS)	<0.51		1.9	0.51	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorononanesulfonic acid (PFNS)	<0.35		1.9	0.35	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorodecanesulfonic acid (PFDS)	<0.30		1.9	0.30	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorododecanesulfonic acid (PFDoS)	<0.92		1.9	0.92	ng/L		09/28/21 11:45	09/29/21 22:14	1
Perfluorooctanesulfonamide (FOSA)	<0.93		1.9	0.93	ng/L		09/28/21 11:45	09/29/21 22:14	1
NEtFOSA	<0.82		1.9	0.82	ng/L		09/28/21 11:45	09/29/21 22:14	1
NMeFOSA	<0.41		1.9	0.41	ng/L		09/28/21 11:45	09/29/21 22:14	1
NMeFOSAA	<1.1		4.7	1.1	ng/L		09/28/21 11:45	09/29/21 22:14	1
NEtFOSAA	<1.2		4.7	1.2	ng/L		09/28/21 11:45	09/29/21 22:14	1
NMeFOSE	<1.3		3.8	1.3	ng/L		09/28/21 11:45	09/29/21 22:14	1
NEtFOSE	<0.81		1.9	0.81	ng/L		09/28/21 11:45	09/29/21 22:14	1
4:2 FTS	<0.23		1.9	0.23	ng/L		09/28/21 11:45	09/29/21 22:14	1
6:2 FTS	<2.4		4.7	2.4	ng/L		09/28/21 11:45	09/29/21 22:14	1
8:2 FTS	<0.44		1.9	0.44	ng/L		09/28/21 11:45	09/29/21 22:14	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<0.38		1.9	0.38	ng/L		09/28/21 11:45	09/29/21 22:14	1
HFPO-DA (GenX)	<1.4		3.8	1.4	ng/L		09/28/21 11:45	09/29/21 22:14	1
9Cl-PF3ONS	<0.23		1.9	0.23	ng/L		09/28/21 11:45	09/29/21 22:14	1
11Cl-PF3OUdS	<0.30		1.9	0.30	ng/L		09/28/21 11:45	09/29/21 22:14	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*96*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C5 PFPeA	*100*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C2 PFHxA	*98*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C4 PFHpA	*92*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C4 PFOA	*100*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C5 PFNA	*100*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C2 PFDA	*98*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C2 PFUnA	*95*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C2 PFDoA	*92*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C2 PFTeDA	*85*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*
13C3 PFBS	*94*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:14*	*1*

Client Sample ID: AMB-001
Lab Sample ID: 320-79406-5

Date Collected: 09/22/21 10:10
Matrix: Water
Date Received: 09/24/21 09:40

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	<2.2		4.5	2.2	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluoropentanoic acid (PFPeA)	<0.44		1.8	0.44	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorohexanoic acid (PFHxA)	<0.52		1.8	0.52	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluoroheptanoic acid (PFHpA)	<0.23		1.8	0.23	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorooctanoic acid (PFOA)	<0.77		1.8	0.77	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorononanoic acid (PFNA)	<0.24		1.8	0.24	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorodecanoic acid (PFDA)	<0.28		1.8	0.28	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluoroundecanoic acid (PFUnA)	<0.99		1.8	0.99	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorododecanoic acid (PFDoA)	<0.50		1.8	0.50	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorotridecanoic acid (PFTrDA)	<1.2		1.8	1.2	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorotetradecanoic acid (PFTeA)	<0.66		1.8	0.66	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorobutanesulfonic acid (PFBS)	<0.18		1.8	0.18	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluoropentanesulfonic acid (PFPeS)	<0.27		1.8	0.27	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorohexanesulfonic acid (PFHxS)	<0.51		1.8	0.51	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluoroheptanesulfonic Acid (PFHpS)	<0.17		1.8	0.17	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorooctanesulfonic acid (PFOS)	<0.49		1.8	0.49	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorononanesulfonic acid (PFNS)	<0.33		1.8	0.33	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorodecanesulfonic acid (PFDS)	<0.29		1.8	0.29	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorododecanesulfonic acid (PFDoS)	<0.87		1.8	0.87	ng/L		09/28/21 11:45	09/29/21 22:23	1
Perfluorooctanesulfonamide (FOSA)	<0.88		1.8	0.88	ng/L		09/28/21 11:45	09/29/21 22:23	1
NEtFOSA	<0.78		1.8	0.78	ng/L		09/28/21 11:45	09/29/21 22:23	1
NMeFOSA	<0.39		1.8	0.39	ng/L		09/28/21 11:45	09/29/21 22:23	1
NMeFOSAA	<1.1		4.5	1.1	ng/L		09/28/21 11:45	09/29/21 22:23	1
NEtFOSAA	<1.2		4.5	1.2	ng/L		09/28/21 11:45	09/29/21 22:23	1
NMeFOSE	<1.3		3.6	1.3	ng/L		09/28/21 11:45	09/29/21 22:23	1
NEtFOSE	<0.77		1.8	0.77	ng/L		09/28/21 11:45	09/29/21 22:23	1
4:2 FTS	<0.22		1.8	0.22	ng/L		09/28/21 11:45	09/29/21 22:23	1
6:2 FTS	<2.3		4.5	2.3	ng/L		09/28/21 11:45	09/29/21 22:23	1
8:2 FTS	<0.41		1.8	0.41	ng/L		09/28/21 11:45	09/29/21 22:23	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<0.36		1.8	0.36	ng/L		09/28/21 11:45	09/29/21 22:23	1
HFPO-DA (GenX)	<1.4		3.6	1.4	ng/L		09/28/21 11:45	09/29/21 22:23	1
9Cl-PF3ONS	<0.22		1.8	0.22	ng/L		09/28/21 11:45	09/29/21 22:23	1
11Cl-PF3OUdS	<0.29		1.8	0.29	ng/L		09/28/21 11:45	09/29/21 22:23	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*103*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C5 PFPeA	*101*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C2 PFHxA	*101*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C4 PFHpA	*98*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C4 PFOA	*103*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C5 PFNA	*100*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C2 PFDA	*103*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C2 PFUnA	*94*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C2 PFDoA	*91*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C2 PFTeDA	*84*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
13C3 PFBS	*96*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*
18O2 PFHxS	*93*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:23*	*1*

Client Sample ID: FB-101
Lab Sample ID: 320-79406-6

Date Collected: 09/22/21 14:45
Matrix: Water
Date Received: 09/24/21 09:40

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	<2.1		4.5	2.1	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluoropentanoic acid (PFPeA)	<0.44		1.8	0.44	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorohexanoic acid (PFHxA)	<0.52		1.8	0.52	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluoroheptanoic acid (PFHpA)	<0.22		1.8	0.22	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorooctanoic acid (PFOA)	<0.76		1.8	0.76	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorononanoic acid (PFNA)	<0.24		1.8	0.24	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorodecanoic acid (PFDA)	<0.28		1.8	0.28	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluoroundecanoic acid (PFUnA)	<0.98		1.8	0.98	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorododecanoic acid (PFDoA)	<0.49		1.8	0.49	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorotridecanoic acid (PFTrDA)	<1.2		1.8	1.2	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorotetradecanoic acid (PFTeA)	<0.65		1.8	0.65	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorobutanesulfonic acid (PFBS)	<0.18		1.8	0.18	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluoropentanesulfonic acid (PFPeS)	<0.27		1.8	0.27	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorohexanesulfonic acid (PFHxS)	<0.51		1.8	0.51	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluoroheptanesulfonic Acid (PFHpS)	<0.17		1.8	0.17	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorooctanesulfonic acid (PFOS)	<0.48		1.8	0.48	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorononanesulfonic acid (PFNS)	<0.33		1.8	0.33	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorodecanesulfonic acid (PFDS)	<0.29		1.8	0.29	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorododecanesulfonic acid (PFDoS)	<0.87		1.8	0.87	ng/L		09/28/21 11:45	09/29/21 22:32	1
Perfluorooctanesulfonamide (FOSA)	<0.88		1.8	0.88	ng/L		09/28/21 11:45	09/29/21 22:32	1
NEtFOSA	<0.78		1.8	0.78	ng/L		09/28/21 11:45	09/29/21 22:32	1
NMeFOSA	<0.38		1.8	0.38	ng/L		09/28/21 11:45	09/29/21 22:32	1
NMeFOSAA	<1.1		4.5	1.1	ng/L		09/28/21 11:45	09/29/21 22:32	1
NEtFOSAA	<1.2		4.5	1.2	ng/L		09/28/21 11:45	09/29/21 22:32	1
NMeFOSE	<1.3		3.6	1.3	ng/L		09/28/21 11:45	09/29/21 22:32	1
NEtFOSE	<0.76		1.8	0.76	ng/L		09/28/21 11:45	09/29/21 22:32	1
4:2 FTS	<0.21		1.8	0.21	ng/L		09/28/21 11:45	09/29/21 22:32	1
6:2 FTS	<2.2		4.5	2.2	ng/L		09/28/21 11:45	09/29/21 22:32	1
8:2 FTS	<0.41		1.8	0.41	ng/L		09/28/21 11:45	09/29/21 22:32	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<0.36		1.8	0.36	ng/L		09/28/21 11:45	09/29/21 22:32	1
HFPO-DA (GenX)	<1.3		3.6	1.3	ng/L		09/28/21 11:45	09/29/21 22:32	1
9Cl-PF3ONS	<0.21		1.8	0.21	ng/L		09/28/21 11:45	09/29/21 22:32	1
11Cl-PF3OUdS	<0.29		1.8	0.29	ng/L		09/28/21 11:45	09/29/21 22:32	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*99*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C5 PFPeA	*98*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C2 PFHxA	*98*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C4 PFHpA	*92*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C4 PFOA	*98*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C5 PFNA	*99*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C2 PFDA	*99*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C2 PFUnA	*95*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C2 PFDoA	*89*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C2 PFTeDA	*78*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
13C3 PFBS	*92*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*
18O2 PFHxS	*96*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:32*	*1*

Client Sample ID: FDUP-002

Date Collected: 09/22/21 00:00
Date Received: 09/24/21 09:40

Lab Sample ID: 320-79406-7

Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	**4.5**	**J**	4.6	2.2	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluoropentanoic acid (PFPeA)	<0.45		1.9	0.45	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorohexanoic acid (PFHxA)	<0.54		1.9	0.54	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluoroheptanoic acid (PFHpA)	<0.23		1.9	0.23	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorooctanoic acid (PFOA)	**4.0**		1.9	0.79	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorononanoic acid (PFNA)	<0.25		1.9	0.25	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorodecanoic acid (PFDA)	<0.29		1.9	0.29	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluoroundecanoic acid (PFUnA)	<1.0		1.9	1.0	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorododecanoic acid (PFDoA)	<0.51		1.9	0.51	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorotridecanoic acid (PFTrDA)	<1.2		1.9	1.2	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorotetradecanoic acid (PFTeA)	<0.68		1.9	0.68	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorobutanesulfonic acid (PFBS)	**0.33**	**J**	1.9	0.19	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluoropentanesulfonic acid (PFPeS)	<0.28		1.9	0.28	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorohexanesulfonic acid (PFHxS)	<0.53		1.9	0.53	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluoroheptanesulfonic Acid (PFHpS)	<0.18		1.9	0.18	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorooctanesulfonic acid (PFOS)	<0.50		1.9	0.50	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorononanesulfonic acid (PFNS)	<0.34		1.9	0.34	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorodecanesulfonic acid (PFDS)	<0.30		1.9	0.30	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorododecanesulfonic acid (PFDoS)	<0.90		1.9	0.90	ng/L		09/28/21 11:45	09/29/21 22:41	1
Perfluorooctanesulfonamide (FOSA)	<0.91		1.9	0.91	ng/L		09/28/21 11:45	09/29/21 22:41	1
NEtFOSA	<0.81		1.9	0.81	ng/L		09/28/21 11:45	09/29/21 22:41	1
NMeFOSA	<0.40		1.9	0.40	ng/L		09/28/21 11:45	09/29/21 22:41	1
NMeFOSAA	<1.1		4.6	1.1	ng/L		09/28/21 11:45	09/29/21 22:41	1
NEtFOSAA	<1.2		4.6	1.2	ng/L		09/28/21 11:45	09/29/21 22:41	1
NMeFOSE	<1.3		3.7	1.3	ng/L		09/28/21 11:45	09/29/21 22:41	1
NEtFOSE	<0.79		1.9	0.79	ng/L		09/28/21 11:45	09/29/21 22:41	1
4:2 FTS	<0.22		1.9	0.22	ng/L		09/28/21 11:45	09/29/21 22:41	1
6:2 FTS	<2.3		4.6	2.3	ng/L		09/28/21 11:45	09/29/21 22:41	1
8:2 FTS	<0.43		1.9	0.43	ng/L		09/28/21 11:45	09/29/21 22:41	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<0.37		1.9	0.37	ng/L		09/28/21 11:45	09/29/21 22:41	1
HFPO-DA (GenX)	<1.4		3.7	1.4	ng/L		09/28/21 11:45	09/29/21 22:41	1
9Cl-PF3ONS	<0.22		1.9	0.22	ng/L		09/28/21 11:45	09/29/21 22:41	1
11Cl-PF3OUdS	<0.30		1.9	0.30	ng/L		09/28/21 11:45	09/29/21 22:41	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*80*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C5 PFPeA	*95*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C2 PFHxA	*97*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C4 PFHpA	*96*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C4 PFOA	*97*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C5 PFNA	*98*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C2 PFDA	*100*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C2 PFUnA	*91*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C2 PFDoA	*89*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C2 PFTeDA	*82*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*
13C3 PFBS	*93*		*25 - 150*	*09/28/21 11:45*	*09/29/21 22:41*	*1*