Division of Water Resources Identification of Select Emerging PFAS Compounds in Public Water Supply Reservoirs of Jordan Lake (2022)

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY

DIVISION OF WATER RESOURCES

WATER SCIENCES SECTION

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Introduction

In response to the rising interest in the public health effects associated with per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane in drinking water sources, the Intensive Survey Branch (ISB) conducted a special study alongside our Ambient Lakes Monitoring Program to characterize the presence and concentrations of these emerging compounds (EC) in public drinking water supply reservoir Jordan Lake. Beginning in January of 2022, ISB staff collected surface water samples for 1,4-dioxane and 28 (47 starting in December) different per- and polyfluoroalkyl substances at three sampling locations at Jordan Lake. Analytical results indicated the presence of at least one PFAS analyte above the laboratory practical quantitation limit (PQL [2 ng/L]) at each site during the 2022 sampling season. Of the 1, 4-dioxane samples collected during this study period, two were detected above the PQL (1.0 µg/l). It is important to note that all analytical data presented in this document reflect levels of target analytes detected in untreated surface waters, as opposed to finished drinking water.

Background

This study follows a previous survey conducted by ISB in 2018 evaluating the presence of PFAS and 1,4-dioxane in public water supply reservoirs in the Cape Fear, New, and Watauga River Basins and a 2020 study conducted in the Yadkin and Broad River Basins. Both studies highlighted the ubiquitous distribution of these emerging compounds. PFAS and 1,4-dioxane were selected as compounds of interest for this study in response to the rising interest in the public health effects of consumption of these compounds in drinking water sources. In 2020, the Division of Water Resources (DWR) expansion of the Organic Chemistry Branch to include the capability of analyzing PFAS allowed for increased analytical capacity. Samples from the selected locations (Table 1 & Figure 1) were collected monthly from January to December 2022. Please note that North Carolina protective values are health-based guidelines, not regulatory limits, and may be based on limited toxicological information.

1,4-dioxane is a synthetic industrial organic compound that is completely miscible in water. It is persistent in the environment and is difficult to remove through standard water and wastewater treatment process 1,4-dioxane is used as an industrial solvent and is formed as a byproduct of some industrial processes. The compound has been characterized as “likely to be carcinogenic to humans” and is identified in the Third Unregulated Contaminant Monitoring Rule (UCMR) as a potential compound of concern in public drinking water by the United States Environmental Protection Agency (USEPA) The 1,4-dioxane NC Protective Value for Surface Waters Fresh Water, Water Supply (Class WS I-IV) is 0.35 µg/L4. Please note that North Carolina protective values are health-based guidelines, not regulatory limits, and may be based on limited toxicological information.

Per- and Polyfluorinated Alkyl Substances (PFAS) are a class of synthetic chemicals used in the production of a wide variety of manufactured goods. These compounds are composed of fluorinated carbon chains that readily transport in the environment and are highly resistant to degradation. There are many different possible sources of PFAS contamination in surface water, including industrial and consumer derived waste. PFAS are used in various consumer products including non-stick cookware, water-repellent clothing, stain resistant fabrics, cosmetics, food packaging materials, and fire-retardant foams. Although 28 PFAS compounds were the focus of this study, thousands of PFAS compounds exist. Of these compounds, PFOA and PFOS have been the most extensively produced and studied. The USEPA has stated that exposure to PFAS can lead to adverse health effects in humans. Though many companies have significantly decreased or ceased use of PFOA and PFOS in manufacturing, other PFAS compounds are currently being used as replacements. The USEPA established health advisory level in finished drinking water for PFOA and PFOS are 0.004 ng/l and 0.02 ng/l respectively. Health Advisory levels identify the concentration of a compound in drinking water below which adverse health effects in the most sensitive populations are not anticipated to occur over specific exposure durations. A health advisory value is not a legally enforceable federal standard and is subject to change as additional information becomes available. The PFAS compounds selected for this study are abbreviated throughout this document for better readability but are identified more fully in Appendix 1.

Methods

Selected sites were sampled in conjunction with regularly scheduled sampling events as part of ALMP monitoring. Samples were collected in accordance with ISB's Standard Operating Procedures Manual: Physical and Chemical Monitoring v2.1, Dec. 2013, and Ambient Lakes Quality Assurance Project Plan v2.0, March 2014 as well as ISB's Draft Standard Operating Procedures Manual: Per- and Polyfluorinated Alkyl Substances (PFAS) - Field Collection Method. Physical parameters were collected at surface (0.15 m) using an In-Situ multiparameter hydrosonde. Chemical samples were collected as surface grab samples. All PFAS and 1,4- dioxane samples were analyzed by the DWR central laboratory in Raleigh, NC. Appropriate QA/QC samples were collected during each sampling event including trip blanks, field blanks, duplicates, matrix spikes and matrix spike duplicates. Guidance on acceptable supplies, equipment, and personal care products is provided within the ISB Draft Standard Operating Procedures Manual: Per- and Polyfluorinated Alkyl Substances (PFAS) - Field Collection Method. Full PFAS sampling results are shown below in Table 2, with selected compounds and PFAS sums displayed in the graphs in Figure 2.

Results

PFAS analysis was conducted by DWR at the Central Laboratory in Raleigh, NC. Of the 28 PFAS compounds selected for this study, the following eleven compounds were found above the PQL on at least one occasion: 6:2 FTS; PFBA; PFBS; PFHpA; PFHpS; PFHxA; PFHxS; PFNA; PFOA; PFOS; PFPeA. One or more of these compounds were found at all three sites during the 2022 sampling period (January – December). These results demonstrate the widespread distribution of detectable PFAS in public water supply reservoirs.

1,4- dioxane was found above the PQL (1 µg/L) in two samples taken from Jordan lake. 1,4- dioxane was found only at station CPF055CSUR in April (3.1 µg/L) and in November (2.5 µg/L).

Summary

Evaluation of physical and chemical result from this study suggest that while there are detectable levels of target analytes at the public water supply reservoir, Jordan Lake, additional long-term monitoring would need to be conducted to evaluate persistence of these compounds and their associated effects on drinking water. Station CPF055CSUR exhibited the highest total single event PFAS concentration (209.6 ng/L) in November of 2022. The highest PFOA (17 ng/L), PFOS (19 ng/L), and PFBS (52 ng/L) were all detected at CPF055CSUR in November of 2022.

Table 1. *Station ID, Description, and coordinates of sampled sites*.

Station	Station Description	Latitude	Longitude
CPF055CSUR	ABOVE STINKING CK NR PITTSBORO NC	35.69131	-79.0791
CPF087DSUR	MOUTH WHITE OAK CK NR SEAFORTH NC	35.73864	-79.0242
CPF086FSUR	NEAR FARRINGTON NC	35.79700	-79.0108

Figure 1. *Map of Jordan Lake with Stations.*

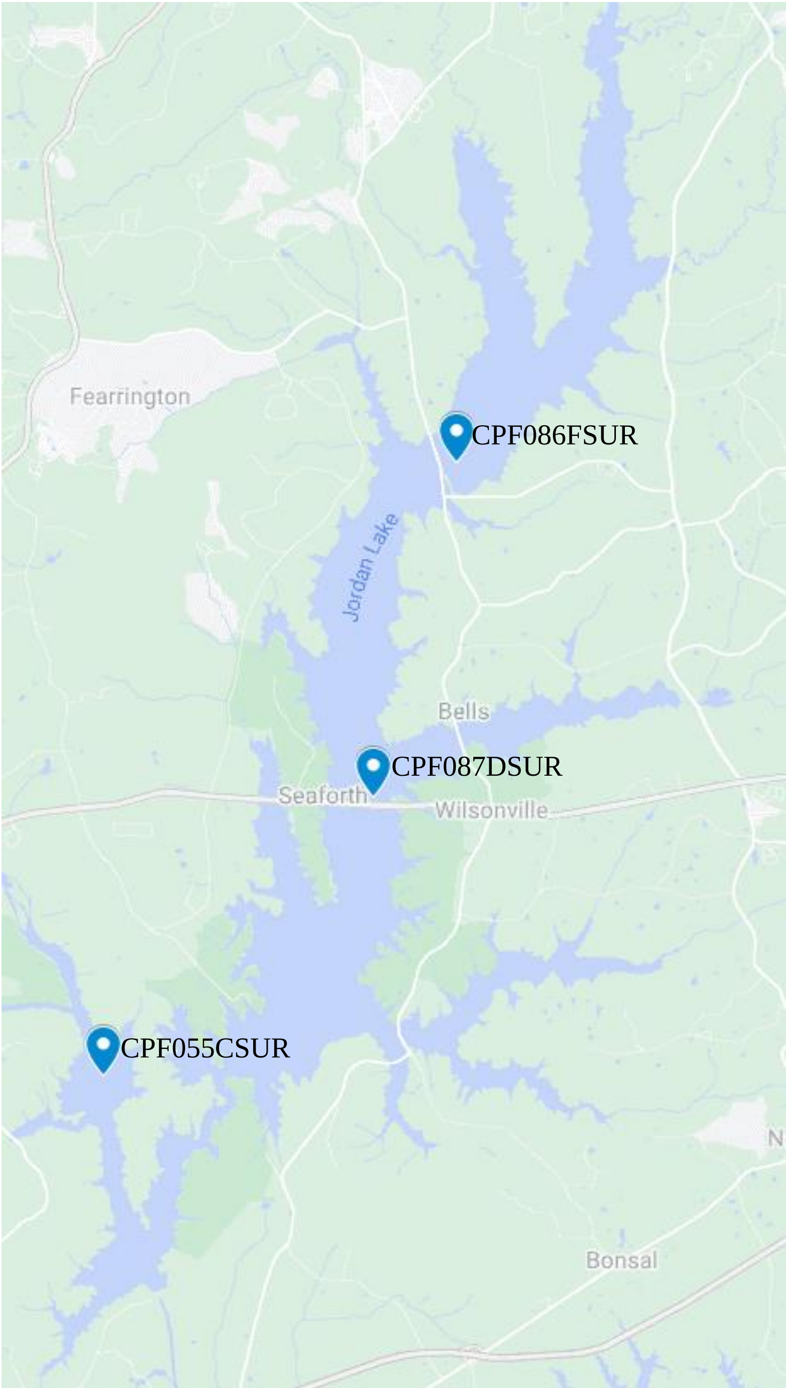
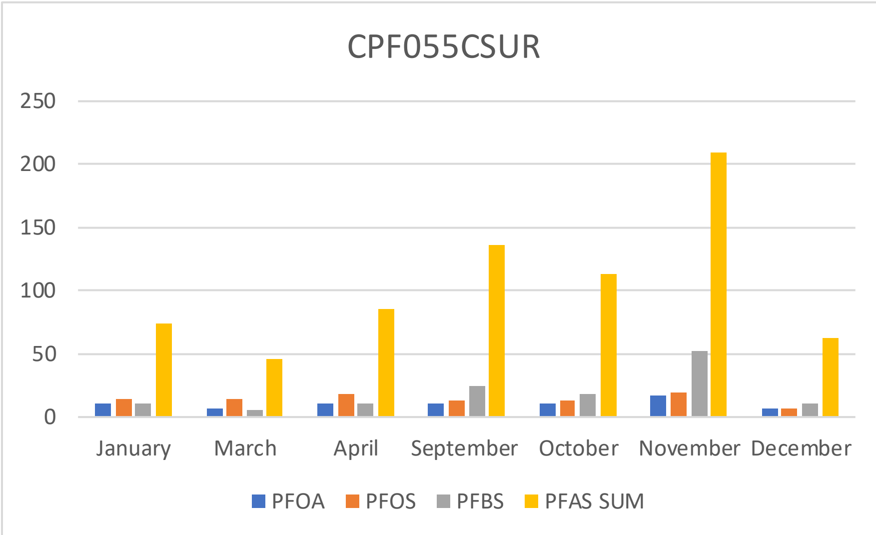
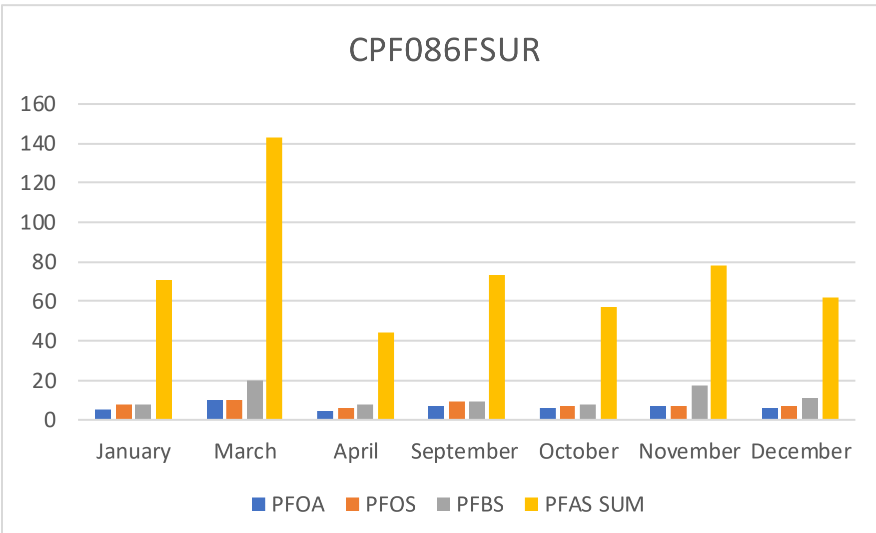
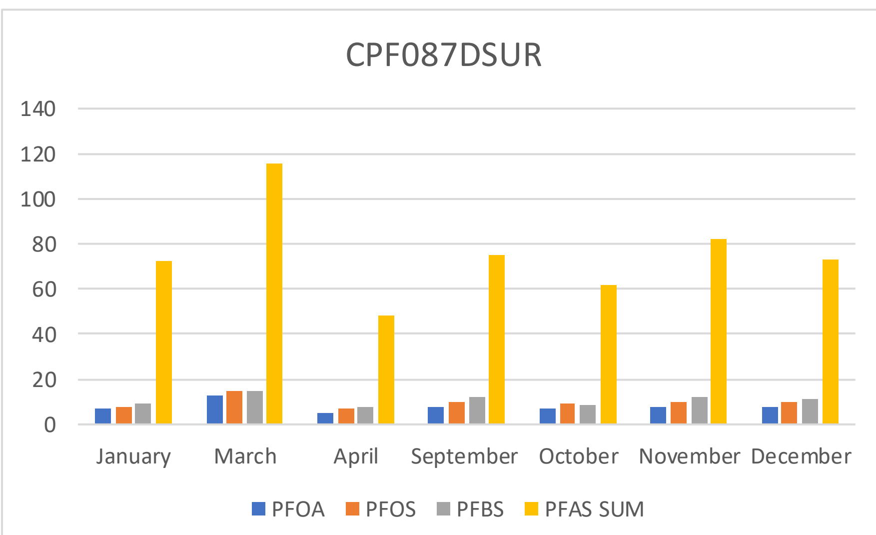


Figure 2. *Graphs of selected and total PFAS analytes.*







Appendix 1. *List of PFAS Compounds*.

Abbreviation	Name	CAS #
HFPO-DA (GenX)	Perfluoro-2-methyl-3-oxahexanoic acid	13252-13-6
PFOS	Perfluorooctanesulfonic acid	1763-23-1
PFUnA	Perfluoroundecanoic acid	2058-94-8
N-MeFOSAA	2-(N- Methylperfluorooctanesulfonamido)acetic acid	2355-31-9
PFPeA	Perfluoropentanoic acid	2706-90-3
PFPeS	Perfluoropentanesulfonic acid	2706-91-4
6:2 FTS	6:2 Fluorotelomer sulfonic acid	27619-97-2
N-EtFOSAA	2-(N- Ethylperfluorooctanesulfonamido)acetic acid	2991-50-6
PFHxA	Perfluorohexanoic acid	307-24-4
PFDoA	Perfluorododecanoic acid	307-55-1
PFOA	Perfluorooctanoic acid	335-67-1
PFDA	Perfluorodecanoic acid	335-76-2
PFDS	Perfluorodecanesulfonic acid	335-77-3
PFHxS	Perfluorohexanesulfonic acid	355-46-4
PFBA	Perfluorobutanoic acid	375-22-4
PFBS	Perfluorobutanesulfonic acid	375-73-5
PFHpA	Perfluoroheptanoic acid	375-85-9
PFHpS	Perfluoroheptanesulfonic acid	375-92-8
PFNA	Perfluorononanoic acid	375-95-1
PFTeDA	Perfluorotetradecanoic acid	376-06-7
8:2 FTS	8:2 Fluorotelomer sulfonic acid	39108-34-4
PFNS	Perfluorononanesulfonic acid	68259-12-1
PFTrDA	Perfluorotridecanoic acid	72629-94-8
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1
4:2 FTS	4:2 Fluorotelomer sulfonic acid	757124-72-4
11Cl-PF3OUdS	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9
PFDoS	Perfluorododecane sulfonic acid	79780-39-5
ADONA	4,8-Dioxa-3H-perfluorononanoicacid	919005-14-4
PFEESA/PES	Perfluoro(2-ethoxyethane)sulphonic acid	113507-82-7
PMPA	Perfluoro-2-methoxypropanoic acid	13140-29-9
PFECA B or NFHDA	Perfluoro-3,6-dioxaheptanoic acid	151772-58-6
R-PSDA (Nafion Byproduct 4)	Perfluoro-4-(2-sulfoethoxy)pentanoic acid	2416366-18-0
Hydrolyzed PSDA (Nafion Byproduct 5)	2-fluoro-2-[1,1,2,3,3,3-hexafluoro-2-(1,1,2,2-tetrafluoro-2-sulfoethoxy)propoxy]-acetic acid	2416366-19-1
R-PSDCA (Nafion Byproduct 6)	1,1,2,2-tetrafluoro-2-[1,2,2,3,3-pentafluoro-1-(trifluoromethyl)propoxy] ethanesulfonic acid	2416366-21-5
R-EVE	4-(2-carboxy-1,1,2,2-tetrafluoroethoxy)-2,2,3,3,4,5,5,5-octafluoro-pentanoic acid	2416366-22-6
PEPA	Perfluoro-2-ethoxypropanoic acid	267239-61-2

PFESA-BP1 (Nafion Byproduct 1)	Perfluoro-3,6-dioxa-4-methyl-7-octenesulfonic acid	29311-67-9
PFO2HxA	Perfluoro (3,5-dioxahexanoic) acid	39492-88-1
PFO3OA	Perfluoro (3,5,7-trioxaoctanoic) acid	39492-89-2
PFO4DA	Perfluoro (3,5,7,9-tetraoxadecanoic) acid	39492-90-5
PFO5DA	Perfluoro(3,5,7,9,11-pentaoxadodecanoic) acid	39492-91-6
PFMOAA	Perfluoro-2-methoxyacetic acid	674-13-5
EVE Acid	2,2,3,3-tetrafluoro-3-({1,1,1,2,3,3-hexafluoro-3-[(1,2,2-trifluoroethenyl)oxy]propan-2- yl}oxy)propionic acid	69087-46-3
PFESA-BP2 (Nafion Byproduct 2)	7H-Perfluoro-4-Methyl-3,6-Dioxaoctanesulfonic Acid	749836-20-2
Hydro-EVE Acid	2,2,3,3-Tetrafluoro-3-{[1,1,1,2,3,3-hexafluoro-3-(1,2,2,2-tetrafluoroethoxy)propan-2-yl]oxy}propanoic acid	773804-62-9
NVHOS	Perfluoroethoxysulfonic acid	801209-99-4
PFECA G	4-(Heptafluoroisopropoxy)hexafluorobutanoic acid	801212-59-9

Table 2. *Values of detected PFAS compounds and detection date for sites with values above PQL (2.0 ng/L).*

Station	Date	PFAS Sum (ng/L)	Analytes Detected	Analyte	Result (ng/L)	Analytes below PQL	PFAS Compounds below PQL
CPF055CSUR	01/18/2022	73.9	9	PFBA PFBS PFHpA PFHpS PFHxA PFHxS PFOA PFOS PFPeA	5.8 J2 11 5.0 2.0 11 5.1 10 14 10	19	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF086FSUR	01/18/2022	70	9	PFBA PFBS PFHpA PFHpS PFHxA PFHxS PFOA PFOS PFPeA	7.7 J2 7.4 2.6 20 7.9 2.4 4.9 8.0 9.1	19	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF087DSUR	01/18/2022	72.4	9	PFBA PFBS PFHpA PFHpS PFHxA PFHxS PFOA PFOS PFPeA	8.0 J2 9.4 4.8 9.8 10 3.2 7.2 8.0 12.0	19	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS

CPF055CSUR	03/14/2022	46.5	8	PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	3.5 J2 4.9 3.6 5.2 3.5 7.3 14 4.5	20	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF086FSUR	03/14/2022	142.8	9	PFBA PFBS PFHpA PFHpS PFHxA PFHxS PFOA PFOS PFPeA	17 J2 20 5.3 44 16 3.8 9.8 9.9 17	19	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF087DSUR	03/14/2022	115.4	9	PFBA PFBS PFHpA PFHxA PFHxS PFNA PFOA PFOS PFPeA	17 J2 15 7.2 19 5.0 2.2 13 15 22	19	PFHpS; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF055CSUR	04/21/2022	84.6	8	PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	7.2 J2 10 6.4 13 5.0 11 18 14	20	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS

CPF086FSUR	04/21/2022	44.2	8	PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	7.4 J2 7.6 2.6 7.2 2.4 4.3 5.7 7.0	20	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF087DSUR	04/21/2022	48.4	8	PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	7.6 7.4 3.1 7.9 2.4 4.9 6.7 8.4	20	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CFP055CSUR	09/22/2022	136.2	10	6:2 FTS PFBA PFBS PFHpA PFHpS PFHxA PFHxS PFOA PFOS PFPeA	3.0 J2, V1, V2 12 J2 25 11 2.1 24 5.1 11 13 30	18	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFNS; PFDS; PFDoS; 4:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF086FSUR	09/22/2022	75.8	11	6:2 FTS PFBA PFBS PFHpA PFHpS PFHxA PFHxS PFOA PFOS PFPeA PFMOAA	2.7 J2, V1, V2 9.1 J2 9.2 5.4 3.6 12 3.1 7.2 8.9 12 2.6 J2, J13, Q2	18	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFNS; PFDS; PFDoS; 4:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS

CPF087DSUR	09/22/2022	75	9	6:2 FTS PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	2.8 J2, V1, V2 8.5 12 6.1 12 3.3 7.6 9.7 13	19	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CFP055CSUR	10/12/2022	113.2	8	PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	10 J2 18 8.5 23 4.7 10 13 26	20	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF086FSUR	10/12/2022	57.4	8	PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	8.4 J2 7.8 3.4 11 2.7 6.1 7.0 11	20	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF087DSUR	10/12/2022	61.9	8	PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	8.0 J2 8.6 4.2 11 2.8 7.0 9.3 11	20	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 6:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS

CFP055CSUR	11/14/2022	209.6	10	6:2 FTS PFBA PFBS PFHpA PFHxA PFHxS PFNA PFOA PFOS PFPeA	6.9 J2, V1, V2 18 J2 52 14 36 6.7 2.0 17 19 38	8	PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF086FSUR	11/14/2022	77.8	9	6:2 FTS PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	6.9 J2, V1, V2 9.5 J2 17 4.6 12 2.8 7.0 7.0 11	19	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS
CPF087DSUR	11/14/2022	82.1	9	6:2 FTS PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	6.5 J2, V1, V2 9.2 J2 12 5.6 14 3.3 7.9 9.6 14	19	PFNA; PFDA; PFUnA; PFDoA; PFTrDA; PFTeDA; PFPeS; PFHpS; PFNS; PFDS; PFDoS; 4:2 FTS; 8:2 FTS; N-MeFOSAA; N-EtFOSAA; HFPO-DA; ADONA; 11Cl-PFOUdS; 9Cl-PF3ONS

CFP055CSUR	12/07/2022	98	8	PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	9.6 J2 21 7.5 17 4.4 9.5 11 18	39	HFPO-DA; PFUnA; N-MeFOSAA; PFPeS; 6:2 FTS; N-EtFOSAA; PFDoA; PFDA; PFDS; PFHpS; PFNA; PFTeDA; 8:2 FTS; PFNS; PFTrDA; 9Cl-PF3ONS; 4:2 FTS; 11Cl-PF3OUdS; PFDoS; ADONA; PFEESA/PES; PMPA; PFECA B/NFHDA; R-PSDA; Hydrolyzed PSDA; R-PSDCA; R-EVE; PEPA; PFESA-BP1; PFO2HxA; PFO3OA; PFO4DA; PFO5DA; PFMOAA; EVE Acid; PFESA-BP2; Hydro-EVE Acid; NVHOS; PFECA G
CPF086FSUR	12/07/2022	79.9	17	11Cl-PF3OUdS 4:2 FTS 6:2 FTS 8:2 FTS 9Cl-PF3ONS ADONA HFPO-DA N-EtFOSAA N-MeFOSAA PFBA PFBS PFHpA PFHxA PFHxS PFOA PFOS PFPeA	2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 9.1 J2 11 3.5 12 3.4 6.2 6.7 10	30	PFUnA; PFPeS; PFDoA; PFDA; PFDS; PFHpS; PFNA; PFTeDA; PFNS; PFTrDA; PFDoS; PFEESA/PES; PMPA; PFECA B/NFHDA; R-PSDA; Hydrolyzed PSDA; R-PSDCA; R-EVE; PEPA; PFESA-BP1; PFO2HxA; PFO3OA; PFO4DA; PFO5DA; PFMOAA; EVE Acid; PFESA-BP2; Hydro-EVE Acid; NVHOS; PFECA G

CPF087DSUR	12/07/2022	91.3	17	11Cl-PF3OUdS 4:2 FTS 6:2 FTS 8:2 FTS 9Cl-PF3ONS ADONA HFPO-DA N-EtFOSAA N-MeFOSAA PFBA PFBS PFHpA PFHxA PFHxS PFOS PFOS PFPeA	2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 9.6 J2 11 5.0 13 3.8 7.9 10 13	30	PFUnA; PFPeS; PFDoA; PFDA; PFDS; PFHpS; PFNA; PFTeDA; PFNS; PFTrDA; PFDoS; PFEESA/PES; PMPA; PFECA B/NFHDA; R-PSDA; Hydrolyzed PSDA; R-PSDCA; R-EVE; PEPA; PFESA-BP1; PFO2HxA; PFO3OA; PFO4DA; PFO5DA; PFMOAA; EVE Acid; PFESA-BP2; Hydro-EVE Acid; NVHOS; PFECA G

Qualifier Codes:

J2: The reported value failed to meet the established quality control criteria for either precision or accuracy.

J13: Standards used for this analyte are from an uncertified source. These are the only standards currently available for the analyte.

Q2: Holding time exceeded following the receipt by lab.

V1: The analyte was detected in both the sample and the method blank.

V2: The analyte was detected in both the sample and field blank.