Ms. Alyssa Sellwood, P.E.
Complex Sites Project Manager – Remediation and Redevelopment Program
Wisconsin Department of Natural Resources
101 South Webster Street
PO Box 7921
Madison, WI 53707

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Date: June 18, 2021
BRRTS #: 02-38-580694
Subject: Collected Foam Cause and Significance Evaluation, Tyco Fire Technology Center PFAS
2700 Industrial Parkway South, Marinette, Wisconsin

Dear Ms. Sellwood,

On behalf of Tyco Fire Products LP (Tyco), Arcadis is providing this cause and significance evaluation of foam collected in the study area ditches as part of the sample results notification for waste characterization and disposal activities related to the Tyco Fire Technology Center (FTC) per- or polyfluoroalkyl substances (PFAS) site located at 2700 Industrial Parkway South in Marinette, Wisconsin (Site).

Consistent with the Revised Foam Monitoring Work Plan submitted in April 2021, Tyco monitored area ditches beginning in March to observe the cessation of freezing conditions in the ditches, at which point Tyco installed booms to capture foam on the water surface of ditches. Each boom is monitored for foam collection daily and when foam is observed, it is documented and removed. In 2021, a boom was deployed in Ditch B on March 19 and booms were deployed in the ditches A, C, D, and E on April 1. Tyco will continue maintaining and monitoring booms in ditches daily during the calendar year to capture and remove foam until the ditches begin to freeze in winter at which time the booms will be removed. Booms will be re-deployed in 2022 following the cessation of freezing conditions.

Between March 19, 2021 and May 19, 2021, a total of approximately 57 gallons of uncollapsed foam was skimmed from the surface water using a pool skimmer at the booms located in Ditch B and Ditch C. That foam was stored on Tyco property in a leak proof, 55-gallon drum where it collapsed to approximately 4.5 gallons of liquid. Waste characterization samples were analyzed for PFAS and the liquid from collapsed foam was sent off site for disposal at a permitted facility outside the state of Wisconsin on June 15, 2021. Final documentation of disposal will be provided to the Wisconsin Department of Natural Resources (WDNR) when available.

Foam observed and collected from Ditch B 5/13/2021

The cause of some PFAS in the collected foam is attributable to Tyco's historic operations at the FTC and the remainder is due to PFAS that is ubiquitous in the environment[1,2]. Investigation and modeling data demonstrate that PFAS is migrating through groundwater from the FTC to the east where it can upwell to surface water resulting in detectable concentrations within the surface water. Tyco has been monitoring the surface water in area ditches since 2018 as part of the site investigation process. The PFAS concentrations in foam are predictably higher than the concentrations in groundwater or surface water due to the physical properties of PFAS at the molecular level as discussed in more detail below.

PFAS and Foam

When leaves, twigs, or other organic substances in water begin to decay, they release organic compounds that reduce the surface tension of the water. When that water is agitated by flow patterns, wind, waves, or other influences, air is introduced to the system which allows bubbles to form and congregate as a naturally occurring foam. Naturally occurring foam frequently collects on the surface of ditches, streams, rivers and lakes[3]. The presence and concentration of PFAS in foam is impossible to detect with the naked eye. In instances where PFAS are present in the water, the foam has been found to accumulate PFAS at higher concentrations than is present in the water. This effect has been demonstrated within the State of Wisconsin at Starkweather Creek and in the City of Peshtigo at a dam within the Peshtigo River where WDNR collected simultaneous samples of foam and surface water for PFAS analyses. The table below demonstrates some of the results posted by WDNR related to those analyses[3,4]:

[1] https://www.epa.gov/sciencematters/understanding-pfas-environment
[2] Rankin, K., Mabury, S.A., Jenkins, T.M. and Washington, J.W., 2016. A North American and global survey of perfluoroalkyl substances in surface soils: Distribution patterns and mode of occurrence. Chemosphere, 161, pp.333-341
[3] DNR Confirms PFAS-Containing Foam Found at the Mouth of Starkweather Creek and Lake Monona News Release - Wisconsin DNR
[4] DNR Confirms PFAS-Containing Foam Found in Peshtigo Area Waterways News Release - Wisconsin DNR

Location Date	Media	PFOA (parts per trillion)	PFOS (parts per trillion)
Olbrich Boat Launch 10/25/2019	Surface Water	9.5-10	400
Olbrich Boat Launch 10/25/2019	Foam	460-610	80,000-92,000*
Below City of Peshtigo Dam 9/18/2019	Surface Water	2.1	6.2
Below City of Peshtigo Dam 9/18/2019	Foam	230	17,000

* Approximate values

In all instances, the concentration of PFAS in foam was amplified as compared to the concentrations of PFAS in the underlying surface water. However, the concentration of PFAS in surface water cannot be used to accurately estimate the concentration of PFAS in foam. As an example, PFOS concentrations were amplified by between 200 and 2,700 times in these reported samples compared to the concentrations of PFOS in the underlying surface water. As summarized in the table below, the increase in concentrations has been observed to be even greater in similar studies conducted by the State of Michigan where the observed PFAS concentrations in surface water were compared to PFAS concentrations in foam[5].

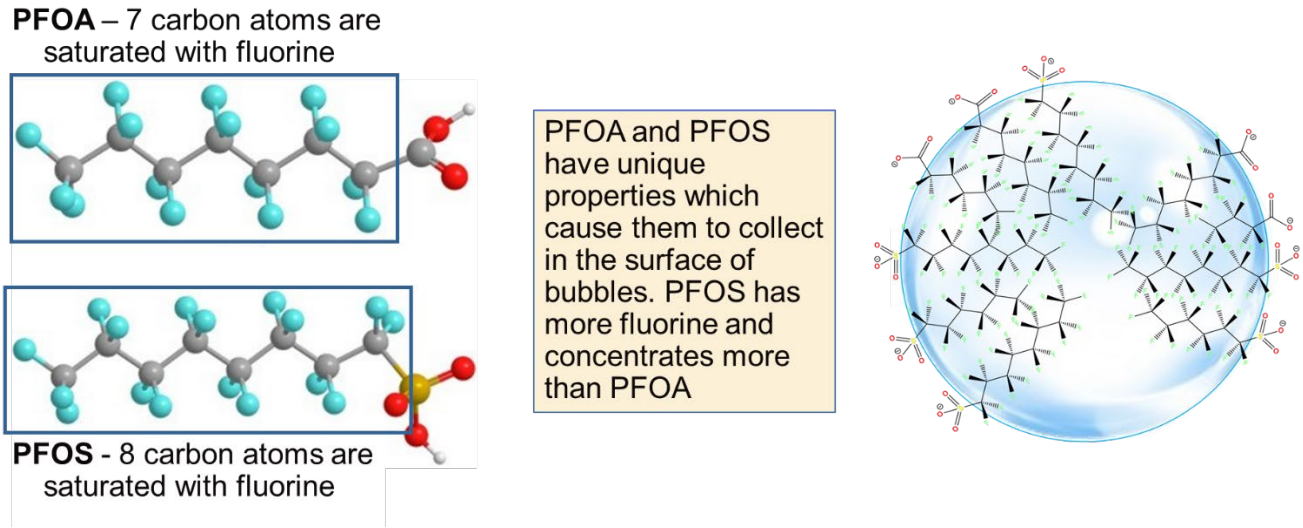
Location Date	Media	PFOA (parts per trillion)	PFOS (parts per trillion)
Rogue River 06 12/3/2019	Surface Water	4.3	29.8
Rogue River 06 12/3/2019	Foam	1,630	97,000
Thornapple River 09 1/3/2020	Surface Water	Not Detected	0.82
Thornapple River 09 1/3/2020	Foam	645	9,590
Huron River 05 11/22/2019	Surface Water	4.54	78.4
Huron River 05 11/22/2019	Foam	439	121,000

[5] Surface Water Foam Study Report (michigan.gov)

The composition of PFAS varies from surface water to foam. In the WDNR samples listed above, there were approximately 8.3 parts per trillion (ppt) of PFOA and PFOS in the surface water at the Peshtigo River Dam. That represents a composition of approximately 25% PFOA and 75% PFOS. The foam at the same location contained approximately 17,230 ppt of PFOA and PFOS and a composition of 1% PFOA and 99% PFOS. The variance is less significant at the Olbrich Boat Launch location where the amount of PFOA in the surface water is 2% of the total volume of PFOA and PFOS while it drops to less than 1% PFOA and more than 99% PFOS in the foam. Samples collected in the State of Michigan demonstrated similar changes in composition from surface water results to foam results. In the samples collected from surface water at the influent of the Ditch B treatment system on May 4, 2021, PFOA represented 94% of the total of PFOA and PFOS. In the waste characterization sample from collapsed foam collected from Ditches B and C, PFOA represented only 26%. Due to the physical properties of PFAS molecules as described below, the ratio of PFAS compounds within foam varies compared to that of the ratio of PFAS compounds within underlying surface water.

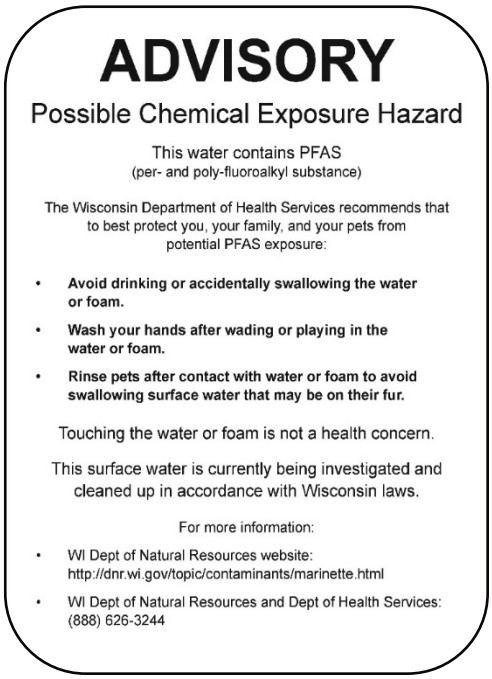
The average concentration of PFOA in Ditch B is currently approximately 2,000 parts per trillion (ppt) while the average concentration of PFOS is approximately 130 ppt. The concentrations of PFOA and PFOS in the collapsed foam were 23,000 ppt for PFOA and 64,000 ppt for PFOS (**Table 1** and **Attachment 1**). As WDNR has previously observed in other locations within the state, PFAS concentrations in the foam have been measured to be 2,700 times higher than PFAS concentrations in surface water demonstrating the accumulation of PFAS in foam[3,4].

At a molecular level, PFAS collect at the air-water interface of bubbles[3,4] with PFAS suspended partially inside and partially outside the bubble. The figure below illustrates the molecular structure of PFOA and PFOS. PFAS molecules have two portions, one portion is water soluble with carbon atoms saturated with fluorine (the boxed portion in the figure below) while the smaller portion, which can be referred to as the “tail” is considered insoluble. When bubbles are created in water containing PFAS, the PFAS accumulates in the film of the bubble. The soluble portion of PFAS resides in the water portion in the film of the bubble, while the tail remains just outside the film.



The significance of the results includes:

1. Foam is naturally occurring in the environment
2. Some PFAS in the collected foam comes from historic FTC operations, the remainder is ubiquitous in the environment[1,2]
3. PFAS concentrations amplify in foam
4. Collecting and properly disposing of foams also removes PFAS from the environment because PFAS aggregates in foam



Advisory sign posted in Marinette, WI

The results reported here and other results referenced demonstrate the science underpinning some emerging PFAS remediation approaches. Specifically, recognizing the strong affinity of PFAS for foam, research groups and private industry are developing techniques to introduce bubbles and foaming agents to PFAS-impacted waters as a means of capturing and removing PFAS. This technology works due to the physical properties of PFAS as explained above, therefore the results presented indicating elevated concentrations of PFAS in foam are expected.

The Groundwater Extraction and Treatment System (GETS) is being constructed and implemented to improve surface water concentrations of PFAS in Ditch B and foam that is collected will continue to be monitored over time.

Tyco posted signs advising the public not to drink, play, or swim in the foam at multiple locations in the City of Marinette. Tyco also offered signs to homeowners with private ponds and select private property owners along area ditches. Tyco will work with WDNR to identify additional locations to augment the existing advisory sign network installed along the ditches as necessary.

Sincerely,
Arcadis U.S., Inc.

Scott T. Potter, PhD
Chief Hydrogeologist

Copies:
Bridget Kelly
Jeff Danko
Scott Wahl

Enclosures: Table 1 Foam Sample Results; Attachment 1 Laboratory Reports

Table 1 - Sample Results

	Location	DRUM 1
	Sample ID	DRUM 1 (051921)
	Sample Date	5/19/2021
	Sample Type	N
Lab EDD Chemical Name	Units	
Perfluorobutanoic acid (PFBA)	ng/l	< 5000 U
Perfluoropentanoic acid (PFPeA)	ng/l	540 J
Perfluoro-n-hexadecanoic acid (PFHxDA)	ng/l	< 2000 U
Perfluoroheptanoic acid (PFHpA)	ng/l	1300 J
Perfluorooctanoic acid (PFOA)	ng/l	23000
Perfluorononanoic acid (PFNA)	ng/l	15000
Perfluorodecanoic acid (PFDA)	ng/l	4200
Perfluoroundecanoic acid (PFUnA)	ng/l	2100
Perfluorododecanoic acid (PFDoA)	ng/l	< 2000 U
Perfluorotridecanoic acid (PFTriA)	ng/l	< 2000 U
Perfluorotetradecanoic acid (PFTeA)	ng/l	< 2000 U
Perfluorohexanoic acid (PFHxA)	ng/l	3400
Perfluoro-n-octadecanoic acid (PFODA)	ng/l	< 2000 U
Perfluorobutanesulfonic acid (PFBS)	ng/l	< 2000 U
Perfluoropentanesulfonic acid (PFPeS)	ng/l	< 2000 U
Perfluorohexanesulfonic acid (PFHxS)	ng/l	< 2000 U
Perfluoroheptanesulfonic Acid (PFHpS)	ng/l	240 J
Perfluorooctanesulfonic acid (PFOS)	ng/l	64000
Perfluorononanesulfonic acid (PFNS)	ng/l	< 2000 U
Perfluorodecanesulfonic acid (PFDS)	ng/l	< 2000 U
Perfluorododecanesulfonic acid (PFDoS)	ng/l	< 2000 U
Perfluorooctanesulfonamide (FOSA)	ng/l	7900
NEtFOSA	ng/l	< 2000 U
NMeFOSA	ng/l	< 2000 U
NMeFOSAA	ng/l	< 5000 U
NEtFOSAA	ng/l	4500 J
NMeFOSE	ng/l	< 4000 U
NEtFOSE	ng/l	< 2000 U
4:2 FTS	ng/l	< 2000 U
6:2 FTS	ng/l	47000
8:2 FTS	ng/l	45000 J-
10:2 FTS	ng/l	< 2000 U
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ng/l	< 2000 U
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ng/l	< 4000 U
F-53B Major	ng/l	< 2000 U
F-53B Minor	ng/l	< 2000 U
Arsenic	ug/l	19
Barium	ug/l	450
Cadmium	ug/l	< 2.5 U
Chromium	ug/l	14 J
Lead	ug/l	3.6
Selenium	ug/l	< 13 U
Silver	ug/l	< 2.5 U
Mercury	ug/l	< 0.20 U

Notes:
< = Compound not detected at reporting detection limit.
-- = No standard
N = Normal sample
ng/l = nanograms per liter
ug/l = micrograms per liter

Data Qualifier:
U = The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J- = The result is an estimated quantity. The associated numerical value is expected to have a negative or low bias.

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Tel: (708)534-5200

Laboratory Job ID: 500-199411-1
Client Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

For:
ARCADIS U.S., Inc.
126 North Jefferson Street
Suite 400
Milwaukee, Wisconsin 53202

Attn: Lisa Rutkowski

Sandra Fredrick

Authorized for release by:
5/28/2021 10:56:36 AM

Sandie Fredrick, Project Manager II
(920)261-1660
sandra.fredrick@eurofinset.com

Table of Contents

Case Narrative

Client: ARCADIS U.S., Inc.
Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Job ID: 500-199411-1

Laboratory: Eurofins TestAmerica, Chicago

Narrative

Job Narrative
500-199411-1

Comments
No additional comments.

Receipt
The sample was received on 5/20/2021 9:20 AM. Unless otherwise noted below, the sample arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 1.6º C.

Metals
Method 6020A: The following sample was diluted due to the nature of the sample matrix: Drum 1 (500-199411-1). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

LCMS
Method 537 (modified): Isotope Dilution Analyte (IDA) recovery is above the method recommended limit for M2-8:2 FTS in the following sample: Drum 1 (500-199411-1). The sample was re-analyzed with concurring results. As a result, the data may be potentially low biased for 8:2 FTS. The client was contacted and gave permission to report.

Method 537 (modified): Results for sample Drum 1 (500-199411-1) was reported from the analysis of a diluted extract due to high concentration of target analytes. The dilution factor was applied to the labeled internal standard area counts and these area counts were within acceptance limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
Method 3535: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 320-492294. 3535-PFC Aqueous

Method 3535: Due to the matrix, the initial volume used for the following sample deviated from the standard procedure: Drum 1 (500-199411-1). A 10x dilution was made on the sample, then fortified with IDA and extracted. The reporting limits (RLs) have been adjusted proportionately. preparation batch 320-492294 3535_PFC_28D Aqueous

Method 3535: Sample is Brown in color and opaque. Sample has a moderate amount of sediment. Drum 1 (500-199411-1) preparation batch 320-492294 3535_PFC_28D Aqueous

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Detection Summary

Client: ARCADIS U.S., Inc.
Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Client Sample ID: Drum 1
Lab Sample ID: 500-199411-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluoropentanoic acid (PFPeA)	540	J	2000	490	ng/L	100		537 (modified)	Total/NA
Perfluorohexanoic acid (PFHxA)	3400		2000	580	ng/L	100		537 (modified)	Total/NA
Perfluoroheptanoic acid (PFHpA)	1300	J	2000	250	ng/L	100		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	23000		2000	850	ng/L	100		537 (modified)	Total/NA
Perfluorononanoic acid (PFNA)	15000		2000	270	ng/L	100		537 (modified)	Total/NA
Perfluorodecanoic acid (PFDA)	4200		2000	310	ng/L	100		537 (modified)	Total/NA
Perfluoroundecanoic acid (PFUnA)	2100		2000	1100	ng/L	100		537 (modified)	Total/NA
Perfluoroheptanesulfonic Acid (PFHpS)	240	J	2000	190	ng/L	100		537 (modified)	Total/NA
Perfluorooctanesulfonic acid (PFOS)	64000		2000	540	ng/L	100		537 (modified)	Total/NA
Perfluorooctanesulfonamide (FOSA)	7900		2000	980	ng/L	100		537 (modified)	Total/NA
NEtFOSAA	4500	J	5000	1300	ng/L	100		537 (modified)	Total/NA
6:2 FTS	47000		5000	2500	ng/L	100		537 (modified)	Total/NA
8:2 FTS	45000		2000	460	ng/L	100		537 (modified)	Total/NA
Arsenic	19		5.0	1.2	ug/L	5		6020A	Total Recoverable
Barium	450		13	3.7	ug/L	5		6020A	Total Recoverable
Chromium	14	J	25	5.7	ug/L	5		6020A	Total Recoverable
Lead	3.6		2.5	0.93	ug/L	5		6020A	Total Recoverable

This Detection Summary does not include radiochemical test results.

Method Summary

Client: ARCADIS U.S., Inc.
Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Method	Method Description	Protocol	Laboratory
537 (modified)	Fluorinated Alkyl Substances	EPA	TAL SAC
6020A	Metals (ICP/MS)	SW846	TAL CHI
7470A	Mercury (CVAA)	SW846	TAL CHI
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	TAL CHI
3535	Solid-Phase Extraction (SPE)	SW846	TAL SAC
7470A	Preparation, Mercury	SW846	TAL CHI

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

TAL SAC = Eurofins TestAmerica, Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: ARCADIS U.S., Inc.
Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
500-199411-1	Drum 1	Water	05/19/21 13:05	05/20/21 09:20	

Client: ARCADIS U.S., Inc.
Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Client Sample ID: Drum 1
Date Collected: 05/19/21 13:05
Date Received: 05/20/21 09:20

Lab Sample ID: 500-199411-1
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	<5000		5000	2400	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluoropentanoic acid (PFPeA)	**540**	**J**	2000	490	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorohexanoic acid (PFHxA)	**3400**		2000	580	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluoroheptanoic acid (PFHpA)	**1300**	**J**	2000	250	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorooctanoic acid (PFOA)	**23000**		2000	850	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorononanoic acid (PFNA)	**15000**		2000	270	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorodecanoic acid (PFDA)	**4200**		2000	310	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluoroundecanoic acid (PFUnA)	**2100**		2000	1100	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorododecanoic acid (PFDoA)	<2000		2000	550	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorotridecanoic acid (PFTriA)	<2000		2000	1300	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorotetradecanoic acid (PFTeA)	<2000		2000	730	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluoro-n-hexadecanoic acid (PFHxDA)	<2000		2000	890	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluoro-n-octadecanoic acid (PFODA)	<2000		2000	940	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorobutanesulfonic acid (PFBS)	<2000		2000	200	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluoropentanesulfonic acid (PFPeS)	<2000		2000	300	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorohexanesulfonic acid (PFHxS)	<2000		2000	570	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluoroheptanesulfonic Acid (PFHpS)	**240**	**J**	2000	190	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorooctanesulfonic acid (PFOS)	**64000**		2000	540	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorononanesulfonic acid (PFNS)	<2000		2000	370	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorodecanesulfonic acid (PFDS)	<2000		2000	320	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorododecanesulfonic acid (PFDoS)	<2000		2000	970	ng/L		05/24/21 21:46	05/25/21 22:32	100
Perfluorooctanesulfonamide (FOSA)	**7900**		2000	980	ng/L		05/24/21 21:46	05/25/21 22:32	100
NEtFOSA	<2000		2000	870	ng/L		05/24/21 21:46	05/25/21 22:32	100
NMeFOSA	<2000		2000	430	ng/L		05/24/21 21:46	05/25/21 22:32	100
NMeFOSAA	<5000		5000	1200	ng/L		05/24/21 21:46	05/25/21 22:32	100
NEtFOSAA	**4500**	**J**	5000	1300	ng/L		05/24/21 21:46	05/25/21 22:32	100
NMeFOSE	<4000		4000	1400	ng/L		05/24/21 21:46	05/25/21 22:32	100
NEtFOSE	<2000		2000	850	ng/L		05/24/21 21:46	05/25/21 22:32	100
4:2 FTS	<2000		2000	240	ng/L		05/24/21 21:46	05/25/21 22:32	100
6:2 FTS	**47000**		5000	2500	ng/L		05/24/21 21:46	05/25/21 22:32	100
8:2 FTS	**45000**		2000	460	ng/L		05/24/21 21:46	05/25/21 22:32	100
10:2 FTS	<2000		2000	670	ng/L		05/24/21 21:46	05/25/21 22:32	100
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<2000		2000	400	ng/L		05/24/21 21:46	05/25/21 22:32	100
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	<4000		4000	1500	ng/L		05/24/21 21:46	05/25/21 22:32	100
F-53B Major	<2000		2000	240	ng/L		05/24/21 21:46	05/25/21 22:32	100
F-53B Minor	<2000		2000	320	ng/L		05/24/21 21:46	05/25/21 22:32	100

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*92*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C5 PFPeA	*89*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C2 PFHxA	*91*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C4 PFHpA	*66*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C4 PFOA	*105*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*

Client Sample ID: Drum 1
Date Collected: 05/19/21 13:05
Date Received: 05/20/21 09:20

Lab Sample ID: 500-199411-1
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C5 PFNA	*90*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C2 PFDA	*71*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C2 PFUnA	*79*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C2 PFDoA	*69*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C2 PFTeDA	*56*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C2 PFHxDA	*50*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C3 PFBS	*87*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
18O2 PFHxS	*76*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C4 PFOS	*79*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C8 FOSA	*92*		*10 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
d3-NMeFOSAA	*105*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
d5-NEtFOSAA	*89*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
d-N-MeFOSA-M	*47*		*10 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
d-N-EtFOSA-M	*60*		*10 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
d7-N-MeFOSE-M	*54*		*10 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
d9-N-EtFOSE-M	*57*		*10 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
M2-4:2 FTS	*97*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
M2-6:2 FTS	*86*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
M2-8:2 FTS	*238*	**5+*	*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C3 HFPO-DA	*75*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*
13C2 10:2 FTS	*90*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:32*	*100*

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**19**		5.0	1.2	ug/L		05/20/21 18:19	05/26/21 00:23	5
Barium	**450**		13	3.7	ug/L		05/20/21 18:19	05/25/21 18:43	5
Cadmium	<2.5		2.5	0.84	ug/L		05/20/21 18:19	05/25/21 18:43	5
Chromium	**14**	**J**	25	5.7	ug/L		05/20/21 18:19	05/25/21 18:43	5
Lead	**3.6**		2.5	0.93	ug/L		05/20/21 18:19	05/26/21 00:23	5
Selenium	<13		13	4.9	ug/L		05/20/21 18:19	05/26/21 00:23	5
Silver	<2.5		2.5	0.58	ug/L		05/20/21 18:19	05/25/21 18:43	5

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.20		0.20	0.098	ug/L		05/21/21 09:25	05/24/21 08:20	1

Definitions/Glossary

Client: ARCADIS U.S., Inc. Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Qualifiers

LCMS

Qualifier	Qualifier Description
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method: 537 (modified) - Fluorinated Alkyl Substances

Lab Sample ID: MB 320-492294/1-A
Matrix: Water
Analysis Batch: 492608

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 492294

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	<5.0		5.0	2.4	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluoropentanoic acid (PFPeA)	<2.0		2.0	0.49	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorohexanoic acid (PFHxA)	<2.0		2.0	0.58	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluoroheptanoic acid (PFHpA)	<2.0		2.0	0.25	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorooctanoic acid (PFOA)	<2.0		2.0	0.85	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorononanoic acid (PFNA)	<2.0		2.0	0.27	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorodecanoic acid (PFDA)	<2.0		2.0	0.31	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluoroundecanoic acid (PFUnA)	<2.0		2.0	1.1	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorododecanoic acid (PFDoA)	<2.0		2.0	0.55	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorotridecanoic acid (PFTriA)	<2.0		2.0	1.3	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorotetradecanoic acid (PFTeA)	<2.0		2.0	0.73	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluoro-n-hexadecanoic acid (PFHxDA)	<2.0		2.0	0.89	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluoro-n-octadecanoic acid (PFODA)	<2.0		2.0	0.94	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorobutanesulfonic acid (PFBS)	<2.0		2.0	0.20	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluoropentanesulfonic acid (PFPeS)	<2.0		2.0	0.30	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorohexanesulfonic acid (PFHxS)	<2.0		2.0	0.57	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluoroheptanesulfonic Acid (PFHpS)	<2.0		2.0	0.19	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorooctanesulfonic acid (PFOS)	<2.0		2.0	0.54	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorononanesulfonic acid (PFNS)	<2.0		2.0	0.37	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorodecanesulfonic acid (PFDS)	<2.0		2.0	0.32	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorododecanesulfonic acid (PFDoS)	<2.0		2.0	0.97	ng/L		05/24/21 21:46	05/25/21 22:04	1
Perfluorooctanesulfonamide (FOSA)	<2.0		2.0	0.98	ng/L		05/24/21 21:46	05/25/21 22:04	1
NEtFOSA	<2.0		2.0	0.87	ng/L		05/24/21 21:46	05/25/21 22:04	1
NMeFOSA	<2.0		2.0	0.43	ng/L		05/24/21 21:46	05/25/21 22:04	1
NMeFOSAA	<5.0		5.0	1.2	ng/L		05/24/21 21:46	05/25/21 22:04	1
NEtFOSAA	<5.0		5.0	1.3	ng/L		05/24/21 21:46	05/25/21 22:04	1
NMeFOSE	<4.0		4.0	1.4	ng/L		05/24/21 21:46	05/25/21 22:04	1
NEtFOSE	<2.0		2.0	0.85	ng/L		05/24/21 21:46	05/25/21 22:04	1
4:2 FTS	<2.0		2.0	0.24	ng/L		05/24/21 21:46	05/25/21 22:04	1
6:2 FTS	<5.0		5.0	2.5	ng/L		05/24/21 21:46	05/25/21 22:04	1
8:2 FTS	<2.0		2.0	0.46	ng/L		05/24/21 21:46	05/25/21 22:04	1
10:2 FTS	<2.0		2.0	0.67	ng/L		05/24/21 21:46	05/25/21 22:04	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	<2.0		2.0	0.40	ng/L		05/24/21 21:46	05/25/21 22:04	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	<4.0		4.0	1.5	ng/L		05/24/21 21:46	05/25/21 22:04	1
F-53B Major	<2.0		2.0	0.24	ng/L		05/24/21 21:46	05/25/21 22:04	1
F-53B Minor	<2.0		2.0	0.32	ng/L		05/24/21 21:46	05/25/21 22:04	1

Isotope Dilution	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*91*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:04*	*1*
13C5 PFPeA	*86*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:04*	*1*
13C2 PFHxA	*84*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:04*	*1*
13C4 PFHpA	*90*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:04*	*1*
13C4 PFOA	*96*		*25 - 150*	*05/24/21 21:46*	*05/25/21 22:04*	*1*

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: MB 320-492294/1-A
Matrix: Water
Analysis Batch: 492608

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 492294

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C5 PFNA	91		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C2 PFDA	92		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C2 PFUnA	84		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C2 PFDoA	91		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C2 PFTeDA	88		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C2 PFHxDA	100		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C3 PFBS	82		25 - 150	05/24/21 21:46	05/25/21 22:04	1
18O2 PFHxS	90		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C4 PFOS	85		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C8 FOSA	95		10 - 150	05/24/21 21:46	05/25/21 22:04	1
d3-NMeFOSAA	90		25 - 150	05/24/21 21:46	05/25/21 22:04	1
d5-NEtFOSAA	90		25 - 150	05/24/21 21:46	05/25/21 22:04	1
d-N-MeFOSA-M	79		10 - 150	05/24/21 21:46	05/25/21 22:04	1
d-N-EtFOSA-M	76		10 - 150	05/24/21 21:46	05/25/21 22:04	1
d7-N-MeFOSE-M	85		10 - 150	05/24/21 21:46	05/25/21 22:04	1
d9-N-EtFOSE-M	75		10 - 150	05/24/21 21:46	05/25/21 22:04	1
M2-4:2 FTS	99		25 - 150	05/24/21 21:46	05/25/21 22:04	1
M2-6:2 FTS	104		25 - 150	05/24/21 21:46	05/25/21 22:04	1
M2-8:2 FTS	99		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C3 HFPO-DA	85		25 - 150	05/24/21 21:46	05/25/21 22:04	1
13C2 10:2 FTS	101		25 - 150	05/24/21 21:46	05/25/21 22:04	1

Lab Sample ID: LCS 320-492294/2-A
Matrix: Water
Analysis Batch: 492608

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 492294

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Perfluorobutanoic acid (PFBA)	40.0	41.4		ng/L		104	60 - 135
Perfluoropentanoic acid (PFPeA)	40.0	40.7		ng/L		102	60 - 135
Perfluorohexanoic acid (PFHxA)	40.0	44.6		ng/L		112	60 - 135
Perfluoroheptanoic acid (PFHpA)	40.0	44.6		ng/L		112	60 - 135
Perfluorooctanoic acid (PFOA)	40.0	39.6		ng/L		99	60 - 135
Perfluorononanoic acid (PFNA)	40.0	43.8		ng/L		110	60 - 135
Perfluorodecanoic acid (PFDA)	40.0	41.1		ng/L		103	60 - 135
Perfluoroundecanoic acid (PFUnA)	40.0	43.3		ng/L		108	60 - 135
Perfluorododecanoic acid (PFDoA)	40.0	43.1		ng/L		108	60 - 135
Perfluorotridecanoic acid (PFTriA)	40.0	47.4		ng/L		119	60 - 135
Perfluorotetradecanoic acid (PFTeA)	40.0	43.1		ng/L		108	60 - 135
Perfluoro-n-hexadecanoic acid (PFHxDA)	40.0	42.1		ng/L		105	60 - 135
Perfluoro-n-octadecanoic acid (PFODA)	40.0	43.5		ng/L		109	60 - 135
Perfluorobutanesulfonic acid (PFBS)	35.4	39.3		ng/L		111	60 - 135
Perfluoropentanesulfonic acid (PFPeS)	37.5	47.9		ng/L		128	60 - 135

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCS 320-492294/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 492608 **Prep Batch: 492294**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Perfluorohexanesulfonic acid (PFHxS)	36.4	41.2		ng/L		113	60 - 135
Perfluoroheptanesulfonic Acid (PFHpS)	38.1	38.5		ng/L		101	60 - 135
Perfluorooctanesulfonic acid (PFOS)	37.1	38.9		ng/L		105	60 - 135
Perfluorononanesulfonic acid (PFNS)	38.4	43.1		ng/L		112	60 - 135
Perfluorodecanesulfonic acid (PFDS)	38.6	38.3		ng/L		99	60 - 135
Perfluorododecanesulfonic acid (PFDoS)	38.7	41.1		ng/L		106	60 - 135
Perfluorooctanesulfonamide (FOSA)	40.0	39.1		ng/L		98	60 - 135
NEtFOSA	40.0	44.8		ng/L		112	60 - 135
NMeFOSA	40.0	41.2		ng/L		103	60 - 135
NMeFOSAA	40.0	44.5		ng/L		111	60 - 135
NEtFOSAA	40.0	42.9		ng/L		107	60 - 135
NMeFOSE	40.0	40.6		ng/L		102	60 - 135
NEtFOSE	40.0	44.3		ng/L		111	60 - 135
4:2 FTS	37.4	39.3		ng/L		105	60 - 135
6:2 FTS	37.9	37.9		ng/L		100	60 - 135
8:2 FTS	38.3	42.7		ng/L		111	60 - 135
10:2 FTS	38.6	36.0		ng/L		93	60 - 135
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	37.7	40.2		ng/L		107	60 - 135
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	40.0	47.3		ng/L		118	60 - 135
F-53B Major	37.3	44.7		ng/L		120	60 - 135
F-53B Minor	37.7	38.6		ng/L		103	60 - 135

Isotope Dilution	*LCS %Recovery*	*LCS Qualifier*	*Limits*
13C4 PFBA	*90*		*25 - 150*
13C5 PFPeA	*88*		*25 - 150*
13C2 PFHxA	*89*		*25 - 150*
13C4 PFHpA	*90*		*25 - 150*
13C4 PFOA	*94*		*25 - 150*
13C5 PFNA	*89*		*25 - 150*
13C2 PFDA	*93*		*25 - 150*
13C2 PFUnA	*85*		*25 - 150*
13C2 PFDoA	*87*		*25 - 150*
13C2 PFTeDA	*88*		*25 - 150*
13C2 PFHxDA	*100*		*25 - 150*
13C3 PFBS	*85*		*25 - 150*
18O2 PFHxS	*87*		*25 - 150*
13C4 PFOS	*90*		*25 - 150*
13C8 FOSA	*94*		*10 - 150*
d3-NMeFOSAA	*87*		*25 - 150*
d5-NEtFOSAA	*86*		*25 - 150*
d-N-MeFOSA-M	*79*		*10 - 150*
d-N-EtFOSA-M	*76*		*10 - 150*

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCS 320-492294/2-A
Matrix: Water
Analysis Batch: 492608

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 492294

Isotope Dilution	*LCS %Recovery*	*LCS Qualifier*	*Limits*
d7-N-MeFOSE-M	*77*		*10 - 150*
d9-N-EtFOSE-M	*75*		*10 - 150*
M2-4:2 FTS	*85*		*25 - 150*
M2-6:2 FTS	*95*		*25 - 150*
M2-8:2 FTS	*86*		*25 - 150*
13C3 HFPO-DA	*88*		*25 - 150*
13C2 10:2 FTS	*98*		*25 - 150*

Lab Sample ID: LCSD 320-492294/3-A
Matrix: Water
Analysis Batch: 492608

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 492294

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Perfluorobutanoic acid (PFBA)			40.0	41.6		ng/L		104	60 - 135	0	30
Perfluoropentanoic acid (PFPeA)			40.0	41.8		ng/L		104	60 - 135	3	30
Perfluorohexanoic acid (PFHxA)			40.0	41.8		ng/L		104	60 - 135	7	30
Perfluoroheptanoic acid (PFHpA)			40.0	42.2		ng/L		105	60 - 135	6	30
Perfluorooctanoic acid (PFOA)			40.0	41.3		ng/L		103	60 - 135	4	30
Perfluorononanoic acid (PFNA)			40.0	41.9		ng/L		105	60 - 135	4	30
Perfluorodecanoic acid (PFDA)			40.0	42.2		ng/L		105	60 - 135	2	30
Perfluoroundecanoic acid (PFUnA)			40.0	47.6		ng/L		119	60 - 135	10	30
Perfluorododecanoic acid (PFDoA)			40.0	44.8		ng/L		112	60 - 135	4	30
Perfluorotridecanoic acid (PFTriA)			40.0	43.9		ng/L		110	60 - 135	8	30
Perfluorotetradecanoic acid (PFTeA)			40.0	45.4		ng/L		114	60 - 135	5	30
Perfluoro-n-hexadecanoic acid (PFHxDA)			40.0	40.0		ng/L		100	60 - 135	5	30
Perfluoro-n-octadecanoic acid (PFODA)			40.0	42.2		ng/L		105	60 - 135	3	30
Perfluorobutanesulfonic acid (PFBS)			35.4	39.5		ng/L		112	60 - 135	1	30
Perfluoropentanesulfonic acid (PFPeS)			37.5	41.2		ng/L		110	60 - 135	15	30
Perfluorohexanesulfonic acid (PFHxS)			36.4	37.6		ng/L		103	60 - 135	9	30
Perfluoroheptanesulfonic Acid (PFHpS)			38.1	43.8		ng/L		115	60 - 135	13	30
Perfluorooctanesulfonic acid (PFOS)			37.1	43.5		ng/L		117	60 - 135	11	30
Perfluorononanesulfonic acid (PFNS)			38.4	44.7		ng/L		116	60 - 135	4	30
Perfluorodecanesulfonic acid (PFDS)			38.6	43.3		ng/L		112	60 - 135	12	30
Perfluorododecanesulfonic acid (PFDoS)			38.7	40.8		ng/L		105	60 - 135	1	30
Perfluorooctanesulfonamide (FOSA)			40.0	37.4		ng/L		94	60 - 135	4	30
NEtFOSA			40.0	44.7		ng/L		112	60 - 135	0	30
NMeFOSA			40.0	41.5		ng/L		104	60 - 135	1	30
NMeFOSAA			40.0	41.9		ng/L		105	60 - 135	6	30

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCSD 320-492294/3-A
Matrix: Water
Analysis Batch: 492608

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 492294

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
NEtFOSAA			40.0	47.1		ng/L		118	60 - 135	9	30
NMeFOSE			40.0	38.7		ng/L		97	60 - 135	5	30
NEtFOSE			40.0	46.1		ng/L		115	60 - 135	4	30
4:2 FTS			37.4	38.4		ng/L		103	60 - 135	2	30
6:2 FTS			37.9	35.4		ng/L		93	60 - 135	7	30
8:2 FTS			38.3	43.7		ng/L		114	60 - 135	2	30
10:2 FTS			38.6	40.7		ng/L		106	60 - 135	12	30
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)			37.7	44.6		ng/L		118	60 - 135	10	30
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)			40.0	38.2		ng/L		96	60 - 135	21	30
F-53B Major			37.3	45.9		ng/L		123	60 - 135	3	30
F-53B Minor			37.7	44.2		ng/L		117	60 - 135	13	30

Isotope Dilution	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
13C4 PFBA	*96*		*25 - 150*
13C5 PFPeA	*96*		*25 - 150*
13C2 PFHxA	*98*		*25 - 150*
13C4 PFHpA	*90*		*25 - 150*
13C4 PFOA	*95*		*25 - 150*
13C5 PFNA	*89*		*25 - 150*
13C2 PFDA	*91*		*25 - 150*
13C2 PFUnA	*81*		*25 - 150*
13C2 PFDoA	*86*		*25 - 150*
13C2 PFTeDA	*83*		*25 - 150*
13C2 PFHxDA	*95*		*25 - 150*
13C3 PFBS	*91*		*25 - 150*
18O2 PFHxS	*89*		*25 - 150*
13C4 PFOS	*84*		*25 - 150*
13C8 FOSA	*95*		*10 - 150*
d3-NMeFOSAA	*98*		*25 - 150*
d5-NEtFOSAA	*87*		*25 - 150*
d-N-MeFOSA-M	*82*		*10 - 150*
d-N-EtFOSA-M	*71*		*10 - 150*
d7-N-MeFOSE-M	*77*		*10 - 150*
d9-N-EtFOSE-M	*74*		*10 - 150*
M2-4:2 FTS	*92*		*25 - 150*
M2-6:2 FTS	*103*		*25 - 150*
M2-8:2 FTS	*97*		*25 - 150*
13C3 HFPO-DA	*101*		*25 - 150*
13C2 10:2 FTS	*91*		*25 - 150*

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 500-600086/1-A
Matrix: Water
Analysis Batch: 600816

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 600086

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Barium	<2.5		2.5	0.73	ug/L		05/20/21 18:19	05/25/21 18:36	1

Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 500-600086/1-A
Matrix: Water
Analysis Batch: 600816

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 600086

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	<0.50		0.50	0.17	ug/L		05/20/21 18:19	05/25/21 18:36	1
Chromium	<5.0		5.0	1.1	ug/L		05/20/21 18:19	05/25/21 18:36	1
Silver	<0.50		0.50	0.12	ug/L		05/20/21 18:19	05/25/21 18:36	1

Lab Sample ID: MB 500-600086/1-A
Matrix: Water
Analysis Batch: 600933

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 600086

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<1.0		1.0	0.23	ug/L		05/20/21 18:19	05/26/21 00:16	1
Lead	<0.50		0.50	0.19	ug/L		05/20/21 18:19	05/26/21 00:16	1
Selenium	<2.5		2.5	0.98	ug/L		05/20/21 18:19	05/26/21 00:16	1

Lab Sample ID: LCS 500-600086/2-A
Matrix: Water
Analysis Batch: 600816

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 600086

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Barium	2000	2000		ug/L		100	80 - 120
Cadmium	50.0	49.7		ug/L		99	80 - 120
Chromium	200	204		ug/L		102	80 - 120
Silver	50.0	51.3		ug/L		103	80 - 120

Lab Sample ID: LCS 500-600086/2-A
Matrix: Water
Analysis Batch: 600933

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 600086

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	100	94.8		ug/L		95	80 - 120
Lead	100	107		ug/L		107	80 - 120
Selenium	100	96.7		ug/L		97	80 - 120

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 500-600211/12-A
Matrix: Water
Analysis Batch: 600524

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 600211

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.20		0.20	0.098	ug/L		05/21/21 09:25	05/24/21 08:16	1

Lab Sample ID: LCS 500-600211/13-A
Matrix: Water
Analysis Batch: 600524

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 600211

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	2.00	2.09		ug/L		105	80 - 120

Lab Chronicle

Client: ARCADIS U.S., Inc.
Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Client Sample ID: Drum 1
Date Collected: 05/19/21 13:05
Date Received: 05/20/21 09:20

Lab Sample ID: 500-199411-1
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			492294	05/24/21 21:46	JER	TAL SAC
Total/NA	Analysis	537 (modified)		100	492608	05/25/21 22:32	RS1	TAL SAC
Total Recoverable	Prep	3005A			600086	05/20/21 18:19	LMN	TAL CHI
Total Recoverable	Analysis	6020A		5	600816	05/25/21 18:43	FXG	TAL CHI
Total Recoverable	Prep	3005A			600086	05/20/21 18:19	LMN	TAL CHI
Total Recoverable	Analysis	6020A		5	600933	05/26/21 00:23	FXG	TAL CHI
Total/NA	Prep	7470A			600211	05/21/21 09:25	MJG	TAL CHI
Total/NA	Analysis	7470A		1	600524	05/24/21 08:20	MJG	TAL CHI

Laboratory References:

TAL CHI = Eurofins TestAmerica, Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

TAL SAC = Eurofins TestAmerica, Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Accreditation/Certification Summary

Client: ARCADIS U.S., Inc. Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Laboratory: Eurofins TestAmerica, Chicago

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wisconsin	State	999580010	08-31-21

Laboratory: Eurofins TestAmerica, Sacramento

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Wisconsin	State	998204680	08-31-21

Eurofins TestAmerica, Chicago
2417 Bond Street

University Park, IL 60484-3101
phone 708 534 5200 fax 708 534 5211

Chain of Custody Record

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Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TestAmerica Laboratories, Inc. d/b/a Eurofins TestAmerica

Client Contact	Project Manager: Lisa Rutkowski	Sampler: Jacob Ramminger	Date: 5-19-21	COC No 1
Arcadis U S , Inc	Email: N/A	Lab Contact: Sandie Fredrick	Carrier: FedEx	1 of 1 COCs
126 North Jefferson Street, Suite 400	Tel/Fax: N/A			
Milwaukee, WI 53202	Analysis Turnaround Time			For Lab Use Only:
Phone	☑ CALENDAR DAYS ☐ WORKING DAYS			Walk-in Client.
FAX	TAT if different from Below			Lab Sampling
Project Name Marinette, WI	☐ 2 weeks			Lab Project Number
Site Marinette, WI	☑ 1 week			50018970
P O # 30015296 00016 (Collapsed Foam)	☐ 2 days ☐ 1 day			500-199411 Sample Specific Notes

500-199411 COC

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	EPA 537 Modified (36 Compounds)	RCRA Metals (6020A, 7470A)
Drum 1	5-19-21	1305	G	W	3	N	N	X	X
								-	4

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact ☐ Yes ☐ No	Custody Seal No	Cooler Temp (°C) Obs'd 1.6	Corr'd. _____	Therm ID No _____
Relinquished by Jacob Ramminger	Company Barley Excavating	Date/Time 5-19-21 1330	Received by Fed Ex	Company / Date/Time
Relinquished by	Company	Date/Time	Received by	Company / Date/Time
Relinquished by:	Company	Date/Time	Received in Laboratory by Ellen Scott	Company EAT-CHI / Date/Time 5/20/21 0920

ORIGIN ID:PHDA (906) 863-9373
JOE BARLEY
BARLEY EXCAVATING
1824 10TH AVE

MENOMINEE, MI 49858
UNITED STATES US

SHIP DATE: 11MAR21
ACTWGT: 10.00 LB MAN
CAD: 0562071/CAFE3409

TO

EUROFINS TESTAMERICA CHICAGO
2417 BOND STREET

UNIVERSITY PARK IL 604843101
(708) 534-5200
REF: 8600 - 90001

500-199411 Wayb

RMA:

FedEx Expres

FedEx
TRK# 0221 9509 0062 7990

RETURNS MON-SA
THU - 20 MAY AA
PRIORITY OVERNIGHT

NA JOTA

60484
IL-US
ORD

FID: 647290 19May2021 GRBA 56DG3/71DC/1B23

48qt.

Eurofins TestAmerica, Chicago
2417 Bond Street
University Park, IL 60484
Phone: 708-534-5200 Fax: 708-534-5211

Chain of Custody Record

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Client Information (Sub Contract Lab)	Sampler:	Lab PM: Fredrick, Sandie	Carrier Tracking No(s):	COC No: 500-148838.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: sandra.fredrick@eurofinset.com	State of Origin: Wisconsin	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note): State - Wisconsin; State Program - Wisconsin		Job #: 500-199411-1
Address: 880 Riverside Parkway, ,	Due Date Requested: 5/27/2021			
City: West Sacramento	TAT Requested (days):			
State, Zip: CA, 95605				
Phone: 916-373-5600(Tel) 916-372-1059(Fax)	PO #:			
Email:	WO #:			
Project Name: Marinette, WI 30015296.00016 Collapsed Foam	Project #: 50018970			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	PFC_IDA_WI3535_PFC_28D PFAS, Standard List (36 Analytes)	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
Drum 1 (500-199411-1)	5/19/21	13:05 Central		Water			X	2	REPORT ALL DILUTIONS

Note: Since laboratory accreditations are subject to change, Eurofins TestAmerica places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins TestAmerica attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to Eurofins TestAmerica.

Possible Hazard Identification *Unconfirmed*	***Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)*** ☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* _____ *Months*
Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:		Date:	Time:	Method of Shipment:	
Relinquished by:	Date/Time: 5/20/21 1600	Company ETA	Received by:	Date/Time: 5-21-21 0935	Company ETASAC
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: 1451723 | Cooler Temperature(s) °C and Other Remarks: 1.2

Ver: 11/01/2020

Login Sample Receipt Checklist

Client: ARCADIS U.S., Inc.

Job Number: 500-199411-1

Login Number: 199411
List Number: 1
Creator: Scott, Sherri L

List Source: Eurofins TestAmerica, Chicago

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	1.6
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: ARCADIS U.S., Inc.

Job Number: 500-199411-1

Login Number: 199411
List Number: 2
Creator: Cahill, Nicholas P

List Source: Eurofins TestAmerica, Sacramento
List Creation: 05/21/21 06:05 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	1451723
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	1.2c
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	Received project as a subcontract.
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

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Sacramento Sample Receiving Notes

500-199411 Field Sheet

Job: _____

Tracking # : 1893 4452 0099

SO / PO / FO / SAT / 2-Day / Ground / UPS / CDO / Courier

GSO / OnTrac / Goldstreak / USPS / Other _____

Use this form to record Sample Custody Seal, Cooler Custody Seal, Temperature & corrected Temperature & other observations. File in the job folder with the COC.

Therm. ID: c-07 Corr. Factor: (+ / -) N/A °C

Ice ✓ Wet ✓ Gel _____ Other _____

Cooler Custody Seal: 1451723

Cooler ID: —

Temp Observed: 1.2 °C Corrected: 1.2 °C

From: Temp Blank ☐ Sample ☑

Opening/Processing The Shipment	Yes	No	NA
Cooler compromised/tampered with?	☐	☑	☐
Cooler Temperature is acceptable?	☑	☐	☐
Frozen samples show signs of thaw?	☐	☐	☑

Initials: NC Date: 5-21-21

Unpacking/Labeling The Samples	Yes	No	NA
CoC is complete w/o discrepancies?	☑	☐	☐
Samples compromised/tampered with?	☐	☑	☐
Sample containers have legible labels?	☑	☐	☐
Sample custody seal?	☐	☐	☑
Containers are not broken or leaking?	☑	☐	☐
Sample date/times are provided?	☑	☐	☐
Appropriate containers are used?	☑	☐	☐
Sample bottles are completely filled?	☑	☐	☐
Sample preservatives verified?	☐	☐	☑
Samples w/o discrepancies?	☑	☐	☐
Zero headspace?*	☐	☐	☑
Alkalinity has no headspace?	☐	☐	☑
Perchlorate has headspace? (Methods 314, 331, 6850)	☐	☐	☑
Multiphasic samples are not present?	☑	☐	☐

*Containers requiring zero headspace have no headspace, or bubble < 6 mm (1/4")

Initials: JH Date: 5/21/21

Notes: _____

Trizma Lot #(s): _____

Login Completion	Yes	No	NA
Receipt Temperature on COC?	☑	☐	☐
Samples received within hold time?	☑	☐	☐
NCM Filed?	☐	☐	☑
Log Release checked in TALS?	☑	☐	☐

Initials: JH Date: 5/21/21

Isotope Dilution Summary

Client: ARCADIS U.S., Inc.
Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

Method: 537 (modified) - Fluorinated Alkyl Substances

Matrix: Water **Prep Type: Total/NA**

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	PFBA (25-150)	PFPeA (25-150)	PFHxA (25-150)	C4PFHA (25-150)	PFOA (25-150)	PFNA (25-150)	PFDA (25-150)	PFUnA (25-150)
500-199411-1	Drum 1	92	89	91	66	105	90	71	79
LCS 320-492294/2-A	Lab Control Sample	90	88	89	90	94	89	93	85
LCSD 320-492294/3-A	Lab Control Sample Dup	96	96	98	90	95	89	91	81
MB 320-492294/1-A	Method Blank	91	86	84	90	96	91	92	84

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	PFDoA (25-150)	PFTDA (25-150)	PFHxDA (25-150)	C3PFBS (25-150)	PFHxS (25-150)	PFOS (25-150)	PFOSA (10-150)	d3NMFOS (25-150)
500-199411-1	Drum 1	69	56	50	87	76	79	92	105
LCS 320-492294/2-A	Lab Control Sample	87	88	100	85	87	90	94	87
LCSD 320-492294/3-A	Lab Control Sample Dup	86	83	95	91	89	84	95	98
MB 320-492294/1-A	Method Blank	91	88	100	82	90	85	95	90

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	d5NEFOS (25-150)	dMeFOSA (10-150)	dEtFOSA (10-150)	NMFM (10-150)	NEFM (10-150)	M242FTS (25-150)	M262FTS (25-150)	M282FTS (25-150)
500-199411-1	Drum 1	89	47	60	54	57	97	86	238 *5+
LCS 320-492294/2-A	Lab Control Sample	86	79	76	77	75	85	95	86
LCSD 320-492294/3-A	Lab Control Sample Dup	87	82	71	77	74	92	103	97
MB 320-492294/1-A	Method Blank	90	79	76	85	75	99	104	99

		Percent Isotope Dilution Recovery (Acceptance Limits)	
Lab Sample ID	Client Sample ID	HFPODA (25-150)	M102FTS (25-150)
500-199411-1	Drum 1	75	90
LCS 320-492294/2-A	Lab Control Sample	88	98
LCSD 320-492294/3-A	Lab Control Sample Dup	101	91
MB 320-492294/1-A	Method Blank	85	101

Surrogate Legend

PFBA = 13C4 PFBA
PFPeA = 13C5 PFPeA
PFHxA = 13C2 PFHxA
C4PFHA = 13C4 PFHpA
PFOA = 13C4 PFOA
PFNA = 13C5 PFNA
PFDA = 13C2 PFDA
PFUnA = 13C2 PFUnA
PFDoA = 13C2 PFDoA
PFTDA = 13C2 PFTeDA
PFHxDA = 13C2 PFHxDA
C3PFBS = 13C3 PFBS
PFHxS = 18O2 PFHxS
PFOS = 13C4 PFOS
PFOSA = 13C8 FOSA
d3NMFOS = d3-NMeFOSAA
d5NEFOS = d5-NEtFOSAA
dMeFOSA = d-N-MeFOSA-M
dEtFOSA = d-N-EtFOSA-M
NMFM = d7-N-MeFOSE-M
NEFM = d9-N-EtFOSE-M
M242FTS = M2-4:2 FTS

Isotope Dilution Summary

Client: ARCADIS U.S., Inc.
Job ID: 500-199411-1
Project/Site: Marinette, WI 30015296.00016 Collapsed Foam

M262FTS = M2-6:2 FTS
M282FTS = M2-8:2 FTS
HFPODA = 13C3 HFPO-DA
M102FTS = 13C2 10:2 FTS