

Investigation of PFAS in the Flint River

Surface Water Sampling Update

Background

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) are a very large class of man-made organic chemicals that have been used in numerous industrial processes and consumer products for over 60 years. Validated analytical methods are available for relatively few of the thousands of compounds. Much of the environmental monitoring of PFAS in Michigan has focused on measuring only perfluorinated chemicals.

Many PFAS are persistent, some bioaccumulate in the environment, and several are toxic to mammals and/or birds in laboratory tests. The toxicities of most PFAS have not been evaluated. Two perfluorinated compounds; perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), have been the subject of the most toxicological work and environmental monitoring. Both compounds were manufactured intentionally, but they can also be generated as byproducts when other fluorinated compounds break down. Many products containing PFAS are used in numerous industrial processes including metal plating, textile production and treatment, and specialty paper production. Industrial and domestic waste containing these compounds can enter the environment through municipal or private waste treatment systems, stormwater runoff, venting groundwater, or as atmospheric deposition via emissions. In addition, several PFAS are key ingredients in Aqueous Film-Forming Foam. These foams have been used extensively in fire suppression training exercises at military bases nationwide as well as in emergency firefighting. In recent years PFAS have been detected in surface and groundwater near many military facilities. Both PFOS and PFOA have been measured in surface waters across the state, and PFOS has been detected in most fish tissue samples from Michigan waters that have been analyzed for PFAS.

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) has generated Rule 57 surface water quality values (WQV) for the protection of human health and aquatic life, as listed in Table 1. Rule 57 WQV (listed in nanograms per liter (ng/L), which is equivalent to parts per trillion) are available for PFOS, PFOA, perfluorobutane sulfonate (PFBS), perfluorohexanesulphonic acid (PFHxS), and perfluorononanoic acid (PFNA)..

Table 1. Rule 57 WQV for PFAS

PFAS	Human Noncancer Value (HNV) Drinking (ng/L)	HNV Nondrinking (ng/L)	Final Chronic Value (FCV) (ng/L)	Aquatic Maximum Value (AMV) (ng/L)	Final Acute Value (FAV) (ng/L)
PFOS	11	12	140,000	780,000	1,600,000
PFOA	66	170	880,000	7,700,000	15,000,000
PFBS	8,300	670,000	24,000,000	120,000,000	240,000,000
PFHxS	59	210	-	-	-
PFNA	19	30	-	-	-

(-) Aquatic Life Values for PFHxS and PFNA are currently under development

The HNV Drinking is applied to surface waters of the Great Lakes, Connecting Channels, within 3,000 feet of a drinking water intake, and as deemed necessary by the Department. The HNV Nondrinking is applied to all other surface waters of the State. The AMV is the highest concentration of a substance to which an aquatic community can be exposed briefly without resulting in adverse effects, whereas the FCV is the highest concentration of a substance to which an aquatic community can be exposed for a long period of time without experiencing adverse effects. The FAV is the value applied directly at the end of an effluent point source for EGLE discharge permitting purposes.

Flint River Investigation

In 2023, during sampling for PFAS in outfalls discharging to the Flint River, elevated concentrations of PFOS, up to 79,000 ng/L, were observed in samples associated with RACER Buick City. Ongoing projects within the area may have led to changes in hydrology since surface water samples were last collected from this portion of the Flint River in 2021. Historical surface water sampling results from the Flint River are listed in Table 2 and shown in Figure 1. The Michigan Department of Health and Human Services' fish consumption guidelines due to chemical contamination, including PFOS, are available for anglers fishing in the Flint River downstream of the Mott Dam. Please refer to the Eat Safe Fish guides for the latest advisory information.

The objectives of this sampling plan were to determine if and to what extent surface water PFAS concentrations have changed in comparison to historical data and the extent of PFAS surface water contamination in the area near the RACER Buick City Michigan PFAS Action Response Team (MPART) Site. Specifically, the Flint River was sampled downstream of stormwater outfalls at the sampling locations listed in Table 3.

Samples were collected in accordance with the EGLE Surface Water PFAS Sampling Guidance document (EGLE, 2022a). Each sample was collected in two polypropylene vials (certified PFAS-free). All personnel handling sample bottles used nitrile gloved hands. One duplicate and one replicate sample were collected. Sites were randomly selected for the duplicate and replicate sample.

All samples were delivered to the EGLE Environmental Laboratory within the required holding period for surface water PFAS samples. Samples were analyzed for selected PFAS, as described in the Quality Assurance Project Plan (EGLE, 2022b) and listed in Table 4.

Surface water sampling results for select PFAS (PFOS, PFOA, PFBS, PFHxS, and PFNA) are listed in Table 3 and shown in Figure 2. Two sampling locations, 23-FR-0357 and 23-FR-0355, on the Flint River near the RACER Buick City MPART Site exceeded the Rule 57 HNV (nondrinking) WQV for PFOS. One of these locations also exceeded the Rule 57 HNV (nondrinking) WQV for PFOA and PFHxS. These locations were downstream of an outfall located at 43.031302, -83.684026. Comparing the surface water sampling results from equivalent historical and 2024 sampling locations, PFAS concentrations appeared to be consistent and below Rule 57 HNV (nondrinking) WQV (outside of sampling locations 23-FR-0357 and 23-FR-0355, where PFAS concentrations were observed above Rule 57 HNV (nondrinking) WQV and no historical data was available). Sampling location 23-GC-0010 had a surface water PFOS concentration of 11 ng/L, which is consistent with known upstream sources and historic results (which range from 5.5 to 25.0 ng/L PFOS).

References

EGLE. 2022a. Surface Water PFAS Sampling Guidance.

EGLE. 2022. Michigan Surface Water Perfluoroalkyl and Polyfluoroalkyl Compound (PFAS) Investigation: Quality Assurance Project Plan.

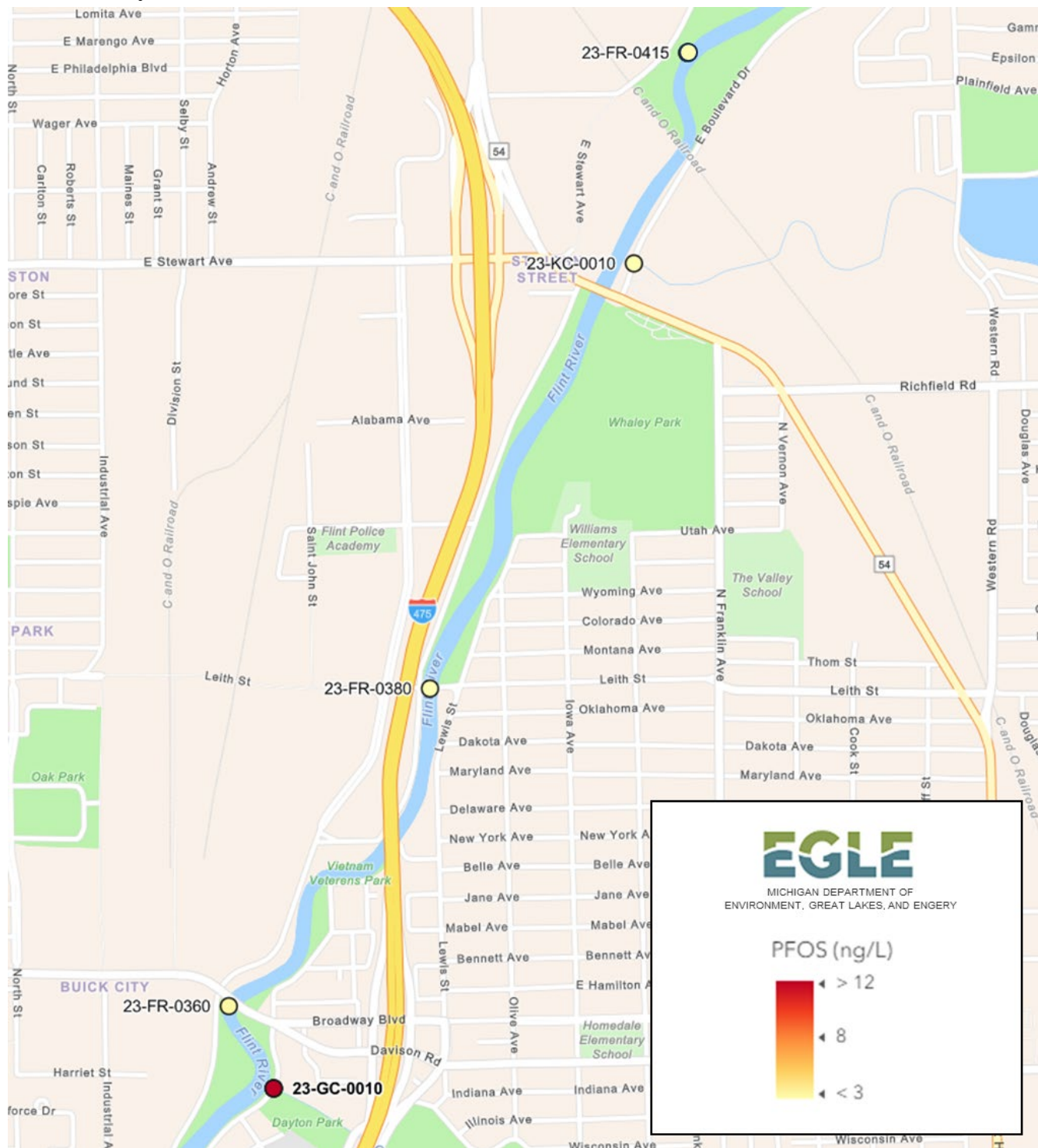
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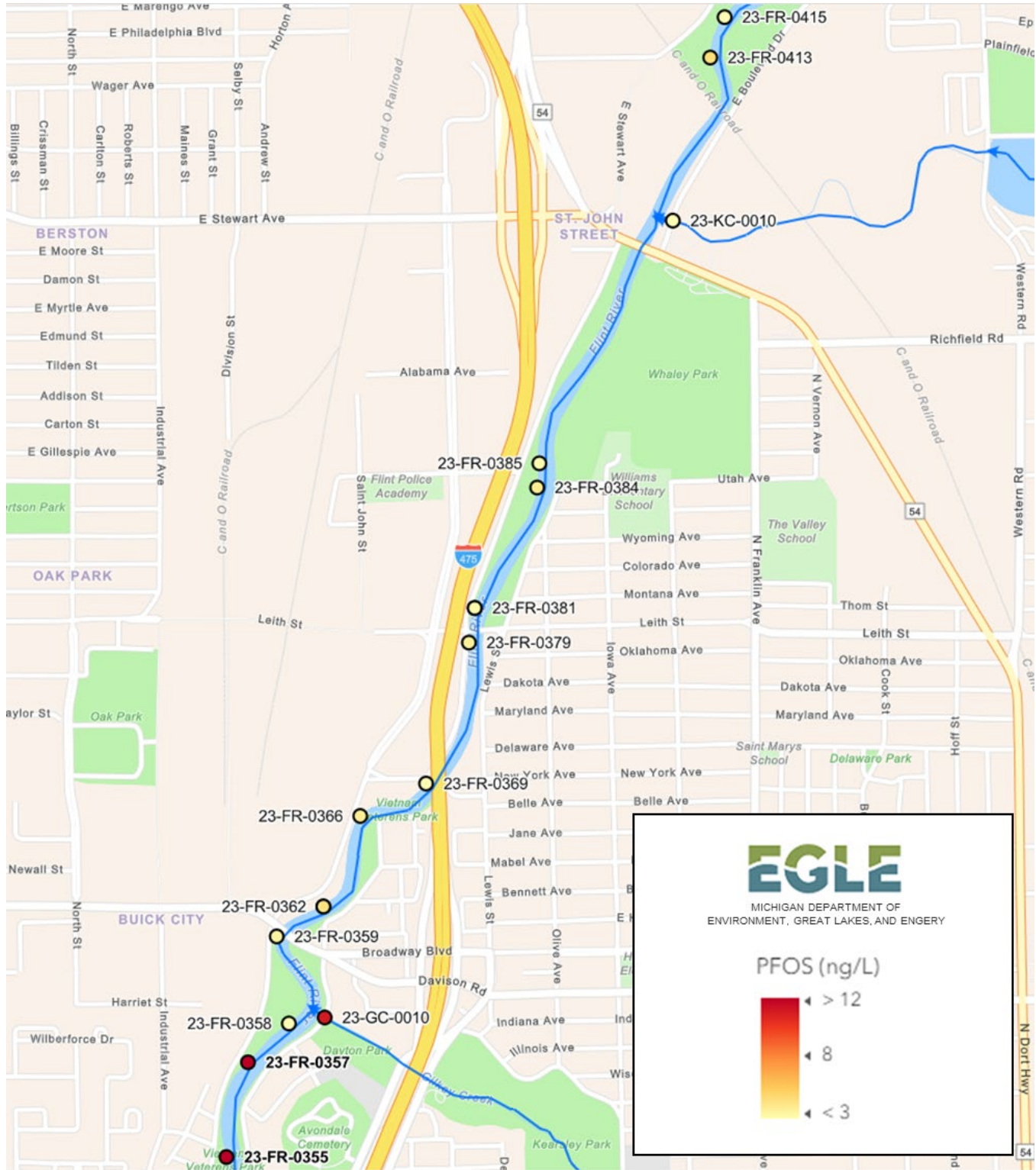
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Figure 1. Overview of the 2021 surface water PFAS sampling of the Flint River near RACER Buick City. Locations with a Rule 57 WQV exceedance are in bold.



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Figure 2. Overview of the August 2024 surface water PFAS sampling of the Flint River near RACER Buick City. Locations with a Rule 57 WQV exceedance are in bold.



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Table 2: Historical PFOS, PFOA, PFBS, PFHxS, and PFNA concentrations in surface water samples collected from the Flint River from 2016 to 2021. Concentrations exceeding the Rule 57 HNV (nondrinking) WQV are in bold.

Sampling Date	Sample ID	Sample Description	Latitude	Longitude	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)	PFHxS (ng/L)	PFNA (ng/L)
7/6/2016	23-KC-0010	Kearsley Creek at E. Boulevard Drive	43.05397	-83.66830	6.9	2.4	<2	<2	<2
6/1/2021	23-KC-0010	Kearsley Creek at E. Boulevard Drive	43.05397	-83.66830	<2	<2	3.3	<2	<2
7/6/2016	23-GC-0010	Gilkey Creek at E. Boulevard Drive	43.03239	-83.68119	25.0	4.7	4.8	5.0	<2
5/9/2017	23-GC-0010	Gilkey Creek at E. Boulevard Drive	43.03239	-83.68119	5.5	2.4	5.7	<2	<2
6/1/2021	23-GC-0010	Gilkey Creek at E. Boulevard Drive	43.03239	-83.68119	12.0	8.6	5.1	<2	<2
7/6/2016	23-FR-0415	Flint River at W. Boulevard Dr	43.05948	-83.66638	2.6	<2	<2	<2	<2
5/4/2021	23-FR-0415	Flint River at W. Boulevard Dr	43.05948	-83.66638	<2	<2	<2	<2	<2
6/1/2021	23-FR-0380	Flint River at W. Boulevard Dr	43.04285	-83.67560	2.3	<2	<2	<2	<2
5/4/2021	23-FR-0360	Flint River at James P Cole Blvd	43.03454	-83.68280	4.3	<2	2.3	<2	<2

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Table 3: PFOS, PFOA, PFBS, PFHxS, and PFNA concentrations in surface water samples collected from the Flint River in August 2024. Concentrations exceeding the Rule 57 HNV (nondrinking) WQV are in bold.

Sample ID	Sample Description	Latitude	Longitude	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)	PFHxS (ng/L)	PFNA (ng/L)
23-KC-0010	Kearsley Creek at E. Boulevard Drive	43.05397	-83.66830	2.5	2.8	2.1	<2	<2
23-GC-0010	Gilkey Creek at E. Boulevard Drive	43.03239	-83.68119	11.0	5.0	7.1	<2	<2
23-FR-0415	Flint River at W. Boulevard Dr	43.05948	-83.66638	3.0	<2	<2	<2	<2
23-FR-0413	Flint River at W. Boulevard Dr	43.05839	-83.66691	4.5	2.4	<2	<2	<2
23-FR-0385	Flint River at W. Boulevard Dr	43.04740	-83.67324	3.1	2.4	<2	<2	<2
23-FR-0384	Flint River at W. Boulevard Dr	43.04674	-83.67332	3.9	<2	<2	<2	<2
23-FR-0381R	Replicate Flint River at W. Boulevard Dr	43.04348	-83.67564	3.5	2.0	<2	<2	<2
23-FR-0381	Flint River at W. Boulevard Dr	43.04348	-83.67564	3.2	<2	<2	<2	<2
23-FR-0379	Flint River at W. Boulevard Dr	43.04254	-83.67585	3.7	<2	<2	<2	<2
23-FR-0369	Flint River at Garfield Avenue	43.03872	-83.67744	3.0	<2	<2	<2	<2
23-FR-0366	Flint River at James P Cole Blvd	43.03785	-83.67988	3.8	2.0	<2	<2	<2
23-FR-0362D	Duplicate Flint River at James P Cole Blvd	43.03539	-83.68124	3.5	2.0	<2	<2	<2
23-FR-0362	Flint River at James P Cole Blvd	43.03539	-83.68124	4.3	2.0	<2	<2	<2
23-FR-0359	Flint River at James P Cole Blvd	43.03458	-83.68297	3.5	<2	<2	<2	<2
23-FR-0358	Flint River at James P Cole Blvd	43.03223	-83.68252	3.0	<2	<2	<2	<2
23-FR-0357	Flint River at James P Cole Blvd	43.03118	-83.68404	3100.0	170.0	38.0	1900.0	15.0
23-FR-0355	Flint River at James P Cole Blvd	43.02861	-83.68484	16.0	2.1	<2	6.4	<2
00-TB-0010	Trip Blank	N/A	N/A	<2	<2	<2	<2	<2
00-FB-0010	Field Blank	N/A	N/A	<2	<2	<2	<2	<2

Table 4. PFAS analyzed in surface water.

Compound	Abbreviation	CAS #
Perfluorotetradecanoic acid	PFTeA	376-06-7
Perfluorotridecanoic acid	PFTriA	72629-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorodecanoic acid	PFDA	335-76-2
Perfluorononanoic acid	PFNA	375-95-1
Perfluorooctanoic acid	PFOA	335-67-1
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorooctanesulfonamide	PFOSA	754-91-6
Fluorotelomer sulphonic acid 8:2	FtS 8:2	39108-34-4
Fluorotelomer sulphonic acid 6:2	FtS 6:2	27619-97-2
Fluorotelomer sulphonic acid 4:2	FtS 4:2	757124-72-4
2-(N-Ethylperfluorooctanesulfonamido) acetic acid	N-EtFOSAA	2991-50-6
2-(N-Methylperfluorooctanesulfonamido) acetic acid	N-MeFOSAA	2355-31-9
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
11-chloroeicosafluoro-3 oxaundecane-1-sulfonic acid oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
9-chlorohexadecafluoro-3-oxanone1-sulfonic acid	9Cl-PF3ONS	756426-58-1
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Perfluoroethylcyclohexanesulfonate	PFECHS	67584-42-3
Perfluorobutylsulfonamide	PFBSA	30334-69-1
Perfluorohexanesulfonamide	PFHxSA	41997-13-1