PROTECT OUR PROPERTY RIGHTS – LAND AND WATER, INC.

372 South Eagle Road #293
Eagle, Idaho 83616
PrOPR.LandWater@gmail.com

October 2, 2026

Re: Recycled Water – Docket No. 58-0117-2601

At the September 18, 2026, initial meeting of the Recycled Water Negotiated Rulemaking, IDEQ requested input on the following proposed revisions to section 300.04 of the Recycled Water Rules by September 25, 2026, for rapid implementation in 2027 in an effort to streamline the recycled water permit application process and address permitting backlog:

> Revisions to the recycled water rules related to renewal of industrial reuse permits.
>
> 300.04. Exceptions. Application content for new, modified or renewing permits ~~will~~ may be clarified at the pre-application conference and may result in the omission of one (1) or more of the items listed in Subsection 300.03.

Since Protect Our Property Rights – Land and Water, Inc. ("PrOPR") submitted comments on September 25, 2026, to this language revision, more information on this proposed language has become available through public records request no. PRR-2026-1912. Therefore, please include all the records provided in response to public records request no. PRR-2026-1912 in the record for Docket No. 58-0117-2601.

At the September 18, 2026, meeting, IDEQ also requested suggestions about any desired additional revisions to the Recycled Water Rules by October 2, 2026, indicating that any further revisions to these Rules likely would not be able to be implemented until 2028 or later. This document provides PrOPR's additional comments on other aspects of the Recycled Water Rules. Please also include these comments and their Exhibits in the record for this negotiated rulemaking.

Class A Recycled Water, the highest class of recycled water identified in the Recycled Water Rules with authorized uses including even food crops and ground water recharge, only provide for the regulation and monitoring of 5 constituents: Total Coliform, Turbidity, Nitrogen, pH and BOD5. Yet, it is well known that municipal and industrial effluent contains many many many more substances, likely 1000's, that are known to or may pose risks to human health and the environment. *See* the comments of Citizens Allied for Integrity and Accountability ("CAIA"), also submitted today in this Docket No. 58-0117-2601, regarding the various substances posing

known or potential risks to human health and the environment which are incorporated herein along with CAIA's associated referenced authorities as if set forth in full.

As an example of just one of the kinds of harmful substances present in sewer effluent but that is not regulated under the current Recycled Water Rules, attached as Exhibit A is information about forever chemicals ("PFAS") found in Idaho treated municipal effluent. These types of substances are known to have documented health impacts and some forever chemicals even have been identified as Comprehensive Environmental Response Compensation & Liability Act ("CERCLA" or "Superfund") hazardous substances. *See Chamber of Commerce U.S.A v. U.S.EPA*, (D.C. Cir August 18, 2026) (upholding EPA's listing of PFOA and PFOs as CERCLA hazardous substances based on EPA's "determination supported by extensive studies that linked PFOA and PFOS exposure to serious health conditions in humans, including cancer and developmental delays"), Exhibit B hereto. This is just one example of one class of substances that are in sewer effluent but that are not regulated under the Recycled Water Rules and that can be expected to be present even in Class A Recycled Water. Many, many, many more substances can be expected to be found in recycled water, some of which have known health and environmental effects; many more of which may have as yet unknown or undetermined health and human effects.

IDEQ's recent regulatory analysis of the Recycled Water Rules (Exhibit C hereto), stressed that the purpose of the Recycled Water Rules is to protect human health and the environment. Knowing that there are innumerable harmful and potentially harmful unregulated substances present even in Class A Recycled Water, how can it be claimed without putting one's head in the proverbial sand that the Recycled Water Rules, which allow such sensitive use as food crops and ground water recharge, protect human health and the environment? Rather, the Recycled Water Rules, promote the widespread contamination of Idaho's land and water, creating the Brownfields and Superfund sites of the future.

In view of the risks posed by many substances, including PFASs, a "precautionary principle" in chemicals management has been proposed. *See* Cousins, *et al*., *The Precautionary Principle and Chemicals Management: The Example of Perfluoroalkyl Acids in Groundwater*, 94 Environment International 331-340 (Sept. 2016) (attached as Exhibit D hereto). The precautionary principle involves, among other things, minimizing dissemination of harmful persistent chemicals to avoid exposure and minimize cleanup costs in the future. However, the Recycled Water Rules, as currently formulated, throw caution to the wind (and groundwater and soil) and allow/encourage the widespread dissemination of industrial and municipal wastes and their brews of harmful substances to contaminate Idaho's precious land and water resources.

Other states have taken a more careful approach to PFAS management, commensurate with documented health effects, anticipated exorbitant cleanup costs and technological cleanup

limitations. *See,* Snow and Jennings, *An Emerging Contaminant of (Legal) Concern: PFAS Legal Issues at the State and Federal Level*, Spring 2020 (attached hereto as Exhibit E). While, perhaps waste water reuse could make sense in certain limited instances where waste streams have few constituents, treatment protocols are well proven and proposed uses are appropriate, controlled and carefully monitored. On the other hand, effluent reuse of complex industrial and municipal waste streams, for which treatment only addresses a handful of constituents, the effluent is disseminated over wide areas and the uses involve human exposures, such as food crops and groundwater recharge, can only lead to catastrophic results down the road.

Conclusion

At a minimum, the Recycled Water Rules need to be revamped to eliminate recycled water uses and applications where human and environmental exposure is expected unless high levels of effective and comprehensive contaminant removal will be achieved prior to discharge to the environment. Certainly, uses such as food crops and aquifer recharge, should not even be contemplated without a dependable and thorough treatment option, removing all harmful and potentially harmful substances. Likewise, applications, such as involving unlined ponds, ditches, canals, etc., where ground water impacts are to be expected should be precluded without thorough treatment to remove contaminants. Unless revisions like these to the Recycled Rules are undertaken, the Idaho sand may become too contaminated for us even to stick our heads in anymore.

Enclosures: Exhibits A, B, C, D and E

WHAT ARE PFAS?

Per- and polyfluoroalkyl substances (PFAS), often called "forever chemicals," are man-made chemicals used in industrial processes and consumer products. Since the 1940s, PFAS have been used in items such as water-repellent clothing, stain-resistant fabrics, cosmetics, and firefighting foams. PFAS can persist in the environment and accumulate in the body over time. Studies suggest exposure to some PFAS compounds may be linked to adverse health effects. [1]

Eagle Sewer District has voluntarily tested influent and effluent PFAS levels to provide information on current levels as part of their curated plan to understand PFAS within their system. Information is also presented for a few neighboring communities.

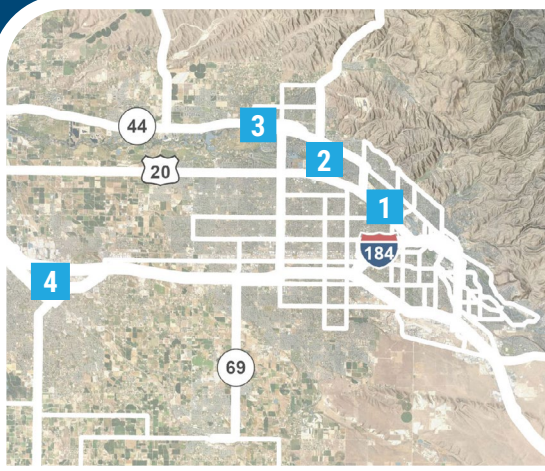
There are currently no federal PFAS regulations for wastewater. Efforts are ongoing to evaluate PFAS concentrations in wastewater effluent and receiving waters to determine whether regulation is necessary and at what levels. Irrigation reuse water is non-potable and intended for agricultural use. It is not currently subject to federal drinking water standards.

PFAS IN DRINKING WATER

April 2024 the EPA established preliminary National Primary Drinking Water Regulations for six PFAS. PFAS maximum containment levels (MCLs) will be enforceable in 2029. [2]

PFAS AND SURFACE WATER

The EPA has developed draft Human Health Criteria exposure limits for PFOA, PFOS, and PFBS. [3] [4]



1 2 Boise Water Renewal Facilities

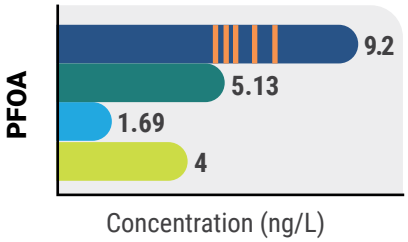
3 Eagle Sewer District

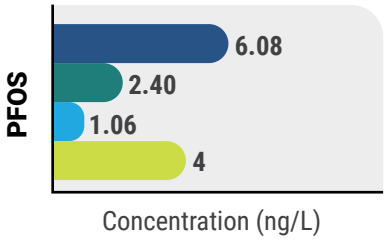
4 Nampa Water Renewal Facility

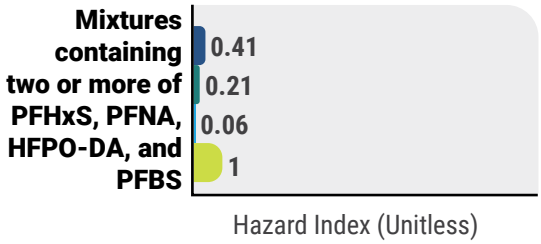
EAGLE SEWER DISTRICT

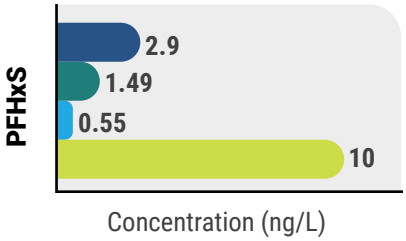
EFFLUENT PFAS RESULTS

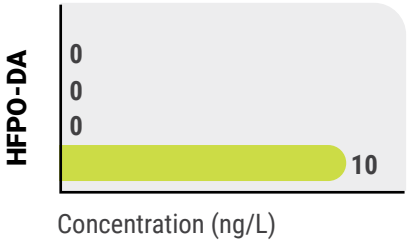
Testing results for Boise Water Renewal Facilities (2023-2024), Eagle Sewer District (2026), and Nampa Water Renewal Facility (2022-2025). **ESD results include Non-Detect Result for 5 of the 6 PFAS Compounds monitored in all five effluent samples.**

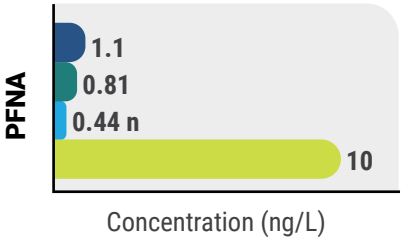












DATA KEY

- Maximum Recorded Level
- Average Recorded Level
- Minimum Recorded Level
- EPA Maximum Contaminant Level[1]
- Eagle Sewer District Results[2]

[1] Drinking Water Regulation shown for reference only. No current or proposed wastewater regulations are available.

[2] The results shown are for ESD effluent concentrations. Once the reuse water is mixed with canal water, the PFAS concentrations will be diluted, resulting in levels lower than those presented.

References: [1] https://www.atsdr.cdc.gov/pfas/about/index.html [2] https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas [3] https://www.epa.gov/system/files/documents/2024-12/draft-hhc-pfas-tech-fact-sheet.pdf [4] https://www.epa.gov/system/files/documents/2024-09/pfoa-pfos-pfas-final-factsheet-2024.pdf

Analytical Laboratories Inc

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www.analyticallaboratories.com
Lab Federal ID# ID00020

Laboratory Analysis Report

Report To: RON GEARHART
EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: rgearhart@eaglesewer.org
Date Received: 03/05/2026
Collection Date/Time: 03/05/2026 11:35

County: ADA
Lab/Sample Number: 2604783-01
Sample Location: EFFLUENT - GRAB

Date Printed: 03/31/2026 7:44
Collector's Name: ZANE
Transported By: ZANE
Temp C Received at Lab: 8.50

Field Measurements

pH: Total Chlorine mg/L: DO mg/L:
Temp C: Free Chlorine mg/L: Flow g/min:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0396	0.00989		3/25/26 4:12	ZHW	EPA 1633	U
PFPeA	0.00549	ug/L	0.0198	0.00495		3/25/26 4:12	ZHW	EPA 1633	J
PFHxA	0.00776	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	J
PFHpA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFOA	0.00534	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	J
PFNA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFDA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFUnA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFDoA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFTrDA	ND	ug/L	0.00989	0.00989		3/25/26 4:12	ZHW	EPA 1633	U
PFTeDA	ND	ug/L	0.00989	0.00989		3/25/26 4:12	ZHW	EPA 1633	U
PFBS	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFPeS	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFHxS	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFHpS	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFOS	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFNS	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFDS	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
PFDoS	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
4:2FTS	ND	ug/L	0.0371	0.00989		3/25/26 4:12	ZHW	EPA 1633	U
6:2FTS	ND	ug/L	0.0396	0.0124		3/25/26 4:12	ZHW	EPA 1633	U
8:2FTS	ND	ug/L	0.0396	0.0148		3/25/26 4:12	ZHW	EPA 1633	U
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NMeFOSA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
NEtFOSA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
N-MeFOSAA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
N-EtFOSSA	ND	ug/L	0.00989	0.00495		3/25/26 4:12	ZHW	EPA 1633	U
NMeFOSE	ND	ug/L	0.0989	0.0198		3/25/26 4:12	ZHW	EPA 1633	U
NEtFOSE	ND	ug/L	0.0989	0.0198		3/25/26 4:12	ZHW	EPA 1633	U
HFPO-DA	ND	ug/L	0.0396	0.00989		3/25/26 4:12	ZHW	EPA 1633	U
ADONA	ND	ug/L	0.0396	0.00989		3/25/26 4:12	ZHW	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0371	0.0148		3/25/26 4:12	ZHW	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0371	0.00989		3/25/26 4:12	ZHW	EPA 1633	U
3:3FTCA	ND	ug/L	0.0495	0.0247		3/25/26 4:12	ZHW	EPA 1633	U
5:3FTCA	ND	ug/L	0.247	0.0989		3/25/26 4:12	ZHW	EPA 1633	U

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Lab Federal ID# ID00020

Semivolatiles (Continued)
2604783-01

7:3FTCA	ND	ug/L	0.247	0.0989	3/25/26	4:12	ZHW	EPA 1633	U
PFEESA	ND	ug/L	0.0198	0.00989	3/25/26	4:12	ZHW	EPA 1633	U
PFMPA	ND	ug/L	0.0198	0.00495	3/25/26	4:12	ZHW	EPA 1633	U
PFMBA	ND	ug/L	0.0198	0.00495	3/25/26	4:12	ZHW	EPA 1633	U
NFDHA	ND	ug/L	0.0198	0.00989	3/25/26	4:12	ZHW	EPA 1633	U
Surrogate: 13C4-PFBA EIS	106	%5-174							
Surrogate: 13C5-PFPeA EIS	107	%20-162							
Surrogate: 13C5-PFHxA EIS	107	%41-150							
Surrogate: 13C4-PFHpA EIS	106	%55-150							
Surrogate: 13C8-PFOA EIS	106	%42-150							
Surrogate: 13C9-PFNA EIS	101	%47-142							
Surrogate: 13C6-PFDA EIS	100	%37-140							
Surrogate: 13C7-PFUnA EIS	93.5	%10-190							
Surrogate: 13C2-PFDoA EIS	85.7	%5-171							
Surrogate: 13C2-PFTeDA EIS	62.1	%5-140							
Surrogate: 13C3-PFBS EIS	112	%39-150							
Surrogate: 13C3-PFHxS EIS	107	%52-150							
Surrogate: 13C8-PFOS EIS	93.4	%32-144							
Surrogate: 13C2-4:2FTS EIS	107	%25-200							
Surrogate: 13C2-6:2FTS EIS	110	%24-200							
Surrogate: 13C2-8:2FTS EIS	96.8	%5-200							
Surrogate: 13C8-PFOSA EIS	79.2	%30-142							
Surrogate: D3-NMeFOSA EIS	57.4	%5-167							
Surrogate: D5-NEtFOSA EIS	64.3	%5-170							
Surrogate: D3-NMeFOSAA EIS	84.1	%45-200							
Surrogate: D5-NEtFOSAA EIS	89.1	%10-200							
Surrogate: D7-NMeFOSE EIS	40.6	%5-150							
Surrogate: D9-NEtFOSE EIS	45.6	%5-150							
Surrogate: 13C3-HFPO-DA EIS	103	%25-160							
Surrogate: 13C3-PFBA NIS	99.0	%50-150							
Surrogate: 13C2-PFHxA NIS	96.2	%50-150							
Surrogate: 13C4-PFOA NIS	98.6	%50-150							
Surrogate: 13C5-PFNA NIS	99.4	%50-150							
Surrogate: 13C2-PFDA NIS	94.7	%50-150							
Surrogate: 18O2-PFHxS NIS	93.5	%50-150							
Surrogate: 13C4-PFOS NIS	102	%50-150							

J The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

U Compound was analyzed for but not detected

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Lab Federal ID# ID00020

Laboratory Analysis Report

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EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: rgearhart@eaglesewer.org
Date Received: 03/05/2026
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County: ADA
Lab/Sample Number: 2604783-02
Sample Location: INFLUENT - GRAB

Date Printed: 03/31/2026 7:44
Collector's Name: ZANE
Transported By: ZANE
Temp C Received at Lab: 8.50

Field Measurements

pH: Total Chlorine mg/L: DO mg/L:
Temp C: Free Chlorine mg/L: Flow g/min:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0396	0.00991		3/25/26 4:28	ZHW	EPA 1633	U
PFPeA	0.00530	ug/L	0.0198	0.00496		3/25/26 4:28	ZHW	EPA 1633	J
PFHxA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFHpA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFOA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFNA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFDA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFUnA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFDoA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFTrDA	ND	ug/L	0.00991	0.00991		3/25/26 4:28	ZHW	EPA 1633	U
PFTeDA	ND	ug/L	0.00991	0.00991		3/25/26 4:28	ZHW	EPA 1633	U
PFBS	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFPeS	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFHxS	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFHpS	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFOS	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFNS	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFDS	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
PFDoS	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
4:2FTS	ND	ug/L	0.0372	0.00991		3/25/26 4:28	ZHW	EPA 1633	U
6:2FTS	ND	ug/L	0.0396	0.0124		3/25/26 4:28	ZHW	EPA 1633	U
8:2FTS	ND	ug/L	0.0396	0.0149		3/25/26 4:28	ZHW	EPA 1633	U
PFOSA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
NMeFOSA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
NEtFOSA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
N-MeFOSAA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
N-EtFOSSA	ND	ug/L	0.00991	0.00496		3/25/26 4:28	ZHW	EPA 1633	U
NMeFOSE	ND	ug/L	0.0991	0.0198		3/25/26 4:28	ZHW	EPA 1633	U
NEtFOSE	ND	ug/L	0.0991	0.0198		3/25/26 4:28	ZHW	EPA 1633	U
HFPO-DA	ND	ug/L	0.0396	0.00991		3/25/26 4:28	ZHW	EPA 1633	U
ADONA	ND	ug/L	0.0396	0.00991		3/25/26 4:28	ZHW	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0372	0.0149		3/25/26 4:28	ZHW	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0372	0.00991		3/25/26 4:28	ZHW	EPA 1633	U
3:3FTCA	ND	ug/L	0.0496	0.0248		3/25/26 4:28	ZHW	EPA 1633	U
5:3FTCA	ND	ug/L	0.248	0.0991		3/25/26 4:28	ZHW	EPA 1633	U

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Lab Federal ID# ID00020

Semivolatiles (Continued)

2604783-02

7:3FTCA	ND	ug/L	0.248	0.0991	3/25/26	4:28	ZHW	EPA 1633	U
PFEESA	ND	ug/L	0.0198	0.00991	3/25/26	4:28	ZHW	EPA 1633	U
PFMPA	ND	ug/L	0.0198	0.00496	3/25/26	4:28	ZHW	EPA 1633	U
PFMBA	ND	ug/L	0.0198	0.00496	3/25/26	4:28	ZHW	EPA 1633	U
NFDHA	ND	ug/L	0.0198	0.00991	3/25/26	4:28	ZHW	EPA 1633	U
Surrogate: 13C4-PFBA EIS	106	%5-174							
Surrogate: 13C5-PFPeA EIS	105	%20-162							
Surrogate: 13C5-PFHxA EIS	106	%41-150							
Surrogate: 13C4-PFHpA EIS	111	%55-150							
Surrogate: 13C8-PFOA EIS	104	%42-150							
Surrogate: 13C9-PFNA EIS	107	%47-142							
Surrogate: 13C6-PFDA EIS	113	%37-140							
Surrogate: 13C7-PFUnA EIS	106	%10-190							
Surrogate: 13C2-PFDoA EIS	88.6	%5-171							
Surrogate: 13C2-PFTeDA EIS	64.6	%5-140							
Surrogate: 13C3-PFBS EIS	111	%39-150							
Surrogate: 13C3-PFHxS EIS	115	%52-150							
Surrogate: 13C8-PFOS EIS	107	%32-144							
Surrogate: 13C2-4:2FTS EIS	180	%25-200							
Surrogate: 13C2-6:2FTS EIS	205	%24-200							S4
Surrogate: 13C2-8:2FTS EIS	192	%5-200							
Surrogate: 13C8-PFOSA EIS	82.6	%30-142							
Surrogate: D3-NMeFOSA EIS	61.6	%5-167							
Surrogate: D5-NEtFOSA EIS	55.8	%5-170							
Surrogate: D3-NMeFOSAA EIS	99.6	%45-200							
Surrogate: D5-NEtFOSAA EIS	104	%10-200							
Surrogate: D7-NMeFOSE EIS	58.5	%5-150							
Surrogate: D9-NEtFOSE EIS	50.5	%5-150							
Surrogate: 13C3-HFPO-DA EIS	101	%25-160							
Surrogate: 13C3-PFBA NIS	101	%50-150							
Surrogate: 13C2-PFHxA NIS	100	%50-150							
Surrogate: 13C4-PFOA NIS	114	%50-150							
Surrogate: 13C5-PFNA NIS	115	%50-150							
Surrogate: 13C2-PFDA NIS	99.8	%50-150							
Surrogate: 18O2-PFHxS NIS	105	%50-150							
Surrogate: 13C4-PFOS NIS	125	%50-150							

J	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
S4	Surrogate recovery was above laboratory and method acceptance limits. No target analytes were detected in the sample
U	Compound was analyzed for but not detected

Remarks

EPA Method 1633 was performed by Anatek Labs.

Analytical Laboratories Inc

1804 N. 33rd Street
Boise, Idaho 83703
Phone (208) 342-5515

www.analyticallaboratories.com
Lab Federal ID# ID00020

Authorized Signature,



BRIAN MCGOVERN, Client Manager

This report shall not be reproduced except in full, without the written approval of the laboratory
The results reported relate only to the samples indicated.

ND - Non Detect
MCL - Maximum Contaminant Level
MDL - Method Detection Limit
MRL - Method Reporting Limit

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Quality Control Data

Semivolatiles

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGC1001 - PFAS 537										
Blank (BGC1001-BLK1)					Prepared: 3/23/2026 Analyzed: 3/25/2026					
PFBA	ND	U	0.00765	ug/L						
PFPeA	ND	U	0.00383	ug/L						
PFHxA	ND	U	0.00191	ug/L						
PFHpA	ND	U	0.00191	ug/L						
PFOA	ND	U	0.00191	ug/L						
PFNA	ND	U	0.00191	ug/L						
PFDA	ND	U	0.00191	ug/L						
PFUnA	ND	U	0.00191	ug/L						
PFDoA	ND	U	0.00191	ug/L						
PFTrDA	ND	U	0.00191	ug/L						
PFTeDA	ND	U	0.00191	ug/L						
PFBS	ND	U	0.00191	ug/L						
PFPeS	ND	U	0.00191	ug/L						
PFHxS	ND	U	0.00191	ug/L						
PFHpS	ND	U	0.00191	ug/L						
PFOS	ND	U	0.00191	ug/L						
PFNS	ND	U	0.00191	ug/L						
PFDS	ND	U	0.00191	ug/L						
PFDoS	ND	U	0.00191	ug/L						
4:2FTS	ND	U	0.00718	ug/L						
6:2FTS	ND	U	0.00765	ug/L						
8:2FTS	ND	U	0.00765	ug/L						
PFOSA	ND	U	0.00191	ug/L						
NMeFOSA	ND	U	0.00191	ug/L						
NEtFOSA	ND	U	0.00191	ug/L						
N-MeFOSAA	ND	U	0.00191	ug/L						
N-EtFOSSA	ND	U	0.00191	ug/L						
NMeFOSE	ND	U	0.0191	ug/L						
NEtFOSE	ND	U	0.0191	ug/L						
HFPO-DA	ND	U	0.00765	ug/L						
ADONA	ND	U	0.00765	ug/L						
9Cl-PF3ONS	ND	U	0.00718	ug/L						
11Cl-PF3OUdS	ND	U	0.00718	ug/L						
3:3FTCA	ND	U	0.00957	ug/L						
5:3FTCA	ND	U	0.0478	ug/L						
7:3FTCA	ND	U	0.0478	ug/L						
PFEESA	ND	U	0.00383	ug/L						
PFMPA	ND	U	0.00383	ug/L						
PFMBA	ND	U	0.00383	ug/L						
NFDHA	ND	U	0.00383	ug/L						
Surrogate: 13C4-PFBA EIS			*0.0983*	*ug/L*	*0.0957*		*103*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0493*	*ug/L*	*0.0478*		*103*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0247*	*ug/L*	*0.0239*		*103*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0242*	*ug/L*	*0.0239*		*101*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0252*	*ug/L*	*0.0239*		*105*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0128*	*ug/L*	*0.0120*		*107*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.0129*	*ug/L*	*0.0120*		*108*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0128*	*ug/L*	*0.0120*		*107*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.0120*	*ug/L*	*0.0120*		*101*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.0113*	*ug/L*	*0.0120*		*94.9*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0238*	*ug/L*	*0.0223*		*107*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0245*	*ug/L*	*0.0227*		*108*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0232*	*ug/L*	*0.0229*		*101*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0485*	*ug/L*	*0.0449*		*108*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0496*	*ug/L*	*0.0455*		*109*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0458*	*ug/L*	*0.0459*		*99.6*	*5-200*		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGC1001 - PFAS 537 (Continued)										
Blank (BGC1001-BLK1)					Prepared: 3/23/2026 Analyzed: 3/25/2026					
Surrogate: 13C8-PFOSA EIS			*0.0219*	*ug/L*	*0.0239*		*91.6*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0198*	*ug/L*	*0.0239*		*82.6*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0192*	*ug/L*	*0.0239*		*80.4*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0448*	*ug/L*	*0.0478*		*93.7*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0446*	*ug/L*	*0.0478*		*93.2*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.206*	*ug/L*	*0.239*		*86.0*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.200*	*ug/L*	*0.239*		*83.6*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.0969*	*ug/L*	*0.0957*		*101*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0485*	*ug/L*	*0.0478*		*101*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0238*	*ug/L*	*0.0239*		*99.4*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0237*	*ug/L*	*0.0239*		*98.9*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0115*	*ug/L*	*0.0120*		*95.9*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0114*	*ug/L*	*0.0120*		*95.6*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0218*	*ug/L*	*0.0227*		*96.3*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0236*	*ug/L*	*0.0229*		*103*	*50-150*		
LCS (BGC1001-BS1)					Prepared: 3/23/2026 Analyzed: 3/25/2026					
PFBA	0.0880		0.00746	ug/L	0.0933		94.3	50-150		
PFPeA	0.0438		0.00373	ug/L	0.0467		93.8	50-150		
PFHxA	0.0220		0.00187	ug/L	0.0233		94.2	50-150		
PFHpA	0.0216		0.00187	ug/L	0.0233		92.7	50-150		
PFOA	0.0216		0.00187	ug/L	0.0233		92.8	50-150		
PFNA	0.0215		0.00187	ug/L	0.0233		92.0	50-150		
PFDA	0.0227		0.00187	ug/L	0.0233		97.4	50-150		
PFUnA	0.0220		0.00187	ug/L	0.0233		94.1	50-150		
PFDoA	0.0228		0.00187	ug/L	0.0233		98.0	50-150		
PFTrDA	0.0206		0.00187	ug/L	0.0233		88.4	50-150		
PFTeDA	0.0228		0.00187	ug/L	0.0233		97.8	50-150		
PFBS	0.0191		0.00187	ug/L	0.0207		92.2	50-150		
PFPeS	0.0209		0.00187	ug/L	0.0219		95.5	50-150		
PFHxS	0.0204		0.00187	ug/L	0.0213		96.0	50-150		
PFHpS	0.0207		0.00187	ug/L	0.0222		93.2	50-150		
PFOS	0.0203		0.00187	ug/L	0.0216		93.6	50-150		
PFNS	0.0214		0.00187	ug/L	0.0224		95.4	50-150		
PFDS	0.0206		0.00187	ug/L	0.0225		91.5	50-150		
PFDoS	0.0177		0.00187	ug/L	0.0226		78.3	50-150		
4:2FTS	0.0888		0.00700	ug/L	0.0874		102	50-150		
6:2FTS	0.0884		0.00746	ug/L	0.0887		99.7	50-150		
8:2FTS	0.0970		0.00746	ug/L	0.0896		108	50-150		
PFOSA	0.0224		0.00187	ug/L	0.0233		96.2	50-150		
NMeFOSA	0.0227		0.00187	ug/L	0.0233		97.4	50-150		
NEtFOSA	0.0216		0.00187	ug/L	0.0233		92.8	50-150		
N-MeFOSAA	0.0218		0.00187	ug/L	0.0233		93.5	50-150		
N-EtFOSSA	0.0224		0.00187	ug/L	0.0233		95.9	50-150		
NMeFOSE	0.212		0.0187	ug/L	0.233		90.7	50-150		
NEtFOSE	0.213		0.0187	ug/L	0.233		91.2	50-150		
HFPO-DA	0.0880		0.00746	ug/L	0.0933		94.3	50-150		
ADONA	0.0839		0.00746	ug/L	0.0882		95.1	50-150		
9Cl-PF3ONS	0.0828		0.00700	ug/L	0.0870		95.1	50-150		
11Cl-PF3OUdS	0.0825		0.00700	ug/L	0.0880		93.8	50-150		
3:3FTCA	0.106		0.00933	ug/L	0.117		91.0	50-150		
5:3FTCA	0.551		0.0467	ug/L	0.583		94.4	50-150		
7:3FTCA	0.530		0.0467	ug/L	0.583		90.8	50-150		
PFEESA	0.0389		0.00373	ug/L	0.0416		93.6	50-150		
PFMPA	0.0429		0.00373	ug/L	0.0467		92.0	50-150		
PFMBA	0.0437		0.00373	ug/L	0.0467		93.7	50-150		

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Lab Federal ID# ID00020

Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGC1001 - PFAS 537 (Continued)										
LCS (BGC1001-BS1)					Prepared: 3/23/2026 Analyzed: 3/25/2026					
NFDHA	0.0438		0.00373	ug/L	0.0467		93.9	50-150		
Surrogate: 13C4-PFBA EIS			*0.102*	*ug/L*	*0.0933*		*109*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0523*	*ug/L*	*0.0467*		*112*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0259*	*ug/L*	*0.0233*		*111*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0262*	*ug/L*	*0.0233*		*112*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0254*	*ug/L*	*0.0233*		*109*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0135*	*ug/L*	*0.0117*		*116*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.0135*	*ug/L*	*0.0117*		*116*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0133*	*ug/L*	*0.0117*		*114*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.0128*	*ug/L*	*0.0117*		*110*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.0118*	*ug/L*	*0.0117*		*102*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0251*	*ug/L*	*0.0217*		*116*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0246*	*ug/L*	*0.0221*		*111*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0241*	*ug/L*	*0.0223*		*108*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0479*	*ug/L*	*0.0438*		*109*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0515*	*ug/L*	*0.0444*		*116*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0499*	*ug/L*	*0.0448*		*112*	*5-200*		
Surrogate: 13C8-PFOSA EIS			*0.0232*	*ug/L*	*0.0233*		*99.3*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0194*	*ug/L*	*0.0233*		*83.2*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0195*	*ug/L*	*0.0233*		*83.5*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0468*	*ug/L*	*0.0467*		*100*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0476*	*ug/L*	*0.0467*		*102*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.214*	*ug/L*	*0.233*		*91.6*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.206*	*ug/L*	*0.233*		*88.2*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.102*	*ug/L*	*0.0933*		*109*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0426*	*ug/L*	*0.0467*		*91.2*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0209*	*ug/L*	*0.0233*		*89.7*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0216*	*ug/L*	*0.0233*		*92.6*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0102*	*ug/L*	*0.0117*		*87.3*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.00994*	*ug/L*	*0.0117*		*85.2*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0196*	*ug/L*	*0.0221*		*88.5*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0210*	*ug/L*	*0.0223*		*93.8*	*50-150*		

U Compound was analyzed for but not detected

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Laboratory Analysis Report

Report To: CHRIS KOSSOW
EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: ckossow@eaglesewer.org
Date Received: 03/12/2026
Collection Date/Time: 03/12/2026 13:10

County: ADA
Lab/Sample Number: 2605396-01
Sample Location: EFFLUENT - GRAB

Date Printed: 04/02/2026 14:43
Collector's Name: TOM
Transported By: TOM
Temp C Received at Lab: 10.40

Field Measurements

pH: Total Chlorine mg/L: DO mg/L:
Temp C: Free Chlorine mg/L: Flow g/min:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0144	0.00361		3/30/26 23:10	ZHW	EPA 1633	U
PFPeA	0.00320	ug/L	0.00722	0.00181		3/30/26 23:10	ZHW	EPA 1633	J
PFHxA	0.00717	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	
PFHpA	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFOA	0.00522	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	
PFNA	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFDA	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFUnA	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFDoA	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFTrDA	ND	ug/L	0.00361	0.00361		3/30/26 23:10	ZHW	EPA 1633	U
PFTeDA	ND	ug/L	0.00361	0.00361		3/30/26 23:10	ZHW	EPA 1633	U
PFBS	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFPeS	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFHxS	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFHpS	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFOS	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFNS	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFDS	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
PFDoS	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
4:2FTS	ND	ug/L	0.0135	0.00361		3/30/26 23:10	ZHW	EPA 1633	U
6:2FTS	ND	ug/L	0.0144	0.00451		3/30/26 23:10	ZHW	EPA 1633	U
8:2FTS	ND	ug/L	0.0144	0.00542		3/30/26 23:10	ZHW	EPA 1633	U
PFOSA	0.0168	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	
NMeFOSA	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
NEtFOSA	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
N-MeFOSAA	0.00204	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	J
N-EtFOSSA	ND	ug/L	0.00361	0.00181		3/30/26 23:10	ZHW	EPA 1633	U
NMeFOSE	0.00975	ug/L	0.0361	0.00722		3/30/26 23:10	ZHW	EPA 1633	J
NEtFOSE	0.00838	ug/L	0.0361	0.00722		3/30/26 23:10	ZHW	EPA 1633	J
HFPO-DA	ND	ug/L	0.0144	0.00361		3/30/26 23:10	ZHW	EPA 1633	U
ADONA	ND	ug/L	0.0144	0.00361		3/30/26 23:10	ZHW	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0135	0.00542		3/30/26 23:10	ZHW	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0135	0.00361		3/30/26 23:10	ZHW	EPA 1633	U
3:3FTCA	ND	ug/L	0.0181	0.00903		3/30/26 23:10	ZHW	EPA 1633	U
5:3FTCA	ND	ug/L	0.0903	0.0361		3/30/26 23:10	ZHW	EPA 1633	U

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Semivolatiles (Continued)

2605396-01

7:3FTCA	ND	ug/L	0.0903	0.0361	3/30/26	23:10	ZHW	EPA 1633	U
PFEESA	ND	ug/L	0.00722	0.00361	3/30/26	23:10	ZHW	EPA 1633	U
PFMPA	ND	ug/L	0.00722	0.00181	3/30/26	23:10	ZHW	EPA 1633	U
PFMBA	ND	ug/L	0.00722	0.00181	3/30/26	23:10	ZHW	EPA 1633	U
NFDHA	ND	ug/L	0.00722	0.00361	3/30/26	23:10	ZHW	EPA 1633	U
Surrogate: 13C4-PFBA EIS	106	%5-174							
Surrogate: 13C5-PFPeA EIS	105	%20-162							
Surrogate: 13C5-PFHxA EIS	106	%41-150							
Surrogate: 13C4-PFHpA EIS	109	%55-150							
Surrogate: 13C8-PFOA EIS	107	%42-150							
Surrogate: 13C9-PFNA EIS	106	%47-142							
Surrogate: 13C6-PFDA EIS	102	%37-140							
Surrogate: 13C7-PFUnA EIS	91.6	%10-190							
Surrogate: 13C2-PFDoA EIS	75.0	%5-171							
Surrogate: 13C2-PFTeDA EIS	42.6	%5-140							
Surrogate: 13C3-PFBS EIS	113	%39-150							
Surrogate: 13C3-PFHxS EIS	111	%52-150							
Surrogate: 13C8-PFOS EIS	104	%32-144							
Surrogate: 13C2-4:2FTS EIS	114	%25-200							
Surrogate: 13C2-6:2FTS EIS	106	%24-200							
Surrogate: 13C2-8:2FTS EIS	101	%5-200							
Surrogate: 13C8-PFOSA EIS	78.8	%30-142							
Surrogate: D3-NMeFOSA EIS	45.6	%5-167							
Surrogate: D5-NEtFOSA EIS	66.5	%5-170							
Surrogate: D3-NMeFOSAA EIS	83.1	%45-200							
Surrogate: D5-NEtFOSAA EIS	92.6	%10-200							
Surrogate: D7-NMeFOSE EIS	25.3	%5-150							
Surrogate: D9-NEtFOSE EIS	35.6	%5-150							
Surrogate: 13C3-HFPO-DA EIS	98.2	%25-160							
Surrogate: 13C3-PFBA NIS	95.8	%50-150							
Surrogate: 13C2-PFHxA NIS	95.6	%50-150							
Surrogate: 13C4-PFOA NIS	96.7	%50-150							
Surrogate: 13C5-PFNA NIS	98.6	%50-150							
Surrogate: 13C2-PFDA NIS	94.1	%50-150							
Surrogate: 18O2-PFHxS NIS	93.0	%50-150							
Surrogate: 13C4-PFOS NIS	98.6	%50-150							

J The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

U Compound was analyzed for but not detected

Remarks

EPA Method 1633 was performed by Anatek Labs.

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Authorized Signature,



BRIAN MCGOVERN, Client Manager

This report shall not be reproduced except in full, without the written approval of the laboratory
The results reported relate only to the samples indicated.

ND - Non Detect
MCL - Maximum Contaminant Level
MDL - Method Detection Limit
MRL - Method Reporting Limit

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Quality Control Data

Semivolatiles

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGC1273 - PFAS 537										
Blank (BGC1273-BLK1)					Prepared: 3/27/2026 Analyzed: 3/30/2026					
PFBA	ND	U	0.00817	ug/L						
PFPeA	ND	U	0.00408	ug/L						
PFHxA	ND	U	0.00204	ug/L						
PFHpA	ND	U	0.00204	ug/L						
PFOA	ND	U	0.00204	ug/L						
PFNA	ND	U	0.00204	ug/L						
PFDA	ND	U	0.00204	ug/L						
PFUnA	ND	U	0.00204	ug/L						
PFDoA	ND	U	0.00204	ug/L						
PFTrDA	ND	U	0.00204	ug/L						
PFTeDA	ND	U	0.00204	ug/L						
PFBS	ND	U	0.00204	ug/L						
PFPeS	ND	U	0.00204	ug/L						
PFHxS	ND	U	0.00204	ug/L						
PFHpS	ND	U	0.00204	ug/L						
PFOS	ND	U	0.00204	ug/L						
PFNS	ND	U	0.00204	ug/L						
PFDS	ND	U	0.00204	ug/L						
PFDoS	ND	U	0.00204	ug/L						
4:2FTS	ND	U	0.00766	ug/L						
6:2FTS	ND	U	0.00817	ug/L						
8:2FTS	ND	U	0.00817	ug/L						
PFOSA	ND	U	0.00204	ug/L						
NMeFOSA	ND	U	0.00204	ug/L						
NEtFOSA	ND	U	0.00204	ug/L						
N-MeFOSAA	ND	U	0.00204	ug/L						
N-EtFOSSA	ND	U	0.00204	ug/L						
NMeFOSE	0.00433	J	0.0204	ug/L						
NEtFOSE	0.00421	J	0.0204	ug/L						
HFPO-DA	ND	U	0.00817	ug/L						
ADONA	ND	U	0.00817	ug/L						
9Cl-PF3ONS	ND	U	0.00766	ug/L						
11Cl-PF3OUdS	ND	U	0.00766	ug/L						
3:3FTCA	ND	U	0.0102	ug/L						
5:3FTCA	ND	U	0.0511	ug/L						
7:3FTCA	ND	U	0.0511	ug/L						
PFEESA	ND	U	0.00408	ug/L						
PFMPA	ND	U	0.00408	ug/L						
PFMBA	ND	U	0.00408	ug/L						
NFDHA	ND	U	0.00408	ug/L						
Surrogate: 13C4-PFBA EIS			*0.106*	*ug/L*	*0.102*		*104*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0527*	*ug/L*	*0.0511*		*103*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0259*	*ug/L*	*0.0255*		*101*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0271*	*ug/L*	*0.0255*		*106*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0273*	*ug/L*	*0.0255*		*107*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0129*	*ug/L*	*0.0128*		*101*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.0142*	*ug/L*	*0.0128*		*111*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0129*	*ug/L*	*0.0128*		*101*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.0125*	*ug/L*	*0.0128*		*98.1*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.0123*	*ug/L*	*0.0128*		*96.3*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0244*	*ug/L*	*0.0238*		*102*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0258*	*ug/L*	*0.0242*		*107*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0247*	*ug/L*	*0.0245*		*101*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0499*	*ug/L*	*0.0479*		*104*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0498*	*ug/L*	*0.0486*		*102*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0542*	*ug/L*	*0.0490*		*111*	*5-200*		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGC1273 - PFAS 537 (Continued)										
Blank (BGC1273-BLK1)					Prepared: 3/27/2026 Analyzed: 3/30/2026					
Surrogate: 13C8-PFOSA EIS			*0.0241*	*ug/L*	*0.0255*		*94.4*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0216*	*ug/L*	*0.0255*		*84.5*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0213*	*ug/L*	*0.0255*		*83.4*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0487*	*ug/L*	*0.0511*		*95.3*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0465*	*ug/L*	*0.0511*		*91.1*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.199*	*ug/L*	*0.255*		*77.9*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.203*	*ug/L*	*0.255*		*79.7*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.102*	*ug/L*	*0.102*		*99.8*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0511*	*ug/L*	*0.0511*		*100*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0251*	*ug/L*	*0.0255*		*98.2*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0251*	*ug/L*	*0.0255*		*98.3*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0129*	*ug/L*	*0.0128*		*101*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0121*	*ug/L*	*0.0128*		*95.1*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0236*	*ug/L*	*0.0242*		*97.7*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0251*	*ug/L*	*0.0245*		*103*	*50-150*		
LCS (BGC1273-BS1)					Prepared: 3/27/2026 Analyzed: 3/30/2026					
PFBA	0.0895		0.00750	ug/L	0.0937		95.5	50-150		
PFPeA	0.0460		0.00375	ug/L	0.0469		98.2	50-150		
PFHxA	0.0222		0.00187	ug/L	0.0234		94.7	50-150		
PFHpA	0.0211		0.00187	ug/L	0.0234		90.1	50-150		
PFOA	0.0213		0.00187	ug/L	0.0234		90.7	50-150		
PFNA	0.0213		0.00187	ug/L	0.0234		90.8	50-150		
PFDA	0.0221		0.00187	ug/L	0.0234		94.4	50-150		
PFUnA	0.0224		0.00187	ug/L	0.0234		95.6	50-150		
PFDoA	0.0215		0.00187	ug/L	0.0234		91.7	50-150		
PFTrDA	0.0204		0.00187	ug/L	0.0234		87.3	50-150		
PFTeDA	0.0218		0.00187	ug/L	0.0234		93.0	50-150		
PFBS	0.0190		0.00187	ug/L	0.0208		91.3	50-150		
PFPeS	0.0200		0.00187	ug/L	0.0220		90.8	50-150		
PFHxS	0.0196		0.00187	ug/L	0.0214		91.6	50-150		
PFHpS	0.0203		0.00187	ug/L	0.0223		91.2	50-150		
PFOS	0.0210		0.00187	ug/L	0.0217		96.4	50-150		
PFNS	0.0211		0.00187	ug/L	0.0225		93.7	50-150		
PFDS	0.0196		0.00187	ug/L	0.0226		86.6	50-150		
PFDoS	0.0173		0.00187	ug/L	0.0227		76.4	50-150		
4:2FTS	0.0812		0.00703	ug/L	0.0878		92.5	50-150		
6:2FTS	0.0903		0.00750	ug/L	0.0891		101	50-150		
8:2FTS	0.0810		0.00750	ug/L	0.0900		90.1	50-150		
PFOSA	0.0223		0.00187	ug/L	0.0234		95.4	50-150		
NMeFOSA	0.0230		0.00187	ug/L	0.0234		98.0	50-150		
NEtFOSA	0.0192		0.00187	ug/L	0.0234		81.9	50-150		
N-MeFOSAA	0.0237		0.00187	ug/L	0.0234		101	50-150		
N-EtFOSSA	0.0226		0.00187	ug/L	0.0234		96.6	50-150		
NMeFOSE	0.217		0.0187	ug/L	0.234		92.8	50-150		
NEtFOSE	0.218		0.0187	ug/L	0.234		93.0	50-150		
HFPO-DA	0.0931		0.00750	ug/L	0.0937		99.3	50-150		
ADONA	0.0880		0.00750	ug/L	0.0886		99.4	50-150		
9Cl-PF3ONS	0.0904		0.00703	ug/L	0.0874		103	50-150		
11Cl-PF3OUdS	0.0842		0.00703	ug/L	0.0884		95.3	50-150		
3:3FTCA	0.109		0.00937	ug/L	0.117		92.9	50-150		
5:3FTCA	0.566		0.0469	ug/L	0.586		96.7	50-150		
7:3FTCA	0.533		0.0469	ug/L	0.586		91.0	50-150		
PFEESA	0.0390		0.00375	ug/L	0.0418		93.4	50-150		
PFMPA	0.0434		0.00375	ug/L	0.0469		92.7	50-150		
PFMBA	0.0446		0.00375	ug/L	0.0469		95.1	50-150		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGC1273 - PFAS 537 (Continued)										
LCS (BGC1273-BS1)					Prepared: 3/27/2026 Analyzed: 3/30/2026					
NFDHA	0.0447		0.00375	ug/L	0.0469		95.3	50-150		
Surrogate: 13C4-PFBA EIS			*0.0984*	*ug/L*	*0.0937*		*105*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0505*	*ug/L*	*0.0469*		*108*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0257*	*ug/L*	*0.0234*		*110*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0263*	*ug/L*	*0.0234*		*112*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0253*	*ug/L*	*0.0234*		*108*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0126*	*ug/L*	*0.0117*		*108*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.0123*	*ug/L*	*0.0117*		*105*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0120*	*ug/L*	*0.0117*		*103*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.0120*	*ug/L*	*0.0117*		*102*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.0109*	*ug/L*	*0.0117*		*93.4*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0237*	*ug/L*	*0.0218*		*108*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0244*	*ug/L*	*0.0222*		*110*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0238*	*ug/L*	*0.0224*		*106*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0489*	*ug/L*	*0.0440*		*111*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0472*	*ug/L*	*0.0446*		*106*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0490*	*ug/L*	*0.0450*		*109*	*5-200*		
Surrogate: 13C8-PFOSA EIS			*0.0226*	*ug/L*	*0.0234*		*96.6*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0185*	*ug/L*	*0.0234*		*78.9*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0217*	*ug/L*	*0.0234*		*92.5*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0445*	*ug/L*	*0.0469*		*94.9*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0437*	*ug/L*	*0.0469*		*93.2*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.191*	*ug/L*	*0.234*		*81.4*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.182*	*ug/L*	*0.234*		*77.7*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.0963*	*ug/L*	*0.0937*		*103*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0430*	*ug/L*	*0.0469*		*91.8*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0210*	*ug/L*	*0.0234*		*89.8*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0218*	*ug/L*	*0.0234*		*93.2*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0108*	*ug/L*	*0.0117*		*92.1*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0106*	*ug/L*	*0.0117*		*90.1*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0204*	*ug/L*	*0.0222*		*91.7*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0212*	*ug/L*	*0.0224*		*94.5*	*50-150*		

J The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

U Compound was analyzed for but not detected

Analytical Laboratories Inc

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Laboratory Analysis Report

Report To: CHRIS KOSSOW
EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: ckossow@eaglesewer.org
Date Received: 04/16/2026
Collection Date/Time: 04/16/2026 9:35

County: ADA
Lab/Sample Number: 2608073-01
Sample Location: INFLUENT - GRAB

Date Printed: 05/13/2026 8:24
Collector's Name: ZANE
Transported By: TOM
Temp C Received at Lab: 7.00

Field Measurements

pH: Total Chlorine mg/L: DO mg/L: Conductivity umhos/cm:
Temp C: Free Chlorine mg/L: Flow g/min: Turbidity NTU:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0312	0.00779		5/8/26 0:53	MER	EPA 1633	U
PFPeA	ND	ug/L	0.0156	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFHxA	0.00663	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	J
PFHpA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFOA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFNA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFDA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFUnA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFDoA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFTrDA	ND	ug/L	0.00779	0.00779		5/8/26 0:53	MER	EPA 1633	U
PFTeDA	ND	ug/L	0.00779	0.00779		5/8/26 0:53	MER	EPA 1633	U
PFBS	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFPeS	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFHxS	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFHpS	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFOS	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFNS	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFDS	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
PFDoS	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
4:2FTS	ND	ug/L	0.0292	0.00779		5/8/26 0:53	MER	EPA 1633	U
6:2FTS	ND	ug/L	0.0312	0.00974		5/8/26 0:53	MER	EPA 1633	U
8:2FTS	ND	ug/L	0.0312	0.0117		5/8/26 0:53	MER	EPA 1633	U
PFOSA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
NMeFOSA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
NEtFOSA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
N-MeFOSAA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
N-EtFOSSA	ND	ug/L	0.00779	0.00390		5/8/26 0:53	MER	EPA 1633	U
NMeFOSE	ND	ug/L	0.0779	0.0156		5/8/26 0:53	MER	EPA 1633	U
NEtFOSE	ND	ug/L	0.0779	0.0156		5/8/26 0:53	MER	EPA 1633	U
HFPO-DA	ND	ug/L	0.0312	0.00779		5/8/26 0:53	MER	EPA 1633	U
ADONA	ND	ug/L	0.0312	0.00779		5/8/26 0:53	MER	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0292	0.0117		5/8/26 0:53	MER	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0292	0.00779		5/8/26 0:53	MER	EPA 1633	U
3:3FTCA	ND	ug/L	0.0390	0.0195		5/8/26 0:53	MER	EPA 1633	U
5:3FTCA	ND	ug/L	0.195	0.0779		5/8/26 0:53	MER	EPA 1633	U
7:3FTCA	ND	ug/L	0.195	0.0779		5/8/26 0:53	MER	EPA 1633	U

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Semivolatiles (Continued)
2608073-01

PFEESA	ND	ug/L	0.0156	0.00779	5/8/26	0:53	MER	EPA 1633	U
PFMPA	ND	ug/L	0.0156	0.00390	5/8/26	0:53	MER	EPA 1633	U
PFMBA	ND	ug/L	0.0156	0.00390	5/8/26	0:53	MER	EPA 1633	U
NFDHA	ND	ug/L	0.0156	0.00779	5/8/26	0:53	MER	EPA 1633	U
Surrogate: 13C4-PFBA EIS	92.7	%5-174							
Surrogate: 13C5-PFPeA EIS	89.2	%20-162							
Surrogate: 13C5-PFHxA EIS	82.7	%41-150							
Surrogate: 13C4-PFHpA EIS	106	%55-150							
Surrogate: 13C8-PFOA EIS	158	%42-150							S4
Surrogate: 13C9-PFNA EIS	100	%47-142							
Surrogate: 13C6-PFDA EIS	86.7	%37-140							
Surrogate: 13C7-PFUnA EIS	81.8	%10-190							
Surrogate: 13C2-PFDoA EIS	64.6	%5-171							
Surrogate: 13C2-PFTeDA EIS	46.8	%5-140							
Surrogate: 13C3-PFBS EIS	88.2	%39-150							
Surrogate: 13C3-PFHxS EIS	97.2	%52-150							
Surrogate: 13C8-PFOS EIS	96.2	%32-144							
Surrogate: 13C2-4:2FTS EIS	97.4	%25-200							
Surrogate: 13C2-6:2FTS EIS	109	%24-200							
Surrogate: 13C2-8:2FTS EIS	152	%5-200							
Surrogate: 13C8-PFOSA EIS	88.2	%30-142							
Surrogate: D3-NMeFOSA EIS	70.3	%5-167							
Surrogate: D5-NEtFOSA EIS	71.2	%5-170							
Surrogate: D3-NMeFOSAA EIS	82.5	%45-200							
Surrogate: D5-NEtFOSAA EIS	93.9	%10-200							
Surrogate: D7-NMeFOSE EIS	61.4	%5-150							
Surrogate: D9-NEtFOSE EIS	56.8	%5-150							
Surrogate: 13C3-HFPO-DA EIS	98.9	%25-160							
Surrogate: 13C3-PFBA NIS	94.7	%50-150							
Surrogate: 13C2-PFHxA NIS	98.8	%50-150							
Surrogate: 13C4-PFOA NIS	119	%50-150							
Surrogate: 13C5-PFNA NIS	96.4	%50-150							
Surrogate: 13C2-PFDA NIS	104	%50-150							
Surrogate: 18O2-PFHxS NIS	99.3	%50-150							
Surrogate: 13C4-PFOS NIS	99.6	%50-150							

J	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
S4	Surrogate recovery was above laboratory and method acceptance limits. No target analytes were detected in the sample
U	Compound was analyzed for but not detected

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Laboratory Analysis Report

Report To: CHRIS KOSSOW
EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: ckossow@eaglesewer.org
Date Received: 04/16/2026
Collection Date/Time: 04/16/2026 9:30

County: ADA
Lab/Sample Number: 2608073-02
Sample Location: EFFLUENT - GRAB

Date Printed: 05/13/2026 8:24
Collector's Name: TOM
Transported By: TOM
Temp C Received at Lab: 7.00

Field Measurements

pH: Total Chlorine mg/L: DO mg/L: Conductivity umhos/cm:
Temp C: Free Chlorine mg/L: Flow g/min: Turbidity NTU:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0312	0.00780		5/8/26 1:18	MER	EPA 1633	U
PFPeA	ND	ug/L	0.0156	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFHxA	0.00693	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	J
PFHpA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFOA	0.00669	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	J
PFNA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFDA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFUnA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFDoA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFTrDA	ND	ug/L	0.00780	0.00780		5/8/26 1:18	MER	EPA 1633	U
PFTeDA	ND	ug/L	0.00780	0.00780		5/8/26 1:18	MER	EPA 1633	U
PFBS	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFPeS	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFHxS	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFHpS	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFOS	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFNS	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFDS	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
PFDoS	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
4:2FTS	ND	ug/L	0.0293	0.00780		5/8/26 1:18	MER	EPA 1633	U
6:2FTS	ND	ug/L	0.0312	0.00975		5/8/26 1:18	MER	EPA 1633	U
8:2FTS	ND	ug/L	0.0312	0.0117		5/8/26 1:18	MER	EPA 1633	U
PFOSA	0.0123	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	
NMeFOSA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
NEtFOSA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
N-MeFOSAA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
N-EtFOSSA	ND	ug/L	0.00780	0.00390		5/8/26 1:18	MER	EPA 1633	U
NMeFOSE	ND	ug/L	0.0780	0.0156		5/8/26 1:18	MER	EPA 1633	U
NEtFOSE	ND	ug/L	0.0780	0.0156		5/8/26 1:18	MER	EPA 1633	U
HFPO-DA	ND	ug/L	0.0312	0.00780		5/8/26 1:18	MER	EPA 1633	U
ADONA	ND	ug/L	0.0312	0.00780		5/8/26 1:18	MER	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0293	0.0117		5/8/26 1:18	MER	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0293	0.00780		5/8/26 1:18	MER	EPA 1633	U
3:3FTCA	ND	ug/L	0.0390	0.0195		5/8/26 1:18	MER	EPA 1633	U
5:3FTCA	ND	ug/L	0.195	0.0780		5/8/26 1:18	MER	EPA 1633	U
7:3FTCA	ND	ug/L	0.195	0.0780		5/8/26 1:18	MER	EPA 1633	U

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Semivolatiles (Continued)
2608073-02

PFEESA	ND	ug/L	0.0156	0.00780	5/8/26	1:18	MER	EPA 1633	U
PFMPA	ND	ug/L	0.0156	0.00390	5/8/26	1:18	MER	EPA 1633	U
PFMBA	ND	ug/L	0.0156	0.00390	5/8/26	1:18	MER	EPA 1633	U
NFDHA	ND	ug/L	0.0156	0.00780	5/8/26	1:18	MER	EPA 1633	U
Surrogate: 13C4-PFBA EIS	91.0	%5-174							
Surrogate: 13C5-PFPeA EIS	86.8	%20-162							
Surrogate: 13C5-PFHxA EIS	85.9	%41-150							
Surrogate: 13C4-PFHpA EIS	102	%55-150							
Surrogate: 13C8-PFOA EIS	154	%42-150							S10
Surrogate: 13C9-PFNA EIS	91.1	%47-142							
Surrogate: 13C6-PFDA EIS	79.4	%37-140							
Surrogate: 13C7-PFUnA EIS	76.7	%10-190							
Surrogate: 13C2-PFDoA EIS	65.2	%5-171							
Surrogate: 13C2-PFTeDA EIS	54.2	%5-140							
Surrogate: 13C3-PFBS EIS	79.8	%39-150							
Surrogate: 13C3-PFHxS EIS	93.1	%52-150							
Surrogate: 13C8-PFOS EIS	84.6	%32-144							
Surrogate: 13C2-4:2FTS EIS	88.8	%25-200							
Surrogate: 13C2-6:2FTS EIS	84.8	%24-200							
Surrogate: 13C2-8:2FTS EIS	84.3	%5-200							
Surrogate: 13C8-PFOSA EIS	68.8	%30-142							
Surrogate: D3-NMeFOSA EIS	60.5	%5-167							
Surrogate: D5-NEtFOSA EIS	62.6	%5-170							
Surrogate: D3-NMeFOSAA EIS	78.6	%45-200							
Surrogate: D5-NEtFOSAA EIS	73.7	%10-200							
Surrogate: D7-NMeFOSE EIS	26.0	%5-150							
Surrogate: D9-NEtFOSE EIS	37.5	%5-150							
Surrogate: 13C3-HFPO-DA EIS	97.7	%25-160							
Surrogate: 13C3-PFBA NIS	93.6	%50-150							
Surrogate: 13C2-PFHxA NIS	94.9	%50-150							
Surrogate: 13C4-PFOA NIS	108	%50-150							
Surrogate: 13C5-PFNA NIS	87.3	%50-150							
Surrogate: 13C2-PFDA NIS	88.9	%50-150							
Surrogate: 18O2-PFHxS NIS	95.5	%50-150							
Surrogate: 13C4-PFOS NIS	94.5	%50-150							

J	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
S10	Surrogate recovery was above laboratory and method acceptance limits.
U	Compound was analyzed for but not detected

Remarks

EPA Method 1633 was performed by Anatek Labs.

Analytical Laboratories Inc

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Authorized Signature,



BRIAN MCGOVERN, Client Manager

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The results reported relate only to the samples indicated.

ND - Non Detect
MCL - Maximum Contaminant Level
MDL - Method Detection Limit
MRL - Method Reporting Limit

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Quality Control Data

Semivolatiles

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE0155 - PFAS 537										
Blank (BGE0155-BLK1)					Prepared & Analyzed: 5/7/2026					
PFBA	ND	U	0.00731	ug/L						
PFPeA	ND	U	0.00365	ug/L						
PFHxA	ND	U	0.00183	ug/L						
PFHpA	ND	U	0.00183	ug/L						
PFOA	ND	U	0.00183	ug/L						
PFNA	ND	U	0.00183	ug/L						
PFDA	ND	U	0.00183	ug/L						
PFUnA	ND	U	0.00183	ug/L						
PFDoA	ND	U	0.00183	ug/L						
PFTrDA	ND	U	0.00183	ug/L						
PFTeDA	ND	U	0.00183	ug/L						
PFBS	ND	U	0.00183	ug/L						
PFPeS	ND	U	0.00183	ug/L						
PFHxS	ND	U	0.00183	ug/L						
PFHpS	ND	U	0.00183	ug/L						
PFOS	ND	U	0.00183	ug/L						
PFNS	ND	U	0.00183	ug/L						
PFDS	ND	U	0.00183	ug/L						
PFDoS	ND	U	0.00183	ug/L						
4:2FTS	ND	U	0.00685	ug/L						
6:2FTS	ND	U	0.00731	ug/L						
8:2FTS	ND	U	0.00731	ug/L						
PFOSA	ND	U	0.00183	ug/L						
NMeFOSA	ND	U	0.00183	ug/L						
NEtFOSA	ND	U	0.00183	ug/L						
N-MeFOSAA	ND	U	0.00183	ug/L						
N-EtFOSSA	ND	U	0.00183	ug/L						
NMeFOSE	ND	U	0.0183	ug/L						
NEtFOSE	ND	U	0.0183	ug/L						
HFPO-DA	ND	U	0.00731	ug/L						
ADONA	ND	U	0.00731	ug/L						
9Cl-PF3ONS	ND	U	0.00685	ug/L						
11Cl-PF3OUdS	ND	U	0.00685	ug/L						
3:3FTCA	ND	U	0.00914	ug/L						
5:3FTCA	ND	U	0.0457	ug/L						
7:3FTCA	ND	U	0.0457	ug/L						
PFEESA	ND	U	0.00365	ug/L						
PFMPA	ND	U	0.00365	ug/L						
PFMBA	ND	U	0.00365	ug/L						
NFDHA	ND	U	0.00365	ug/L						
Surrogate: 13C4-PFBA EIS			*0.0929*	*ug/L*	*0.0914*		*102*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0437*	*ug/L*	*0.0457*		*95.7*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0214*	*ug/L*	*0.0228*		*93.7*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0239*	*ug/L*	*0.0228*		*105*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0328*	*ug/L*	*0.0228*		*144*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0121*	*ug/L*	*0.0114*		*106*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.0110*	*ug/L*	*0.0114*		*96.0*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0117*	*ug/L*	*0.0114*		*102*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.00884*	*ug/L*	*0.0114*		*77.4*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.00765*	*ug/L*	*0.0114*		*67.0*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0196*	*ug/L*	*0.0213*		*92.3*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0218*	*ug/L*	*0.0217*		*101*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0232*	*ug/L*	*0.0219*		*106*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0402*	*ug/L*	*0.0429*		*93.7*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0395*	*ug/L*	*0.0434*		*90.8*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0433*	*ug/L*	*0.0439*		*98.7*	*5-200*		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE0155 - PFAS 537 (Continued)										
Blank (BGE0155-BLK1)					Prepared & Analyzed: 5/7/2026					
Surrogate: 13C8-PFOSA EIS			*0.0197*	*ug/L*	*0.0228*		*86.3*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0137*	*ug/L*	*0.0228*		*59.9*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0156*	*ug/L*	*0.0228*		*68.2*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0412*	*ug/L*	*0.0457*		*90.2*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0404*	*ug/L*	*0.0457*		*88.3*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.149*	*ug/L*	*0.228*		*65.2*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.143*	*ug/L*	*0.228*		*62.8*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.0837*	*ug/L*	*0.0914*		*91.6*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0450*	*ug/L*	*0.0457*		*98.5*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0233*	*ug/L*	*0.0228*		*102*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0237*	*ug/L*	*0.0228*		*104*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0105*	*ug/L*	*0.0114*		*91.8*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0106*	*ug/L*	*0.0114*		*92.9*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0221*	*ug/L*	*0.0217*		*102*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0207*	*ug/L*	*0.0219*		*94.4*	*50-150*		
LCS (BGE0155-BS1)					Prepared & Analyzed: 5/7/2026					
PFBA	0.107		0.00743	ug/L	0.0929		115	50-150		
PFPeA	0.0493		0.00371	ug/L	0.0464		106	50-150		
PFHxA	0.0272		0.00186	ug/L	0.0232		117	50-150		
PFHpA	0.0226		0.00186	ug/L	0.0232		97.2	50-150		
PFOA	0.0260		0.00186	ug/L	0.0232		112	50-150		
PFNA	0.0243		0.00186	ug/L	0.0232		105	50-150		
PFDA	0.0295		0.00186	ug/L	0.0232		127	50-150		
PFUnA	0.0266		0.00186	ug/L	0.0232		115	50-150		
PFDoA	0.0278		0.00186	ug/L	0.0232		120	50-150		
PFTrDA	0.0262		0.00186	ug/L	0.0232		113	50-150		
PFTeDA	0.0259		0.00186	ug/L	0.0232		111	50-150		
PFBS	0.0237		0.00186	ug/L	0.0206		115	50-150		
PFPeS	0.0240		0.00186	ug/L	0.0218		110	50-150		
PFHxS	0.0249		0.00186	ug/L	0.0212		117	50-150		
PFHpS	0.0250		0.00186	ug/L	0.0221		113	50-150		
PFOS	0.0240		0.00186	ug/L	0.0215		112	50-150		
PFNS	0.0255		0.00186	ug/L	0.0223		114	50-150		
PFDS	0.0239		0.00186	ug/L	0.0224		107	50-150		
PFDoS	0.0189		0.00186	ug/L	0.0225		84.1	50-150		
4:2FTS	0.100		0.00697	ug/L	0.0870		115	50-150		
6:2FTS	0.105		0.00743	ug/L	0.0883		119	50-150		
8:2FTS	0.102		0.00743	ug/L	0.0892		115	50-150		
PFOSA	0.0262		0.00186	ug/L	0.0232		113	50-150		
NMeFOSA	0.0252		0.00186	ug/L	0.0232		109	50-150		
NEtFOSA	0.0222		0.00186	ug/L	0.0232		95.8	50-150		
N-MeFOSAA	0.0268		0.00186	ug/L	0.0232		115	50-150		
N-EtFOSSA	0.0265		0.00186	ug/L	0.0232		114	50-150		
NMeFOSE	0.269		0.0186	ug/L	0.232		116	50-150		
NEtFOSE	0.265		0.0186	ug/L	0.232		114	50-150		
HFPO-DA	0.106		0.00743	ug/L	0.0929		114	50-150		
ADONA	0.107		0.00743	ug/L	0.0878		122	50-150		
9Cl-PF3ONS	0.0965		0.00697	ug/L	0.0866		111	50-150		
11Cl-PF3OUdS	0.0897		0.00697	ug/L	0.0876		102	50-150		
3:3FTCA	0.133		0.00929	ug/L	0.116		115	50-150		
5:3FTCA	0.687		0.0464	ug/L	0.580		118	50-150		
7:3FTCA	0.624		0.0464	ug/L	0.580		108	50-150		
PFEESA	0.0494		0.00371	ug/L	0.0414		119	50-150		
PFMPA	0.0539		0.00371	ug/L	0.0464		116	50-150		
PFMBA	0.0508		0.00371	ug/L	0.0464		109	50-150		

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Lab Federal ID# ID00020

Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE0155 - PFAS 537 (Continued)										
LCS (BGE0155-BS1)					Prepared & Analyzed: 5/7/2026					
NFDHA	0.0552		0.00371	ug/L	0.0464		119	50-150		
Surrogate: 13C4-PFBA EIS			*0.0905*	*ug/L*	*0.0929*		*97.4*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0431*	*ug/L*	*0.0464*		*92.9*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0208*	*ug/L*	*0.0232*		*89.4*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0246*	*ug/L*	*0.0232*		*106*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0260*	*ug/L*	*0.0232*		*112*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0122*	*ug/L*	*0.0116*		*105*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.00989*	*ug/L*	*0.0116*		*85.2*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0107*	*ug/L*	*0.0116*		*92.1*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.00926*	*ug/L*	*0.0116*		*79.8*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.00818*	*ug/L*	*0.0116*		*70.5*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0199*	*ug/L*	*0.0216*		*92.0*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0207*	*ug/L*	*0.0220*		*93.9*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0202*	*ug/L*	*0.0222*		*90.9*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0427*	*ug/L*	*0.0436*		*98.0*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0397*	*ug/L*	*0.0442*		*89.9*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0435*	*ug/L*	*0.0446*		*97.5*	*5-200*		
Surrogate: 13C8-PFOSA EIS			*0.0191*	*ug/L*	*0.0232*		*82.3*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0155*	*ug/L*	*0.0232*		*66.9*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0172*	*ug/L*	*0.0232*		*74.3*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0401*	*ug/L*	*0.0464*		*86.4*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0404*	*ug/L*	*0.0464*		*87.1*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.157*	*ug/L*	*0.232*		*67.5*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.155*	*ug/L*	*0.232*		*66.8*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.0856*	*ug/L*	*0.0929*		*92.1*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0428*	*ug/L*	*0.0464*		*92.3*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0220*	*ug/L*	*0.0232*		*94.9*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0220*	*ug/L*	*0.0232*		*94.8*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0104*	*ug/L*	*0.0116*		*89.2*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0111*	*ug/L*	*0.0116*		*95.7*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0206*	*ug/L*	*0.0220*		*93.5*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0211*	*ug/L*	*0.0222*		*95.0*	*50-150*		

U Compound was analyzed for but not detected

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Boise, Idaho 83703
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Laboratory Analysis Report

Report To: BRANDON PECHIN
EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: bpechin@eaglesewer.org
Date Received: 04/30/2026
Collection Date/Time: 04/30/2026 9:30

County: ADA
Lab/Sample Number: 2609205-01
Sample Location: INFLUENT - GRAB

Date Printed: 05/20/2026 12:29
Collector's Name: ZANE
Transported By: ZANE
Temp C Received at Lab: 15.40

Field Measurements

pH: Total Chlorine mg/L: DO mg/L: Conductivity umhos/cm:
Temp C: Free Chlorine mg/L: Flow g/min: Turbidity NTU:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0336	0.00840		5/15/26 17:47	MER	EPA 1633	U
PFPeA	ND	ug/L	0.0168	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFHxA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFHpA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFOA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFNA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFDA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFUnA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFDoA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFTrDA	ND	ug/L	0.00840	0.00840		5/15/26 17:47	MER	EPA 1633	U
PFTeDA	ND	ug/L	0.00840	0.00840		5/15/26 17:47	MER	EPA 1633	U
PFBS	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFPeS	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFHxS	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFHpS	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFOS	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFNS	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFDS	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
PFDoS	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
4:2FTS	ND	ug/L	0.0315	0.00840		5/15/26 17:47	MER	EPA 1633	U
6:2FTS	ND	ug/L	0.0336	0.0105		5/15/26 17:47	MER	EPA 1633	U
8:2FTS	ND	ug/L	0.0336	0.0126		5/15/26 17:47	MER	EPA 1633	U
PFOSA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
NMeFOSA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
NEtFOSA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
N-MeFOSAA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
N-EtFOSSA	ND	ug/L	0.00840	0.00420		5/15/26 17:47	MER	EPA 1633	U
NMeFOSE	ND	ug/L	0.0840	0.0168		5/15/26 17:47	MER	EPA 1633	U
NEtFOSE	ND	ug/L	0.0840	0.0168		5/15/26 17:47	MER	EPA 1633	U
HFPO-DA	ND	ug/L	0.0336	0.00840		5/15/26 17:47	MER	EPA 1633	U
ADONA	ND	ug/L	0.0336	0.00840		5/15/26 17:47	MER	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0315	0.0126		5/15/26 17:47	MER	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0315	0.00840		5/15/26 17:47	MER	EPA 1633	U
3:3FTCA	ND	ug/L	0.0420	0.0210		5/15/26 17:47	MER	EPA 1633	U
5:3FTCA	ND	ug/L	0.210	0.0840		5/15/26 17:47	MER	EPA 1633	U
7:3FTCA	ND	ug/L	0.210	0.0840		5/15/26 17:47	MER	EPA 1633	U

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Semivolatiles (Continued)
2609205-01

PFEESA	ND	ug/L	0.0168	0.00840	5/15/26	17:47	MER	EPA 1633	U
PFMPA	ND	ug/L	0.0168	0.00420	5/15/26	17:47	MER	EPA 1633	U
PFMBA	ND	ug/L	0.0168	0.00420	5/15/26	17:47	MER	EPA 1633	U
NFDHA	ND	ug/L	0.0168	0.00840	5/15/26	17:47	MER	EPA 1633	U
Surrogate: 13C4-PFBA EIS	94.5	%5-174							
Surrogate: 13C5-PFPeA EIS	103	%20-162							
Surrogate: 13C5-PFHxA EIS	92.9	%41-150							
Surrogate: 13C4-PFHpA EIS	130	%55-150							
Surrogate: 13C8-PFOA EIS	93.6	%42-150							
Surrogate: 13C9-PFNA EIS	100	%47-142							
Surrogate: 13C6-PFDA EIS	97.2	%37-140							
Surrogate: 13C7-PFUnA EIS	77.9	%10-190							
Surrogate: 13C2-PFDoA EIS	79.1	%5-171							
Surrogate: 13C2-PFTeDA EIS	42.8	%5-140							
Surrogate: 13C3-PFBS EIS	87.2	%39-150							
Surrogate: 13C3-PFHxS EIS	99.6	%52-150							
Surrogate: 13C8-PFOS EIS	90.6	%32-144							
Surrogate: 13C2-4:2FTS EIS	102	%25-200							
Surrogate: 13C2-6:2FTS EIS	135	%24-200							
Surrogate: 13C2-8:2FTS EIS	149	%5-200							
Surrogate: 13C8-PFOSA EIS	87.6	%30-142							
Surrogate: D3-NMeFOSA EIS	62.9	%5-167							
Surrogate: D5-NEtFOSA EIS	66.4	%5-170							
Surrogate: D3-NMeFOSAA EIS	91.3	%45-200							
Surrogate: D5-NEtFOSAA EIS	90.1	%10-200							
Surrogate: D7-NMeFOSE EIS	58.9	%5-150							
Surrogate: D9-NEtFOSE EIS	55.4	%5-150							
Surrogate: 13C3-HFPO-DA EIS	92.3	%25-160							
Surrogate: 13C3-PFBA NIS	99.0	%50-150							
Surrogate: 13C2-PFHxA NIS	93.2	%50-150							
Surrogate: 13C4-PFOA NIS	112	%50-150							
Surrogate: 13C5-PFNA NIS	105	%50-150							
Surrogate: 13C2-PFDA NIS	105	%50-150							
Surrogate: 18O2-PFHxS NIS	109	%50-150							
Surrogate: 13C4-PFOS NIS	105	%50-150							

U Compound was analyzed for but not detected

Analytical Laboratories Inc

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Boise, Idaho 83703
Phone (208) 342-5515

www.analyticallaboratories.com
Lab Federal ID# ID00020

Laboratory Analysis Report

Report To: BRANDON PECHIN
EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: bpechin@eaglesewer.org
Date Received: 04/30/2026
Collection Date/Time: 04/30/2026 9:20

County: ADA
Lab/Sample Number: 2609205-02
Sample Location: EFFLUENT - GRAB

Date Printed: 05/20/2026 12:29
Collector's Name: ZANE
Transported By: ZANE
Temp C Received at Lab: 15.40

Field Measurements

pH: Total Chlorine mg/L: DO mg/L: Conductivity umhos/cm:
Temp C: Free Chlorine mg/L: Flow g/min: Turbidity NTU:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0308	0.00769		5/15/26 18:12	MER	EPA 1633	U
PFPeA	ND	ug/L	0.0154	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFHxA	0.00654	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	J
PFHpA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFOA	0.00581	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	J
PFNA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFDA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFUnA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFDoA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFTrDA	ND	ug/L	0.00769	0.00769		5/15/26 18:12	MER	EPA 1633	U
PFTeDA	ND	ug/L	0.00769	0.00769		5/15/26 18:12	MER	EPA 1633	U
PFBS	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFPeS	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFHxS	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFHpS	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFOS	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFNS	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFDS	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
PFDoS	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
4:2FTS	ND	ug/L	0.0288	0.00769		5/15/26 18:12	MER	EPA 1633	U
6:2FTS	ND	ug/L	0.0308	0.00962		5/15/26 18:12	MER	EPA 1633	U
8:2FTS	ND	ug/L	0.0308	0.0115		5/15/26 18:12	MER	EPA 1633	U
PFOSA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
NMeFOSA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
NEtFOSA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
N-MeFOSAA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
N-EtFOSSA	ND	ug/L	0.00769	0.00385		5/15/26 18:12	MER	EPA 1633	U
NMeFOSE	ND	ug/L	0.0769	0.0154		5/15/26 18:12	MER	EPA 1633	U
NEtFOSE	ND	ug/L	0.0769	0.0154		5/15/26 18:12	MER	EPA 1633	U
HFPO-DA	ND	ug/L	0.0308	0.00769		5/15/26 18:12	MER	EPA 1633	U
ADONA	ND	ug/L	0.0308	0.00769		5/15/26 18:12	MER	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0288	0.0115		5/15/26 18:12	MER	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0288	0.00769		5/15/26 18:12	MER	EPA 1633	U
3:3FTCA	ND	ug/L	0.0385	0.0192		5/15/26 18:12	MER	EPA 1633	U
5:3FTCA	ND	ug/L	0.192	0.0769		5/15/26 18:12	MER	EPA 1633	U
7:3FTCA	ND	ug/L	0.192	0.0769		5/15/26 18:12	MER	EPA 1633	U

Analytical Laboratories Inc

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Lab Federal ID# ID00020

Semivolatiles (Continued)
2609205-02

PFEESA	ND	ug/L	0.0154	0.00769	5/15/26	18:12	MER	EPA 1633	U
PFMPA	ND	ug/L	0.0154	0.00385	5/15/26	18:12	MER	EPA 1633	U
PFMBA	ND	ug/L	0.0154	0.00385	5/15/26	18:12	MER	EPA 1633	U
NFDHA	ND	ug/L	0.0154	0.00769	5/15/26	18:12	MER	EPA 1633	U
Surrogate: 13C4-PFBA EIS	98.1	%5-174							
Surrogate: 13C5-PFPeA EIS	97.8	%20-162							
Surrogate: 13C5-PFHxA EIS	101	%41-150							
Surrogate: 13C4-PFHpA EIS	111	%55-150							
Surrogate: 13C8-PFOA EIS	112	%42-150							
Surrogate: 13C9-PFNA EIS	100	%47-142							
Surrogate: 13C6-PFDA EIS	84.8	%37-140							
Surrogate: 13C7-PFUnA EIS	85.0	%10-190							
Surrogate: 13C2-PFDoA EIS	79.7	%5-171							
Surrogate: 13C2-PFTeDA EIS	53.0	%5-140							
Surrogate: 13C3-PFBS EIS	91.2	%39-150							
Surrogate: 13C3-PFHxS EIS	95.9	%52-150							
Surrogate: 13C8-PFOS EIS	89.9	%32-144							
Surrogate: 13C2-4:2FTS EIS	83.6	%25-200							
Surrogate: 13C2-6:2FTS EIS	88.7	%24-200							
Surrogate: 13C2-8:2FTS EIS	80.0	%5-200							
Surrogate: 13C8-PFOSA EIS	77.0	%30-142							
Surrogate: D3-NMeFOSA EIS	63.7	%5-167							
Surrogate: D5-NEtFOSA EIS	72.4	%5-170							
Surrogate: D3-NMeFOSAA EIS	78.8	%45-200							
Surrogate: D5-NEtFOSAA EIS	77.6	%10-200							
Surrogate: D7-NMeFOSE EIS	48.4	%5-150							
Surrogate: D9-NEtFOSE EIS	45.4	%5-150							
Surrogate: 13C3-HFPO-DA EIS	91.7	%25-160							
Surrogate: 13C3-PFBA NIS	98.6	%50-150							
Surrogate: 13C2-PFHxA NIS	96.4	%50-150							
Surrogate: 13C4-PFOA NIS	82.6	%50-150							
Surrogate: 13C5-PFNA NIS	94.1	%50-150							
Surrogate: 13C2-PFDA NIS	98.7	%50-150							
Surrogate: 18O2-PFHxS NIS	105	%50-150							
Surrogate: 13C4-PFOS NIS	101	%50-150							

J The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

U Compound was analyzed for but not detected

Remarks

EPA Method 1633 was performed by Anatek Labs.

Authorized Signature,



BRIAN MCGOVERN, Client Manager

Analytical Laboratories Inc

1804 N. 33rd Street
Boise, Idaho 83703
Phone (208) 342-5515

www.analyticallaboratories.com
Lab Federal ID# ID00020

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The results reported relate only to the samples indicated.

ND - Non Detect
MCL - Maximum Contaminant Level
MDL - Method Detection Limit
MRL - Method Reporting Limit

Analytical Laboratories Inc

1804 N. 33rd Street
Boise, Idaho 83703
Phone (208) 342-5515

www.analyticallaboratories.com
Lab Federal ID# ID00020

Quality Control Data

Semivolatiles

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE0574 - PFAS 537										
Blank (BGE0574-BLK1)					Prepared: 5/13/2026 Analyzed: 5/15/2026					
PFBA	ND	U	0.00747	ug/L						
PFPeA	ND	U	0.00373	ug/L						
PFHxA	ND	U	0.00187	ug/L						
PFHpA	ND	U	0.00187	ug/L						
PFOA	ND	U	0.00187	ug/L						
PFNA	ND	U	0.00187	ug/L						
PFDA	ND	U	0.00187	ug/L						
PFUnA	ND	U	0.00187	ug/L						
PFDoA	ND	U	0.00187	ug/L						
PFTrDA	ND	U	0.00187	ug/L						
PFTeDA	ND	U	0.00187	ug/L						
PFBS	ND	U	0.00187	ug/L						
PFPeS	ND	U	0.00187	ug/L						
PFHxS	ND	U	0.00187	ug/L						
PFHpS	ND	U	0.00187	ug/L						
PFOS	ND	U	0.00187	ug/L						
PFNS	ND	U	0.00187	ug/L						
PFDS	ND	U	0.00187	ug/L						
PFDoS	ND	U	0.00187	ug/L						
4:2FTS	ND	U	0.00700	ug/L						
6:2FTS	ND	U	0.00747	ug/L						
8:2FTS	ND	U	0.00747	ug/L						
PFOSA	ND	U	0.00187	ug/L						
NMeFOSA	ND	U	0.00187	ug/L						
NEtFOSA	ND	U	0.00187	ug/L						
N-MeFOSAA	ND	U	0.00187	ug/L						
N-EtFOSSA	ND	U	0.00187	ug/L						
NMeFOSE	ND	U	0.0187	ug/L						
NEtFOSE	ND	U	0.0187	ug/L						
HFPO-DA	ND	U	0.00747	ug/L						
ADONA	ND	U	0.00747	ug/L						
9Cl-PF3ONS	ND	U	0.00700	ug/L						
11Cl-PF3OUdS	ND	U	0.00700	ug/L						
3:3FTCA	ND	U	0.00933	ug/L						
5:3FTCA	ND	U	0.0467	ug/L						
7:3FTCA	ND	U	0.0467	ug/L						
PFEESA	ND	U	0.00373	ug/L						
PFMPA	ND	U	0.00373	ug/L						
PFMBA	ND	U	0.00373	ug/L						
NFDHA	ND	U	0.00373	ug/L						
Surrogate: 13C4-PFBA EIS			*0.0906*	*ug/L*	*0.0933*		*97.0*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0454*	*ug/L*	*0.0467*		*97.2*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0264*	*ug/L*	*0.0233*		*113*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0247*	*ug/L*	*0.0233*		*106*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0207*	*ug/L*	*0.0233*		*88.6*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0115*	*ug/L*	*0.0117*		*98.3*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.0109*	*ug/L*	*0.0117*		*93.3*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0112*	*ug/L*	*0.0117*		*96.0*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.0111*	*ug/L*	*0.0117*		*94.8*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.00907*	*ug/L*	*0.0117*		*77.8*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0185*	*ug/L*	*0.0217*		*85.2*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0206*	*ug/L*	*0.0221*		*93.0*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0203*	*ug/L*	*0.0224*		*90.9*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0379*	*ug/L*	*0.0438*		*86.5*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0366*	*ug/L*	*0.0444*		*82.5*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0377*	*ug/L*	*0.0448*		*84.1*	*5-200*		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE0574 - PFAS 537 (Continued)										
Blank (BGE0574-BLK1)					Prepared: 5/13/2026 Analyzed: 5/15/2026					
Surrogate: 13C8-PFOSA EIS			*0.0219*	*ug/L*	*0.0233*		*93.9*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0168*	*ug/L*	*0.0233*		*72.1*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0194*	*ug/L*	*0.0233*		*83.0*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0428*	*ug/L*	*0.0467*		*91.6*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0439*	*ug/L*	*0.0467*		*94.2*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.192*	*ug/L*	*0.233*		*82.3*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.189*	*ug/L*	*0.233*		*81.0*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.0819*	*ug/L*	*0.0933*		*87.7*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0502*	*ug/L*	*0.0467*		*108*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0248*	*ug/L*	*0.0233*		*106*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0263*	*ug/L*	*0.0233*		*113*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0120*	*ug/L*	*0.0117*		*103*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0123*	*ug/L*	*0.0117*		*105*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0257*	*ug/L*	*0.0221*		*116*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0234*	*ug/L*	*0.0224*		*105*	*50-150*		
LCS (BGE0574-BS1)					Prepared: 5/13/2026 Analyzed: 5/15/2026					
PFBA	0.0986		0.00772	ug/L	0.0965		102	50-150		
PFPeA	0.0463		0.00386	ug/L	0.0482		95.9	50-150		
PFHxA	0.0235		0.00193	ug/L	0.0241		97.4	50-150		
PFHpA	0.0272		0.00193	ug/L	0.0241		113	50-150		
PFOA	0.0238		0.00193	ug/L	0.0241		98.8	50-150		
PFNA	0.0212		0.00193	ug/L	0.0241		87.9	50-150		
PFDA	0.0253		0.00193	ug/L	0.0241		105	50-150		
PFUnA	0.0251		0.00193	ug/L	0.0241		104	50-150		
PFDoA	0.0236		0.00193	ug/L	0.0241		98.1	50-150		
PFTrDA	0.0256		0.00193	ug/L	0.0241		106	50-150		
PFTeDA	0.0248		0.00193	ug/L	0.0241		103	50-150		
PFBS	0.0225		0.00193	ug/L	0.0214		105	50-150		
PFPeS	0.0224		0.00193	ug/L	0.0227		99.0	50-150		
PFHxS	0.0220		0.00193	ug/L	0.0220		100	50-150		
PFHpS	0.0238		0.00193	ug/L	0.0230		104	50-150		
PFOS	0.0235		0.00193	ug/L	0.0224		105	50-150		
PFNS	0.0242		0.00193	ug/L	0.0231		104	50-150		
PFDS	0.0229		0.00193	ug/L	0.0232		98.4	50-150		
PFDoS	0.0199		0.00193	ug/L	0.0233		85.1	50-150		
4:2FTS	0.0893		0.00723	ug/L	0.0904		98.8	50-150		
6:2FTS	0.0922		0.00772	ug/L	0.0917		101	50-150		
8:2FTS	0.0978		0.00772	ug/L	0.0926		106	50-150		
PFOSA	0.0245		0.00193	ug/L	0.0241		102	50-150		
NMeFOSA	0.0278		0.00193	ug/L	0.0241		115	50-150		
NEtFOSA	0.0273		0.00193	ug/L	0.0241		113	50-150		
N-MeFOSAA	0.0258		0.00193	ug/L	0.0241		107	50-150		
N-EtFOSSA	0.0263		0.00193	ug/L	0.0241		109	50-150		
NMeFOSE	0.258		0.0193	ug/L	0.241		107	50-150		
NEtFOSE	0.254		0.0193	ug/L	0.241		105	50-150		
HFPO-DA	0.0914		0.00772	ug/L	0.0965		94.8	50-150		
ADONA	0.0872		0.00772	ug/L	0.0911		95.7	50-150		
9Cl-PF3ONS	0.0846		0.00723	ug/L	0.0900		94.0	50-150		
11Cl-PF3OUdS	0.0828		0.00723	ug/L	0.0910		91.0	50-150		
3:3FTCA	0.123		0.00965	ug/L	0.121		102	50-150		
5:3FTCA	0.574		0.0482	ug/L	0.603		95.2	50-150		
7:3FTCA	0.600		0.0482	ug/L	0.603		99.5	50-150		
PFEESA	0.0386		0.00386	ug/L	0.0430		89.8	50-150		
PFMPA	0.0491		0.00386	ug/L	0.0482		102	50-150		
PFMBA	0.0471		0.00386	ug/L	0.0482		97.7	50-150		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE0574 - PFAS 537 (Continued)										
LCS (BGE0574-BS1)				Prepared: 5/13/2026 Analyzed: 5/15/2026						
NFDHA	0.0437		0.00386	ug/L	0.0482		90.6	50-150		
Surrogate: 13C4-PFBA EIS			*0.0941*	*ug/L*	*0.0965*		*97.6*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0472*	*ug/L*	*0.0482*		*98.0*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0265*	*ug/L*	*0.0241*		*110*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0229*	*ug/L*	*0.0241*		*95.2*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0243*	*ug/L*	*0.0241*		*101*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0141*	*ug/L*	*0.0121*		*117*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.0109*	*ug/L*	*0.0121*		*90.4*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0116*	*ug/L*	*0.0121*		*95.8*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.0114*	*ug/L*	*0.0121*		*94.8*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.00931*	*ug/L*	*0.0121*		*77.2*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0199*	*ug/L*	*0.0225*		*88.6*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0221*	*ug/L*	*0.0229*		*96.7*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0219*	*ug/L*	*0.0231*		*94.6*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0446*	*ug/L*	*0.0452*		*98.7*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0431*	*ug/L*	*0.0459*		*93.9*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0425*	*ug/L*	*0.0463*		*91.8*	*5-200*		
Surrogate: 13C8-PFOSA EIS			*0.0215*	*ug/L*	*0.0241*		*89.1*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0163*	*ug/L*	*0.0241*		*67.6*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0176*	*ug/L*	*0.0241*		*73.0*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0438*	*ug/L*	*0.0482*		*90.9*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0439*	*ug/L*	*0.0482*		*91.1*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.189*	*ug/L*	*0.241*		*78.5*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.188*	*ug/L*	*0.241*		*77.9*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.100*	*ug/L*	*0.0965*		*104*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0497*	*ug/L*	*0.0482*		*103*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0245*	*ug/L*	*0.0241*		*102*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0236*	*ug/L*	*0.0241*		*97.9*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0123*	*ug/L*	*0.0121*		*102*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0130*	*ug/L*	*0.0121*		*108*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0239*	*ug/L*	*0.0229*		*104*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0238*	*ug/L*	*0.0231*		*103*	*50-150*		

U Compound was analyzed for but not detected

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Laboratory Analysis Report

Report To: CHRIS KOSSOW
EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: ckossow@eaglesewer.org
Date Received: 05/14/2026
Collection Date/Time: 05/14/2026 10:00

County: ADA
Lab/Sample Number: 2610487-01RE1
Sample Location: EFFLUENT +5

Date Printed: 06/12/2026 13:08
Collector's Name: ZANE
Transported By:
Temp C Received at Lab: 15.50

Field Measurements

pH: Total Chlorine mg/L: DO mg/L: Conductivity umhos/cm:
Temp C: Free Chlorine mg/L: Flow g/min: Turbidity NTU:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0321	0.00801		6/9/26 16:38	MER	EPA 1633	U
PFPeA	ND	ug/L	0.0160	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFHxA	0.00861	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	
PFHpA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFOA	0.00732	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	J
PFNA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFDA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFUnA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFDoA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFTrDA	ND	ug/L	0.00801	0.00801		6/9/26 16:38	MER	EPA 1633	U
PFTeDA	ND	ug/L	0.00801	0.00801		6/9/26 16:38	MER	EPA 1633	U
PFBS	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFPeS	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFHxS	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFHpS	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFOS	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFNS	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFDS	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
PFDoS	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
4:2FTS	ND	ug/L	0.0300	0.00801		6/9/26 16:38	MER	EPA 1633	U
6:2FTS	ND	ug/L	0.0321	0.0100		6/9/26 16:38	MER	EPA 1633	U
8:2FTS	ND	ug/L	0.0321	0.0120		6/9/26 16:38	MER	EPA 1633	U
PFOSA	0.00808	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	
NMeFOSA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
NEtFOSA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
N-MeFOSAA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
N-EtFOSSA	ND	ug/L	0.00801	0.00401		6/9/26 16:38	MER	EPA 1633	U
NMeFOSE	ND	ug/L	0.0801	0.0160		6/9/26 16:38	MER	EPA 1633	U
NEtFOSE	ND	ug/L	0.0801	0.0160		6/9/26 16:38	MER	EPA 1633	U
HFPO-DA	ND	ug/L	0.0321	0.00801		6/9/26 16:38	MER	EPA 1633	U
ADONA	ND	ug/L	0.0321	0.00801		6/9/26 16:38	MER	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0300	0.0120		6/9/26 16:38	MER	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0300	0.00801		6/9/26 16:38	MER	EPA 1633	U
3:3FTCA	ND	ug/L	0.0401	0.0200		6/9/26 16:38	MER	EPA 1633	U
5:3FTCA	ND	ug/L	0.200	0.0801		6/9/26 16:38	MER	EPA 1633	U
7:3FTCA	ND	ug/L	0.200	0.0801		6/9/26 16:38	MER	EPA 1633	U

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Semivolatiles (Continued)
2610487-01RE1

PFEESA	ND	ug/L	0.0160	0.00801	6/9/26	16:38	MER	EPA 1633	U
PFMPA	ND	ug/L	0.0160	0.00401	6/9/26	16:38	MER	EPA 1633	U
PFMBA	ND	ug/L	0.0160	0.00401	6/9/26	16:38	MER	EPA 1633	U
NFDHA	ND	ug/L	0.0160	0.00801	6/9/26	16:38	MER	EPA 1633	U
Surrogate: 13C4-PFBA EIS	90.3	%5-174							
Surrogate: 13C5-PFPeA EIS	93.1	%20-162							
Surrogate: 13C5-PFHxA EIS	90.0	%41-150							
Surrogate: 13C4-PFHpA EIS	94.0	%55-150							
Surrogate: 13C8-PFOA EIS	57.6	%42-150							
Surrogate: 13C9-PFNA EIS	82.7	%47-142							
Surrogate: 13C6-PFDA EIS	89.0	%37-140							
Surrogate: 13C7-PFUnA EIS	71.4	%10-190							
Surrogate: 13C2-PFDoA EIS	66.5	%5-171							
Surrogate: 13C2-PFTeDA EIS	47.4	%5-140							
Surrogate: 13C3-PFBS EIS	83.2	%39-150							
Surrogate: 13C3-PFHxS EIS	94.5	%52-150							
Surrogate: 13C8-PFOS EIS	78.5	%32-144							
Surrogate: 13C2-4:2FTS EIS	74.2	%25-200							
Surrogate: 13C2-6:2FTS EIS	85.9	%24-200							
Surrogate: 13C2-8:2FTS EIS	78.0	%5-200							
Surrogate: 13C8-PFOSA EIS	65.8	%30-142							
Surrogate: D3-NMeFOSA EIS	56.8	%5-167							
Surrogate: D5-NEtFOSA EIS	66.3	%5-170							
Surrogate: D3-NMeFOSAA EIS	75.3	%45-200							
Surrogate: D5-NEtFOSAA EIS	68.2	%10-200							
Surrogate: D7-NMeFOSE EIS	33.2	%5-150							
Surrogate: D9-NEtFOSE EIS	42.3	%5-150							
Surrogate: 13C3-HFPO-DA EIS	81.9	%25-160							
Surrogate: 13C3-PFBA NIS	108	%50-150							
Surrogate: 13C2-PFHxA NIS	103	%50-150							
Surrogate: 13C4-PFOA NIS	161	%50-150							I2
Surrogate: 13C5-PFNA NIS	106	%50-150							
Surrogate: 13C2-PFDA NIS	105	%50-150							
Surrogate: 18O2-PFHxS NIS	112	%50-150							
Surrogate: 13C4-PFOS NIS	113	%50-150							

I2 Internal standard response does not meet method criteria - confirmation extraction and analysis confirmed IS failure was due to matrix.

J The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

U Compound was analyzed for but not detected

Analytical Laboratories Inc

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Laboratory Analysis Report

Report To: CHRIS KOSSOW
EAGLE SEWER DISTRICT
44 N PALMETTO AVE
EAGLE, ID 83616
Phone: (208) 939-0781 Copy:
e-mail: ckossow@eaglesewer.org
Date Received: 05/14/2026
Collection Date/Time: 05/14/2026 10:10

County: ADA
Lab/Sample Number: 2610487-02RE1
Sample Location: INFLUENT

Date Printed: 06/12/2026 13:08
Collector's Name: ZANE
Transported By:
Temp C Received at Lab: 15.50

Field Measurements

pH: Total Chlorine mg/L: DO mg/L: Conductivity umhos/cm:
Temp C: Free Chlorine mg/L: Flow g/min: Turbidity NTU:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Semivolatiles									
PFBA	ND	ug/L	0.0397	0.00992		6/9/26 17:04	MER	EPA 1633	U
PFPeA	ND	ug/L	0.0198	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFHxA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFHpA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFOA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFNA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFDA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFUnA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFDoA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFTrDA	ND	ug/L	0.00992	0.00992		6/9/26 17:04	MER	EPA 1633	U
PFTeDA	ND	ug/L	0.00992	0.00992		6/9/26 17:04	MER	EPA 1633	U
PFBS	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFPeS	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFHxS	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFHpS	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFOS	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFNS	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFDS	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
PFDoS	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
4:2FTS	ND	ug/L	0.0372	0.00992		6/9/26 17:04	MER	EPA 1633	U
6:2FTS	ND	ug/L	0.0397	0.0124		6/9/26 17:04	MER	EPA 1633	U
8:2FTS	ND	ug/L	0.0397	0.0149		6/9/26 17:04	MER	EPA 1633	U
PFOSA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
NMeFOSA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
NEtFOSA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
N-MeFOSAA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
N-EtFOSSA	ND	ug/L	0.00992	0.00496		6/9/26 17:04	MER	EPA 1633	U
NMeFOSE	ND	ug/L	0.0992	0.0198		6/9/26 17:04	MER	EPA 1633	U
NEtFOSE	ND	ug/L	0.0992	0.0198		6/9/26 17:04	MER	EPA 1633	U
HFPO-DA	ND	ug/L	0.0397	0.00992		6/9/26 17:04	MER	EPA 1633	U
ADONA	ND	ug/L	0.0397	0.00992		6/9/26 17:04	MER	EPA 1633	U
9Cl-PF3ONS	ND	ug/L	0.0372	0.0149		6/9/26 17:04	MER	EPA 1633	U
11Cl-PF3OUdS	ND	ug/L	0.0372	0.00992		6/9/26 17:04	MER	EPA 1633	U
3:3FTCA	ND	ug/L	0.0496	0.0248		6/9/26 17:04	MER	EPA 1633	U
5:3FTCA	ND	ug/L	0.248	0.0992		6/9/26 17:04	MER	EPA 1633	U
7:3FTCA	ND	ug/L	0.248	0.0992		6/9/26 17:04	MER	EPA 1633	U

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Semivolatiles (Continued)
2610487-02RE1

PFEESA	ND	ug/L	0.0198	0.00992	6/9/26 17:04	MER	EPA 1633	U
PFMPA	ND	ug/L	0.0198	0.00496	6/9/26 17:04	MER	EPA 1633	U
PFMBA	ND	ug/L	0.0198	0.00496	6/9/26 17:04	MER	EPA 1633	U
NFDHA	ND	ug/L	0.0198	0.00992	6/9/26 17:04	MER	EPA 1633	U
Surrogate: 13C4-PFBA EIS	86.4	%5-174						
Surrogate: 13C5-PFPeA EIS	89.0	%20-162						
Surrogate: 13C5-PFHxA EIS	68.8	%41-150						
Surrogate: 13C4-PFHpA EIS	94.1	%55-150						
Surrogate: 13C8-PFOA EIS	98.2	%42-150						
Surrogate: 13C9-PFNA EIS	87.5	%47-142						
Surrogate: 13C6-PFDA EIS	96.6	%37-140						
Surrogate: 13C7-PFUnA EIS	71.3	%10-190						
Surrogate: 13C2-PFDoA EIS	77.0	%5-171						
Surrogate: 13C2-PFTeDA EIS	44.7	%5-140						
Surrogate: 13C3-PFBS EIS	73.0	%39-150						
Surrogate: 13C3-PFHxS EIS	92.3	%52-150						
Surrogate: 13C8-PFOS EIS	82.7	%32-144						
Surrogate: 13C2-4:2FTS EIS	91.1	%25-200						
Surrogate: 13C2-6:2FTS EIS	128	%24-200						
Surrogate: 13C2-8:2FTS EIS	185	%5-200						
Surrogate: 13C8-PFOSA EIS	78.4	%30-142						
Surrogate: D3-NMeFOSA EIS	65.9	%5-167						
Surrogate: D5-NEtFOSA EIS	59.9	%5-170						
Surrogate: D3-NMeFOSAA EIS	79.1	%45-200						
Surrogate: D5-NEtFOSAA EIS	87.4	%10-200						
Surrogate: D7-NMeFOSE EIS	54.4	%5-150						
Surrogate: D9-NEtFOSE EIS	50.1	%5-150						
Surrogate: 13C3-HFPO-DA EIS	83.4	%25-160						
Surrogate: 13C3-PFBA NIS	108	%50-150						
Surrogate: 13C2-PFHxA NIS	101	%50-150						
Surrogate: 13C4-PFOA NIS	105	%50-150						
Surrogate: 13C5-PFNA NIS	117	%50-150						
Surrogate: 13C2-PFDA NIS	121	%50-150						
Surrogate: 18O2-PFHxS NIS	120	%50-150						
Surrogate: 13C4-PFOS NIS	120	%50-150						

U Compound was analyzed for but not detected

Remarks

EPA Method 1633 was performed by Anatek Labs.

Authorized Signature,



BRIAN MCGOVERN, Client Manager

Analytical Laboratories Inc

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The results reported relate only to the samples indicated.
Results rely on client provided information and may be invalidated by any inaccuracies.

ND - Non Detect
MCL - Maximum Contaminant Level
MDL - Method Detection Limit
MRL - Method Reporting Limit

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Quality Control Data

Semivolatiles

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE1475 - PFAS 537										
Blank (BGE1475-BLK1)					Prepared: 5/29/2026 Analyzed: 6/1/2026					
PFBA	ND	U	0.00722	ug/L						
PFPeA	ND	U	0.00361	ug/L						
PFHxA	ND	U	0.00181	ug/L						
PFHpA	ND	U	0.00181	ug/L						
PFOA	ND	U	0.00181	ug/L						
PFNA	ND	U	0.00181	ug/L						
PFDA	ND	U	0.00181	ug/L						
PFUnA	ND	U	0.00181	ug/L						
PFDoA	ND	U	0.00181	ug/L						
PFTrDA	ND	U	0.00181	ug/L						
PFTeDA	ND	U	0.00181	ug/L						
PFBS	ND	U	0.00181	ug/L						
PFPeS	ND	U	0.00181	ug/L						
PFHxS	ND	U	0.00181	ug/L						
PFHpS	ND	U	0.00181	ug/L						
PFOS	ND	U	0.00181	ug/L						
PFNS	ND	U	0.00181	ug/L						
PFDS	ND	U	0.00181	ug/L						
PFDoS	ND	U	0.00181	ug/L						
4:2FTS	ND	U	0.00677	ug/L						
6:2FTS	ND	U	0.00722	ug/L						
8:2FTS	ND	U	0.00722	ug/L						
PFOSA	ND	U	0.00181	ug/L						
NMeFOSA	ND	U	0.00181	ug/L						
NEtFOSA	ND	U	0.00181	ug/L						
N-MeFOSAA	ND	U	0.00181	ug/L						
N-EtFOSSA	ND	U	0.00181	ug/L						
NMeFOSE	ND	U	0.0181	ug/L						
NEtFOSE	ND	U	0.0181	ug/L						
HFPO-DA	ND	U	0.00722	ug/L						
ADONA	ND	U	0.00722	ug/L						
9Cl-PF3ONS	ND	U	0.00677	ug/L						
11Cl-PF3OUdS	ND	U	0.00677	ug/L						
3:3FTCA	ND	U	0.00903	ug/L						
5:3FTCA	ND	U	0.0451	ug/L						
7:3FTCA	ND	U	0.0451	ug/L						
PFEESA	ND	U	0.00361	ug/L						
PFMPA	ND	U	0.00361	ug/L						
PFMBA	ND	U	0.00361	ug/L						
NFDHA	ND	U	0.00361	ug/L						
Surrogate: 13C4-PFBA EIS			*0.0829*	*ug/L*	*0.0903*		*91.9*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0366*	*ug/L*	*0.0451*		*81.2*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0183*	*ug/L*	*0.0226*		*81.1*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0207*	*ug/L*	*0.0226*		*91.7*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0306*	*ug/L*	*0.0226*		*136*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.0103*	*ug/L*	*0.0113*		*90.9*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.00928*	*ug/L*	*0.0113*		*82.2*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.00917*	*ug/L*	*0.0113*		*81.3*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.00829*	*ug/L*	*0.0113*		*73.5*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.00702*	*ug/L*	*0.0113*		*62.2*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0170*	*ug/L*	*0.0210*		*80.7*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0185*	*ug/L*	*0.0214*		*86.7*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0191*	*ug/L*	*0.0216*		*88.3*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0328*	*ug/L*	*0.0423*		*77.6*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0358*	*ug/L*	*0.0429*		*83.4*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0381*	*ug/L*	*0.0433*		*87.9*	*5-200*		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE1475 - PFAS 537 (Continued)										
Blank (BGE1475-BLK1)					Prepared: 5/29/2026 Analyzed: 6/1/2026					
Surrogate: 13C8-PFOSA EIS			*0.0185*	*ug/L*	*0.0226*		*82.1*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0155*	*ug/L*	*0.0226*		*68.9*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0155*	*ug/L*	*0.0226*		*68.5*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0419*	*ug/L*	*0.0451*		*92.9*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0413*	*ug/L*	*0.0451*		*91.6*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.168*	*ug/L*	*0.226*		*74.5*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.158*	*ug/L*	*0.226*		*70.2*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.0785*	*ug/L*	*0.0903*		*87.0*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0495*	*ug/L*	*0.0451*		*110*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0269*	*ug/L*	*0.0226*		*119*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0295*	*ug/L*	*0.0226*		*131*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0122*	*ug/L*	*0.0113*		*108*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0134*	*ug/L*	*0.0113*		*119*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0239*	*ug/L*	*0.0214*		*112*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0229*	*ug/L*	*0.0216*		*106*	*50-150*		
LCS (BGE1475-BS1)					Prepared: 5/29/2026 Analyzed: 6/1/2026					
PFBA	0.101		0.00736	ug/L	0.0920		109	50-150		
PFPeA	0.0429		0.00368	ug/L	0.0460		93.3	50-150		
PFHxA	0.0255		0.00184	ug/L	0.0230		111	50-150		
PFHpA	0.0211		0.00184	ug/L	0.0230		91.7	50-150		
PFOA	0.0248		0.00184	ug/L	0.0230		108	50-150		
PFNA	0.0250		0.00184	ug/L	0.0230		109	50-150		
PFDA	0.0279		0.00184	ug/L	0.0230		121	50-150		
PFUnA	0.0260		0.00184	ug/L	0.0230		113	50-150		
PFDoA	0.0264		0.00184	ug/L	0.0230		115	50-150		
PFTrDA	0.0260		0.00184	ug/L	0.0230		113	50-150		
PFTeDA	0.0251		0.00184	ug/L	0.0230		109	50-150		
PFBS	0.0231		0.00184	ug/L	0.0204		113	50-150		
PFPeS	0.0202		0.00184	ug/L	0.0216		93.3	50-150		
PFHxS	0.0221		0.00184	ug/L	0.0210		105	50-150		
PFHpS	0.0250		0.00184	ug/L	0.0219		114	50-150		
PFOS	0.0228		0.00184	ug/L	0.0214		107	50-150		
PFNS	0.0245		0.00184	ug/L	0.0221		111	50-150		
PFDS	0.0226		0.00184	ug/L	0.0222		102	50-150		
PFDoS	0.0150		0.00184	ug/L	0.0223		67.2	50-150		
4:2FTS	0.102		0.00690	ug/L	0.0862		119	50-150		
6:2FTS	0.101		0.00736	ug/L	0.0875		115	50-150		
8:2FTS	0.101		0.00736	ug/L	0.0883		114	50-150		
PFOSA	0.0312		0.00184	ug/L	0.0230		135	50-150		
NMeFOSA	0.0270		0.00184	ug/L	0.0230		117	50-150		
NEtFOSA	0.0248		0.00184	ug/L	0.0230		108	50-150		
N-MeFOSAA	0.0254		0.00184	ug/L	0.0230		111	50-150		
N-EtFOSSA	0.0239		0.00184	ug/L	0.0230		104	50-150		
NMeFOSE	0.280		0.0184	ug/L	0.230		122	50-150		
NEtFOSE	0.255		0.0184	ug/L	0.230		111	50-150		
HFPO-DA	0.103		0.00736	ug/L	0.0920		112	50-150		
ADONA	0.100		0.00736	ug/L	0.0870		116	50-150		
9Cl-PF3ONS	0.0783		0.00690	ug/L	0.0859		91.2	50-150		
11Cl-PF3OUdS	0.0669		0.00690	ug/L	0.0868		77.1	50-150		
3:3FTCA	0.139		0.00920	ug/L	0.115		121	50-150		
5:3FTCA	0.685		0.0460	ug/L	0.575		119	50-150		
7:3FTCA	0.628		0.0460	ug/L	0.575		109	50-150		
PFEESA	0.0469		0.00368	ug/L	0.0410		114	50-150		
PFMPA	0.0541		0.00368	ug/L	0.0460		118	50-150		
PFMBA	0.0518		0.00368	ug/L	0.0460		113	50-150		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BGE1475 - PFAS 537 (Continued)										
LCS (BGE1475-BS1)					Prepared: 5/29/2026 Analyzed: 6/1/2026					
NFDHA	0.0571		0.00368	ug/L	0.0460		124	50-150		
Surrogate: 13C4-PFBA EIS			*0.0848*	*ug/L*	*0.0920*		*92.2*	*5-174*		
Surrogate: 13C5-PFPeA EIS			*0.0399*	*ug/L*	*0.0460*		*86.7*	*20-162*		
Surrogate: 13C5-PFHxA EIS			*0.0198*	*ug/L*	*0.0230*		*86.2*	*41-150*		
Surrogate: 13C4-PFHpA EIS			*0.0242*	*ug/L*	*0.0230*		*105*	*55-150*		
Surrogate: 13C8-PFOA EIS			*0.0340*	*ug/L*	*0.0230*		*148*	*42-150*		
Surrogate: 13C9-PFNA EIS			*0.00992*	*ug/L*	*0.0115*		*86.2*	*47-142*		
Surrogate: 13C6-PFDA EIS			*0.0109*	*ug/L*	*0.0115*		*94.6*	*37-140*		
Surrogate: 13C7-PFUnA EIS			*0.0110*	*ug/L*	*0.0115*		*95.4*	*10-190*		
Surrogate: 13C2-PFDoA EIS			*0.00944*	*ug/L*	*0.0115*		*82.1*	*5-171*		
Surrogate: 13C2-PFTeDA EIS			*0.00812*	*ug/L*	*0.0115*		*70.6*	*5-140*		
Surrogate: 13C3-PFBS EIS			*0.0190*	*ug/L*	*0.0214*		*88.5*	*39-150*		
Surrogate: 13C3-PFHxS EIS			*0.0207*	*ug/L*	*0.0218*		*94.9*	*52-150*		
Surrogate: 13C8-PFOS EIS			*0.0197*	*ug/L*	*0.0220*		*89.2*	*32-144*		
Surrogate: 13C2-4:2FTS EIS			*0.0384*	*ug/L*	*0.0432*		*88.9*	*25-200*		
Surrogate: 13C2-6:2FTS EIS			*0.0396*	*ug/L*	*0.0438*		*90.5*	*24-200*		
Surrogate: 13C2-8:2FTS EIS			*0.0392*	*ug/L*	*0.0442*		*88.7*	*5-200*		
Surrogate: 13C8-PFOSA EIS			*0.0191*	*ug/L*	*0.0230*		*83.1*	*30-142*		
Surrogate: D3-NMeFOSA EIS			*0.0157*	*ug/L*	*0.0230*		*68.0*	*5-167*		
Surrogate: D5-NEtFOSA EIS			*0.0164*	*ug/L*	*0.0230*		*71.4*	*5-170*		
Surrogate: D3-NMeFOSAA EIS			*0.0423*	*ug/L*	*0.0460*		*91.9*	*45-200*		
Surrogate: D5-NEtFOSAA EIS			*0.0443*	*ug/L*	*0.0460*		*96.2*	*10-200*		
Surrogate: D7-NMeFOSE EIS			*0.185*	*ug/L*	*0.230*		*80.6*	*5-150*		
Surrogate: D9-NEtFOSE EIS			*0.175*	*ug/L*	*0.230*		*76.1*	*5-150*		
Surrogate: 13C3-HFPO-DA EIS			*0.0937*	*ug/L*	*0.0920*		*102*	*25-160*		
Surrogate: 13C3-PFBA NIS			*0.0480*	*ug/L*	*0.0460*		*104*	*50-150*		
Surrogate: 13C2-PFHxA NIS			*0.0243*	*ug/L*	*0.0230*		*106*	*50-150*		
Surrogate: 13C4-PFOA NIS			*0.0267*	*ug/L*	*0.0230*		*116*	*50-150*		
Surrogate: 13C5-PFNA NIS			*0.0125*	*ug/L*	*0.0115*		*109*	*50-150*		
Surrogate: 13C2-PFDA NIS			*0.0114*	*ug/L*	*0.0115*		*99.0*	*50-150*		
Surrogate: 18O2-PFHxS NIS			*0.0224*	*ug/L*	*0.0218*		*103*	*50-150*		
Surrogate: 13C4-PFOS NIS			*0.0229*	*ug/L*	*0.0220*		*104*	*50-150*		

U Compound was analyzed for but not detected

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

Argued January 20, 2026 Decided August 18, 2026

No. 24-1193

CHAMBER OF COMMERCE OF THE UNITED STATES OF AMERICA, ET AL.,
PETITIONERS

v.

ENVIRONMENTAL PROTECTION AGENCY AND LEE M. ZELDIN, IN HIS OFFICIAL CAPACITY AS ADMINISTRATOR, UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,
RESPONDENTS

CLEAN CAPE FEAR, ET AL.,
INTERVENORS

Consolidated with Nos. 24-1261, 24-1266, 24-1271, 24-1272

On Petitions for Review of a Final Rule
of the Environmental Protection Agency

Elbert Lin argued the cause for petitioners. With him on the briefs were *Andrew R. Varcoe*, *Stephanie A. Maloney*, *Paul T. Nyffeler*, *David M. Parker*, *Matthew Z. Leopold*, *Christopher*

L. Bell, *Susan Parker Bodine*, *Richard S. Moskowitz*, and *Tyler Kubik*. *Brittany M. Pemberton* entered an appearance.

Michael B. Kimberly and *Michael A. Tilghman II* were on the brief for amici curiae National Association of Manufacturers and Printing United Alliance in support of petitioners. *Nicole E. Wittstein* entered an appearance.

Douglas A. Hastings and *Mark Donatiello* were on the brief for amicus curiae Superfund Settlements Project in support of petitioners.

Erica Spitzig, *Aaron M. Herzig*, *Anne M. McClellan*, and *David C. Roper* were on the brief for amicus curiae Passive Receivers in support of remand.

Riley W. Walters, Counsel to the Assistant Attorney General, U.S. Department of Justice, argued the cause for respondents. On the brief were *Adam R.F. Gustafson*, Principal Deputy Assistant Attorney General, and *Jin Hyung Lee*, Attorney, and *Elizabeth G. Berg* and *Noel M. Johnson*, Attorneys, U.S. Environmental Protection Agency.

Jonathan Kalmuss-Katz argued the cause for intervenors Clean Cape Fear, et al. in support of respondents. With him on the brief were *Lillian Zhou* and *Alana R. Reynolds*.

Letitia James, Attorney General for the State of New York, *Barbara D. Underwood*, Solicitor General, *Judith Vale*, Deputy Solicitor General, *Joshua N. Cohen*, Assistant Solicitor General, *Philip M. Bein*, Senior Counsel, *Kyle Burns*, Assistant Attorney General, *Mihir Desai*, Assistant Attorney General, *Kristin K. Mayes*, Attorney General for the State of Arizona, *Philip J. Weiser*, Attorney General for the State of Colorado, *William Tong*, Attorney General for the State of Connecticut,

Brian L. Schwalb, Attorney General for the District of Columbia, *Kwame Raoul*, Attorney General for the State of Illinois, *Anthony G. Brown*, Attorney General for the State of Maryland, *Andrea J. Campbell*, Attorney General for the Commonwealth of Massachusetts, *Dana Nessel*, Attorney General for the State of Michigan, *Keith Ellison*, Attorney General for the State of Minnesota, *Matthew J. Platkin*, Attorney General for the State of New Jersey, *Raúl Torrez*, Attorney General for the State of New Mexico, *Dan Rayfield*, Attorney General for the State of Oregon, *Nicholas W. Brown*, Attorney General for the State of Washington, and *Josh Kaul*, Attorney General for the State of Wisconsin, were on the brief for amici curiae States of New York, et al. in support of respondents.

Before: MILLETT, KATSAS, and RAO, *Circuit Judges*.

Opinion for the Court filed by *Circuit Judge* MILLETT.

MILLETT, *Circuit Judge*: Perfluorooctanoic Acid ("PFOA") and Perfluorooctanesulfonic Acid ("PFOS") are two compounds in a large group of human-made substances commonly referred to as "forever chemicals." In 2024, the Environmental Protection Agency designated PFOA and PFOS as "hazardous substances" under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. EPA based its determination on extensive studies that link PFOA and PFOS exposure to serious health conditions in humans, including cancer and developmental delays.

Seven interest groups representing industries that use, transport, or discharge PFOA and PFOS petitioned this court to overturn EPA's decision. We deny those petitions.

I

A

Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act, Pub. L. No. 96-510, 94 Stat. 2767, in 1980, and added to that regime in 1986 with the Superfund Amendments and Reauthorization Act of 1986, Pub. L. No. 99-499, 100 Stat. 1613, now codified together at 42 U.S.C. § 9601 *et seq.* ("CERCLA"). CERCLA governs the cleanup of "hazardous substances" and "pollutants or contaminants" from the environment. 42 U.S.C. §§ 9604, 9606. The Act was Congress's response to a series of high-profile toxic chemical releases, including the infamous dump of thousands of tons of chemicals in Love Canal, New York that led to birth defects, miscarriages, and a devastated community. *See* S. REP. NO. 848, 96th Cong., 2d Sess. 4–5, 8–10 (1980); *see also Niagara Mohawk Power Corp. v. Chevron U.S.A., Inc.*, 596 F.3d 112, 120 & n.5 (2d Cir. 2010).

CERCLA classifies as a "hazardous substance" those substances listed in or designated under other environmental laws, like the Clean Water Act. There are currently over 800 such hazardous substances. 42 U.S.C. § 9601(14); 40 C.F.R. § 302.4 table (enumerating those substances). CERCLA also authorizes EPA to designate as additional "hazardous substances" those "elements, compounds, mixtures, solutions, and substances" that, "when released into the environment[,] may present substantial danger to the public health or welfare or the environment[.]" 42 U.S.C. § 9602(a).

CERCLA both encourages "timely cleanup" of harmful chemical releases and hazardous waste sites and "ensure[s] that the costs" of cleanups are "borne by those responsible" for the pollution. *Atlantic Richfield Co. v. Christian*, 140 S. Ct. 1335,

1345 (2020) (quoting *CTS Corp. v. Waldburger*, 573 U.S. 1, 4 (2014)).

CERCLA provides for two kinds of cleanups: (1) removal actions and (2) remedial actions. 42 U.S.C. § 9601(23), (24), (25). Removal actions are short-term measures aimed at promptly preventing or mitigating a release of dangerous chemicals. J.A. 447–448.

Remedial actions, on the other hand, are longer-term efforts involving "a complex, multi-phase process" aimed at "significantly reduc[ing] serious but not immediately life-threatening risks" from chemical releases. J.A. 447; *see* 42 U.S.C. § 9601(24). Remedial actions are generally conducted at locations listed on the "National Priorities List," a statutorily mandated list of sites across the country that present the greatest danger to public health. 42 U.S.C. § 9605(a)(8)(A)–(B); *Linemaster Switch Corp. v. EPA*, 938 F.2d 1299, 1301 (D.C. Cir. 1991). They are commonly known as "Superfund sites[.]" *Atlantic Richfield Co.*, 140 S. Ct. at 1346.

Cleanups can proceed along two statutory pathways. First, "Section 106" cleanups are triggered only by the release of a "hazardous substance[.]" 42 U.S.C. § 9606(a). For these cleanups, EPA may compel responsible parties to undertake the cleanup in the first instance. *Id.*

Second, "Section 104" cleanups can be triggered by the release of either (1) a "hazardous substance" or (2) a "pollutant or contaminant" if it "may present an imminent and substantial danger to the public health or welfare[.]" 42 U.S.C. § 9604(a)(1). A "pollutant or contaminant" is defined as including:

> [A]ny element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring[.]
>
> 42 U.S.C. § 9601(33).

Within Section 104 cleanups, who foots the bill depends on what needs cleaning up. When EPA leads the cleanup of hazardous substances, the responsible polluters can later be made to cover the costs through cost-recovery actions, so long as the cleanups were "not inconsistent with the national contingency plan[.]" 42 U.S.C. § 9607(a); *Cooper Indus., Inc. v. Aviall Servs., Inc.*, 543 U.S. 157, 161 (2004). The National Contingency Plan, in turn, is a series of statutorily required regulations that prescribe the methods and scope of Section 104 cleanups. 42 U.S.C. § 9605; 40 C.F.R. pt. 300.

Such refund actions are not possible for releases of pollutants or contaminants, however. *See* 42 U.S.C. § 9607(a). That means that Section 104 cleanups of pollutants or contaminants are paid for entirely by public funds, either (1) through the Superfund, which Congress set up to pay for major CERCLA cleanup efforts, 42 U.S.C. § 9611(a); *Ohio v. Department of the Interior*, 880 F.2d 432, 439 (D.C. Cir. 1989), or (2) through appropriations by Congress, *see* GOVERNMENT ACCOUNTABILITY OFF., GAO-15-812, SUPERFUND: TRENDS IN

FEDERAL FUNDING AND CLEANUP OF EPA'S NONFEDERAL NATIONAL PRIORITIES LIST SITES 12 (2015).

B

Perfluoroalkyl and Polyfluoroalkyl Substances ("PFAS") is the scientific name for a broad category of human-made chemicals. Designation of Perfluorooctanoic Acid (PFOA) and Perfluorooctanesulfonic Acid (PFOS) as CERCLA Hazardous Substances, 89 Fed. Reg. 39,124, 39,125 (May 8, 2024) ("*Designation*"). They have been used in the United States since the 1940s to create water- and oil-resistant products like cookware, rain-repellent clothing, and firefighting foam. *Id.* at 39,126.

PFAS take hundreds of years to degrade in the environment and take decades to be eliminated from human bodies, earning them the title "forever chemicals[.]" *Designation*, 89 Fed. Reg. at 39,126 (quotation marks omitted). PFAS have also been linked to many adverse health effects, including cancer, developmental effects in children, and cardiovascular conditions. *See id.* at 39,145–39,146.

EPA has historically regulated two of the most common PFAS—PFOA and PFOS—as "pollutants or contaminants" under CERCLA. *Designation*, 89 Fed. Reg. at 39,153.

Several years ago, as scientific evidence of the harms posed by PFOA and PFOS accumulated, EPA began considering whether to designate the two chemicals as "hazardous substances" under CERCLA. In studying the issue, EPA published in August 2022 an Economic Assessment delving into a quantitative cost-benefit analysis of the direct impacts of such a designation and a qualitative analysis of the indirect impacts. J.A. 103–111. The Assessment also

requested public comment on thirteen discreet issues regarding its initial cost-benefit analyses. J.A. 118.

One month later, EPA published a Notice of Proposed Rulemaking suggesting the designation of PFOA and PFOS as "hazardous substances" under CERCLA. *See* Designation of [PFOA] and [PFOS] as CERCLA Hazardous Substances, 87 Fed. Reg. 54,415, 54,417 (Sept. 6, 2022).

In doing so, EPA requested comments specifically on:

> (1) Whether CERCLA section 102(a) precludes, allows, or requires consideration of cost in designation decisions, and, if so, (2) which costs and benefits of those discussed in the EA [Economic Assessment] should be considered, (3) whether additional benefits and costs not identified in the EA should be considered, (4) if indirect benefits and costs are considered, how they should be assessed in light of the discretion and uncertainties described above, (5) how benefits and costs could be incorporated into the designation decision, and (6) whether designation would be justified if costs were to be considered in the Agency's designation decision.

87 Fed. Reg. at 54,423.

After receiving comments, including from Petitioners, EPA issued its final rule in May 2024. *Designation*, 89 Fed. Reg. at 39,124; *e.g.*, J.A. 681, 687, 714. EPA used two factors to determine that PFOA and PFOS qualified as "hazardous substances." First, EPA considered "the potential harm to humans or the environment from exposure to the substance (i.e., hazard)," and second, "how the substance potentially moves, persists, and/or changes when in the environment (i.e.,

environmental fate and transport)." *Designation*, 89 Fed. Reg. at 39,141. EPA concluded that both weighed in favor of designation, crediting the significant body of research on adverse health effects as well as the tendency of PFOA and PFOS to remain for many years in the environment and to bioaccumulate in human bodies. *See id.* at 39,143–39,148.

EPA then assumed without deciding that CERCLA required a cost-benefit analysis of that designation. *Designation*, 89 Fed. Reg. at 39,143. EPA's evaluation of the costs and benefits contained both "quantitative and qualitative" considerations. *Id.* at 39,149. EPA published the cost-benefit analysis in a document entitled "Regulatory Impact Analysis[,]" and attached it to the final rule. *Id.* at 39,149; J.A. 368–659.

EPA's designation of PFOA and PFOS as "hazardous substances" has three direct impacts on regulated parties.

First, parties responsible for a release of more than one pound of PFOA or PFOS must report that release to national authorities, 42 U.S.C. §§ 9602(b), 9603; *Waterkeeper Alliance v. EPA*, 853 F.3d 527, 531 (D.C. Cir. 2017), and, in some cases, to local authorities and the public, 42 U.S.C. §§ 9611(g), 11004; 40 C.F.R. § 355.

Second, federal agencies selling land contaminated with PFOA and PFOS generally must provide notice of the presence of hazardous substances. 42 U.S.C. § 9620(h).

Third, shippers must identify and mark shipments of PFOA and PFOS weighing more than one pound, pursuant to the Hazardous Materials Transportation Act of 1975, 49 U.S.C. § 5101 *et seq.*, 42 U.S.C. § 9656(a); 49 C.F.R. § 171.1.

The Designation leads to indirect impacts as well. In some circumstances, after several more regulatory steps, EPA may compel polluters to abate and clean up releases of PFOA or PFOS. 42 U.S.C. § 9606. In other circumstances, the federal government, States, and adversely affected private parties may pursue enforcement actions to recover cleanup costs from responsible polluters. 42 U.S.C. § 9607; *see* 40 C.F.R. §§ 300.410, 300.420; 42 U.S.C. § 9606(a).

Seven interest groups for various companies that use, transport, or discharge PFOA and PFOS in their manufacturing, transportation, and waste management ("Petitioners"), petitioned this court to vacate the Designation. Petitioners challenge EPA's (1) interpretation of "hazardous substances" to include PFOA and PFOS as contrary to law, 5 U.S.C. § 706(2)(A); (2) cost-benefit analysis as arbitrary and capricious, *id.*, and in violation of Administrative Procedure Act's notice requirement, *id.* § 553; and (3) decision to regulate in the face of uncertainties as arbitrary and capricious, *id.* § 706(2)(A).[1]

II

We have exclusive jurisdiction over these petitions for review of a "regulation promulgated under" CERCLA. 42 U.S.C. § 9613(a).

[1] Petitioners are the Chamber of Commerce of the United States of America ("Chamber of Commerce"), American Chemistry Council, American Fuel & Petrochemical Manufacturers, Associated General Contractors of America, Inc., National Waste & Recycling Association, Institute of Scrap Recycling Industries, d/b/a the Recycled Materials Association, and American Forest & Paper Association.

Petitioners have the jurisdictionally required Article III associational standing. *See, e.g.*, *Students for Fair Admissions, Inc. v. President & Fellows of Harvard College*, 143 S. Ct. 2141, 2157 (2023). Petitioners have identified member companies that use PFOA- and PFOS-containing products and attest that they "are already seeing impacts on their overall project expenses" in complying with the terms of CERCLA. *See* Decl. of Leah Pilconis ¶¶ 19, 23–24, 27–28; Decl. of Charles Mull ¶¶ 7, 9–12; Decl. of John M. Perkey ¶¶ 18–20; Decl. of Anne Germain ¶ 10. Those increased expenses are concrete injuries in fact assertedly caused by the Designation that could be redressed by court action. In addition, the associations' interests in protecting companies from CERCLA's liability regime are germane to their missions of promoting the financial and regulatory interests of private industry. *See* Decl. of Martin Durbin ¶ 5; Decl. of Anne Germain ¶ 3; Decl. of Leah Pilconis ¶¶ 4–5. Petitioners also have shown that the participation of individual members is not required to seek the equitable relief of vacatur. *See Center for Biological Diversity v. EPA*, 56 F.4th 55, 67 (D.C. Cir. 2022).

In reviewing Petitioners' contrary to law claims, we must independently determine the "best" reading of CERCLA's text by "applying all relevant interpretive tools." *Loper Bright Enters. v. Raimondo*, 144 S. Ct. 2244, 2266 (2024). Our review of Petitioners' arbitrary and capricious claims is "deferential" to the agency. *FCC v. Prometheus Radio Project*, 141 S. Ct. 1150, 1158 (2021) ("A court simply ensures that the agency has acted within a zone of reasonableness and, in particular, has reasonably considered the relevant issues and reasonably explained the decision."); *see also Meritor, Inc. v. EPA*, 966 F.3d 864, 869 (D.C. Cir. 2020) ("In conducting this review, we

afford the EPA significant deference with respect to the highly technical issues involved.") (formatting modified).

Finally, we must set aside a rule if the agency failed to provide the requisite notice and comment and the petitioner has shown prejudice. 5 U.S.C. § 553(b); *Petaluma FX Partners, LLC v. Commissioner*, 792 F.3d 72, 81 (D.C. Cir. 2015).

III

Petitioners advance three challenges to the Designation. They contend that: (1) EPA misinterpreted the term "may present substantial danger" in CERCLA's definition of a hazardous substance; (2) EPA's cost-benefit analysis provided insufficient notice to the parties; and (3) EPA's cost-benefit analysis and decision to regulate in the face of uncertainty were arbitrary and capricious.

None of those claims succeeds. The plain language of Section 9602 allows EPA to designate as hazardous substances chemicals like PFOA and PFOS that repeatedly have been linked to adverse health effects in myriad peer-reviewed studies. EPA provided adequate notice of its cost-benefit analysis underlying the ultimate Designation through its earlier Economic Assessment and request for comments on it. Finally, EPA acted reasonably based on the record before it in its calculation of costs and benefits, and in its decision to take this regulatory step of designating PFOA and PFOS to be hazardous substances.

A

Petitioners argue that, in interpreting the phrase "may present substantial danger" in CERCLA's definition of a hazardous substance, EPA had to find that substantial danger

"will" occur upon release to avoid overinclusion and to comply with the nondelegation and void-for-vagueness doctrines. Pet'rs' Reply Br. 14; Pet'rs' Opening Br. at 31–32. Petitioners are wrong as a matter of statutory text and precedent.

1

The plain statutory text refutes Petitioners' argument. CERCLA provides that EPA "shall" "designat[e] as hazardous substances" those "elements, compounds, mixtures, solutions, and substances which, when released into the environment may present substantial danger to the public health or welfare or the environment[.]" 42 U.S.C. § 9602(a).

In making the Designation, EPA determined that "may" means "at a minimum, there is a possibility" that the released substance presents a substantial danger to public health, welfare or the environment, and that "EPA need not have certainty" of that danger. *Designation*, 89 Fed. Reg. at 39,141.

Petitioners challenge EPA's interpretation of "may[,]" arguing that reading it to mean a "possibility" of substantial harm lacks "fix[ed] boundaries" and is "unreasonably broad." Pet'rs' Opening Br. 28–29 (secondly quoting *Loper Bright*, 144 S. Ct. at 2263). According to Petitioners, "may" in the statute means that whenever a substance is released, the danger "will be actually existing or real." Pet'rs' Reply Br. 12–13 (quotation marks omitted).

EPA has the best reading of the statute as a matter of text and context.

To start, the statute straightforwardly uses "may" to refer to the chance of harm to public health, not its certainty. The primary meaning of "may" is one of contingency both in

ordinary usage and in dictionaries at the time of CERCLA's enactment. *See May*, BLACK'S LAW DICTIONARY (5th ed. 1979) ("An auxiliary verb qualifying the meaning of another verb by expressing ability, competency, liberty, permission, possibility, probability or contingency."); *May*, BALLENTINE'S LAW DICTIONARY 785 (3d. ed. 1969) ("Ordinarily a permissive, rather than a mandatory, term in a statute."); *May*, OXFORD AMERICAN DICTIONARY 410 (1980) ("expressing possibility (*it may be true*)"); *May*, WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 1396 (1981) ("be in some degree likely to" as in "you [may] be right"); *May*, WEBSTER'S NEW WORLD DICTIONARY 463 (2d Concise ed. 1982) ("possibility or likelihood [it *may* rain]"); *May*, THE RANDOM HOUSE DICTIONARY OF THE ENGLISH LANGUAGE 1189 (2d unabr. ed. 1987) ("used to express possibility" as in "[*i*]*t may rain*").

Even more to the point, the statute says when that contingency should be assessed, which is at the time—"when"—the substance is "released into the environment[.]" 42 U.S.C. § 9602(a). In that way, the statute directs EPA to forecast the future risk of harm at the time of a release.

Petitioners' insistence that the harm must be certain to occur at the time of release rewrites rather than interprets the statutory text. If Congress wanted to adopt Petitioners' preferred approach, it would have said: "substances which, when released into the environment ~~may~~ **will** present substantial danger to the public health or welfare or the environment[.]" *Compare* Pet'rs' Reply Br. 12–13 ("[I]f the condition of release is satisfied, the result of substantial danger to the public health or welfare or the environment will be actually existing or real.") (quotation marks omitted), *with* 42 U.S.C. § 9602(a) (using simply "may").

Also, the dictionaries on which Petitioners rely refute their argument, providing that the word "may" will not be treated as a word of command or requirement "unless there is something in [the] context" of a statute "to indicate that it was used in such sense." *May*, BLACK'S LAW DICTIONARY (5th ed. 1979); *see also May*, BALLENTINE'S LAW DICTIONARY 785 (3d. ed. 1969) ("Discretionary in its grammatical sense, but subject to construction as mandatory *where the sense of the entire context impels such construction*[.]") (emphasis added). Missing from Petitioners' argument is anything in the context that impels overriding the ordinary meaning of "may[.]"

Petitioners also forget that, in CERCLA, Congress wrote a statute that would operate on the basis of scientific knowledge and information about health and environmental risks. Congress presumably knew that "[s]cientists typically speak not of certainty, but of probability; they are trained to act on probabilities that statistically constitute 'certainties.'" *Ethyl Corp. v. EPA*, 541 F.2d 1, 25 n.52 (D.C. Cir. 1976) (*en banc*); *see also id.* ("Even scientific 'facts' are not certain, but only theories with high probabilities of validity."); *cf. Center for Biological Diversity v. EPA*, 749 F.3d 1079, 1090 (D.C. Cir. 2014) ("[A statute] may at times require * * * action in the face of uncertainty, lest 'the precautionary purpose of the statute' be undermined.") (quoting *Ethyl Corp.*, 541 F.2d at 28). To require absolute scientific certainty as to what will happen upon every individual release of a dangerous chemical would have been to legislatively paralyze CERCLA.

Petitioners worry that such an ordinary and contextual reading of the text would permit EPA to categorize table salt as a hazardous substance. Petitioners' argument overlooks the required finding that a release may present "substantial danger" to public health, welfare, or the environment. 42 U.S.C. § 9602(a). That criterion has real bite. The risk of harm must

be both serious and real, not hypothesized. *See Substantial*, BLACK'S LAW DICTIONARY (5th ed. 1979) ("actually existing; real; not seeming or imaginary; not illusive; solid; true; veritable"); *Substantial*, OXFORD AMERICAN DICTIONARY 683 (1980) ("of considerable amount or intensity or validity"); *Substantial*, WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 2280 (1981) ("considerable in amount, value, or worth"); *Substantial*, XVII THE OXFORD ENGLISH DICTIONARY 66 (2d ed. 1989) ("That is, or exists as, a substance; having a real existence"); *Danger*, BLACK'S LAW DICTIONARY (5th ed. 1979) ("Jeopardy; exposure to loss or injury; peril."); *Danger*, OXFORD AMERICAN DICTIONARY 160 (1980) ("liability or exposure to harm or to death"); *Danger*, WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 573 (1981) ("Harm, Injury, Damage") (capitalization altered); *Danger*, IV THE OXFORD ENGLISH DICTIONARY 241 (2d ed. 1989) ("Liability or exposure to harm or injury; the condition of being exposed to the chance of evil; risk, peril.").

More to the point, this case does not require rigidly defining the precise boundaries of the term "substantial danger[.]" That is because, for all their verbal debating, Petitioners tellingly do not dispute that PFOA and PFOS qualify as substances that may pose a substantial risk to public health, welfare, and the environment if released. Nor could they. The Designation cited dozens of studies showing "[c]ollectively" that "each PFOA and PFOS individually pose[s] a human health hazard[.]" *Designation*, 89 Fed. Reg. at 39,144. The Designation spent three full pages cataloguing just "some" of the health conditions associated with PFOA and PFOS exposure: developmental effects including decreased infant birth weight and effects on fetuses during pregnancy; cardiovascular impacts like increased cholesterol in adolescents; increased liver enzymes, which can impact liver function; immunosuppression in adults and children; impacted

thyroid function; and preeclampsia and gestational hypertension in pregnant women. *Id.* at 39,144–39,146.

That is not all. After reviewing toxicity assessments in drinking water, EPA classified PFOA and PFOS as "likely to be carcinogenic to humans[.]" *Designation*, 89 Fed. Reg. at 39,143 (formatting modified). The PFOA determination was based on "evidence of kidney and testicular cancer in humans and Leydig cell tumors, pancreatic acinar cell tumors, and hepatocellular adenomas in rats." *Id.* at 39,144. So too was the PFOS determination based on "evidence of hepatocellular tumors in humans and rats, pancreatic islet cell carcinomas in male rats, and mixed but plausible evidence of bladder, prostate, kidney, and breast cancers in humans[.]" *Id.*

EPA is not alone in these concerns. As the Designation noted, the International Agency for Research on Cancer, a subsidiary of the World Health Organization, has categorized PFOA as "carcinogenic to humans" and PFOS as "possibly carcinogenic to humans[.]" *Designation*, 89 Fed. Reg. at 39,143.

Lastly, Petitioners' worry overlooks the political accountability issues that would arise from a misguided designation. In addition, Petitioners could voice objections to an unreasonable designation in the ordinary course of notice and comment rulemaking and, if necessary, bring suit to challenge the final designation as contrary to law.

For all of these reasons, the phrase "may present a substantial risk of harm" when released into the environment

carries its plain meaning of a scientifically possible substantial risk of harm upon release.[2]

2

Petitioners next argue that the definition of "hazardous substances" must be read more narrowly than "pollutant or contaminant" because "CERCLA confers significantly more authority to address 'hazardous substances' than 'pollutants or contaminants.'" Pet'rs' Opening Br. 33. Petitioners are mistaken.

To start, Petitioners' insistence that courts must enforce some inflexible hierarchy between these two categories is not supported by anything in the statutory text. Their definitions each require a probability of substantial danger to the public or environmental organisms. *Compare* 42 U.S.C. § 9601(33) (defining a "pollutant or contaminant" as a substance which "will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations" in animals and humans), *and id.* § 9604(a) (requiring EPA to determine that pollutants or contaminants "may present an imminent and

[2] Petitioners urge us not to afford EPA's interpretation any "respect" in our interpretation of Section 9602 because of (1) a 1983 notice of proposed rulemaking, which never materialized into a final rule, proposing quantitative metrics to operationalize Section 9602, and (2) regulations with more concrete metrics that implement Section 9605, a part of CERCLA that does not use the word "may." Pet'rs' Opening Br. 35 & n.12 (citing *Loper Bright Enters.*, 144 S. Ct. at 2258). Contrary to Petitioners' contention, non-rules and definitions in materially different regulations do not show inconsistency with prior agency positions. More to the point, our decision is made *de novo* without deference to EPA's view.

substantial danger to the public health or welfare" before initiating cleanup), *with id.* § 9602(a) (defining "hazardous substances" as those which "may present substantial danger to the public health or welfare or the environment").

So CERCLA does not draw a comparative-harm line between pollutants or contaminants and hazardous substances. Instead, it creates two distinctive cleanup regimes with two different paths for designation. The difference in how hazardous substances and pollutants or contaminants are treated in cleanups turns on (1) the imminence of harm and (2) whether the risk of harm posed is uniform or could vary based on site-specific conditions.

Pollutants or contaminants are identified for clean up on a site-by-site basis based both on the risk of harm and—uniquely—the harm's "imminen[ce.]" 42 U.S.C. § 9604(a)(1); *Designation*, 89 Fed. Reg. at 39,172. In addition, CERCLA does not require EPA to promulgate any regulations or make formal certifications to designate substances as pollutants or contaminants, presumably because the imminence of harm may not allow for such delays. *See* 42 U.S.C. § 9604(a)(1).

On the other hand, CERCLA mandates that EPA designate hazardous substances in a single rulemaking that then applies to all CERCLA sites. 42 U.S.C. § 9602. While Section 9602 does not explicitly call for notice and comment rulemaking, EPA opted to do so for the PFOA and PFOS Designation, and committed itself to further notice-and-comment rulemaking if it were to update the Designation. *Designation*, 89 Fed. Reg. at 39,174.

To the extent the statutory scheme allows substances, like PFOA and PFOS, to originally qualify as pollutants or contaminants and then later, be designated hazardous

substances based on advances in scientific knowledge, that is the "belt and suspenders approach" that CERCLA's text and context straightforwardly allow. *Atlantic Richfield Co.*, 140 S. Ct. at 1350 n.5.

3

Finally, Petitioners contend that EPA's reading of Section 9602 runs afoul of the nondelegation and void-for-vagueness doctrines, and that we should reject EPA's reading to avoid those constitutional questions. Pet'rs' Opening Br. 31–32. There are no such constitutional concerns in this case.

Allowing agencies to make discretionary judgments informed by evidence fully comports with the nondelegation doctrine as long as "Congress has set out an 'intelligible principle' to guide what it has given the agency to do." *FCC v. Consumers' Rsch.*, 145 S. Ct. 2482, 2497 (2025) (quoting *J.W. Hampton, Jr., & Co. v. United States*, 276 U.S. 394, 409 (1928)). Under the "intelligible principle" test, courts require Congress to "ma[ke] clear both the general policy that the agency must pursue and the boundaries of its delegated authority." *Id.* (formatting modified).

Congress has laid out the "general policy" for EPA to pursue—regulating substances that are particularly harmful to humans and the environment by creating a cleanup and cost-allocation scheme that puts the onus on polluters rather than taxpayers. *See* 42 U.S.C. §§ 9602, 9606, 9607; *cf. United States v. E.I. Dupont De Nemours & Co.*, 432 F.3d 161, 169 (3d Cir. 2005) ("Congress's decision to hold responsible parties strictly liable for the government's costs of responding to hazardous waste contamination [in CERCLA] is both a reasonable exercise of legislative authority and different in

kind from the unbounded delegation" found in cases that run afoul of the nondelegation doctrine.).

Congress also has set fixed "boundaries" for the agency's authority and "provided sufficient standards" for courts to police agency compliance. *Consumers' Rsch.*, 145 S. Ct. at 2497. For example, to categorize substances as "hazardous," EPA must determine that they are harmful enough to risk "substantial danger" to human welfare or the environment. 42 U.S.C. § 9602(a).

Tying EPA's decisions to scientific findings based on a public health standard easily satisfies the requirement that there be an intelligible principle to limit agency action. *See, e.g.*, *Consumers' Rsch.*, 145 S. Ct. at 2501–2503 (finding an intelligible principle in the Telecommunications Act's requirement that subsidies paid by telecommunications carriers be enough to "contribute" to "sufficient mechanisms * * * to preserve and advance universal service[,]" 47 U.S.C. § 254(d)); *Whitman v. American Trucking Ass'ns*, 531 U.S. 457, 465 (2001) (same for Clean Air Act's delegation to EPA to set ambient air quality standards "'the attainment and maintenance of which * * * are requisite to protect the public health' with 'an adequate margin of safety'") (quoting 42 U.S.C. § 7409(b)(1)); *Touby v. United States*, 500 U.S. 160, 163, 165 (1991) (same for Controlled Substances Act's authorization of the Attorney General to temporarily add a substance to a controlled drug schedule if doing so is "necessary to avoid an imminent hazard to the public safety") (quoting 21 U.S.C. § 811(h)(1)); *see also Sessions v. Dimaya*, 584 U.S. 148, 159 (2018) ("Many perfectly constitutional statutes use imprecise terms like 'serious potential risk' * * * or 'substantial risk[.]'").

Section 9602's plain meaning also fully comports with the Fifth Amendment's Due Process Clause by affording "the

person of ordinary intelligence a reasonable opportunity" to predict whether a substance could be designated hazardous. *Grayned v. City of Rockford*, 408 U.S. 104, 108–109 (1972). Notice is particularly easy to find here given that PFOA and PFOS previously have been designated under CERCLA as "pollutant[s] or contaminant[s]" that "will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations[.]" 42 U.S.C. § 9601(33); *Designation*, 89 Fed. Reg. at 39,173. That alone provided fair notice that PFOA and PFOS might also qualify as "hazardous substances[.]"

Beyond that, Petitioners' members are seasoned participants in the highly regulated area of chemical substances' commercial uses. They were provided ample notice and opportunity to be heard through the notice and comment rulemaking process that designated PFOA and PFOS as hazardous substances, followed by judicial review. *See Village of Hoffman Ests. v. The Flipside, Hoffman Ests., Inc.*, 455 U.S. 489, 498 (1982) ("[E]conomic regulation is subject to a less strict vagueness test because * * * the regulated enterprise may have the ability to clarify the meaning of the regulation by its own inquiry, or by resort to an administrative process.").

For all those reasons, affording Section 9602's "may present substantial danger to the public health or welfare or the environment" language its ordinary meaning comports fully with the nondelegation doctrine and due process. Petitioners' contrary to law claim fails.

B

The second chapter in Petitioners' challenge focuses on EPA's cost-benefit analysis. Petitioners argue that EPA (1) violated the APA's notice requirement by failing to disclose its Regulatory Impact Analysis until publication of the final rule, and (2) conducted its cost-benefit analysis in an arbitrary and capricious manner. Pet'rs' Opening Br. 41–49.

Petitioners' arguments do not hold up. The Regulatory Impact Analysis was a logical outgrowth of the Economic Assessment's cost-benefit analysis, which was then supplemented with data to address comments made by Petitioners and others. EPA also reasonably explained its quantitative analyses.[3]

1

First, Petitioners contend that EPA failed to provide adequate notice of its cost-benefit analysis. While they acknowledge that the Economic Assessment provided with the notice of proposed rulemaking contained a cost-benefit analysis, Petitioners argue that the final Regulatory Impact Analysis differed such that they were no longer provided sufficient notice. Pet'rs' Opening Br. 43.

The APA requires that a notice of proposed rulemaking include "either the terms or substance of the proposed rule or a description of the subjects and issues involved," 5 U.S.C. § 553(b)(3), and "give interested persons an opportunity to

[3] Because we reject Petitioners' challenges to EPA's cost-benefit analysis, we need not decide whether EPA was required to consider such costs in the first instance. EPA assumed without deciding that it had to do so, 89 Fed. Reg. at 39,143, and we do the same.

participate in the rule making through submission of written data, views, or arguments," *id.* § 553(c). Notice "ensure[s] that agency regulations are tested via exposure to diverse public comment," promotes fairness to impacted parties, and gives them "an opportunity to develop evidence in the record to support their objections[.]" *International Union, United Mine Workers v. Mine Safety & Health Admin.*, 626 F.3d 84, 95 (D.C. Cir. 2010) (formatting modified). This notice requirement extends to "critical information" on which the rule is based. *GPA Midstream Ass'n v. Department of Transportation*, 67 F.4th 1188, 1197 (D.C. Cir. 2023).

Our test for whether an agency has met the APA's notice requirement is whether "affected parties should have anticipated the final rule in light of the notice." *Brennan v. Dickson*, 45 F.4th 48, 69 (D.C. Cir. 2022) (quotation marks omitted). The key question is whether the final rule is a "logical outgrowth" of the proposal. *National Ass'n of Broadcasters v. FCC*, 147 F.4th 978, 992 (D.C. Cir. 2025) (quotation marks omitted).

The Regulatory Impact Analysis was a logical outgrowth of the Economic Assessment and notice and comment process. First, its cost-benefit analysis reasonably followed from the notice of proposed rulemaking and related Economic Assessment. Second, the additional cost data was not information "critical" to the final decision.

a

Petitioners first contend that they lacked notice that EPA would pursue a cost-benefit analysis in the final rule. Because they had been put on notice by the Economic Assessment, and

the Regulatory Impact Analysis was the logical outgrowth of that initial cost-benefit analysis, Petitioners' argument fails.

The content of a final rule is the logical outgrowth of an agency's earlier proposal if "a party c[ould] reasonably anticipate" the outcome "in light of the initial notice as a guidepost." *National Ass'n of Broadcasters*, 147 F.4th at 992 (quotation marks omitted).

Petitioners do not and cannot dispute that they were on notice that EPA was considering a full cost-benefit analysis that would build on the initial cost-benefit analysis already provided in the Economic Assessment, which was incorporated into the notice of proposed rulemaking. 87 Fed. Reg. at 54,418 n.4. The notice, after all, included the following "Request for Comment":

> EPA is taking comment on its approach to the consideration of costs, including: (1) Whether CERCLA section 102(a) precludes, allows, or requires consideration of cost in designation decisions, and, if so, (2) which costs and benefits of those discussed in the EA [Economic Assessment] should be considered, (3) whether additional benefits and costs not identified in the EA should be considered, [and] (4) if indirect benefits and costs are considered, how they should be assessed in light of the discretion and uncertainties described above[.]

Id. at 54,423.

Petitioners next contend that even if they did have notice that EPA would conduct a cost-benefit analysis, the Economic Assessment "bore no resemblance" to the Regulatory Impact Analysis because the latter included estimates of indirect costs

that EPA had previously assessed qualitatively. Pet'rs' Opening Br. 43. That argument misunderstands the logical outgrowth standard.

Because "the very premise of agencies' duty to solicit, consider, and respond appropriately to comments is that rules evolve from conception to completion[,]" this court does not require that a final rule avoid any material change from the notice of proposed rulemaking. *Brennan*, 45 F.4th at 69; *see id.* ("[T]he APA does not require that rules be subjected to multiple cycles of notice and comment until the version adopted as final is identical to the last notice of proposed rulemaking[.]"); *Connecticut Light & Power Co. v. Nuclear Regul. Comm'n*, 673 F.2d 525, 533 (D.C. Cir. 1982) ("The agency need not renotice changes that follow logically from or that reasonably develop the rules it proposed originally. Otherwise, the comment period would be a perpetual exercise rather than a genuine interchange resulting in improved rules.").

As with any final rule that has adapted in response to critical public comments, then, there were changes between the Economic Assessment and the Regulatory Impact Analysis. As Petitioners point out, the Economic Assessment performed a qualitative assessment that included more high-level cost-benefit considerations such as whether "harness[ing] the efficiency and expertise of the private sector" in shifting the costs of cleanup to polluters rather than the government would result in lower costs than the current baseline, given that PFOA and PFOS had been designated as pollutants or contaminants at select Superfund sites. J.A. 144.

That does not mean that Petitioners lacked notice that EPA might perform a quantitative analysis in the final rule. Notably, the Economic Assessment's qualitative analysis included

quantitative cost estimates as well. EPA cited a 2019 study on the "historical average" cost of remedial actions at sites on the National Priorities List, estimating that range to be "between $35.2 and $48.2 million per site." J.A. 149. And further, recognizing the "lack of information and systemic analysis of remediation of PFOS and PFOA" specifically, EPA explicitly sought "information and comment that may allow EPA to estimate incremental indirect costs associated with this rule." J.A. 148.

That EPA made changes between the quantitative estimates in the Economic Assessment and the Regulatory Impact Analysis is proof that notice and comment rulemaking is working as it should. The whole point of this kind of rulemaking is for the agency to learn, adapt, and change its proposed action in response to public input if warranted. *Brennan*, 45 F.4th at 69.

Further, so long as an agency has "expressly asked for comments on a particular issue or otherwise made clear that the agency was contemplating a particular change[,]" the APA notice requirement has been met. *Brennan*, 45 F.4th at 69. That is the case here. Petitioner the Chamber of Commerce and others submitted comments calling on EPA to conduct a Regulatory Impact Analysis. J.A. 212, 326, 339. The Chamber of Commerce also submitted a detailed cost-benefit analysis, including its own models for a quantitative cost calculation of impacts on private parties, to be included in that Regulatory Impact Analysis. *See* J.A. 212–220.

Other commentators similarly propounded direct and indirect costs not identified in the Economic Assessment for EPA to address in formulating a final rule. *See, e.g.*, J.A. 242–243 (identifying categories of costs "left unaddressed in the economic assessment" relating to possible "over-adjustment"

in PFAS treatment by companies seeking to avoid CERCLA liability); J.A. 285 (estimating increased annual costs of "PFAS management" for municipal solid waste landfills); J.A. 340 (estimating increased costs to the solid waste sector); J.A. 364–365 (urging EPA to increase its upper-bound estimate of direct costs).

EPA heeded those demands and included additional cost estimations and a more detailed cost-benefit analysis in the Regulatory Impact Analysis. *See* J.A. 525–595. In response to the Chamber of Commerce's Coalition of Companies and Trade Associations' comments that the Economic Assessment's $370,000 estimate for an upper-bound cost of annual notifications was "simply not representative" of the true cost, J.A. 365, EPA increased its upper-bound estimation of those costs to $1,630,000, J.A. 528–529. In response to that same party's comments that EPA's qualitative approach to indirect costs was insufficient, *see* J.A. 363, 365, the agency added a quantitative analysis to its consideration of indirect costs, J.A. 534–571.

In this way, the Designation's cost-benefit analysis evolved logically from the notice of proposed rulemaking and Economic Assessment in light of comments submitted by Petitioners and others such that Petitioners "should have anticipated the final rule in light of the notice[.]" *Brennan*, 45 F.4th at 69 (quotation marks omitted). In addition, as long as the agency provides "notice" in its proposed rulemaking that it may elect to proceed with a qualitative rather than quantitative analysis, the agency's "way of proceeding" qualifies as a "'logical outgrowth' of the notice[.]" *Mozilla Corp. v. FCC*, 940 F.3d 1, 70 (D.C. Cir. 2019) (*per curiam*). The same is true for the reverse situation here, where EPA sought comment on whether it should proceed with a quantitative analysis in the

final rule, 87 Fed. Reg. at 54,423, and Petitioners proposed that it do just that, *see* J.A. 212–220.

Because the cost-benefit analysis in the Designation and its accompanying Regulatory Impact Analysis logically followed from the notice of proposed rulemaking and incorporated Economic Assessment, the changes made to the final rule and its cost-benefit analysis satisfy the APA's notice requirement.

b

Petitioners next contend that EPA withheld critical information in the form of the "specific methodology, data, and assumptions that EPA used to evaluate cost in the Final Rule." Pet'rs' Opening Br. 46–47.

Petitioners are correct that an agency must share "critical information" upon which a final rule is based and subject it to public comment. *GPA Midstream Ass'n*, 67 F.4th at 1197; *Owner-Operator Indep. Drivers Ass'n v. Federal Motor Carrier Safety Admin.*, 494 F.3d 188, 199 (D.C. Cir. 2007). At the same time, we do not require repeated rounds of notice and comment "when additional fact gathering merely supplements information in the rulemaking record[.]" *Chamber of Commerce of the U.S. v. SEC*, 443 F.3d 890, 900 (D.C. Cir. 2006). Supplementary information "expands on and confirms information" in the notice of proposed rulemaking, "and addresses alleged deficiencies in the pre-existing data[.]" *Id.* (quotation marks omitted).

Supplementation of the cost-benefit analysis is exactly what happened here. Though EPA added some additional data and basic calculations of indirect cost predictions, those additions merely supplemented what had been put forward in

the Economic Assessment, which was incorporated as part of the notice of proposed rulemaking.

True, EPA added some additional data and basic calculations of cost probability distributions to its calculations of indirect costs, but that just built on the data and qualitative analyses that EPA had put out for notice and comment. The additional data of which Petitioners complain was added in response to comments and simply "expand[ed] on and confirm[ed]" the data and analysis provided in the Economic Assessment. *Chamber of Commerce*, 443 F.3d at 900 (quoting *Solite Corp. v. EPA*, 952 F.2d 473, 484 (D.C. Cir. 1991) (*per curiam*)).

Take the estimated cleanup costs for sites listed on the National Priorities List, on which Petitioners say they had no opportunity to comment. Pet'rs' Opening Br. 46. The Economic Assessment provided estimates of these costs "for reference[,]" pointing to a 2019 study that calculated the historic average cost of cleanups at these sites to be between $35.2 and $48.2 million per site. J.A. 148–149. That number was not perfect, EPA noted, because those were cleanups of all hazardous substances at a site, and it is possible that cleanup of PFOA and PFOS would not add significantly to the existing cleanup costs of other preexisting hazardous substances at these sites. J.A. 149. The Regulatory Impact Analysis then calculated the estimated increase in cleanup costs after the designation of PFOA and PFOS as hazardous substances to be between $10.3 million and $51.7 million. J.A. 567. That lower end is significantly lower than that in the 2019 study, but that follows from EPA's explanation in the Economic Assessment that, where cleanup efforts are already ongoing, the marginal increase in cost to add two additional hazardous substances would often not significantly add to the cleanup costs. *See* J.A. 149. And the Regulatory Impact Analysis's upper-bound

estimation of $51.7 million is just a hair's breadth away from the 2019 study's upper-bound of $48.2 million, after accounting for inflation over the intervening five years.

Nor could it have been a surprise to Petitioners that the cleanup costs at sites not on the National Priorities List were estimated to be significantly lower than the cleanup costs at sites on the List. *Compare* J.A. 546, *with* J.A. 567. As EPA explained in the notice of proposed rulemaking, the sites on the National Priorities List are considered "among the worst hazardous substance sites" in the country, 87 Fed. Reg. at 54,420, which almost always renders cleanups at those sites larger undertakings with higher price tags.

Petitioners also take issue with the Regulatory Impact Analysis's "calculation of quantified benefits" at sites on the National Priorities List, complaining that they "had no chance to address" this calculation. Pet'rs' Opening Br. 46. But because of difficulties in estimating the exact monetary value of benefits to human health and the environment, EPA did not tally up a total "benefit" amount, relying instead on "illustrative" examples of some benefits, including cleaner well water and higher property values near impacted sites. *See* J.A. 579–584. These new data points are just case studies and illustrations of the benefits previewed in the Economic Assessment. *See* J.A. 144–147. The data, drawn in part from studies put forward by commenters, *see* J.A. 242 & n.7; J.A. 584 & n.301, serve simply to "confirm" the qualitative assessment of these benefits previously put forward. J.A. 694, 696 (emphasis omitted). A new round of notice and comment for confirmatory material is not required. *See Owner-Operator*, 494 F.3d at 201 ("[A]n agency does not violate the APA if its methodology remains constant and new data is merely used to check or confirm prior assessments.") (formatting modified). That is especially appropriate here,

where Petitioners are challenging a cost-benefit analysis that responded to their own comments that EPA should have used a more quantitative approach. *See* J.A. 212–213, 361, 363. They cannot be prejudiced by getting what they asked for.

Petitioners rely on *Owner-Operator Independent Drivers Association v. Federal Motor Carrier Safety Administration*, 494 F.3d 188 (D.C. Cir. 2007), to argue that even when an agency makes only *one* change to its cost-benefit analysis, it must go through another round of notice and comment, *id.* at 200–201; Pet'rs' Opening Br. 44, 46.

Owner-Operator imposed no such categorical rule. In that case, the Federal Motor Carrier Safety Administration promulgated a final rule regulating the hours a commercial vehicle driver could work without resting. 494 F.3d at 195–196. That rule relied on a novel cubic curve that was first presented in the Regulatory Impact Analysis. *Id.* at 200. This "entirely new" methodology of graphing, which "derived [from] a regression equation," was "a central component of the justification" for the final rule. *Id.* at 199–201. Notably, the new cubic curve was how the agency had justified increasing the daily driving hours from ten hours to eleven hours. *See id.* at 200–202. While prior studies in the record based on a national database of crash statistics supported a ten-hour driving limit, the new cubic curve "substantially" shrunk the estimated crashes related to fatigue between hours ten to eleven. *Id.* at 200. Because of the new methodology's centrality to the change in regulation, we held that it was "not a minor modification used to check or confirm prior analyses" or to supplement data, but instead was "central" to the agency's decision. *Id.* at 201.

Nothing so novel or unforeseeable happened in the Designation's Regulatory Impact Analysis. EPA employed no

novel methodology to reach a materially new or different conclusion. Instead, the final rule simply used corroborating data to confirm quantitatively its prior qualitative analysis after receiving comments from Petitioners and others urging it to perform just such a quantitative analysis. *See Owner-Operator*, 494 F.3d at 201 ("[A]n agency does not violate the APA if its methodology remains constant and new data is merely used to check or confirm prior assessments.") (formatting modified).

2

Petitioners separately argue that EPA's cost-benefit analysis was arbitrary and capricious because, in their view, EPA (1) miscalculated cleanup costs at sites on the National Priorities List, (2) miscalculated costs at sites off of the National Priorities List, (3) ignored cleanup costs at federal sites, (4) disregarded the impact on certain industries, (5) incorrectly assessed benefits, and (6) failed to consider the impact of the Designation on small businesses. *See* Pet'rs' Opening Br. 50–65. Petitioners are mistaken on all six fronts.

a

Petitioners voice a number of complaints with EPA's estimation of cleanup costs at National Priorities List sites.

To start, they object to EPA assuming that it was already expending costs to clean up PFOA and PFOS at these sites as pollutants or contaminants. Pet'rs' Opening Br. 50. According to Petitioners, EPA failed to show that it was cleaning up PFOA and PFOS at these sites or that it even had the statutory power to clean up these substances as pollutants or contaminants.

Petitioners have their facts wrong. EPA noted in the final rule: "EPA has already identified and treated PFOA and PFOS as pollutants and contaminants at multiple Superfund sites, including the Saint-Gobain Performance Plastics facility in Hoosick Falls, New York, and the Blades Groundwater site in Blades, Delaware." *Designation*, 89 Fed. Reg. at 39,173. So it was reasonable for EPA, given its on-point experience, to consider only the marginal costs beyond what was already incurred for cleanup of PFOA and PFOS as pollutants or contaminants.

Next, Petitioners assert that the Designation "warps EPA's incentives" because it "encourages EPA to clean up sites it might deem too expensive to clean up itself by allowing EPA to recover those costs from others." Pet'rs' Opening Br. 51.

The Designation does not create an incentive problem—it solves one. The Designation shifts the burden to the very private parties that deposit hazardous substances at the site, rather than allowing those parties to spread these two forever chemicals and expect taxpayers to clean up after them. That is the core purpose of CERCLA: "to promote the timely cleanup of hazardous waste sites and to ensure that the costs of such cleanup efforts [are] borne by those responsible for the contamination." *Atlantic Richfield Co.*, 140 S. Ct. at 1345 (quoting *CTS Corp.*, 573 U.S. at 4) (alteration in original).

Petitioners also challenge the reasonableness of EPA's estimation of increased cleanup costs at sites that contain other hazardous substances in addition to PFOA and PFOS. Pet'rs' Opening Br. 52–53. In estimating those costs, EPA "ma[de] the conservative assumption that there [would be] a cost premium"—that is, a marginal increase in costs for PFOA and PFOS cleanups beyond the ongoing efforts. J.A. 553–554. Rather than assuming a single premium, EPA analyzed a range

of scenarios, with the cost premium varying from 2% to 10%. J.A. 553–554, 563–565. Petitioner Chamber of Commerce also baked a cost premium into its estimates, but assumed, based in part on "its own research," that the premium could range from 5% to 100%. J.A. 215–216. EPA rejected the high end of those estimates, *see* J.A. 563–565.

This court "do[es] not review EPA's cost figuring *de novo*, but accord[s] EPA discretion to arrive at a cost figure within a broad zone of reasonable estimat[ion.]" *National Wildlife Fed'n v. EPA*, 286 F.3d 554, 563 (D.C. Cir. 2002) (*per curiam*) (quoting *Weyerhaeuser Co. v. Costle*, 590 F.2d 1011, 1049 (D.C. Cir. 1978)). Given "the complex nature of economic analysis typical in the regulation promulgation process, [Petitioners'] burden to show error is high." *Id.*

Petitioners have not met that burden. EPA reasonably explained why it modeled marginal costs as it did. The agency pointed out that, "in many cases[,]" the necessary infrastructure to treat PFOA and PFOS would already be in place at hazardous-waste sites because it is also required to remove and redress other hazardous substances. J.A. 554. In addition, "some of the same treatment technologies for PFOA and PFOS contamination" would "likely be[] applied for other hazardous substances in many cases." J.A. 554. Because of EPA's factfinding that "infrastructure may already be in place" to address PFOA and PFOS at most sites already on the National Priorities List, EPA reasonably concluded that the marginal cost increase of addressing PFOA and PFOS beyond what would already be cleaned up from the list of over 800 existing hazardous substances would be tempered. *See* J.A. 554.

Further, EPA considered and rejected the Chamber of Commerce's data on this point, stating that the study commissioned by the Chamber of Commerce had relied on

"discussions with industry rather than empirical data" for developing its probability distributions and had relied on "30-year-old data" for the basis of its cost estimates. J.A. 688, 213. In addition, the study "conflate[d] costs to address PFOA and PFOS contamination" at sites on the National Priorities List "with costs attributable to designating PFOA and PFOS as hazardous substances[,]" overlooking that the PFOA and PFOS often have to be cleaned up anyhow as pollutants or contaminants. J.A. 688. Plus even if EPA adds a site to the National Priorities List, that "does not mean that any remedial or removal action will be taken." J.A. 688.

In short, EPA fairly considered the Chamber of Commerce's proposals and reasonably rejected them based in part on its factfinding and experienced judgment. There is nothing arbitrary or capricious about that. *See National Wildlife Fed'n*, 286 F.3d at 563 ("The court should not undertake its own economic study, but must uphold the regulations if EPA has established in the record a reasonable basis for its decision.") (quotation marks omitted); *Mississippi Comm'n on Env't Quality v. EPA*, 790 F.3d 138, 150 (D.C. Cir. 2015) (*per curiam*) (deferring "to the EPA's evaluation of scientific data within its technical expertise") (quotation marks omitted).

Finally, Petitioners argue that EPA failed to account for the addition of sites to the National Priorities List due to the presence of only PFOA and PFOS and no other hazardous substances. Pet'rs' Opening Br. 52.

EPA considered that argument and drew a different conclusion based on the record before it. It estimated that an average of 10.9 new sites would be investigated for addition to the National Priorities List each year. J.A. 561. EPA then noted that at non-federally owned sites on the National

Priorities List, only 5.5% contained a single hazardous substance, which reduces materially Petitioners' concern about independent costs stemming from PFOA/PFOS-only sites. J.A. 509. EPA's cost analysis also explained that "the establishment of new NPL sites with PFOA/PFOS contamination" would be "limit[ed]" because the national production of these chemicals has "largely been phased out[.]" J.A. 564 n.258. That reasoned review of record evidence and the agency's real-world experience adequately explain why EPA concluded that listing PFOA and PFOS would not dramatically increase its estimate of cleanup costs for the sites (if any) with only PFOA and PFOS contamination. Petitioners' disagreement and desire for a different approach does not render EPA's conclusions arbitrary or capricious.

b

Petitioners next argue that EPA made an arbitrarily low estimate of the cleanup costs at sites not listed on the National Priorities List. Pet'rs' Opening Br. 54. They argue those costs should have been higher because there are so many more contaminated sites than are currently listed and because there may be enforcement actions by entities other than the federal government. *Id.* at 54–55.

The record supports EPA's judgment.

First, EPA reasonably estimated the number of sites not on the National Priorities List where it anticipated pursuing enforcement actions and adequately explained its reasoning. EPA estimated the number of PFOA and PFOS contamination sites based on data tracked by companies that participated in a voluntary Stewardship Program to phase out the manufacture of PFAS more generally. J.A. 541. It then filtered for "sites where the likelihood of PFOA/PFOS contamination is the

highest." J.A. 541. That process identified 133 sites that would qualify under EPA's standards for higher levels of contamination. J.A. 541. The agency then assumed that it would pursue enforcement actions at only half of these sites, and those actions would be spread out over time "[d]ue to resource constraints[.]" J.A. 541–542. As a result, EPA calculated costs for enforcement actions at 67 non-National Priorities List sites over a four-year period. J.A. 542.

Petitioners see things differently. They cite a study that EPA had relied on in another part of the Regulatory Impact Analysis that estimated 57,412 sites that likely were contaminated with PFOA and PFOS, making EPA's estimates "far too low[.]" Pet'rs' Opening Br. 55 (citing J.A. 314).

EPA reasonably rejected Petitioners' count of contaminated sites. Their estimate was for sites contaminated with *any* PFAS, which sweeps in "over 9,000 chemicals[,]" J.A. 592, rather than just the two at issue here—PFOA and PFOS.

Given that glaring flaw in Petitioners' numbers, EPA reasonably relied instead on the remedial site investigations of other hazardous substances to reach its estimated 133 qualifying sites. J.A. 542–543. *Contrast* Pet'rs' Opening Br. 56. EPA explained that it selected a low-end and high-end estimate based on that historical data. J.A. 543. That was reasonable given that there is no indication in the record that PFOA and PFOS exposures would be outliers as to frequency compared to the more than 800 already-existing hazardous substances.

Further, Petitioners' argument incorrectly assumes that all contaminated sites are going to face cleanup actions and resulting enforcement actions against responsible parties.

Instead, EPA assumed that it would pursue investigations "at approximately half" of the estimated 133 qualifying sites. J.A. 541. There is little question that funding constraints limit EPA's ability to take enforcement actions. *See* J.A. 542. EPA estimated that "[d]ue to resource constraints," and based on "historical patterns of PFOA/PFOS production and use in the U.S.[,]" it planned to begin enforcement actions at only sixteen to seventeen sites not on the National Priorities List per year. J.A. 541–542.

Petitioners briefly argue that EPA acted arbitrarily and capriciously in "assum[ing]" cleanup would only be initiated by the federal government. Pet'rs' Opening Br. 56. To the contrary, EPA acknowledged that "states may use their own authorities, if available, to require investigations, site characterizations, or further response including cleanup." J.A. 540. EPA then reasonably declined to include a cost estimation for these cleanups in its cost-benefit analysis given the uncertainty over state laws and whether and when States would unilaterally pursue such cleanups. J.A. 540–541. Given that the Designation is a federal regulation interpreting a federal statute and overseen by a federal agency, it was reasonable for EPA to refrain from trying to predict how state laws might or might not affect the independent actions of all 50 States and other jurisdictions.

Lastly, to the extent Petitioners want costs to include indemnification actions by private parties seeking to hold other private parties accountable for the costs of cleanup, they seek to double count expenses because EPA already accounted for that indemnification cost when it allocated cleanup costs to the original polluter. The mere shifting of costs from one private party to another does not create an additional set of costs.

c

Petitioners next attack EPA's estimate of cleanup costs at federal facilities. They argue that the agency put too much stock into voluntary actions by the federal government that EPA assumed would be undertaken even absent the Designation. Pet'rs' Opening Br. 57.

While EPA's analysis was reasonably explained, J.A. 569–572, and based on data from ongoing cleanup efforts by the Department of Defense, *see* J.A. 464–468, 569–572, we also note that any miscalculation in this regard would have no effect on Petitioners. This issue concerns the federal government's expenditure of its own funds to clean up its own sites due to hazardous exposures caused by its own activities. Petitioners nowhere explain how they would be affected, let alone prejudiced, by any calculation errors on this front. *See Prohibition Juice Co. v. United States Food & Drug Admin.*, 45 F.4th 8, 24 (D.C. Cir. 2022); 5 U.S.C. § 706 (requiring reviewing courts to take "due account…of the rule of prejudicial error").

d

Petitioners next take issue with EPA's treatment of costs to certain industries, arguing that EPA ignored the costs of the Designation to the waste management sector, the construction industry, and the recycled materials industry. Pet'rs' Opening Br. 59–63.

EPA, though, acknowledged that industries like waste management and construction historically have used PFOA and PFOS, *see* J.A. 501–502, and spent several paragraphs analyzing possible costs at wastewater treatment plants and landfills that might contain sludge with PFOA and PFOS, *see*

J.A. 502–503. The agency then addressed the concerns expressed in these industries' comments about incurring unlimited third-party liability for PFOA and PFOS contamination of which they were not aware. *See* J.A. 233–235, 330, 339–341; *Designation*, 89 Fed. Reg. at 39,160–39,162. EPA reiterated CERCLA's limitations on liability, including for "situations in which the release or threat of release of a hazardous substance was caused by an act of God, an act of war, or an act or omission of a third party[,]" and for entities that add only a "de minimis" or "de micromis" amount to a release. *Designation*, 89 Fed Reg. at 39,169; *see id.* at 39,175, 39,179–180, 39,183. EPA also noted that the law already requires certain reporting requirements for waste management companies handling toxic chemicals, 42 U.S.C. § 11023; 40 C.F.R. pt. 372). *Designation*, 89 Fed Reg. at 39,175.

In that way, EPA reasonably grappled with Petitioners' concerns. Reasoned decisionmaking does not require EPA to undertake a deep-dive, individualized cost-benefit analysis of indirect impacts for every single potentially affected industry. *See Cigar Ass'n of America v. FDA*, 5 F.4th 68, 76 (D.C. Cir. 2021) ("[A]ppellants cite no authority for the proposition that FDA needed to consider the benefits of premarket review specifically for each industry or product affected by the [final] Rule.").

e

Moving on from cost calculations, Petitioners challenge EPA's calculation of the benefits of listing PFOA and PFOS as hazardous substances. Pet'rs' Opening Br. 53, 64.

Petitioners' central objection is that EPA treated certain costs as benefits by considering CERCLA's shifting of costs

from taxpayers to private industry to be a benefit, rather than recognizing that those costs will be imposed on private industry. Pet'rs' Opening Br. 64.

We reject Petitioners' characterization. EPA's Regulatory Impact Analysis and the Designation did not reclassify costs as benefits. Rather, EPA "recognize[d] that designation will result in economic costs borne by PRPs [private parties]" and "acknowledge[d] that the costs parties expend to clean up PFOA and PFOS is a burden for them." *Designation*, 89 Fed. Reg. at 39,164. EPA then explained that these costs would otherwise be borne by taxpayers, and that the transfer of these costs from taxpayers to polluting companies was an "advantage" of the Designation. *Id.*; *see also id.* at 39,152; J.A. 551–552. Transferring costs, EPA reasoned, would free up Superfund dollars to address sites that EPA otherwise could not address, resulting in benefits to the public. *Designation*, 89 Fed. Reg. at 39,153; J.A. 534, 547. EPA reasonably determined that placing the burden of cleanup on "those responsible for significant contamination represents an improvement in social welfare as a result of the rule." *Designation*, 89 Fed. Reg. at 39,152. EPA's reasoning is consistent with CERCLA's objectives to promote "timely cleanup" and "ensure that the costs of such cleanup efforts [are] borne by those responsible for the contamination." *Atlantic Richfield Co.*, 140 S. Ct. at 1345 (quotation marks omitted). In sum, EPA acknowledged the private sector's costs, but it also reasonably concluded that the transfer of costs from taxpayers to polluters was an advantage of the Designation. That approach was not arbitrary and capricious.

Petitioners also suggest that EPA must "consider whether the purported health benefits of cleaning up PFOA and PFOS could be obtained through less costly means." Pet'rs' Opening Br. 64. Petitioners propose "providing alternative water" to

populations whose water sources are contaminated with PFOA and PFOS. *Id.*

Some alternative solutions are so patently unadministrable that EPA need not directly address them. *See Farmers Union Cent. Exch., Inc. v. FERC*, 734 F.2d 1486, 1511 n.54 (D.C. Cir. 1984) ("Agency action 'cannot be found wanting simply because the agency failed to include every alternative device and thought conceivable by the mind of man * * * regardless of how uncommon or unknown that alternative may have been.'") (quoting *Vermont Yankee Nuclear Power Corp. v. NRDC, Inc.*, 435 U.S. 519, 551 (1978)). Providing bottled water and bringing in and perpetually refilling water tanks for every single person in scores of communities for decades—or however much longer these two forever chemicals remain—fails the common-sense test. Nor does that proposal address the distinct environmental harms from the continuing presence of PFOA and PFOS.

f

Petitioners' final arbitrary and capricious argument is that EPA violated the Regulatory Flexibility Act by excluding indirect costs from its accounting of the Designation's impact on small businesses. Pet'rs' Opening Br. 65–66. That argument fares no better than its predecessors.

The Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act of 1996, 5 U.S.C. § 601 *et seq.*, "is intended to evoke commentary from small businesses about the effect of the rule on their activities, and to require agencies to consider the effect of a regulation on those entities." *Cement Kiln Recycling Coal. v. EPA*, 255 F.3d 855, 868 (D.C. Cir. 2001) (*per curiam*). At the same time, an agency need not undertake a lengthy analysis "if it certifies

'that the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities.'" *Id.* (quoting 5 U.S.C. § 605(b)).

Petitioners do not challenge EPA's calculation of direct costs for small businesses, but argue instead that EPA failed to consider indirect costs associated with the Designation, such as potential future liability for cleanup actions, which they argue would constitute "the lion's share of costs[.]" Pet'rs' Opening Br. 66.

The Regulatory Flexibility Act, however, does not extend to indirect effects on small businesses, at least where, as here, those effects are contingent on multiple intervening and uncertain events. *See Cement Kiln*, 255 F.3d at 869 ("[T]his court has consistently rejected the contention that the RFA applies to small businesses indirectly affected by the regulation of other entities."); *Mid-Tex Elec. Co-op., Inc. v. FERC*, 773 F.2d 327, 343 (D.C. Cir. 1985) ("Congress did not intend to require that every agency consider every indirect effect that any regulation might have on small businesses in any stratum of the national economy.").

By its terms, the Regulatory Flexibility Act requires agencies to consider "the projected reporting, recordkeeping and other compliance requirements of the rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record[.]" 5 U.S.C. § 604(a)(5).

Those requirements capture the direct reporting requirements that EPA evaluated, *Designation*, 89 Fed. Reg. at 39,184–39,185; J.A. 421, but do not extend to Petitioners' perceived downstream risk of liability, which depends upon multiple intervening decisions, analyses, reviews, and

opportunities for public input. *See* Section III.C., *infra*. That leaves several more opportunities for EPA to consider site investigation and cleanup costs borne by small businesses if and when those costs arise. *See* 42 U.S.C. § 9605(a) (requiring notice and comment rulemaking, which triggers a Regulatory Flexibility Act analysis, 5 U.S.C. § 604(a), for sites to be added to the National Priorities List, after which those sites may face remedial action); *see also* 42 U.S.C. § 9605(a)(7) (requiring that EPA develop "means of assuring that remedial action measures are cost-effective"); 40 C.F.R. § 300.430(e)(7)(iii), (9)(iii) (requiring the consideration of cost-effective alternatives for remedial actions).

C

Petitioners separately claim that the Designation is arbitrary and capricious because EPA assertedly did not "carefully assess[] and does not understand" the "severe consequences" this Designation will have. Pet'rs' Opening Br. 67. According to Petitioners, "[t]hese uncertainties included (1) where PFOA and PFOS are located, and in what quantities; (2) what economic costs the Final Rule will impose, and how parties will address contamination; and (3) unintended consequences of designation, including on real estate transactions." *Id.* at 67–68.

EPA fully acknowledged that uncertainties exist in regulating PFOA and PFOS as hazardous substances. *See, e.g.*, *Designation*, 89 Fed. Reg. at 39,129 ("Every site is unique and the extent of action necessary to mitigate risks depends on many factors, which leads to uncertainties regarding response activities and associated costs."); *id.* at 39,150 ("[T]here is considerable uncertainty regarding the cost of health burdens that may result from exposure to PFOA or PFOS, and associated cost savings from reducing the incidence of these

burdens because of designation."); *id.* ("[T]here remains uncertainty concerning the location and number of sites that will be identified as needing remediation and the extent of contamination at those sites. There is also uncertainty regarding the potential incremental increase in cost (if any) of addressing PFOA or PFOS at a site along with other [Contaminants of Concern] present."); *id.* at 39,159 ("EPA assessed potential disadvantages of designation and weighed those against the advantages. The disadvantages include * * * the potential for uncertainty.").

As EPA explained in the Designation, the central reason that these uncertainties exist at the initial designation stage is that "CERCLA response actions are discretionary, contingent, and site-specific determinations." *Designation*, 89 Fed. Reg. at 39,149–39,150; *see also id.* at 39,169 n.65 ("EPA * * * only responds to those releases that pose unacceptable risk to human health and the environment. Even then, EPA may assess relative risk among releases to determine which releases should be prioritized for investigation and, potentially, clean up."). As a consequence, numerous additional regulatory steps must occur before any liability ever attaches to a responsible party.

1

Consider, for example, the case of a new site that requires remedial action. "[R]emedial action" involves a complex and lengthy cleanup process for sites that pose particularly serious risks to human health and the environment. 42 U.S.C. § 9601(24); J.A. 447–448.

Because EPA conducts remedial actions only at sites listed on the National Priorities List (absent limited circumstances, such as a special agreement with the polluting party, which would require a willing counterparty and the negotiation of

party- and site-specific terms), *see* J.A. 448 & n.81, EPA must first proceed through that extensive listing process. And that is just the beginning of the contingent steps before any responsible party might receive a bill for cleanup costs.

For a site even to be considered for the National Priorities List, it has to:

> (1) score above a certain threshold on CERCLA's Hazard Ranking System, which "assesses the relative degree of risk to human health and the environment posed by sites and facilities subject to review[,]" 42 U.S.C. § 9605(c)(1); 40 C.F.R. § 300.425(c)(1);
>
> (2) be designated by a State "as its highest priority" site for cleanup, 40 C.F.R. § 300.425(c)(2); or
>
> (3) be both:
>
> > (a) categorized by EPA as "pos[ing] a significant threat to public health" and as a site for which remedial action "will be more cost-effective" than a removal action, and
> >
> > (b) the subject of a "health advisory" issued by the Agency for Toxic Substances and Disease Registry, *id.* § 300.425(c)(3).

Because of those factors, site placement on the National Priorities List is never certain. EPA reported that it has placed on the List "only about 3 percent of the 53,400 sites assessed since the program's beginning in 1980." *Designation*, 89 Fed. Reg. at 39,138.

And even when EPA decides to place a site on the List, it must go through notice and comment rulemaking, which itself could derail a proposed listing. 42 U.S.C. § 9605(a)(8)(A); *see also Eagle-Picher Indus., Inc. v. EPA*, 759 F.2d 905, 910 (D.C. Cir. 1985) (describing the listing process).

Those few sites that make it to the National Priorities List must then undergo a remedial site evaluation, as required by the National Contingency Plan. *See* 42 U.S.C. § 9607(a) (limiting liability to removal and remedial actions "not inconsistent with the national contingency plan"); 40 C.F.R. § 300.420 (listing requirements for remedial site evaluations).

There is still more. Even if the site satisfies the conditions of the National Contingency Plan, EPA must then develop a remedial action plan. *See* 40 C.F.R. §§ 300.430, 300.435. As part of that process, EPA is required to compare alternative options for cleanup and to assess costs, including direct and indirect capital costs, annual operation and maintenance costs, and the net present value of the costs. *Id.* § 300.430(e)(9)(iii). CERCLA explicitly mandates that EPA "assur[e] that remedial action measures are cost-effective[.]" 42 U.S.C. § 9605(a)(7).

EPA must then undertake a second notice and comment period to approve its proposed remedial plan. *See* 42 U.S.C. § 9617(a).

Only after all that will questions of liability for a responsible party arise, 42 U.S.C. § 9607, and even then, financial costs may be allocated among multiple responsible parties, *see Burlington N. & Santa Fe Ry. Co. v. United States*, 556 U.S. 599, 614–615 (2009) (explaining how joint-and-several liability and apportionment apply to CERCLA tortfeasors).

2

As an alternative to the listing and remedial action route, EPA might conclude that a removal action is called for. Unlike a remedial action, a removal action is a quicker "emergency response[]" stopgap measure for smaller-scale chemical releases. J.A. 447; *see* 42 U.S.C. § 9601(23). Though removal actions are generally shorter term and less costly than remedial actions, EPA still must go through several regulatory steps before questions of liability arise.

First, the National Contingency Plan requires EPA to determine that "there is a threat to public health or welfare of the United States or the environment" before it can undertake a removal action. 40 C.F.R. § 300.415(b)(1).

To determine whether there is such a threat, EPA must consider a list of seven non-exhaustive factors including actual or potential "exposure to nearby human populations," "contamination of drinking water supplies[,]" "[w]eather conditions[,]" "[t]hreat of fire or explosion[,]" and "[t]he availability of other appropriate federal or state response mechanisms to respond to the release[.]" 40 C.F.R. § 300.415(b)(2).

Then, if EPA determines that an extensive removal action is needed—that is, an action requiring six months or more of planning—additional regulatory steps kick in. 40 C.F.R. § 300.415(n)(4). They include the publication of notice "in a major local newspaper of general circulation" and an opportunity for public comment thereafter. *Id.* § 300.415(n)(4)(ii), (iii). EPA also must conduct "an engineering evaluation/cost analysis" of the proposed action. *Id.* § 300.415(b)(4)(i).

3

Finally, for both removal and remedial actions, there are additional statutory layers of protection before a responsible party faces liability.

First, a party has to qualify as a "[c]overed person[]" under 42 U.S.C. § 9607, which limits liability to those who (1) owned or operated a facility with one or more hazardous substances at the time of release or cleanup, or (2) arranged for, conducted, or owned a vehicle used for the transportation or disposal of the hazardous substance. 42 U.S.C. § 9607(a); *see also Burlington N. & Santa Fe Ry. Co.*, 556 U.S. at 610 ("[T]he question whether § 9607(a)(3) liability attaches [based on the "[c]overed person[]" designation] is fact intensive and case specific, [and] such liability may not extend beyond the limits of the statute itself.").

Second, CERCLA provides complete defenses to liability when a release was caused by "an act of God" or "an act or omission of a third party[,]" so long as the defendant has "exercised due care" and taken "precautions against foreseeable" risks. 42 U.S.C. § 9607(b).

Third, the government must show that all costs imposed on the polluter are "not inconsistent with the national contingency plan[,]" 42 U.S.C. § 9607(a), an extensive series of regulations that includes mandatory considerations of cost efficiency, *see* 40 C.F.R. pt. 300; *see also, e.g.*, *id.* § 300.415(b)(4) (requiring the creation of "an engineering evaluation/cost analysis"); *id.* § 300.425(c)(3)(iii) (requiring that "EPA anticipate[] that it will be more cost-effective to use its remedial authority than to use removal"); *id.* § 300.430(e)(7)(iii) (requiring a feasibility study that includes

"[t]he costs of construction and any long-term costs" of alternatives).

Fourth, CERCLA directs EPA to "minimize litigation" and prioritize settlements over enforcement actions. 42 U.S.C. § 9622(a). CERCLA provides that, "[w]henever practicable and in the public interest," EPA must pursue settlement with a responsible party. *Id.* Any settlement agreements also must be "in the public interest and consistent with the National Contingency Plan[.]" *Id.*

* * * * *

All of those uncertainties and contingencies make forecasting liability costs exceptionally difficult upfront. But those same steps also ensure that remedial and recovery actions are undertaken only upon thoroughgoing site-specific consideration and review by EPA, a weighing of the relative harms and benefits of action, and consideration of the statutory limitations on liability. Given all that, Petitioners' worry that listing PFOA and PFOS as hazardous substances will lead ineluctably to significant liability is misplaced.

Further, EPA explained that the Designation's impact on regulated parties can be mitigated, at least in part, by EPA's enforcement discretion and CERCLA's explicit liability limitations. *See Designation*, 89 Fed. Reg. at 39,129–39,130, 39,138–39,139, 39,169 (citing 42 U.S.C. § 9607(a), (b)). In addition to CERCLA's limitations on liability, EPA cited several "de minimis" and "de micromis" protections for polluters who contributed small amounts to a much larger release, *id.* at 39,160–38,161 (citing 42 U.S.C. § 9607(o)), including an expedited settlement process, *id.* at 39,130 n.17 (citing 42 U.S.C. § 9622(g)(1)).

EPA's discussion of liability limitations also disposes of Petitioners' complaint that EPA failed to consider uncertain costs associated with real estate transactions. EPA did not conduct an individualized cost analysis of the Designation's impact on the real estate market. But EPA is not required to "respond to every comment, or to analyze every issue or alternative raised by the comments[.]" *Sherley v. Sebelius*, 689 F.3d 776, 784 (D.C. Cir. 2012) (formatting modified). Because EPA discussed more generally the limitations on liability for those who are not primarily responsible for a release, *see Designation*, 89 Fed. Reg. at 39,139, as well as "innocent landowners" that are protected from liability if they have "no knowledge of the contamination at the time of purchase," *id.* at 39,161 (citing 42 U.S.C. § 9601(35)), which would include individuals who purchase a home polluted by a prior owner, EPA adequately addressed that concern.

Indeed, few if any exercises of regulatory enforcement discretion are roped around with so many required layers of analysis, protections, and limitations. Experience bears that out. PFOA and PFOS are two drops in a bucket of the over 800 hazardous substances under CERCLA, 40 C.F.R. § 302.4 table, including hundreds that have been on the list since CERCLA was enacted in 1980. *See, e.g.*, Air Pollution Prevention and Control List of Hazardous Air Pollutants, 36 Fed. Reg. 5,931, 5,931 (March 31, 1971) (designating asbestos, beryllium, and mercury as hazardous air pollutants under Section 112 of the Clean Air Act, which is incorporated by CERCLA's list of designated hazardous substances, 42 U.S.C. § 9601(14)); Designation of Hazardous Substances, 43 Fed. Reg. 10,474, 10,481–10,486 (March 13, 1978) (same for acetic acid, ammonia, arsenic disulfide, butyric acid, calcium cyanide, chlorine, ferric sulfate, lead acetate, phosphorus, and hundreds of others as hazardous substances under Section 311(b)(2)(A) of the Federal Water Pollution Control Act). Petitioners have

come forward with no evidence that those responsible for the presence of hazardous substances at a site have been unfairly saddled with liability or that the statute's operation has hamstrung industry.

In sum, having adequately considered and reasonably explained its decision to regulate at this initial stage even in the face of acknowledged uncertainties, EPA made a reasoned decision on the record before it in designating the forever chemicals PFOA and PFOS as hazardous substances.

IV

For the foregoing reasons, the petitions for review are denied.

So ordered.

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Review article

The precautionary principle and chemicals management: The example of perfluoroalkyl acids in groundwater

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ABSTRACT

Already in the late 1990s microgram-per-liter levels of perfluorooctane sulfonate (PFOS) were measured in water samples from areas where fire-fighting foams were used or spilled. Despite these early warnings, the problems of groundwater, and thus drinking water, contaminated with perfluoroalkyl and polyfluoroalkyl substances (PFASs) including PFOS are only beginning to be addressed. It is clear that this PFAS contamination is poorly reversible and that the societal costs of clean-up will be high. This inability to reverse exposure in a reasonable timeframe is a major motivation for application of the precautionary principle in chemicals management. We conclude that exposure can be poorly reversible; 1) due to slow elimination kinetics in organisms, or 2) due to poorly reversible environmental contamination that leads to continuous exposure. In the second case, which is relevant for contaminated groundwater, the reversibility of exposure is not related to the magnitude of a chemical's bioaccumulation potential. We argue therefore that all PFASs entering groundwater, irrespective of their perfluoroalkyl chain length and bioaccumulation potential, will result in poorly reversible exposures and risks as well as further clean-up costs for society. To protect groundwater resources for future generations, society should consider a precautionary approach to chemicals management and prevent the use and release of highly persistent and mobile chemicals such as PFASs.

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1. Introduction

Perfluoroalkyl and polyfluoroalkyl substances (PFASs), most notably perfluoroalkyl acids (PFAAs) such as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), are present at elevated concentrations in surface waters, soils, groundwater and drinking water near to domestic and military airports, oil and gas sites, and firefighter training areas at multiple locations globally (for examples, see Table 1) (Awad et al., 2011; Moody et al., 2002; Kwadijk et al., 2014; De Solla et al., 2012; Filipovic et al., 2015; Kärrman et al., 2011; Moody et al., 2003; Schultz et al., 2004a; McGuire et al., 2014; Backe et al., 2013; Weiß et al., 2012; Rumsby et al., 2009; Järnberg et al., 2001). The contamination of the environmental media and drinking water by PFASs at these multiple global sites mostly originates from the repeated use and uncontrolled release of fire-fighting foams containing PFASs to the environment during fire-fighting and firefighter training activities over

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Table 1
Measured concentrations of selected examples of PFASs in the environmental media at sites where fire-fighting foams have been used or spilled. LOD = limit of detection.

Sampling sites	PFOA	PFOS	PFHxS	Ref.
Surface water (ng/L)				
Toronto Pearson Airport, Canada		29–690		Awad et al. (2011)
Toronto Pearson Airport, Canada	<LOD–11,300	<LOD–995,000	<LOD–134,000	Moody et al. (2002)
Schiphol Airport, The Netherlands		20–490		Kwadijk et al. (2014)
Hamilton International Airport, Canada	7.4–62.4	7–458		De Solla et al. (2012)
Air force base F18, Sweden	<1–8.8	<1–45.8	<0.5–25.1	Filipovic et al. (2015)
Flesland airport, Norway		1427–2078		Kärrman et al. (2011)
Groundwater (ng/L)				
Wurtsmith Air Force Base, USA	<LOD–105,000	4000–110,000	9000–120,000	Moody et al. (2003)
Tyndall Air Force Base, USA	<LOD–116,000	147,000–2,300,000	107,000–920,000	Schultz et al. (2004a)
Fallon Naval Air station, USA	<LOD–6570	<LOD–380,000	<LOD–876,000	Schultz et al. (2004a)
Ellsworth Air Force Base, USA	400–300,000	5000–75,000		McGuire et al. (2014)
US military base, USA	12,000–220,000	15,000–78,000	36,000–360,000	Backe et al. (2013)
US military base, USA	8.6–57,000	88–65,000	81–1700	Backe et al. (2013)
Fire training area Cologne, Germany	<LOD–160	20–8350	<10–2360	Weiß et al. (2012)
Air force base F18, Sweden	<1–4470	<1–42,200	<0.5–3470	Filipovic et al. (2015)
Jersey Airport, UK		10,000–98,000		Rumsby et al. (2009)
Soil (ng/g dw)				
Ellsworth Air Force Base, USA	10–10,500	10–34,000		McGuire et al. (2014)
Air force base F18, Sweden		5–8300		Filipovic et al. (2015)
Flesland airport, Norway		<LOD–1905		Kärrman et al. (2011)
Sediment (ng/g dw)				
Toronto Pearson Airport, Canada		1–13		Awad et al. (2011)
Schiphol Airport, The Netherlands		0.5–14		Kwadijk et al. (2014)

many years. Since the mid-1960s (see timeline in Fig. 1) a complex mixture of PFASs (including a wide range of PFAAs and their precursors derived from perfluoroalkane sulfonyl fluorides (PASFs) or fluorotelomer raw materials) were or have been added as; (1) film formers in aqueous film-forming foams (AFFFs) and film-forming fluoroproteins (FFFPs), (2) as fuel repellents in fluoroprotein foams, and (3) as foam stabilizers in FFFPs and alcohol-resistant AFFFs (McGuire et al., 2014; Backe et al., 2013; Moody and Field, 2000; Prevedouros et al., 2006; Moe et al.,

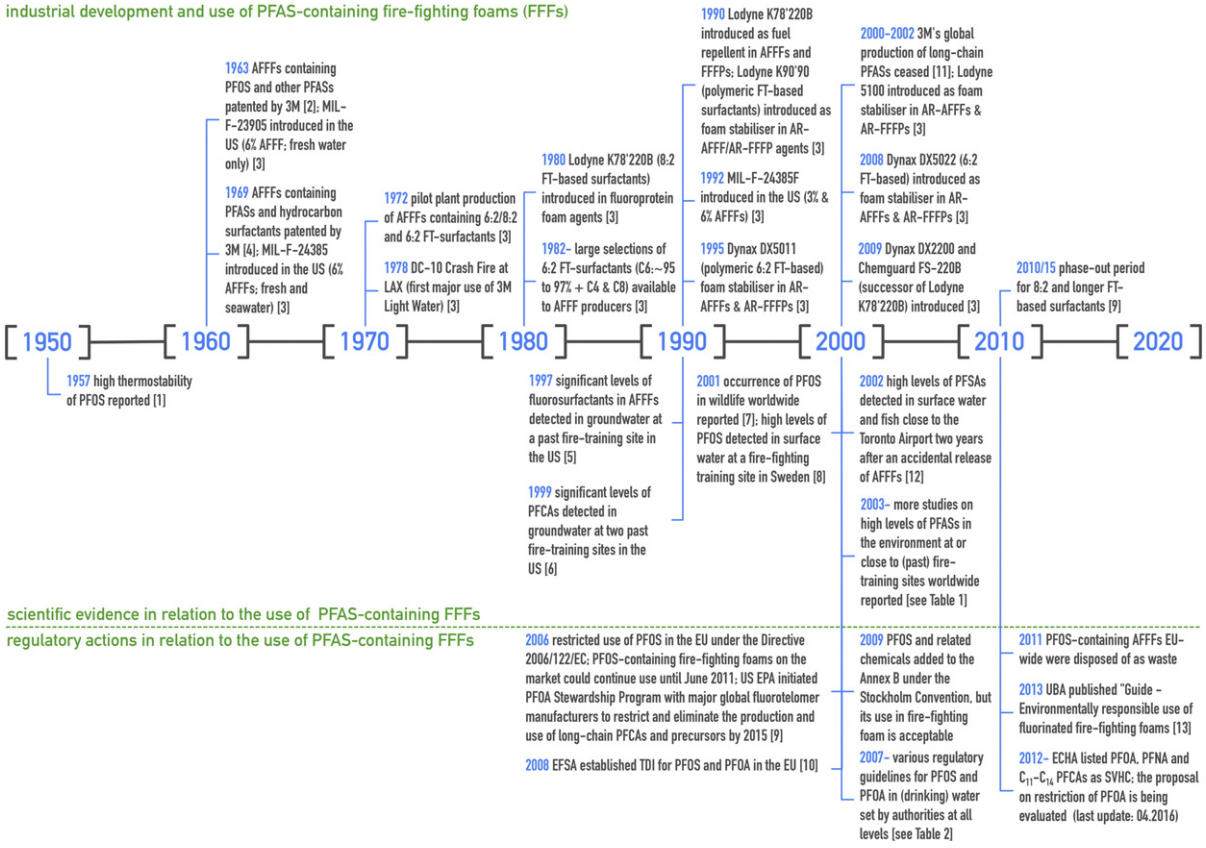


Fig. 1. Timeline of industrial development, scientific evidence and regulatory actions in relation to the use of PFAS-containing fire-fighting foams. References: [1] Gramstad and Haszeldine (1957); [2] Tuve and Jablonski (1966); [3] Kleiner and Jho (2009); [4] Francen (1969); [5] Levine et al. (1997); [6] Moody and Field (1999); [7] Giesy and Kannan (2001); [8] Järnberg et al. (2001); [9] US EPA (2006); [10] EFSA (2008); [11] 3M (2000); [12] Moody et al. (2002); [13] UBA (2013).

2012; Guelfo and Higgins, 2013; Wang et al., 2013; D'Agostino and Mabury, 2014).

Given that elevated concentrations of PFAAs are detected in groundwater at multiple locations, groundwater is often the primary source of drinking water, and certain PFAAs (e.g. PFOA and PFOS) have been associated with severe toxic effects (De Wit, 2015), public concerns have arisen in recent years with respect to the risks from human exposure to PFAAs via drinking water. For example, the drinking water works in the municipality of Kallinge, Sweden were immediately closed down after contamination of the groundwater was discovered near a Swedish Air Force base where AFFFs have been used (Jakobsson et al., 2014). At that time, in December 2013, drinking water levels of PFOS in the outgoing water at a drinking water treatment plant in Kallinge were determined to be between 800 and 10,000 ng/L (n = 3) (Jakobsson et al., 2014). The same study also found that the human serum levels of some PFAAs in the population of Kallinge (e.g. median serum levels of 290 ng/mL PFOS) were approximately 30 times higher than the background exposed population of Sweden (Jakobsson et al., 2014; Glynn et al., 2012). In response to the rising public concern, guideline values for PFAAs in drinking water have been set in many countries to protect against this undesired human exposure pathway. However, determination of guidelines or drinking water standards is not straightforward due to complex toxicokinetics and -dynamics of PFAAs as well as the paucity of conclusive epidemiological evidence (Frisbee et al., 2010; Steenland et al., 2010). A precautionary approach is therefore often used in setting the guidelines i.e., an approach which takes into account that some information may be missing. Depending on the premises and assumptions being used (e.g. chronic or short-term exposure to the contaminated drinking water), risk assessments (EFSA, 2007; Borg et al., 2013) have led to different conclusions regarding safe drinking and natural water levels across countries (see Table 2 for a summary).

In addition to the challenge of defining guideline values, there are technical challenges to reverse the environmental and human exposure to PFASs. PFAAs are not removed from drinking water by conventional treatment technologies (Thompson et al., 2011; Eschauzier et al., 2012). Advanced technologies based on granular activated carbon (GAC) filters (Lampert et al., 2007; Yu et al., 2009), reverse osmosis (Tang et al., 2006), nanofiltration (Tang et al., 2007), ion exchange (Yu et al., 2009) or sorption using modified biopolymers (Yu et al., 2008) have been studied to remove PFAAs from contaminated water. Among them, GAC filtration has been the most widely applied technology due to its cost-efficiency and effectiveness in removing PFOS and PFOA from drinking water (Skutlarek et al., 2006; Bartell et al., 2010; Brede et al., 2010). However, the performance of the technologies mentioned above decreases with decreasing perfluoroalkyl chain length to the point that the technologies no longer function. For example, perfluorobutanoic acid (PFBA) and perfluorobutane sulfonate (PFBS) cannot be removed by GAC (Eschauzier et al., 2012; Lampert et al., 2007; Yu et al., 2009; Tang et al., 2006). Additionally, these technologies require costly disposal of the highly contaminated concentrates or sorbent materials, usually by high-temperature incineration. Furthermore, the PFAS removal technologies mentioned above only represent measures to reduce human exposure via drinking water. Complete remediation of AFFF-contaminated sites is a much more challenging task, both technically and financially, that may require excavation of contaminated soil, pumping and treating of groundwater or in-situ methods to remove contaminants from soil and aquifers (Oliaei et al., 2013). Inadequate remediation measures have been shown to be counterproductive by increasing the mobility of PFASs or advancing the transformation of precursor compounds to PFAAs (McGuire et al., 2014).

Fire-fighting foams have long been known to be a source of PFAAs to the environment. High levels of PFAAs were reported in groundwater impacted by fire-fighting activities in 1999 (Moody and Field, 1999) and following a spill of AFFFs in a creek in Toronto, Canada in 2002 (Moody et al., 2002). However, despite these early warnings, the problems associated with AFFF-contamination are only beginning to be addressed. Reasons for delays in actions on PFAA contamination include: (1) time needed for analytical chemists to develop proper analytical methods and measure the geographical extent and seriousness of the AFFF-related contamination problem, (2) time needed for researchers to fill data gaps on relevant hazardous properties (e.g. toxicity), (3) time needed to properly review available data before setting regulatory guidelines and making decisions, and (4) time needed to devise, agree on and implement regulatory and management measures. Fig. 1 provides a timeline of key industrial and regulatory events related to production, supply, use and management of PFAS-containing fire-fighting foams. Briefly, production of PFAS-containing AFFFs began in the early 1960s, environmental contamination problems were discovered about 40 years later, and the issue began to be systematically addressed another 10–15 years later.

Table 2
Regulatory guidelines for PFOA and PFOS (ng/L) in drinking water set by provincial and national authorities.

	PFOA	PFOS	Ref.
German Drinking Water Commission (HPV_1)	100[a,c]	100[a,c]	German DWC (2011)
German Drinking Water Commission (GV)	300[a,d]	300[a,d]	German DWC (2011)
German Drinking Water Commission (PAV_i)	500[a,e]	500[a,e]	German DWC (2011)
German Drinking Water Commission (PAV_0)	5000[a,c]	5000[a,f]	German DWC (2011)
Danish Environmental Protection Agency	100[b]	100[b]	DEPA (2015)
National Food Agency, Sweden	90[b]	90[b]	NFA (2013)
UK Drinking Water Inspectorate (tier 1)	300	300[g]	DWI (2007)
UK Drinking Water Inspectorate (tier 2)	10,000	1000[h]	DWI (2007)
UK Drinking Water Inspectorate (tier 3)	90,000	9000[i]	DWI (2007)
New Jersey Department of Environmental Protection, USA	40	–	NJ DEP (2007)
Minnesota Department of Health, USA	300	300	MDH (2008)
North Carolina Secretary's Science Advisory Board on Toxic Air Pollutants, USA	1000	–	NC SAB (2010)
Maine Center for Disease Control & Prevention, USA	100	–	MCDCP (2014)
US EPA Office of Water	400[j]	200[j]	US EPA (2012)

[a] Refers to the sum of PFOA and PFOS present in drinking water.
[b] Refers to the sum of PFASs including PFOA and PFOS (the sum of 7 PFASs in Sweden and the sum of 12 PFASs in Denmark) present in drinking water.
[c] Health-based precautionary value (long-term minimum quality goal) for non-genotoxic substances.
[d] Strictly health-based guidance value for safe lifelong exposure for all population groups.
[e] Precautionary action value for infants.
[f] Precautionary action value for adults.
[g] Minimum action to be taken: consult with local health professionals; and monitor levels in drinking water.
[h] Minimum action to be taken: as tier 1 plus: put in place measures to reduce concentrations to below 1000 ng/L (PFOS) or 10,000 ng/L (PFOA) as soon as practicable.
[i] Minimum action to be taken: as tier 2 plus: ensure consultation with local health professionals takes place as soon as possible; and take action to reduce exposure from drinking water within 7 days.
[j] Provisional short-term value.

In this paper we consider how application of the precautionary principle (i.e. introduction of a novel "reversibility of exposure"-based chemicals management paradigm) at an earlier stage might have led to earlier and more effective regulatory and management actions on PFASs. In recent years, fluorinated alternatives have come on the market to replace the legacy long-chain PFASs in certain applications. Among others, AFFFs based principally (>99%) on 6:2-fluorotelomer raw materials (e.g. 6:2-fluorotelomer sulfonamide alkylbetaine in Forafac® 1157 and 6:2-fluorotelomer sulfonamide aminoxide in Forafac® 1183) have been commercialized to replace long-chain PFASs-containing AFFFs (Wang et al., 2013). We also apply the proposed "reversibility of exposure"-based chemicals management paradigm to these fluorinated alternatives currently used in AFFFs.

2. Background to the precautionary principle

One commonly accepted definition of the precautionary principle is provided in Principle 15 of the Rio Declaration on Environment and Development as follows: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (UNEP, 1992). The precautionary principle has emerged as an approach in environmental regulation (Maguire and Ellis, 2005). In the context of chemicals management, it has been argued in the literature for about 40 years that prioritization of the precautionary decision-making process should be governed by the persistence of a chemical (Stephenson, 1977; Klöpffer, 1994; Scheringer, 1997; Webster et al., 1998; Gouin, 2010; Persson et al., 2013). In practice, persistence is adopted as a key criterion for listing chemicals under the Stockholm Convention on Persistent Organic Pollutants, a global treaty that is guided by the precautionary principle (UNEP, 2001). This idea can also be found in the European chemicals regulation, REACH, in which the PBT (persistent, bioaccumulative and toxic) and vPvB (very persistent, very bioaccumulative) designations are cornerstones of classification tools to regulate chemicals based on the precautionary principle (REACH, 2007). The regulation of PBT and vPvB chemicals is motivated as follows: "What distinguishes the PBT and vPvB substances from other substances is that … consequences of an underestimation of adverse effects are not easily reversible by regulatory action, i.e. the effect is occurring or is likely to occur at a certain point in time and, even if there is immediate regulatory action to prevent further emission, the adverse effects will continue" (ECHA, 2012). The central message here is that the target of regulatory actions is a rapid reduction in effects, as otherwise society may face a problem that cannot be managed. Assuming that adverse effects are still mitigatable by reducing exposure, the successful achievement of this target relies on the reversibility of exposure, i.e. that the exposure to a chemical can be rapidly reduced once the emissions are controlled. Hence, it is postulated that reversibility of exposure is a central concept that should guide the incorporation of the precautionary principle in chemicals management.

Recently, another type of hazard assessment scheme was developed to identify chemicals that are planetary-boundary threats (Persson et al., 2013; Rockström et al., 2009), which are chemical-related problems that could destabilize the Earth system. Poorly reversible exposure was considered as one of the three characteristics that a chemical must possess to be considered as a planetary-boundary threat (Persson et al., 2013). In this previous work, it was noted that the well-established hazard assessment indicators (P, B and long-range transport potential (LRTP)) can provide some useful information on reversibility of exposure, but they do not generally address all aspects (e.g. the reversibility and spatial distribution of emissions is not addressed with P, B and LRTP), so new methodologies are required.

The following sections explore how reversibility of exposure can be assessed using PFAS contamination of groundwater as a case study. The chemicals regulation which most closely approaches reversibility of exposure is the vPvB designation in REACH, which stipulates that if both a persistence and a bioaccumulation criterion are exceeded then the chemical is considered a hazard (i.e., vPvB) (ECHA, 2012). The vPvB criteria are applied to PFASs, which have been or are currently used in fire-fighting foams. It is further discussed if vPvB provides a good measure of poorly reversible exposure.

3. How does the persistence criterion relate to the reversibility of exposure?

To assess the possible hazard of environmental exposure to chemicals, environmental persistence is frequently used as an indicator describing the duration of exposure. Environmental persistence can be expressed by either a half-life or residence time of a chemical in the environment (Klöpffer, 1994; Webster et al., 1998). Although a simple concept to understand, estimating persistence for a given chemical turns out to be a challenging task because of the difficulty in measuring and estimating degradation half-lives for chemicals (Klöpffer, 1994; Webster et al., 1998; MacLeod and McKone, 2004; Müller-Herold, 1996; Stroebe et al., 2004; Wegmann et al., 2009). Under REACH, a chemical is considered to have violated the environmental persistence criterion if its degradation half-life ($t_{1/2,DEG}$) in marine, fresh or estuarine water is >40 days (or >60 days for vP) or if its half-life in marine, fresh or estuarine sediment is >120 days (>180 days for vP) or if its half-life in soil is >120 days (>180 days for vP). Additionally, the persistence of relevant transformation/degradation products should also be taken into account; this is particularly relevant for PFASs because, although some PFASs (i.e. the so-called precursors) are degradable, they ultimately degrade into highly stable end products (often PFAAs) due to the high stability of perfluoroalkyl chains (Scheringer et al., 2014; Schultz et al., 2004b). For PFASs, an alternative measure of persistence e.g. "joint persistence" is thus more appropriate for assessing environmental persistence. "Joint persistence" quantifies the environmental persistence of a parent compound and a selection of relevant transformation products (Fenner et al., 2000). Because PFASs are, or ultimately degrade to, stable end products, all PFASs possess a joint persistence that exceeds all three of the REACH single-media persistence criteria mentioned above.

It is now worth considering how the single-media persistence criteria relate to the reversibility of exposure in groundwater. The hydraulic residence time of groundwater at a site sets a minimum limit on the residence time of water-soluble PFASs because transport away from the site in water is the only removal mechanism. If PFASs sorb to solids in the soil or aquifer material, the transport of PFASs will be retarded and their residence time will be even longer than the residence time of the groundwater. Given the long residence times of most groundwaters (Maloszewski and Zuber, 1982; McGuire et al., 2005; Gooddy et al., 2006), the residence times of PFASs in groundwater will nearly always be >40 days and can be of the order of millennia. Thus, PFAS-contaminated groundwater can act as a long-lasting source, leading to poorly reversible exposure to PFASs in the subterranean environment as well as where the contaminated groundwater resurfaces.

Exposure to PFASs may appear to be reversible in the short term in some parts of the environment, as levels of PFOS, PFOA and some other PFAAs are reported to be declining in some regions (Armitage et al., 2006; Armitage et al., 2009; Cousins et al., 2011; Johansson et al., 2014). However, this decline is not due to chemical degradation, but due to the distribution from source regions to the entire global environment via advection, dispersion, dilution and burial processes (Prevedouros et al., 2006; Armitage et al., 2006; Armitage et al., 2009). Modelling studies have shown that recent declines in PFAA concentrations in the Northern Hemisphere are due only to transport processes and that oceans are the ultimate reservoir for PFAAs (Armitage et al., 2006; Armitage et al., 2009). Ocean levels of PFAAs will decline very slowly because the only removal process for PFAAs in surface oceans is the slow mixing into the deep oceans on the hundred-year scale (Armitage et al., 2006; Armitage et al., 2009).

4. How does the bioaccumulation criterion relate to poorly reversible exposure?

Bioaccumulation is a criterion for hazard assessment in a range of chemicals regulations including the Stockholm Convention, UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP), and REACH (Webster et al., 1998; UNEP, 2001; UNECE, 1979). Under REACH, bioaccumulation is primarily evaluated on the basis of the chemical's bioconcentration factor in aquatic species (usually fish; BCF_{FISH}), and the chemical is considered to have violated the "bioaccumulation" (B) criterion if BCF_{FISH} exceeds 2000 and the "very bioaccumulative" (vB) criterion if the BCF_{FISH} exceeds 5000. As of recently, it is also possible to consider terrestrial bioaccumulation, bioaccumulation in human tissues, and evidence from field studies (e.g. food web biomagnification studies) in a weight-of-evidence approach when assessing bioaccumulation (Gobas et al., 2009; ECHA, 2014). Below we query if these bioaccumulation criteria are related to the reversibility of exposure.

In doing so, we need to differentiate between external and internal exposure because bioaccumulation "translates" external exposure to the corresponding internal exposure. In some cases, the time scales of external and internal exposure are different. When the elimination kinetics in an organism are slow, this affects the reversibility of internal exposure. This occurs when the elimination kinetics in the organism are slower than the kinetics for reduction of external exposure. From the perspective of the persistence criterion in hazard regulation, this becomes interesting when the half-life for elimination from the organism exceeds the regulatory threshold for the half-life of the chemical in the medium that the organism lives in. For instance, if the elimination half-life of a chemical in fish exceeded the single-media persistence threshold for water under REACH ($t_{1/2,\ DEG}$ >40 days), then the reversibility of the fish's exposure would be >40 days and thus similar to the reversibility of exposure to persistent chemicals, regardless of whether the chemical in question was persistent in water. Hence, elimination half-life is a bioaccumulation property that can determine the reversibility of internal exposure.

If the primary regulatory criterion for assessing bioaccumulation, BCF_{FISH}, is to be useful for describing the reversibility of internal exposure, then BCF_{FISH} needs to be a good predictor of the elimination rate constant in fish. For small non-polar organic chemicals, there is often a good correlation between the BCF_{FISH} and the elimination rate constant (Gobas and Morrison, 2000; Crookes and Brooke, 2011), which is due to the propensity of these chemicals to partition into the same tissue (lipids) and their relatively constant uptake efficiencies (Gobas and Morrison, 2000; Crookes and Brooke, 2011). However, this correlation breaks down for neutral, polar chemicals for which the uptake efficiency is strongly influenced by the polarity (Armitage et al., 2013). Furthermore, for ionizing compounds, distribution in fish occurs through mechanisms other than partitioning into adipose tissues (e.g., via protein-binding and/or strong partitioning to membrane phospholipids in the case of PFAAs; Armitage et al., 2012; Ng and Hungerbühler, 2014), which results in further complexity and challenges in understanding the correlation between BCF_{FISH} and the elimination rate constants. Despite these potential complications in uptake mechanisms, BCF_{FISH} has been shown to be a good predictor of the elimination rate constant for PFAAs (Martin et al., 2003) and therefore provides an indication of the reversibility of exposure for PFAAs in fish.

A further condition for the usefulness of the regulatory criterion for bioaccumulation is that the BCF_{FISH} predicts (or at least is conservative with respect to) elimination rate constants in higher organisms (e.g., humans). For small non-polar molecules in water-respiring organisms this is generally the case, as the excretion of such a compound is via passive diffusion leading to similarity across species after allometric scaling (Nagilla and Ward, 2004). For chemicals eliminated primarily via metabolism, BCF_{FISH} is often conservative with respect to higher organisms as metabolism is generally more rapid in higher organisms than in fish (Arnot et al., 2010). However, BCF_{FISH} may not be conservative for higher organisms in food webs where there is significant biomagnification of the chemical arising from dietary exposure. Furthermore, for slowly metabolized chemicals with low air-water partition coefficients, BCF_{FISH} may not be conservative with respect to air-breathing organisms because elimination via respiration of air is slower than elimination via respiration of water (Czub and McLachlan, 2004). For PFAAs, elimination occurs through different mechanisms in aquatic and terrestrial species: In mammalian species it is governed by renal and biliary clearance (Harada et al., 2007; Han et al., 2012), whereas in fish PFAAs can also be eliminated via the respiratory system (i.e. gills). Consequently, elimination is much more efficient in fish than in (some) mammalian species (Han et al., 2012; Ng and Hungerbühler, 2014). For instance, PFOA and PFHxS have low BCF_{FISH} due to rapid elimination (Martin et al., 2003), but both chemicals are only slowly eliminated in humans, with half-lives on the scale of years (Olsen et al., 2007).

In summary, bioaccumulation is not a prerequisite for poor reversibility of internal exposure. Poor reversibility of internal exposure occurs if the chemical is persistent in the environment or if the chemical is slowly eliminated from the organism, even if the chemical is not persistent in the environment. For the hazard assessment of PFAAs, bioaccumulation is generally not relevant because the persistence of PFAAs in the environment is much greater than their residence time in humans and top predators. In situations where external exposure decreases rapidly (e.g., as a result of dilution of PFAA contamination in the environment or of technical measures taken to reduce exposure), low elimination rate constants from the organism may still be the factor limiting the reversibility of internal exposure. In the case of groundwater contamination, however, dilution is low and thus P is the only relevant criterion for determining if poorly reversible exposure will occur.

5. Case study of poor reversibility of human exposure to short-chain PFASs via drinking water

Based on the discussion of P and B above, we argue that AFFFs based on short-chain PFASs will also lead to a poorly reversible exposure even though they are not bioaccumulative according to current regulatory criteria. To illustrate this we considered the dynamics of human serum concentrations from exposure via drinking water to perfluorohexanoic acid (PFHxA) and PFOS respectively. PFHxA was chosen as an example since it is an impurity and ultimate degradation product of 6:2-fluorotelomer-based AFFFs (Wang et al., 2011; Weiner et al., 2013) and has a shorter elimination half-life in humans (14–49 days in highly exposed populations) than PFOS (Russell et al., 2013; Zhou et al., 2014). Given that PFHxA is more water soluble and less sorptive than PFOS, it will be even more mobile in the subsurface environment (Vierke et al., 2013).

Therefore, if 6:2-fluorotelomer-based AFFFs are manufactured, used and released in a similar way and amount to the legacy PFOS-based AFFFs and that they similarly environmentally degrade to form PFAAs, it can be expected that concentrations of PFHxA in nearby surface- and groundwaters will be similarly high as those found for PFOS. Fig. 2 shows the effect of identical drinking water levels in aquifers contaminated with PFOS and PFHxA (groundwater levels shown in Fig. 2b) on the internal human exposure (serum concentrations) to these substances (serum levels shown in Fig. 2a). Details regarding the model simulations are provided in the Supplementary material. Overall, the magnitude of internal human exposure (Fig. 2a) is substantially lower for PFHxA than for PFOS for a human exposed to equal amounts of PFOS and PFHxA via drinking contaminated groundwater over a long period (Fig. 2a). In Scenario 1 it is assumed that emissions to groundwater are stopped after 5 years, but no additional measures are taken to reduce groundwater concentrations. Under these conditions both PFOS and PFHxA decrease slowly in human serum (Fig. 2a) with the reversibility of human exposure being primarily governed by the residence

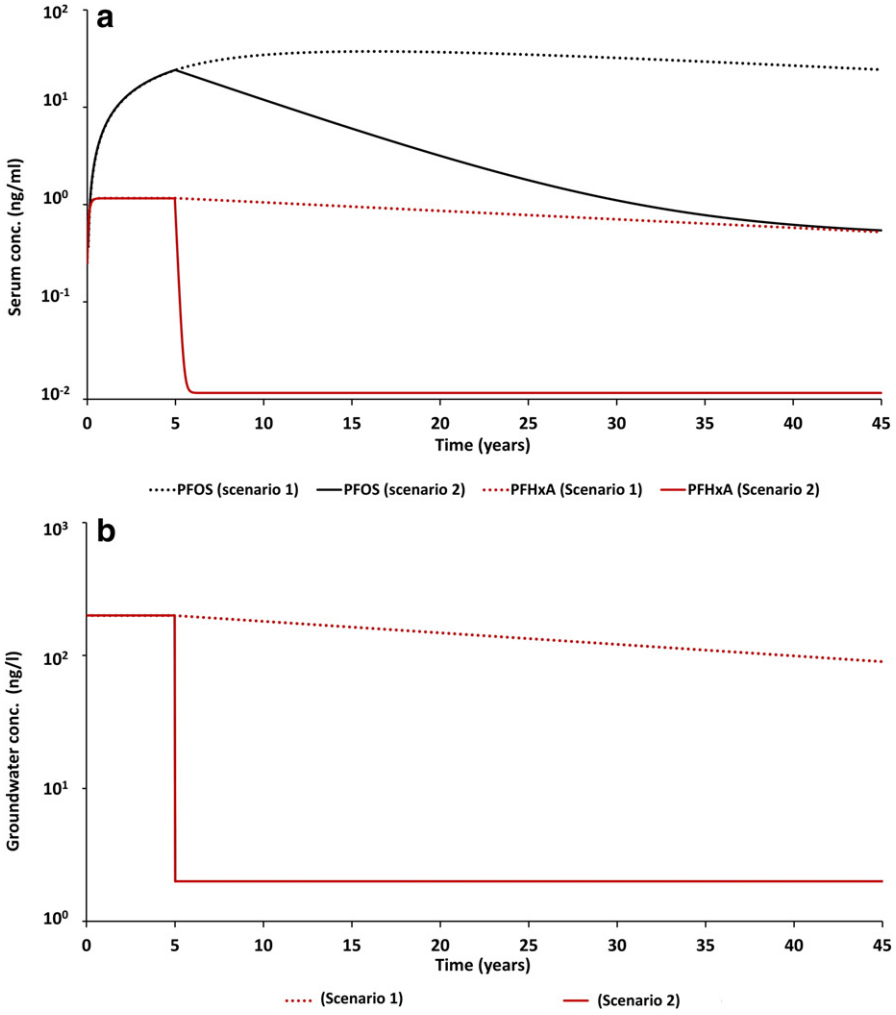


Fig. 2. Predicted human serum concentrations (a) in a population being exposed to PFOS and PFHxA, respectively, from drinking contaminated groundwater (b). The dotted lines represent a scenario where no suitable treatment technology is available and the drinking water concentrations decrease with the residence time of groundwater ($\tau = 50$ years), i.e. Scenario 1. The solid lines illustrate a continuous exposure to water concentrations at 200 ng/L for 5 years before a clean-up technology is installed to remove 99% of the contamination in drinking water, i.e. Scenario 2. Note the logarithmic y-axis.

time of groundwater (Fig. 2b). In Scenario 2 it is assumed that PFAS concentrations in groundwater are effectively reduced by proper measures after emissions ceased. Humans exposed to the contaminated drinking water depicted in Fig. 2a would then be able to eliminate the shorter-chain PFHxA within months, whereas a significant lag-time would be observed for PFOS serum concentrations. Since shorter-chain PFAAs are much more challenging to remove from drinking water than their long-chain analogues (as discussed above), the only technical solution to reduce external exposure to short-chain PFASs (Scenario 2) may be to shift water supply sources. Thus, although the elimination of PFHxA from humans is faster than PFOS, the exposure will be equally poorly reversible until technically and financially feasible exposure mitigation measures are identified and taken.

6. Discussion

In hindsight, many of the worst cases of chemical pollution in recent history were the result of the release of large quantities of persistent chemicals or materials (e.g. polychlorinated biphenyls (PCBs), polychlorinated dibenzo-*p*-dioxins and -furans (PCDD/Fs), polybrominated diphenyl ethers (PBDEs), and PFASs). The problems associated with persistent chemicals including the resulting poorly reversible contamination and chemical exposures have long been known and discussed repeatedly in the literature (Stephenson, 1977; Klöpffer, 1994; Scheringer, 1997; Persson et al., 2013; EEA, 2002; EEA, 2013). Despite this knowledge, the problems associated with poorly reversible contamination have not been adequately addressed in chemicals regulations and society continues to accrue enormous clean-up costs associated with legacy contamination. For example, the costs of the legacy of PCB contamination in the European Union have been estimated to be as high as 75.3 billion Euros between 1971 and 2018 (EEA, 2002; EEA, 2013). It is yet unknown what the costs of AFFF-related PFAS contamination globally will be, but they are also likely to be enormous. For example, the costs to clean up a small site on the Channel Island of Jersey, United Kingdom, where the drinking water for 23 households was contaminated by PFOS from the use of AFFFs for training, were between 3.7 and 30 million pounds Sterling (at 1999–2000 prices) (States of Jersey, 2004). The costs of cleaning up the contaminated site is only one of many costs associated with the contamination legacy from PFAS-containing fire-fighting foams; others include analytical costs for monitoring of PFAS concentrations, incineration of old stockpiles, clean-up of equipment contaminated by previous use, costs of developing and commercializing sustainable alternatives, costs of funding new research, health costs, legal costs, etc. Most of these costs will be borne by taxpayers, as it is challenging and often costly to identify the principal responsible party or parties in practice. Hence, early actions that lead to pollution prevention are much more cost-effective for society than late actions to clean up the pollution.

As we discuss above, the vPvB criteria as they are applied under REACH are not adequate metrics for assessing the reversibility of exposure and new approaches are needed. It has been known for some time that all PFASs which contain persistent perfluoroalkyl moieties (C_nF_{2n+1}-) will ultimately degrade to form non-degradable P chemicals in the environment. Therefore, poorly reversible PFAS exposures will arise in (parts of) the environment. We argue that if poorly reversible exposure had been used as a criterion to regulate PFASs according to the precautionary principle, then PFASs would have been regulated at an earlier stage. However, instead of implementing a precautionary approach, the usual risk-based regulatory approach has been applied. Risk assessment requires a substantial amount of information to prove that there are unacceptably high risks before any action can be taken. Therefore, although high levels of PFASs were identified as early as the late 1990s near to areas where AFFFs had been used or spilled (Moody and Field, 2000), it took a further decade to conduct the overwhelming research and consultancy needed to set risk-based guidelines for levels in drinking water, and even today these guidelines continue to be refined and debated intensely.

We maintain that regulatory criteria are needed for identifying chemicals and chemical uses that lead to poorly reversible exposures. Poorly reversible exposures can occur (1) due to slow elimination kinetics in organisms or (2) due to poorly reversible environmental contamination that leads to continuous exposure. Condition (2) occurs if (a) a substance has a long environmental half-life or ultimately degrades to form substances that have long environmental half-lives (e.g. in the case of precursors to PFAAs) or (b) a substance has poorly reversible emissions (Persson et al., 2013) (e.g. if the use is considered essential). For condition (2a) there are already well-defined regulatory criteria (e.g., the P or vP criteria in the REACH regulation). Condition (1) is related to bioaccumulation, but as shown above the conventional B criterion used in existing regulation is not an adequate predictor of elimination kinetics in humans. The elimination half-life of the chemical in humans (or other target organisms of concern) could be an appropriate regulatory criterion for condition (1). To address condition (2b), new regulatory concepts must be developed that identify combinations of chemical properties and chemical uses that would limit society's ability to reduce emissions of the chemical after it had come into use. Unfortunately, society will continue to use and emit PFAS-based AFFFs in some firefighting applications for the foreseeable future because some users contest that there is a lack of alternatives that provide comparable performance. Although the toxicity of the substance will ultimately determine if the exposure is harmful, there is often a high uncertainty regarding this criterion. This can be a strong argument for not including toxicity in a precautionary regulatory approach, as is the case in the REACH vPvB assessment; poor reversibility of exposure would be a stand-alone criterion for regulation.

If society is to implement a precautionary approach to reduce the likelihood of poorly reversible exposures, “design for degradation” will need to be increasingly implemented in chemical product manufacture. “Design for degradation” denotes one of the 12 principles of Green Chemistry, namely “chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment” (Anastas and Warner, 1998). According to this reasoning, society should replace all PFAS-based fire-fighting foams with non-persistent fire-fighting products, given that they can lead to poorly reversible exposures. A recommendation to limit the production and use of PFASs due to their high persistence was also recently made in the Helsingør (Scheringer et al., 2014) and Madrid Statements (Blum et al., 2015).

Interestingly, and in parallel to our work, a report on behalf of the German Federal Environmental Agency has recently recommended hazard assessment criteria that omit the B criterion for protecting against chemical contamination of “raw water” (e.g. groundwater) used for drinking water (UBA, 2014). Instead of the REACH PBT criteria (REACH, 2007), they recommend using P, M (“mobility”, which is dependent on soil sorption) and T (toxicity) criteria for protecting raw waters from contamination and suggest that even low levels of PMT substances in raw waters should be avoided. M provides an indication of the fraction of chemical that will reach the groundwater and thus the magnitude of exposure.

PFAS-containing fire-fighting foams in current use are often based on shorter perfluoroalkyl chain lengths, such as 6:2-fluorotelomer sulfonamide alkylbetaine (Wang et al., 2013), which will degrade in the environment and biota to form short-chain PFAAs (mostly PFHxA). There are currently few toxicological data published for PFHxA in the peer-reviewed literature and no specific drinking water guidelines have been established for this substance. Industry studies (e.g. Iwai and Hoberman, 2014; Klaunig et al., 2015) indicate that PFHxA is less toxic than PFOA and PFOS. Nevertheless, contamination of drinking water aquifers with short-chain PFAAs is likely because these substances are highly persistent, highly mobile in soils and aquifers (i.e. high solubility in water and low adsorption to organic matter) and will reside in the drinking water aquifers as long as the groundwater itself, i.e. decades to centuries (Guelfo and Higgins, 2013). Levels of short-chain PFAAs will increase in drinking water aquifers near to continuous point-source releases of PFAS-containing fire-fighting foams (e.g. military bases). If the drinking water originating from these contaminated aquifers is not effectively treated, humans will be exposed to the PFAAs and human serum levels will also increase. It is noteworthy that short-chain PFAAs fulfill the P and M criteria (M will decrease with perfluoroalkyl chain length) suggested in the German Federal Environment Agency report (UBA, 2014) discussed above and they are also highly bioavailable to humans (Gannon et al., 2011; Russell et al., 2013; Zhou et al., 2014). Long-chain PFAAs are clearly toxic (De Wit, 2015), but it is unclear if short-chain PFAAs would fulfill the T criterion in the German report due to the uncertainties in their toxicity.

Effective fire-fighting foams are needed and designing fluorine-free fire-fighting foams for rapidly extinguishing class-B fuel fires is a technical challenge. Significant innovation is required to either redesign fire extinguishing processes (i.e. functionality replacement) or develop alternative surfactants that have excellent surface activities equal or similar to that of fluorosurfactants (i.e. chemical replacement). Encouraging progress is being made. Some fluorine-free foam manufacturers have claimed that AFFFs are not necessary for effectively extinguishing all types of class-B fuel fires (Sontake and Wagh, 2014; Williams et al., 2011). A wide range of fluorine-free foams which perform well in many fire-fighting situations are already on the market (Hetzer et al., 2014). Indeed, all Swedish and Norwegian commercial airports have recently replaced PFAS-based AFFFs with fluorine-free foams because of environmental safety concerns (Norström and Viktor, 2011). Additionally, the US EPA has awarded their 2014 Designing Greener Chemicals Award to a fluorine-free fire-fighting foam (US EPA, 2014) based on a blend of hydrocarbon surfactants. Development of novel siloxane surfactants-based AFFFs is also underway and these display nearly the same performance in fire tests as PFAS-based AFFFs (Hetzer et al., 2014; Blunk et al., 2014).

In the special cases where PFAS-based foams are currently the only viable option for extinguishing certain extreme fires, extra care should be taken during use and disposal. For example, in Germany there are guidelines for responsible use (UBA, 2013), which include the use of non-fluorinated “training foams” in training activities, containment and collection of PFAS-containing fire-fighting foam residues used for fire-fighting, and appropriate treatment of collected wastes. In any substitution strategy, environmental and human health risks from exposure to chemicals in fire-fighting foams as well as clean-up costs for society have to be balanced against the technical performance of the foams in extinguishing fires and thus fire risk to human life. The eventual replacement of persistent PFASs in fire-fighting foams with degradable alternatives that achieve acceptable functionality is a strategy that is in harmony with a future sustainable society.

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Appendix A. Supplementary data

Additional information on the one-box pharmacokinetic model used to generate Fig. 2 and its parameterization. Supplementary data associated with this article can be found in the online version, at http://dx.doi.org/10.1016/j.envint.2016.04.044.

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Regulatory Analysis: 8 Year Review Rulemaking (3/11/26)

Complete between 3/1 and 3/31

Agency Information
Agency: Department of Environmental Quality
Rule Chapter:
Agency Contact Name: Diane Cutler
Agency Contact Email: diane.cutler@deq.idaho.gov
Agency Contact Phone: 208-373-0165

Part 1: Governor's Requirements

Is the specific Idaho statutory legal authority that authorizes this chapter mandatory or discretionary? *(Please cite the Idaho Code section or sections that authorize this rulemaking (e.g. Idaho Code 56-202). Additionally, please include a hyperlink to that section(s) (you must link to the official text from the Idaho Legislature's website, found here).*

Authority Type: Mandatory, Discretionary *(underline one)*
Statutory Authority:

- Idaho Code § 39-105 – Powers and Duties of the Board
- Idaho Code § 39-107 – Powers and Duties of the Department
- Idaho Code § 39-115 – Permits
- Idaho Code § 39-118 – Review of Plans and Specifications

Is this chapter related to any existing federal law?
(If yes, cite the law and include a hyperlink.)

Yes:
No | Proceed

Description of this Rule Chapter:
IDAPA 58.01.17 establishes the requirements and permitting process for the beneficial reuse of treated municipal and industrial wastewater. The rule regulates the design, operation, monitoring, and permitting of reuse facilities that apply treated effluent to land or otherwise reuse recycled water. The chapter also establishes treatment classifications for recycled water, allowable reuse applications, operational requirements, monitoring standards, and permit conditions to ensure protection of public health and the environment.

History and Background of the Rule – *Explain the origin of this rule chapter (e.g. was it required due to state or federal law, court order, audit finding, operational issues, stakeholder feedback, or some other factor). At a minimum, explain the following in answering this section:*

- *origin for this rule chapter, including what prompted the agency to initiate the rulemaking to create this chapter (e.g. Idaho Legislature granted us rulemaking authority under HB 450 (2019).*
- *was this chapter recently updated? If so, why?*
- *did the agency follow a certain process to develop the rules in this chapter (e.g., convene a working group, use model code)?*

The Recycled Water Rules were adopted to provide a regulatory framework for the reuse of treated municipal and industrial wastewater in Idaho. The rules were developed under DEQ's statutory authority to regulate wastewater treatment and pollution sources and to protect groundwater and surface water resources.

As water reuse became a more viable wastewater management strategy, the Department developed these rules to ensure reuse activities are conducted safely and consistently across the state. The rules establish treatment classifications, reuse standards, and permit requirements that ensure recycled water is used in a manner protective of human health and the environment.

The rules have been periodically updated to reflect evolving wastewater treatment technologies, reuse practices, and regulatory experience. The most recent updates included revisions to treatment classifications, monitoring requirements, and reuse standards.

Development and updates of this chapter involved technical review by DEQ staff and consultation with stakeholders including municipalities, wastewater utilities, engineers, and other regulated entities.

Scope of the Rule – *Summarize the scope of the rule.*

This rule applies to municipal and industrial facilities that treat wastewater and reuse the treated effluent through land application or other approved reuse methods. The rule establishes permitting requirements, treatment standards, operational requirements, monitoring provisions, and restrictions on the use of recycled water.

Facilities regulated under this rule include municipal wastewater treatment plants, industrial wastewater treatment facilities, and other entities that reuse treated wastewater through irrigation, groundwater recharge, or other approved applications.

Statement of Need – *Provide a statement explaining the need for the rule chapter and an evaluation of the goal behind this chapter. Under Idaho Code Section 67-5292, the Legislature asks agencies to "consider whether the substantive content in the rule chapter is still necessary, and if it is determined to be necessary, the rationale for such determination." Your response should explain the need for the rule chapter (e.g., it is required under state law, it is required to maintain primacy, it addresses an operational issue, it's required to comply with a court order) and an evaluation of the policy rationale or goal behind this chapter.*

Please be as detailed as possible in answering this question. This answer will help in completing the legislative report required under Idaho Code Section 67-5292.
This rule chapter is necessary to ensure that the reuse of treated wastewater in Idaho occurs in a manner that protects public health, groundwater, surface water, and other environmental resources.

Recycled water reuse provides a beneficial alternative to traditional wastewater disposal methods and supports water conservation. However, reuse activities can present risks to human health and environmental quality if not properly managed.

The rule establishes treatment standards, monitoring requirements, operational controls, and permitting requirements that ensure recycled water is safely reused. It also provides regulatory certainty and consistency for municipalities, industries, and other entities seeking to implement water reuse projects.

Without these rules, DEQ would lack a clear regulatory framework for permitting reuse facilities and ensuring that recycled water use protects groundwater quality and other beneficial uses of Idaho waters. The rule therefore supports the Department's statutory responsibilities under Title 39, Idaho Code, to protect environmental quality and public health.

Impacted Parties – *Identify all parties that are impacted by this rule and include a specific number of such estimated parties. Consider the impact of this rule chapter on ALL people affected by it - not just regulated persons. To identify impacted parties, look at agency records, calculations, research, estimates, and surveys.*

The rule impacts entities involved in wastewater treatment and reuse activities in Idaho. Estimated impacted parties include:

- Municipal wastewater treatment facilities: ~35–45 facilities with reuse permits or potential reuse operations
- Industrial wastewater treatment facilities: ~85-90 facilities using or proposing recycled water reuse
- Engineering consultants and wastewater system designers: ~ 15-25 consulting and engineering firms regularly provide design services to systems in Idaho.
- Agricultural operations receiving recycled water: ~ 40-60 ag operations or landowners receive recycled water for irrigation or other uses.
- Property owners near reuse sites
- General public using areas irrigated with recycled water

Overall, approximately 150-190 regulated facilities and associated stakeholders are directly affected by this rule chapter. These reuse systems divert approximately 6 billion gallons of treated wastewater annually from surface water discharge, supporting water conservation and nutrient recycling while protecting groundwater quality.

Is this rule chapter, or part thereof, more restrictive than Wyoming, Utah, Alaska, or South Dakota?
Add citation and hyperlink to all Yes states.If the Idaho rule chapter is more stringent than any of these states, describe the evidence base or unique circumstances that justify the enhanced requirement for those states. If any federal or state law is less stringent than Idaho, there is a rebuttable assumption that Idaho's more stringent restrictions are unnecessary and should at a minimum be adjusted to the law that is less stringent.

No|Proceed
Yes: Complete table for all that apply:
Protection of groundwater quality is the primary driver of Idaho's Recycled Water Rules because recycled water is applied to land and can infiltrate into underlying aquifers that serve as drinking water sources across the state. As a result, the rule establishes treatment standards, monitoring requirements, and operational controls to ensure that land-applied recycled water does not degrade groundwater quality or impair its beneficial uses. Comparison with Wyoming, Utah, Alaska, and South Dakota indicates that Idaho's rules are occasionally more prescriptive because Idaho has adopted a comprehensive standalone rule chapter specifically governing recycled water reuse. Idaho establishes a five-class recycled water system, detailed treatment and monitoring requirements, explicit allowable uses tied to treatment classifications, and distribution system identification requirements. Other states reviewed regulate wastewater reuse through fewer reuse classes, permit conditions, or general wastewater disposal rules rather than through a detailed statewide recycled water rule framework. Given the scale and prevalence of land application systems in Idaho along with the significant use of groundwater as a drinking water source, these enhanced requirements are necessary to ensure consistent protection of groundwater and human health in areas with potential public exposure.

State	Citation and hyperlink	Justification for enhanced stringency
Wyoming		Wyoming regulates wastewater reuse through Chapter 11, Part H of its Water Quality Rules and Regulations. Compared to Wyoming, Idaho's Recycled Water Rules may be perceived as more stringent because Idaho uses a more detailed and prescriptive regulatory framework. Idaho establishes five municipal recycled water classes instead of Wyoming's three, specifies additional treatment and effluent-quality criteria for higher classes, requires more detailed use-specific restrictions, and includes more explicit monitoring, signage, and distribution-system requirements. Wyoming's reuse rule is comparatively performance-based and does not itself establish treatment-process requirements, making direct one-to-one comparison incomplete for some elements.

		Idaho's recycled water rule may appear more prescriptive than Wyoming's reuse provisions because Idaho establishes a more detailed classification framework, numeric treatment criteria, monitoring requirements, and operational controls. These enhanced requirements are justified based on several Idaho-specific regulatory needs. First, Idaho relies heavily on groundwater as a primary drinking water source, and a large number of reuse systems apply treated wastewater directly to land where infiltration to groundwater may occur. Idaho's rule therefore includes additional controls such as nitrogen limits for certain reuse applications and detailed monitoring requirements to ensure that groundwater quality standards are protected. Second, Idaho has a large number of municipal land application systems, including systems serving communities in arid and semi-arid regions where land application is used in place of surface water discharge. Because these systems may operate year-round and apply large volumes of wastewater to land, Idaho's rule provides a more structured classification system (Class A–E) and detailed operational requirements to ensure consistent protection of human health and environmental quality. Third, Idaho's rule contains more explicit distribution system identification and signage requirements, including color-coded piping and warning signage. These provisions are intended to prevent cross-connections and accidental consumption of recycled water, particularly in systems where recycled water may be distributed in pressurized irrigation systems or used in publicly accessible areas. Wyoming's rule takes a more performance-based approach, leaving many

		implementation details to permits and site-specific determinations. Idaho's more detailed framework provides regulatory certainty for permit applicants and regulators and supports consistent implementation across a large number of reuse facilities.
Utah	• Utah reuse technical requirements: https://rules.utah.gov/publicat/code/r317/r317-003.htm • Utah approvals and permits for water reuse projects: https://rules.utah.gov/publicat/code_rtf/r317-013.rtf • Utah operating permits page: https://deq.utah.gov/water-quality/wastewater-treatment-facilities-operating-permits	Utah regulates reclaimed water reuse through a combination of technical requirements in UAC R317-3-11 and project approval requirements in UAC R317-13, with current operating-permit materials referencing Type I and Type II reuse and requiring a reuse project plan. Compared to Utah, Idaho's Recycled Water Rules may be perceived as more stringent because Idaho's rule is more detailed and prescriptive on its face. Idaho establishes five municipal recycled water classes, sets explicit class-based use restrictions, includes numeric total nitrogen limits and lower BOD5 limits for some groundwater-recharge applications, and contains detailed signage and distribution-system identification requirements. Utah regulates reuse through a smaller number of reuse categories and relies heavily on permit conditions and project-specific approvals. Idaho's rule may appear more stringent because it establishes a broader and more detailed statewide framework for recycled water reuse. Idaho's enhanced requirements are justified by the scope and diversity of reuse activities in Idaho. Idaho's rule includes detailed use categories and treatment classifications to address a wide range of reuse applications, including agricultural irrigation, landscape irrigation, groundwater recharge, and other beneficial uses. In particular, Idaho includes nutrient limits for certain reuse applications, such as groundwater recharge systems. These

		provisions are intended to prevent degradation of groundwater quality in areas where treated wastewater is intentionally infiltrated into the subsurface. Because many Idaho communities rely on groundwater for drinking water supplies, these controls help ensure compliance with Idaho's Ground Water Quality Rule and protect existing beneficial uses of groundwater. Idaho's rule also provides more explicit monitoring and operational standards for higher-quality recycled water. These provisions support safe reuse in areas with potential public exposure, including parks, golf courses, and residential landscape irrigation. While Utah's framework provides similar environmental protections through permits and project approvals, Idaho's more detailed rule structure provides additional clarity and consistency for regulators and reuse system operators.
Alaska	Alaska DEC regulations page: https://dec.alaska.gov/commish/regulations/ 18 AAC 72 – Wastewater Disposal: https://dec.alaska.gov/media/k3zjcdo4/18-aac-72.pdf Alaska DEC – Wastewater Discharge Permits: https://dec.alaska.gov/water/wastewater/permit-entry/ Alaska DEC – Engineered Wastewater Disposal Systems: https://dec.alaska.gov/water/wastewater/engineering/engineered-systems Alaska DEC – Alaska Water and Sewer Challenge:	Alaska's current regulatory structure appears to address land application / land disposal / alternative wastewater systems through general wastewater disposal and engineering approval requirements, not through a dedicated statewide recycled-water program with reuse classes, use tables, signage requirements, or class-specific monitoring standards like Idaho's Chapter 58.01.17. Alaska requires plan approval or permits for wastewater disposal, recognizes land surface disposal systems as systems that dispose of treated wastewater onto land, and sets minimum treatment, separation-distance, construction, and monitoring authorities under 18 AAC 72. Alaska regulates wastewater disposal primarily through general wastewater disposal rules rather than through a

	https://dec.alaska.gov/water/water-sewer-challenge/	dedicated recycled water reuse framework. Idaho's rule therefore appears more prescriptive because it establishes a comprehensive regulatory framework specifically designed for recycled water reuse. Idaho's enhanced requirements reflect the greater prevalence of wastewater reuse in Idaho. Many Idaho communities rely on land application systems to manage treated wastewater, and reuse is commonly integrated into irrigation practices in agricultural and landscaped areas. As a result, Idaho has adopted more detailed standards governing treatment classifications, monitoring, and reuse practices. Additionally, Idaho's rule addresses public exposure scenarios that may be more common in Idaho reuse systems, such as irrigation of parks, golf courses, and other publicly accessible areas. The rule includes detailed signage, distribution system identification, and treatment standards intended to protect public health when recycled water is used in locations accessible to the public. Alaska's regulatory framework addresses wastewater disposal more broadly and may rely on site-specific engineering review and permitting rather than statewide reuse standards. Idaho's more detailed rule structure supports consistent statewide implementation of reuse practices and reflects the larger role that wastewater reuse plays in Idaho's wastewater management strategies.
South Dakota	• South Dakota Legislature, water pollution control authority: https://sdlegislature.gov/Statutes/34A-2	South Dakota does not appear to regulate recycled water reuse through a dedicated statewide rule chapter comparable to Idaho's Recycled Water Rules. Instead, the closest comparable framework consists of

	• South Dakota DANR, General Permit for Minor Non-Discharging Domestic Wastewater Treatment Facilities (Statement of Basis): https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/docs/DANR_General_No_Discharge_SOB.pdf • South Dakota DANR, General Surface Water Discharge Permit: https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/docs/DANR_General%20910permit.pdf • South Dakota DANR, Recommended Design Criteria Manual: https://danr.sd.gov/PlansSpecifications/docs/DesignCriteriaManual.pdf	permit coverage for minor non-discharging domestic wastewater treatment facilities, a general surface water discharge permit that contemplates effluent used for irrigation, and a recommended design criteria manual for disposal of effluent by irrigation. Compared to South Dakota, Idaho's rule may be perceived as more stringent because Idaho establishes a dedicated recycled-water framework with five treatment classes, class-specific allowable uses, more explicit monitoring and operational standards, and detailed signage and distribution-system requirements. South Dakota regulates wastewater irrigation and non-discharging systems primarily through permitting programs and design guidance rather than through a dedicated reclaimed water rule chapter. Idaho's rule may therefore appear more detailed and prescriptive. Idaho's enhanced requirements are justified by the extent of land application and beneficial reuse systems operating in Idaho. Statewide program data indicate that numerous facilities apply treated wastewater to land rather than discharging to surface waters. These systems collectively manage billions of gallons of treated wastewater annually across thousands of acres of land application sites. Because of the scale of these systems, Idaho's rule establishes a structured classification system for recycled water, detailed operational standards, and monitoring requirements to ensure that reuse activities remain protective of human health and environmental quality. Idaho's rule also includes more explicit standards for uses involving potential public exposure, such as irrigation of parks, recreational areas, and landscaped areas. These provisions provide clear expectations

		for system design, operation, and public notification. South Dakota's regulatory framework addresses many of these issues through permit conditions and engineering review. Idaho's rule codifies these requirements in rule to ensure consistent statewide implementation and regulatory clarity for reuse system operators.

Fiscal Impact & Costs Analysis

A: Does the agency collect any fees or fines under this rule?
No|Proceed to Section B. Fees to support the recycled water program are authorized at IDAPA 58.01.14.
Yes:
How much are the fees or fines? *Please include page number and section of the rule chapter where the fees or fines are found. In this section, you need to lay out the individual fees and fines in this rule chapter and the reason for such fees and fines (e.g., to address negative fund balance).*

Can the fees or fines be reduced?
Yes: *Explain why and by how much the fees or fines can be reduced*

No: *Explain why the fees or fines cannot be reduced*

B: Is there a continued fiscal impact to federal funds, the state general fund, state dedicated funds, local governments' funds, or other funds? *Please specify positive and negative impacts to all fund sources selected below. If the rule chapter impacts expenditures and revenues, please quantify the total impact by year (if possible) for each type of fund.*

Fiscal Impact?	$ Fiscal Impact	Explain Fiscal Impact or Why N/A
Federal Funds	$	
General Funds	$	
Dedicated Funds	$	
Local Governments' Funds	$	
Other	$	

Not Applicable		

C. What are the costs of compliance on regulated entities?
Costs are the burden of complying with this rule chapter and can include costs of fees, new equipment or supplies, increased labor and training, education, supervisory costs, and any other compliance cost imposed by the requirements of the rule. If there are no costs associated with this rule chapter besides fees or fines, please insert the following statement in the textbox: please see the above section relating to fees and fines.

Compliance costs for IDAPA 58.01.17 are generally moderate and lower than discharge-based permitting programs.
Facilities are primarily required to submit annual reports demonstrating compliance with permit conditions, including application rates and loading limits. Unlike NPDES/IPDES permits, ongoing reporting and monitoring requirements are less frequent. Operational costs related to land application (e.g., irrigation management) are typically part of normal facility operations and do not represent significant additional burden. Capital costs (e.g., infrastructure or treatment upgrades) are project-specific and occur when a facility elects to implement reuse, not as a direct requirement of the rule.

Overall, compliance costs are moderate and may be lower than surface water discharge alternatives, particularly due to operational flexibility and reduced reporting frequency.

Enter any costs of compliance:

D. What are the administrative expenses imposed by the rules?
(e.g., legal, consulting, reporting, accounting, or other administrative expenses imposed by the requirements of the rule) This is administrative costs to regulated parties (not the agency).

Administrative costs for regulated entities under IDAPA 58.01.17 are generally low.

Facilities are required to maintain records and prepare annual reports documenting compliance with permit conditions, including land application volumes and loading rates. These costs primarily reflect staff time or occasional consultant support for data compilation and report preparation. Administrative burdens are minimal compared to discharge-based permitting programs, as requirements are limited to annual reporting and routine recordkeeping rather than frequent or complex reporting obligations.

Enter any administrative expenses of rule:

Part 2: Idaho Code Section 67-5292 Requirements

Is the substantive content in the rule chapter still necessary?
Yes Identify and cite sections that contain substantive content.
Key substantive provisions include:

- **Section 300 – Permit Requirements and Application**
- **Section 400 – Application Processing**
- **Section 500 – Standard Conditions**
- **Section 600 – Specific Conditions**
- **Sections 601–603 – Recycled Water Classification, Treatment, and Use**
- **Sections 604–607 – Buffer Distances, Design, and Groundwater Protection**
- **Sections 700–920 – Permit Modification, Transfer, Closure, and Revocation**

These sections establish the core regulatory requirements for permitting, operation, monitoring, and management of recycled water reuse systems.

Would the substantive content be more appropriately integrated into Idaho Code as opposed to remaining as a separate administrative code?
Integrated | Separate *(select one and explain your selection below)*

Integrated: Please explain why it would be more appropriately integrated into Idaho code.

Separate: Please explain why the rule should remain as a separate administrative rule.

The rule should remain separate because it contains detailed technical requirements for wastewater treatment, monitoring, and reuse that need to be updated periodically. Keeping these requirements in administrative rule allows the Department to adjust standards as technology and best practices evolve, and to account for site-specific conditions that affect groundwater protection.

Placing this level of technical detail in Idaho Code would make updates more difficult and reduce flexibility, while the existing statute already provides the necessary authority and policy direction. The rule is more appropriately maintained as an administrative rule to ensure it remains flexible, current, and protective of groundwater and public health.

No - Since not necessary, should this rule chapter be repealed?

Yes | Proceed
No: Specify why this rule chapter should not be repealed

When was the last time the substantive content of this chapter was updated in the prior five (5) years? *July 1, 2023*

How often do you anticipate that this rule chapter will need to be updated?
Anticipated Update Frequency
Annually

Every 2-3 years
Every 4-5 years
Rarely

Besides rulemaking, are there other items related to this rule chapter that need to be addressed?
(Diane's insert – based on what DFM is trying to get from this question, the better question would be 'How can this rule chapter be improved?')

No | End

Yes: Please specify (e.g., technological updates, statutory changes, internal policy changes).

Does your agency believe that a rulemaking should be initiated for this chapter?

If yes: why?

If no: why?

This rule chapter went through the zero based rulemaking effort in CY2022 resulting in updates finalized and approved by the Legislature in 2023. During that effort 3 years ago, we were able to make significant improvements to rule implementation resulting in a reduced and streamlined rule chapter. At this time, additional rulemaking is unlikely to make implementing the chapter more efficient or easier to understand. DEQ does take the obligation to streamline provisions and reduce regulatory burden seriously and will continue to monitor this chapter for further improvements.

If the agency were to initiate a rulemaking for this chapter, could the agency propose specific, substantive rule revisions that would reduce a regulatory burden on Idahoans or streamline the regulations in this chapter?

If yes: please be as specific as possible and identify the relevant section numbers where opportunities exist to streamline or reduce regulatory requirements.

If no: why not?

An Emerging Contaminant of (Legal) Concern:
PFAS Legal Issues at the State and Federal Level



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About the Authors



Conor Jennings is a third-year student at William & Mary Law School. At William & Mary, he is a fellow with the Virginia Coastal Policy Center, involved with the Student Environmental & Animal Law Society, and is on the William & Mary Law Review. He graduated in 2011 from the University of Virginia with a double major in Biology and Psychology. Following graduation from William & Mary, Conor will be working at Eversheds Sutherland LLP in Washington, D.C.



Michael Heard Snow is a second-year law student at William & Mary Law School. He earned his B.S. from Northeastern University in Environmental Science, and his M.Sc. from the University of Edinburgh in Marine Systems and Policies. Before law school he was a fisheries biologist in the Bering Sea. In 2019, Michael worked as a summer research assistant for VCPC and as a fall extern with the U.S. House Select Committee on the Climate Crisis. He will continue to pursue environmental law with the Oceans Litigation Office at Earthjustice in the summer of 2020.

About the Virginia Coastal Policy Center

The Virginia Coastal Policy Center (VCPC) at the College of William & Mary Law School provides science-based legal and policy analysis of ecological issues affecting the state's coastal resources, by offering education and advice to a host of Virginia's decision-makers, from government officials and legal scholars to non-profit and business leaders.

With two nationally prominent science partners – the Virginia Institute of Marine Science and Virginia Sea Grant – VCPC works with scientists, local and state political figures, community leaders, the military, and others to integrate the latest science with legal and policy analysis to solve coastal resource management issues. VCPC activities are inherently interdisciplinary, drawing on scientific, economic, public policy, sociological, and other expertise from within the University and across the country. With access to internationally recognized scientists at VIMS, to Sea Grant's national network of legal and science scholars, and to elected and appointed officials across the nation, VCPC engages in a host of information exchanges and collaborative partnerships.

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questions, or suggestions.

VCPC grounds its pedagogical goals in the law school's philosophy of the citizen lawyer. VCPC students' highly diverse interactions beyond the borders of the legal community provide the framework for their efforts in solving the complex coastal resource management issues that currently face Virginia and the nation.

I. INTRODUCTION[1]

Per- and polyfluoroalkyl substances, or PFAS, are a class of man-made industrial chemicals that have been widely used in a variety of ways, primarily in water-resistant coatings and fire-fighting foam.[2] Their widespread use has led to broad contamination threats to human drinking water sources, including surface and groundwater. As a result, they are an emerging contaminant of concern that are swiftly turning into a global health threat on the forefront of regulatory and policy debates. PFAS have been detected in both aquatic life and humans, and research is increasingly clear that there are concrete health risks to excessive exposure.[3] Currently there are no binding federal restrictions of PFAS, leading some states to take the lead in developing regulations for this class of emerging contaminants. This paper will give a brief overview of what PFAS is, what the federal and state governments are doing about it, and various recommendations.

II. WHAT ARE PFAS AND HOW DO THEY AFFECT HUMANS?

PFAS are a class of industrial chemicals used in a wide variety of ways. The common uses are as (1) surfactants for use in water-resistant coatings (*e.g.*, Teflon), food contact paper (e.g., wax paper), (2) electronics like semiconductors, and (3) firefighting foam.[4] PFAS are a diverse set of chemicals, but the unifying characteristic is the substitution of fluorine for hydrogen in carbon chains.[5] This carbon-fluorine bond is incredibly strong and accounts for why PFAS remain present in the environment and never really break down—leading to their nickname, "forever chemicals."[6] Thus, as a class, they are extremely resistant to degradation in any environment.[7] Their persistence is also why they are dangerous, because they can become ubiquitous in things that humans and animals come in contact with, like water, and then accumulate in the body.[8] PFAS have been detected in humans and animals all around the world, in surface water, and in ground

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[1] The authors would like to thank Emily Russell, Assistant County Attorney, Chesterfield County, Virginia, for her valuable suggestions and insights for this paper.

[2] Mohammad F. Rahman, Sigrid Peldszus, & William B. Anderson, *Behaviour and Fate of Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs) in Drinking Water Treatment: A Review*, 50 WATER RES., 318, 319 (2014), http://dx.doi.org/10.1016/j.watres.2013.10.045.

[3] Gloria B. Post, Jessie A. Gleason, & Keith R. Cooper, *Key Scientific Issues in Developing Drinking Water Guidelines for Perfluoroalkyl Acids: Contaminants of Emerging Concern*, PLOS BIOLOGY, Dec. 20, 2017 at 1, 2, https://doi.org/10.1371/journal.pbio.2002855.

[4] Rahman et al., *supra* note 2, at 319.

[5] *See id.* The "F" in PFAS reflects the fluorine substitution.

[6] *See id.* at 322; Molly M. Ginty, *"Forever Chemicals" Called PFAS Show Up in Your Food, Clothes, and Home*, NAT. RESOURCES DEF. COUNCIL, Jan. 7, 2020, https://www.nrdc.org/stories/forever-chemicals-called-pfas-show-your-food-clothes-and-home. As a result, PFAS can remain in the environment long after introduction stops. Zhanyun Wang, Jamie C. DeWitt, Christopher P. Higgins, & Ian T. Cousins, *A Never-Ending Story of Per- and Polyfluoroalkyl Substances (PFASs)?*, 51 ENVTL. SCI. & TECH. 2508, 2508 (2017), http://dx.doi.org/10.1021/acs.est.6b04806.

[7] Rahman et al., *supra*, note 2, at 322.

[8] *See* Post et al., *supra* note 3, at 1-2; Jessica L. Reiner & Benjamin J. Place, *Perfluorinated Alkyl Acids in Wildlife*, *in* TOXICOLOGICAL EFFECTS OF PERFLUOROALKYL AND POLYFLUOROALKYL SUBSTANCES 127, 132 (Jamie C. DeWitt ed., 2015), doi:10.1007/978-3-319-15518-0_5.

water.[9] In fact, scientists now believe PFAS is likely detectable in all major water supplies in the U.S.[10]

For name brand products like Teflon, Scotchgard, and Gore-Tex, PFAS are used as surfactants precisely because of the strong carbon-fluorine bond, one of the strongest chemical bonds known.[11] Compared to the carbon-hydrogen bond it replaces, the carbon-fluorine bond is almost completely chemically inert, meaning it does not react to any chemical stimuli, like heat, acids, bases, oxidation, reduction, or even biodegradation.[12] This is why it is so good as a surfactant, but also why it persists in the environment.

While several PFAS such as perfluorooctane sulfonic acid (PFOS), perfluorononanoic acid (PFNA), and perfluorooctanoic acid (PFOA) have recently come to the forefront of public and regulatory attention, the thousands of PFAS substances that make up the vast majority of the class remain unstudied.[13] PFOA and PFOS, two of the most well-known and widespread chemicals from the PFAS class, were made in large amounts in the United States from the 1940s until 2006 when they were phased out through a voluntary program with the Environmental Protection Agency (EPA).[14] While most studies have been focused on these common PFAS such as PFOA, the vast majority of compounds currently in use are new PFAS that have replaced PFOA and PFOS in many industrial processes.[15] These compounds lack toxicological or environmental impact data,

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[9] *See* Craig M. Butt, Urs Berger, Rossana Bossi, & Gregg T. Tomy, *Levels and Trends of Poly- and Perfluorinated Compounds in the Arctic Environment*, 408 SCI. OF THE TOTAL ENV'T 2936, 2937-38 (2010) (documenting the finding of PFAS even in Arctic environments without human populations), doi:10.1016/j.scitotenv.2010.03.015. *See also* Andrew B. Lindstrom et al., *Application of WWTP Biosolids and Resulting Perfluorinated Compound Contamination of Surface and Well Water in Decatur, Alabama, USA*, 45 ENVTL. SCI. & TECH. 8015, 8021 (2011), https://doi.org/10.1021/es1039425; Gloria B. Post, Judith B. Louis, R. L. Lippincott, & Nicholas A. Procopio, *Occurrence of Perfluorinated Compounds in Raw Water from New Jersey Public Drinking Water Systems*, 47 ENVT. SCI. & TECH. 13266, 13273 (2013), https://doi.org/10.1021/es402884x; Laurel A. Schaider, Janet M. Ackerman, & Ruthann A. Rudel, *Septic Systems as Sources of Organic Wastewater Compounds in Domestic Drinking Water Wells in a Shallow Sand and Gravel Aquifer*, SCI. OF THE TOTAL ENV'T 470, 473-74 (2016), http://dx.doi.org/10.1016/j.scitotenv.2015.12.081.

[10] SYDNEY EVANS, DAVID ANDREWS, TASHA STOIBER, & OLGA NAIDENKO, ENVTL WORKING GROUP, PFAS CONTAMINATION OF DRINKING WATER FAR MORE PREVALENT THAN PREVIOUSLY REPORTED (January 22, 2020) [hereinafter *EWG*], https://www.ewg.org/research/national-pfas-testing/. The Environmental Working Group (EWG) is a non-profit organization that commissioned laboratory tests of water samples from every state in the US, finding PFAS contamination in forty-nine out of the fifty states. *See id.*

[11] *See* Xindi C. Hu et al., *Detection of Poly- and Perfluoroalkyl Substances (PFASs) in U.S. Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants*, 3 ENVTL. SCI. & TECH. LETTERS 344, 344-45 (2016), https://doi.org/10.1021/acs.estlett.6b00260; Rahman et al., *supra* note 2, at 319; Wang et al., *supra* note 6, at 2511.

[12] Cheryl Hogue et al., *A Guide to the PFAS Found in Our Environment*, CHEMICAL & ENGINEERING NEWS, https://cen.acs.org/sections/pfas.html (last visited Feb. 14, 2020); Rahman et al., *supra* note 2, at 322.

[13] Wang et al., *supra* note 6, at 2508.

[14] *See* ENVTL. WORKING GROUP, WHAT ARE PFAS CHEMICALS? (2017), https://www.ewg.org/pfaschemicals/what-are-forever-chemicals.html.

[15] Alex Ebert & Maya Goldman, *PFAS Sleuths Seek 'Forever Chemical' Fingerprint*, BLOOMBERG ENV'T, July 9, 2019, https://news.bloombergenvironment.com/environment-and-energy/pfas-sleuths-seek-forever-chemical-fingerprints. Of the approximately 6000 PFAS compounds, only a dozen can be reliably tested for at the moment, and fewer than that have accurate toxicological data. *Id.*

and are more resistant to traditional water cleaning techniques such as carbon filtration.[16] The lack of regulation of the compounds combined with their high solubility, low sorption and both biological and chemical resistance has resulted in their widespread presence in aquatic environments.[17]

As a result of their long half-lives and widespread use, PFAS have found their way into waters, sediments, soils, wastewater, compost, plants, animals, and humans.[18] Multiple studies have shown that even limited exposure to PFAS can result in a wide range of negative health impacts.[19] Funded through a multi-million dollar settlement with DuPont de Nemours, Inc., the largest study of PFAS effects on human health to date was undertaken to identify the exposure-disease relationship in over 69,000 participants in the Ohio River Valley.[20] The study found a correlation between PFAS exposure and cancers[21] (specifically testicular cancer[22] and kidney cancer[23]), ulcerative colitis,[24] thyroid disease,[25] pregnancy-induced hypertension,[26]

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[16] Mohamed Ateia, Amith Maroli, Nishanth Tharayil, & Tanju Karanfil, *The Overlooked Short- and Ultrashort-Chain Poly- and Perfluorinated Substances: A Review*, 220 CHEMOSPHERE 866, 874 (2019), https://doi.org/10.1016/j.chemosphere.2018.12.186.

[17] *Id.*; *see also* READE ET AL., *infra* note 36, at 12-14.

[18] *See* Para Zareitalabad, Jan Siemans, M. Hamer, & Wulf Amelung, *Perfluorooctanoic Acid (PFOA) and Perfluorooctanesulfonic Acid (PFOS) in Surface Waters, Sediments, Soils and Wastewater – A Review on Concentrations and Distribution Coefficients*, 91 CHEMOSPHERE 725, 728 (2013), https://doi.org/10.1016/j.chemosphere.2013.02.024; ENVTL. PROTECTION AGENCY, RISK MANAGEMENT FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFASS) UNDER TSCA, https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfass#tab-3 (last visited Feb. 14, 2020); PA. DEP'T OF HEALTH, PERFLUOROOCTANESULFONIC ACID (PFOS) AND PERFLUOROOCTANOIC ACID (PFOA), http://files.dep.state.pa.us/RegionalResources/SERO/SEROPortalFiles/Community%20Info/EastonRoadPFC/PA%20Department%20of%20Health%20Fact%20Sheet-%20PFOS%20and%20PFOA.pdf (last visited Feb. 14, 2020).

[19] *See generally* Alissa Cordner et al., *Guideline Levels for PFOA and PFOS in Drinking Water: The Role of Scientific Uncertainty, Risk Assessment Decisions, and Social Factors*, 29 J. OF EXPOSURE SCI. & ENV'L EPIDEMIOLOGY 157, 161 (2018), https://doi.org/10.1038/s41370-018-0099-9 (describing PFAS studies documenting negative health effects below the EPA's lifetime advisory guideline of 70 ppt).

[20] Lauren Richter, Alissa Cordner, & Phil Brown, *Non-stick Science: Sixty Years of Research and (In)action on Fluorinated Compounds*, 48 SOC. STUD. OF SCI. 691, 704 (2018), doi:10.1177/0306312718799960. The scientists who studied the Ohio River Valley contamination were known as the C8 Science panel. C8 was one of the PFAS compounds manufactured by DuPont. *See* C8 SCI. PANEL, http://www.c8sciencepanel.org/panel.html (last visited Feb. 14, 2020).

[21] Vaughn Barry, Andrea Winquist, & Kyle Steenland, *Perfluorooctanoic Acid (PFOA) Exposures and Incident Cancers Among Adults Living Near a Chemical Plant*, 121 ENVTL. HEALTH PERSPECTIVES 1313, 1316-17 (2013), https://doi.org/10.1289/ehp.1306615.

[22] C8 SCI. PANEL, PROBABLE LINK EVALUATION OF CANCER 8-12 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Cancer_16April2012_v2.pdf (last visited Feb. 14, 2020).

[23] *Id.*

[24] C8 SCI. PANEL, PROBABLE LINK EVALUATION OF AUTOIMMUNE DISEASES 5-7 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Autoimmune_Disease_30Jul2012.pdf (last visited Feb. 14, 2020).

[25] C8 SCI. PANEL, PROBABLE LINK EVALUATION OF THYROID DISEASE 6-11 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Thyroid_30Jul2012.pdf (last visited Feb. 14, 2020).

[26] C8 SCI. PANEL, PROBABLE LINK EVALUATION OF PREGNANCY-INDUCED HYPERTENSION AND PREECLAMPSIA 3-5 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_PIH_5Dec2011.pdf (last visited Feb. 14, 2020).

preeclampsia,[27] and hypercholesterolemia.[28] Other studies in lab and in-vivo have shown links to DNA methylation among firefighters,[29] changes in renal gene expression from a single exposure,[30] association with atopic dermatitis in children,[31] high cholesterol,[32] and other health complications.[33]

III. STATUS OF THE LAW CONCERNING PFAS

A. Federal

The EPA currently recommends a lifetime health advisory limit for PFOA and PFOS of 70 parts per trillion (ppt).[34] However, the Agency for Toxic Substances and Disease Registry (ATSDR) within the U.S. Department of Health and Human Services announced that health impacts from PFAS exposure could be significant at levels seven to ten times lower than the current EPA standard, with multiple assessments from other states and independent scientists concurring.[35] One of the significant reasons why there is such disparity in health guidelines stems from who the health researchers identify as their target population—"an average male adult versus a lactating mother versus a breastfeeding or formula-fed infant"—as well as inherent calculation assumptions, including "drinking water intake rate, body weight, relative source contribution from drinking water, [and] the exposure levels."[36]

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[27] *Id.*

[28] C8 SCI. PANEL, PROBABLE LINK EVALUATION FOR HEART DISEASE 6-10 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Heart_Disease_29Oct2012.pdf (last visited Feb. 14, 2020).

[29] Jin Zhou et al., *DNA Methylation Among Firefighters*, PLOS ONE, Mar. 26, 2019, at 6-8, https://doi.org/10.1371/journal.pone.0214282. DNA methylation refers to the alteration of DNA by the addition of a methyl group (CH_3) and is associated with an increased risk of cancer because hypermethylation can interfere with tumor suppressor gene expression. *Id.* at 2.

[30] Akiko Sakuma et al., *Changes in Hepato-Renal Gene Expression in Microminipigs Following a Single Exposure to a Mixture of Perfluoroalkyl Acids*, PLOS ONE, Jan. 4, 2019, at 1, https://doi.org/10.1371/journal.pone.0210110.

[31] Hui-Ju Wen et al., *Prenatal Perfluorooctanoic Acid Exposure and Glutathione s-Transferase T1/M1 Genotypes and Their Association with Atopic Dermatitis at 2 Years of Age*, PLOS ONE, Jan. 16, 2019, at 1, https://doi.org/10.1371/journal.pone.0210708.

[32] VT. DEP'T OF HEALTH, PFOA EXPOSURE & HEALTH STUDIES 1 (2016), http://www.healthvermont.gov/sites/default/files/documents/2016/12/Env_DW_PFOA_c8_health_project_summary.pdf (last visited Feb. 14, 2020).

[33] Other complications include low birth weight, infertility, early onset menopause, increased impulsivity in children, and low semen quality. *See* AGENCY FOR TOXIC SUBSTANCES & DISEASE REGISTRY, PER- & POLYFLUOROALKYL SUBSTANCES (PFAS) & YOUR HEALTH: WHAT ARE THE HEALTH EFFECTS*?* (2020), https://www.atsdr.cdc.gov/pfas/health-effects.html; ENVTL. PROTECTION AGENCY, DRINKING WATER HEALTH ADVISORIES FOR PFOA AND PFOS, https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos (last visited Feb. 14, 2020).

[34] ENVTL. PROTECTION AGENCY, *supra* note 33.

[35] Cordner et al., *supra* note 19, at 157, 159-160; Matthew Thurlow, *Fear and Loathing of PFAS*, AM. BAR ASS'N. (2018), https://www.americanbar.org/groups/environment_energy_resources/publications/trends/2018-2019/january-february-2019/fear-and-loathing/.

[36] ANNA READE, TRACY QUINN, & JUDITCH S. SCHREIBER, NAT. RESOURCES DEF. COUNCIL, SCIENTIFIC AND POLICY ASSESSMENT FOR ADDRESSING PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IN DRINKING WATER 44 (2019), https://www.nrdc.org/sites/default/files/media-uploads/nrdc_pfas_report.pdf. *See also* Cordner et al., *supra* note 19, at 157-171.

Through the PFOA Stewardship Program, the EPA has worked with eight major chemical companies to voluntarily phase out PFOA and PFOS from production in America.[37] However, modeling studies have shown than this will only shift the production overseas and potentially increase the overall production of PFOA and PFOS as developing economies ramp up production to meet increasing import demand.[38] The EPA has collected data on six PFAS,[39] and PFAS potentially could be regulated at the federal level through the Safe Drinking Water Act (SDWA)[40], the Toxic Substances Control Act (TSCA)[41], the Comprehensive Environmental Response, Compensation and Liability Act ("Superfund")[42], or the Clean Air Act.[43] However, at the time of this research, there is no binding, nationwide environmental regulation of any PFAS at the federal level,[44] since the 70 ppt EPA lifetime health level for PFOA and PFOS is advisory only.[45] There are currently 330 non-Confidential Business Information (CBI) and 148 CBI PFAS that have been reported to the EPA;[46] from 2006 to 2008 the EPA reviewed 294 new PFAS for commercial purposes and regulated the commercial uses of 191 of them.[47]

Despite the current lack of federal regulations, efforts are underway to address the PFAS problem, although challenges remain. For example, the 2020 National Defense Authorization Act (NDAA) that was signed into law in December 2019 addresses PFAS that are related to

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[37] ENVTL. PROTECTION AGENCY, FACT SHEET: 2010/2015 PFOA STEWARDSHIP PROGRAM, https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-20102015-pfoa-stewardship-program (last visited Feb. 14, 2020).

[38] Raphael M. Janousek, Jens Mayer, & Thomas P. Knepper, *Is the Phase-Out of Long-Chain PFASs Measurable as Fingerprint in a Defined area? Comparison of Global PFAS Concentrations and a Monitoring Study Performed in Hesse, Germany from 2014 to 2018*, TRAC TRENDS IN ANALYTICAL CHEMISTRY, Feb. 1, 2019, at 2, https://doi.org/10.1016/j.trac.2019.01.017; *see* ENVTL. PROTECTION AGENCY, *supra* note 37;

[39] Perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), perfluoroheptanoic acid (PFHpA), and perfluorobutanesulfonic acid (PFBS).

[40] 42 U.S.C. § 300 *et seq*. (2018).

[41] 15 U.S.C. § 2601 *et seq*. (2018).

[42] 42 U.S.C. § 9601 *et seq*. (2018).

[43] 42 U.S.C. §§ 7401*et seq.* (2018).

[44] *But see* National Defense Authorization Act (NDAA) for Fiscal Year 2020, *infra* note 47. The 2020 NDAA prohibits firefighting foam containing PFAS, but only on military bases. *Id.*

[45] ENVTL. PROTECTION AGENCY, *supra* note 33.

[46] ENVTL. PROTECTION AGENCY, PFAS LAWS AND REGULATIONS, https://www.epa.gov/pfas/pfas-laws-and-regulations (last visited Feb. 14, 2020). CBI are information collected by the EPA under the TSCA § 14 that are considered proprietary and cannot be disclosed through Freedom of Information Act requests or otherwise. ENVTL. PROTECTION AGENCY, CONFIDENTIAL BUSINESS INFORMATION UNDER TSCA, https://www.epa.gov/tsca-cbi (last visited Feb. 14, 2020).

[47] These substances were reported to the EPA under the revised TSCA, and the reporting requirements are for industrially manufactured chemicals in the U.S. over the past ten years. Since this information is only used by the EPA to determine if the substances are "active" or "inactive" in the U.S., they cannot be considered binding regulation. 15 U.S.C. § 2607(b); *see also* Hogue, *supra* note 12; ENVTL. PROT. AGENCY, USCA INVENTORY NOTIFICATION (ACTIVE-INACTIVE) RULE, https://www.epa.gov/tsca-inventory/tsca-inventory-notification-active-inactive-rule (last visited Feb. 14, 2020); PFAS LAWS & REGULATIONS, *supra* note 46; ENVTL. PROTECTION AGENCY, PFAS MASTER LIST OF PFAS SUBSTANCES, https://comptox.epa.gov/dashboard/chemical_lists/PFASMASTER (last visited Feb. 14, 2020).

Department of Defense (DoD) activities.[48] Most notably, it phases out the use of PFAS in firefighting foam on military bases beginning in 2024.[49] This is significant because environmental contamination by PFAS is common around military bases throughout the country and is usually attributed to firefighting foam.[50] The act also bans PFAS use in food packaging[51] and directs additional DoD monitoring of PFAS around military communities.[52] It also requires the Department of Defense to provide blood serum tests for PFAS to every Department of Defense firefighter as part of their annual physical exams.[53] However, key provisions that were initially included in the NDAA were ultimately removed, including a provision that required DoD to organize clean-up of PFAS-contaminated military areas and directions to the EPA to step up PFAS monitoring.[54] In a further sign of the halting nature of the federal response, the PFAS Action bill passed the House of Representatives in January 2020 and includes notable measures such as requiring the EPA to designate PFAS as a hazardous substance and to develop an enforceable threshold level.[55] However, the bill faces hurdles in the Senate and would face a likely veto from President Trump.[56] Other bills have been introduced by members of Congress but have not advanced since introduction.[57]

B. State

Lacking federal guidance, states have been leading the way in protecting their own citizens and waters from these substances. There are currently 142 proposals working their way through the legislatures of 29 states and 21 policies regulating PFAS adopted in 10 states.[58] For a full list of enacted state laws, see Appendix 1, infra. There are currently three states that have state-binding maximum advisory levels lower than the EPA's health advisory for PFOA and PFOS,[59] while multiple other states either follow the EPA guidelines or have significantly higher guidelines than the EPA.[60] Several states' attorneys general have filed suit against chemical manufacturers, while

[48] National Defense Authorization Act (NDAA) for Fiscal Year 2020, Pub. L. No. 116-92, 133 Stat. 1198 (2019), https://www.govinfo.gov/content/pkg/BILLS-116s1790enr/pdf/BILLS-116s1790enr.pdf.
[49] *Id.* § 322(c).
[50] *EWG*, *supra* note 10.
[51] NDAA § 329(a).
[52] *Id.* § 332(a).
[53] *Id.* §707(a).
[54] SAFER CHEMICALS, HEALTHY FAMILIES, NDAA CONFERENCE REPORT FAILS TO INCLUDE PFAS CLEAN-UP MEASURES; WILL END MILITARY USE OF PFAS FIREFIGHTING FOAM (2019), https://saferchemicals.org/2019/12/10/ndaa-conference-report-fails-to-include-pfas-clean-up-measures-will-end-military-use-of-pfas-firefighting-foam/.
[55] PFAS Action Act of 2019, H.R. 535, 116th Cong. §§ 2, 5 (2019), https://www.congress.gov/bill/116th-congress/house-bill/535/all-actions?overview=closed&KWICView=false.
[56] Office of Mgmt. & Budget, Exec. Office of the President, Statement of Administration Policy (Jan. 7, 2020), https://www.whitehouse.gov/wp-content/uploads/2020/01/SAP_HR-535.pdf.
[57] PFAS Release Disclosure Act, S. 1507, 116th Cong. (2019); Protect Drinking Water from PFAS Act of 2019, H.R. 2377, 116th Cong. (2019).
[58] *Bill Tracker for PFAS*, SAFER STATES, http://www.saferstates.com/toxic-chemicals/pfas/ (last visited Mar. 20, 2020); *see* Appendix 1 *infra*.
[59] Minnesota (15 ng/l), New Jersey (14 ng/l), and Vermont (20 ng/l). Cordner et al., *supra* note 19, at 159-160.
[60] *Id.*

some administrative agencies and legislatures have initiated bans, set binding health guidelines, and started state-wide testing programs.[61] Some of the leading state actions are discussed below, culminating in a detailed look at Virginia.

1. New Jersey

"In the absence of action at the federal level to meaningfully regulate these contaminants, New Jersey has acted to protect its citizens and environment" by creating the nation's strictest regulations of PFAS to date.[62] New Jersey has established Maximum Contaminant Levels (MCLs) at 14 nanograms per liter (ng/l)[63] for PFOA, 13 ng/l for PFNA, and 13 ng/l for PFOS.[64] New Jersey was also the first state to regulate PFNA.[65] New Jersey MCLs are added to its administrative code pursuant to the Safe Drinking Water Act (SDWA), and the limits apply to public and private water systems and create mandatory monitoring and containment requirements if the MCL is exceeded.[66] The State has also set Groundwater Quality Standards (GWQs) at 14 ng/l for PFOA, 13 ng/l for PFNA, and 13 ng/l for PFOS;[67] GWQs are binding limits on groundwater discharges pursuant to pollutant discharge and groundwater remediation standards within the New Jersey code.[68] The state started testing programs for PFAS in 2006, finding PFAS in 70% of tested drinking water.[69] As of March 2019, 70 public water systems not previously identified reported PFAS above the new New Jersey MCL.[70] In a study testing around 1,000 wells in 2018, 43% were found to contain PFAS at a level 31% above the MCL and 21% required "point of entry treatment systems."[71] A study of 13 PFAS compounds in waterway ecosystems found PFAS in the fish from every single waterbody, and lead to consumption restrictions imposed by the New Jersey Department of Environmental Protection (NJDEP).[72] The State also filed suit in 2019 against 3M and other corporations including Tyco Fire, Chemguard, Buckeye Fire, National Foam, and DuPont for "injuries to the natural resources of the State"[73] and fraud.[74]

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[61] *See infra* part 3b i-iv.
[62] N.J. DEP'T OF ENVTL. PROTECTION, STATEWIDE PFAS DIRECTIVE (2019) [hereinafter *N.J. Directive*], https://www.nj.gov/dep/docs/statewide-pfas-directive-20190325.pdf.
[63] A note on units: 1 nanogram per liter equals 1 part per trillion, so state regulations that are promulgated in "ng/l" are directly comparable to the EPA health advisory that is in "ppt." *See* ENVTL. PROTECTION AGENCY, CONVERTING LABORATORY UNITS INTO CONSUMER CONFIDENCE REPORT UNITS at 2, https://www.epa.gov/sites/production/files/2015-09/documents/epa816f15001.pdf (last visited Mar. 5, 2020).
[64] *N.J. Directive*, *supra* note 62, at 3; 51 N.J. Reg. 437(a) (April 1, 2019).
[65] *N.J. Directive*, *supra* note 62,62 at 3-4. PFNA has not been as widely studied as PFOS or PFOA. *See* Cheryl Rockwell et al., *Acute Immunotoxic Effects of Perfluorononanoic Acid (PFNA) in C57BL/6 Mice*, J. CLINICAL & EXPERIMENTAL PHARMACOLOGY, April 18, 2013, at 1, doi:10.4172/2161-1459.S4-002.
[66] *N.J. Directive*, *supra* note 62, at 3.
[67] *Id*; N.J. Admin. Code § 7:9C-Appendix (2018); 51 N.J. Reg. 437(a) (April 1, 2019).
[68] *N.J. Directive*, *supra* note 62, at 3.
[69] *Id*. at 4.
[70] *Id*. at 4.
[71] *Id*. at 4-5.
[72] *Id*. at 4.
[73] Compl. at 1, 5, Grewal v. 3M Co., MER-L-000953-19 (N.J. Super. Ct. Law Div. 2019), https://www.nj.gov/oag/newsreleases19/AFFF_Complaint.pdf.
[74] *Id*. at 2-3.

2. Vermont

In 2016, Vermont was the first state to set a primary groundwater enforcement standard below the revised EPA guidelines at 20 ng/l for both PFOA and PFAS[75] and expanded to 20ng/l cumulatively for five PFAS substances in 2018.[76] Vermont calculated their health advisory standard based on direct ingestion via drinking water and a non-cancer endpoint.[77] In 2019, the Vermont legislature passed bills to regulate PFAS that include mandating testing of all public water systems and requiring the Vermont Agency of Natural Resources to treat the contamination and issue "do not drink" notices until the contamination has been treated.[78] Vermont also initiated a public notice and comment process to regulate PFAS compounds as a class, requiring that the state's Secretary of Natural Resources undertake a state-wide investigation of contamination sources and submit both a class-wide regulation proposal by 2021 and water quality standards by 2020.[79] Vermont's legislature also passed a law, vetoed by the governor, that would have prohibited businesses operating in the state to use or manufacture PFAS.[80] The bill was spurred by discovery of PFOA in regional groundwater, but Vermont Governor Phil Scott said the bill would make the state less competitive for business.[81]

In June 2019, Vermont filed suit against the 3M Company, DuPont, and other chemical companies and manufacturers in the Vermont Superior Court.[82] The suit is based on several causes of action including: (1) natural resource damages and restoration,[83] (2) violations of the Vermont Groundwater Protection Act,[84] (3) strict liability for design and product defects,[85] (4) strict liability

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[75] Memorandum from Sarah Vose, State Toxicologist, Vt. Dep't of Health, to Chuck Schwer, Director, Waste Management, Vt. Department of Envtl. Conservation (June 22, 2016), https://anrweb.vt.gov/PubDocs/DEC/PFOA/PFOA%20-%20PFOS%20Health%20Advisories/Vermont/PFOA_PFOS_HealthAdvisory_June_22_2016.pdf.

[76] Memorandum from Emily Boedecker, Commissioner, Vt. Dep't of Health, to Mark A. Levine, Commissioner, Vt. Dep't of Health (July 10, 2018), https://www.healthvermont.gov/sites/default/files/documents/pdf/ENV_DW_PFAS_HealthAdvisory.pdf. The five PFAS that Vermont regulates are PFOA, PFOS, PFHxS, PFHpA and PFNA. *Id.*

[77] *Id.* at 3. Endpoints are an objective measurement to see if the intervention being studied is harmful or beneficial. NAT'L CANCER INST., NCI DICTIONARY OF CANCER TERMS, https://www.cancer.gov/publications/dictionaries/cancer-terms/def/endpoint (last visited Feb. 14, 2020). Here, a non-cancer endpoint would be the level of exposure before developing cancer.

[78] S. 49 (Vt. 2019).

[79] *Id.*

[80] S. 103 (Vt. 2019).

[81] *See* Cole Alder, *Vermont Governor Vetoes Chemical Regulation Bill*, PFAS PROJECT, NORTHEASTERN U. (April 19, 2018), https://pfasproject.com/2018/04/19/vermont-governor-vetoes-chemical-regulation-bill/.

[82] Compl. at 2, Vermont v. 3M Co. (Vt. Super. Ct. 2019), https://ago.vermont.gov/wp-content/uploads/2019/06/20190626-SOV-v-3M-et-al-Complaint-AFFF-FILE-STAMPED-COPY.pdf.

[83] *Id.* at 50.

[84] *Id.* at 51; Vt. Stat. Ann. tit. 10, § 1410 (2012).

[85] Compl. at 53, Vermont v. 3M Co. (Vt. Super. Ct. 2019).

for failure to warn,[86] (5) negligence,[87] (6) public nuisance,[88] (7) private nuisance,[89] (8) trespass,[90] and (9) violation of the Vermont Voidable Transactions Act.[91] Vermont is requesting a jury trial and asking for both compensatory and punitive damages.[92]

3. Minnesota

The Minnesota Department of Health (MDH) has issued "health-based values" on PFOS, PFOA, PFBS, PFBA, and PFHxS. In April 2019, the State updated their PFOS advisory level to 15 ng/l (from 27 ng/l) and set an advisory of 47 ng/l for PFHxS.[93] In March 2019, after testing over 2700 private wells and public water supplies, MDH issued over 1,100 drinking water advisories.[94] In the 2019 legislative session, the Minnesota legislature banned the use of PFAS firefighting foams in testing and firefighting training exercises,[95] passed a quarter of a million dollars in funding to study the effect of PFAS on raptors,[96] and prohibited manufacturers and wholesalers from selling, distributing, or offering to sell any PFAS firefighting foams except at oil refineries, airports, and the Camp Ripley base.[97]

In 2018, on the day it was supposed to go to trial, Minnesota settled their 8-year-old, $5 billion suit against 3M for $850 million.[98] The State is using those funds for safe drinking water and natural resource projects.[99] In addition to the 2018 settlement, 3M is also bound by a 2007 Consent Order between Minnesota and 3M over the release of PFAS at three specific sites in the State. The order requires 3M to fund all costs for "remedial investigations and response actions to address" discharges and to "cover all drinking water expenses due to the contamination" even after the settlement money runs out, as well as pay for remediation costs for three contaminated disposal sites in the State.[100]

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[86] *Id*. at 55.
[87] *Id*. at 58.
[88] *Id*. at 61.
[89] *Id*. at 64.
[90] *Id*. at 65.
[91] *Id*. at 67; Vt. Stat. Ann tit. 9, § 2285, *et seq*. (2018).
[92] Compl. at 2, Vermont v. 3M Co. (Vt. Super. Ct. 2019).
[93] MINN. DEP'T OF HEALTH, PERFLUOROALKYL SUBSTANCES (PFAS), https://www.health.state.mn.us/communities/environment/hazardous/topics/pfcs.html#guidancerelease (last visited Feb. 14, 2020).
[94] *Id*.
[95] H.B. 359, 91st Reg. Sess. (Minn. 2019).
[96] S.B. 7A, 1st Spec. Sess. (Minn. 2019).
[97] S.B. 2314 91st Reg. Sess. (Minn. 2019).
[98] Bob Shaw, *Minnesota, 3M Reach Settlement Ending $5 Billion Lawsuit*, TWIN CITIES PIONEER PRESS (Feb. 20, 2018), https://www.twincities.com/2018/02/20/minnesota-3m-reach-settlement-ending-5-billion-lawsuit/.
[99] MINN. POLLUTION CONTROL AGENCY, SETTLEMENT AGREEMENT & CONSENT ORDER, 1-2, May 22, 2017, https://www.pca.state.mn.us/sites/default/files/pfc-3mchemolite-consent.pdf; *see also* 3M PFC SETTLEMENT, https://3msettlement.state.mn.us/ (last visited Feb. 14, 2020).
[100] MINN. POLLUTION CONTROL AGENCY, 3M SETTLEMENT: KEY FACTS (2019), https://3msettlement.state.mn.us/sites/default/files/3M%20settlement-FINAL.pdf.

4. Virginia

As of this writing, the Virginia General Assembly has adopted two bills related to PFAS. House Bill 586 directs the Commissioner of Health to study the levels of PFAS in drinking water across the State and recommend MCLs for PFOA, PFOS, and other PFAS for inclusion in regulations of the Board of Health applicable to waterworks.[101] House Bill 1257 directs the State Board of Health to adopt regulations establishing MCLs in public drinking water systems for PFOS, PFOA, and other PFAS.[102] A third bill addressing PFAS in food packaging was continued to 2021.[103] If signed by the Governor, these laws would join an existing ban on PFAS in firefighting foam.[104]

The recent Environmental Working Group study of PFAS hot spots identified ten locations in Virginia where PFAS levels exceeded the EPA recommended levels in water sources.[105] Military sites in the Tidewater area such as Fort Eustis and Langley Air Force Base show PFAS levels in the tens of thousands and even millions of parts per trillion, likely from widespread use of firefighting foam.[106] Several counties and cities also have elevated levels from previous industrial processes.[107] See Table 1 for a full list of sites from the EWG study.

Table 1: Known PFAS Sites in Virginia [108]

PFAS Location	*Concentration & Type*	*Suspected Source*
Fort Eustis, Newport News – Groundwater	PFOA 4,600 ppt PFOS 73,000 ppt	Firefighting foam
Naval Air Station Oceana, Virginia Beach – Groundwater	Combined PFOA/PFOS 493,600 ppt	Firefighting foam
Norfolk Virginia Naval Base, Norfolk – Groundwater	Combined PFOA/PFOS 3,373 ppt	Firefighting foam
Naval Auxiliary Landing Field Fentress, Chesapeake	Combined PFOS/PFOA: - Drinking water 1,660 ppt - Groundwater 52,900 ppt	Firefighting foam
Langley Air Force Base, Hampton – Groundwater	PFOA 26,000 ppt PFOS 2,200,000 ppt	Firefighting foam
Henrico County: Richmond International Airport - Groundwater	PFNA 50 ppt PFOA 588 ppt PFOS 1,680 ppt	Firefighting foam
Richmond: James River - Surface water	PFOA 7,500 ppt	Industrial Manufacturing

[101] H.B. 586, 2020 Sess. (Va. 2020).
[102] H.B. 1257, 2020 Sess. (Va. 2020).
[103] H.B. 1712, 2020 Sess. (Va. 2020).
[104] VA. CODE ANN. § 9.1-207.1(B) (2020).
[105] *EWG*, *supra* note 10.
[106] *Id.*
[107] *Id.*
[108] *Id.*

Prince William County Service Authority's East End Service Area - Drinking water	PFHpA 12 ppt	Industrial Manufacturing
Washington County Service Authority - Drinking water	PFOA 22 ppt	Industrial Manufacturing
NASA Wallops Flight Center, Chincoteague - Drinking water	Total PFAS 70 ppt	Firefighting foam

In the Tidewater region, PFAS could be an additional issue facing an underway project to restore the Potomac Aquifer. The Hampton Roads Sanitation District's Sustainable Water Initiative for Tomorrow (SWIFT) project treats wastewater in Hampton Roads before injecting it back into the aquifer.[109] SWIFT uses a combination of sedimentation, ozone, biologically active carbon (BAC), granular activated carbon (GAC), ultraviolet light (UV), and chlorine to filter water before reinjecting it into the Potomac Aquifer.[110] Because the carbon-fluorine bond is chemically inert, PFAS are resistant to biological and oxidative processes.[111] Thus, the UV, ozone, and BAC steps will not remove PFAS from the water. However, GAC, as the most studied treatment for PFAS removal,[112] offers known, effective filtration that should serve SWIFT well. While not perfect, GAC is the current water treatment standard for removing PFAS[113] and can remove 90% of PFOA.[114] Going forward, the biggest issue facing SWIFT, and other water treatment facilities, is the effectiveness of any current filtering strategy against the newer forms of PFAS that are not as well studied.[115]

IV. LEGAL ACTION

In addition to state government regulation, citizens and environmental groups are also taking action to demand PFAS clean up. As mentioned above, states have had success suing large companies that produce PFAS like 3M and Dupont,[116] and recent action by the Southern Environmental Law Center (SELC) provides a potential model for how private citizens can show standing and harm when suing for relief from PFAS contamination. In November 2019, SELC sent a Notice of Intent to sue to the city of Burlington, North Carolina for violations of the federal Clean Water Act (CWA) and Resource Conservation and Recovery Act (RCRA).[117] The letter

[109] HAMPTON ROADS SANITATION DISTRICT, *What is SWIFT?*, https://www.hrsd.com/swift/about (last visited Mar. 5, 2020); s*ee also* CONOR M. JENNINGS, VA. COASTAL POLICY CTR., GROUNDWATER INJECTION PROJECTS: MITIGATING THE RISK OF EMERGING CONTAMINANTS 1 (2018), https://law.wm.edu/academics/programs/jd/electives/clinics/vacoastal/reports/emergingcontaminantsfinal2.pdf.
[110] *Id.* at 5-7.
[111] *See* Rahman et al., *supra* note 2, at 322.
[112] READE ET AL., *supra* note 36, at 52.
[113] *Id.*
[114] *Id.* at 52-53.
[115] *Id.*
[116] *See* section 3(b) ii-iii *supra*.
[117] Letter from Kelly Moser, Geoff Gisler, & Jean Zhuang, Southern Envtl. Law Center, to The Honorable Ian Baltutis, Mayor, City of Burlington at 1 (Nov. 7, 2019),

alleged that two wastewater treatment plants (WWTP) are illegally discharging PFAS into local waterways.[118] SELC is representing the Haw River Assembly (HRA), a non-profit corporation dedicated to protection of the Haw River, which is downstream of the WWTPs.[119]

As an entity with nearly 900 members who live near, drink from and use the Haw River, HRA believes it can demonstrate the necessary harm to achieve standing to sue.[120] HRA collected its own data about PFAS contamination in the waterways surrounding Burlington.[121] Although PFAS are not yet classified as a hazardous compound by the federal government, SELC pointed in its letter to the developing scientific literature demonstrating clear harm from PFAS exposure.[122]

SELC's legal theory asserts violations of the CWA and RCRA.[123] The CWA prohibits the discharge of pollutants into waterways without a permit, and, in the letter, SELC argued that PFAS is a harmful pollutant that the WWTPs are discharging without a permit.[124] Thus, SELC points to the WWTPs as the point source, and uses current scientific research to support the characterization of PFAS as a pollutant. HRA collected samples of water discharged from the WWTPs to show they are the source of the PFAS. RCRA allows citizens to sue when there is disposal of solid or hazardous waste that endangers the environment, and SELC points to the WWTPs' biosolid discharge as a qualifying solid disposal that also contains PFAS and is therefore harming the environment.[125]

While SELC's case against Burlington has not yet commenced, it provides a model for framing the standing, harm, and legal violation issues that citizens face when seeking relief from PFAS contamination. In other litigation, in December 2018, seventy-five cases brought by firefighters and localities involving 3M firefighting foam were consolidated as multidistrict litigation (MDL) and transferred to the District of South Carolina and are currently pending.[126] In addition to pending litigation, influential and completed litigation includes the Ohio River Valley

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https://www.southernenvironment.org/uploads/words_docs/2019_11_07_-Notice_of_Intent_-_City_of_Burlington_.pdf.

[118] *Id.* at 2.

[119] *Id.* at 3.

[120] *Id.*

[121] *Id.* at 12-17.

[122] *Id.* at 6-7.

[123] *Id.* at 1.

[124] *Id.* at 19.

[125] *Id.* at 27-28.

[126] *In re:* Aqueous Film-Forming Foams Products Liability Litigation, 357 F. Supp. 3d 1391, 1395 (J.P.M.L. 2018); Aaron Leibowitz, *3M Fire Suppressant MDL Will Be Heard In South Carolina*, LAW360 (Dec. 11, 2018), https://www.law360.com/articles/1109934. Judge Richard M. Gergel, who will hear the case in the District of South Carolina, held a "Science Day" in October prior to trial where experts arranged by both the plaintiffs and defendants explained how PFAS work, how they are used, and their potential dangers. David Shultz, *Judge Asks for Crash Course in the Science of PFAS Chemicals*, Bloomberg Env't, Oct. 4, 2019, https://news.bloombergenvironment.com/environment-and-energy/judge-asks-for-crash-course-in-the-science-of-pfas-chemicals.

class action suit, certified in 2004 for persons in the Parkersburg, West Virginia regional area.[127] The original case, *Leach v. E. I. DuPont*, was settled after confidential negotiations in February 2005 for $70 million to plaintiffs and an additional $30 million for a health study into the effects of PFAS contamination on people's health.[128] The settlement also required the installation of "state-of-the-art water treatment technology for the six identified water districts and private wells" for affected residents, which subsequent research has found reduced blood serum levels of PFOA by 40-60%.[129] Finally, common law claims have also been used by citizens seeking relief and include the following causes of action with representative examples:

- Natural Resource Damages - In 2018, Minnesota and 3M entered into a settlement agreement resolving a suit by the state over toxic discharge from a 3M plant.[130] As part of the agreement, 3M will reimburse the Minnesota Pollution Control Agency for damages to state natural resources caused by PFAS discharge.[131]
- Injury to Property - Landowners with property surrounding a Saint-Gobain's chemical plant in New Hampshire sued the company for harming their property by releasing a form of PFOA that migrated to the soil and groundwater.[132] The court held that the plaintiffs alleged compensable injury under the common law torts of trespass and nuisance, since PFOA harmed their property through a diminution in value, which in turn harmed the plaintiffs themselves.[133]
- Medical Monitoring Damages - A majority of states allow damages to pay for medical monitoring of likely future medical harm.[134] Courts do not require a showing of present physical injury, as long as plaintiffs can show a significantly increased risk to health that is not speculative.[135] With the adverse health effects of PFAS becoming clearer, courts are willing to consider medical monitoring for effects of exposure to PFAS discharge.[136]
- Consumer Fraud - The State of New Jersey, its localities, and local fire departments are suing 3M and other chemical companies for violations of state anti-fraud acts.[137] The plaintiffs' argument is that 3M knowingly offered PFAS-tainted firefighting foam for sale without

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[127] HILL, PETERSON, CARPER, BEE & DEITZLER, PLLC, C8 CLASS ACTION SETTLEMENT, https://www.hpcbd.com/Personal-Injury/DuPont-C8/C8-Class-Action-Settlement.shtml (last visited Feb. 14, 2020).
[128] Class Action Settlement Agreement at 13-14, Leach v. E.I. du Pont de Nemours Co., No. 01-C-608 (W. Va. Cir. Ct. 2005), https://www.hpcbd.com/dupont/Settlement-Agreement.pdf (last visited Feb. 14, 2020).
[129] *Id*; Robert L. Herrick et al., *Polyfluoroalkyl Substance Exposure in the Mid-Ohio River Valley, 1991-2012*, 228 ENV'T POLLUTION 50, 50 (2017), doi:10.1016/j.envpol.2017.04.092.
[130] Agreement and Order, Minn. v. 3M, No. 27-CV-10-28862 (Minn. Fourth Jud. Dist. Ct. 2018), http://www.mncourts.gov/mncourtsgov/media/High-Profile-Cases/27-CV-10-28862/Agreement-and-Order.pdf (last visited Mar. 16, 2020).
[131] *Id.* at 6.
[132] Brown v. St. Gobain Performance Plastics Corp., 2017 U.S. Dist. LEXIS 200490, at *5-*6 (D. N.H. 2017).
[133] *Id.* at *10-*11.
[134] *See* Exxon Mobil Corp. v. Albright, 71 A.3d 30, 80 (Md. 2013).
[135] *Id.*
[136] *Brown*, 2017 U.S. Dist. LEXIS 200490 at *16.
[137] Compl., Grewal v. 3M Co., MER-L-000953-19 (N.J. Super. Ct. Law Div. 2019), https://www.nj.gov/oag/newsreleases19/AFFF_Complaint.pdf (last visited Mar. 20, 2020).

disclosure of the health risks associated with PFAS contamination.[138] This amounted to a deceptive sales practice that is compensable under state anti-fraud laws.[139]

- Strict Products Liability - In the same New Jersey litigation, the plaintiffs are alleging a two count product liability claim.[140] First, they claim that the presence of PFAS in 3M firefighting foam is a design defect that 3M knew would harm the environment, creating an unreasonably dangerous product.[141] Second, the plaintiffs argue that 3M breached its duty to warn the state, as trustee of all state natural resources, of the foreseeable harm that releasing PFAS into the environment would cause.[142]
- Public Nuisance - New Jersey also asserted a public nuisance allegation in its complaint.[143] The plaintiffs argued that natural resources like groundwater and soil are held in trust by the state for the common use of the general public.[144] Firefighting foam containing PFAS unreasonably interferes with the use of these resources by the public and the state.[145]
- Class Action Suits - In addition to the cases in South Carolina and West Virginia already mentioned, a group of rural utilities (and one locality) sued 3M in a class action suit over clean-up costs caused by PFAS in firefighting foam.[146] The complaint included several claims already discussed, including design defect,[147] failure to warn,[148] public nuisance,[149] and trespass.[150] As these cases move forward, the viability of these claims will continue to become clearer.

V. RECOMMENDATIONS AND FUTURE CONSIDERATIONS

Recommendations to address PFAS contamination can be consolidated into three branching categories: (1) addressing military sites, (2) addressing existing contamination at other sites, and (3) preventing future contamination.

A. Military Sites

Some primary sites of concern with known high PFAS contamination levels in Virginia are at and around military sites which the Commonwealth does not control.[151] Under the provisions

[138] *Id.* at 60-61.
[139] *Id.* at 60.
[140] *Id*, at 38, 45.
[141] *Id.* at 38-40.
[142] *Id.* at 45-46.
[143] *Id.* at 55.
[144] *Id.* at 55-56.
[145] *Id.* at 56.
[146] Compl., City of Millington v. 3M Co., No. 1:20-cv-00546 (Dist. D.C. 2020), https://www.bloomberglaw.com/document/X1Q6O69VVAO2/download?imagename=1-1.pdf.
[147] *Id.* at 30.
[148] *Id.* at 32.
[149] *Id.* at 34.
[150] *Id.*
[151] *See EWG*, *supra* note 10.

of the 2020 NDAA that did pass, the Governor could request the Secretary of Defense to create a cooperative agreement to address testing, monitoring, removal, and remedial action for PFAS contamination around military sites in Virginia.[152] Taking advantage of this opportunity could help Virginia, with its high military presence, address some of the most pressing PFAS contamination in the Commonwealth. Virginia, and many other states, will also benefit from the phase-out of PFAS-laden firefighting foam by the DoD.[153]

B. Existing Contamination

In order to address existing PFAS in the Commonwealth, Virginia first needs an accurate picture of where and who is affected. The legislature could start by instructing the Department of Environmental Quality (DEQ) and Virginia Department of Health (VDH) to perform investigations at PFAS at-risk sites as well as compile a state-wide survey of PFAS levels in public water supplies. Indeed, current legislation in the General Assembly would help spur increased monitoring.[154]

Virginia could establish testing priorities for areas near former PFAS manufacturing or processing facilities, fire-fighting training stations, and communities adjacent to military bases, airports, and landfills. Under legislation adopted by the General Assembly this year, Virginia would develop a MCL for PFAS, which then could be used as a reference to define high risk areas.[155]

C. The End of Forever? – Preventing New Contamination

In order to break the "never ending story of PFAS," the states will have to pursue new ways to address chemical contamination in the drinking water of their citizens. Rather than wait for potential federal regulations to be adopted, the Commonwealth can follow the precedent of states on the frontlines of PFAS regulation like New Jersey, Vermont, and Minnesota, while also adhering to the precautionary principle[156] to protect the quality of its drinking water for the future. The precautionary principle can help guide states, localities, and agencies when deciding how to manage the mounting problem of PFAS.[157]

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[152] NDAA § 329(a).
[153] NDAA § 322(c).
[154] H.B. 586, 2020 Sess. (Va. 2020). As of March 20, 2020, H.B. 586 has passed both houses of the Virginia General Assembly and has been communicated to the Governor. H.B. 1257, 2020 Sess. (Va. 2020). As of March 20, 2020, H.B. 1257 has passed both houses of the Virginia General Assembly and has been communicated to the Governor.
[155] H.B. 586, 2020 Sess. (Va. 2020), H.B. 1257, 2020 Sess. (Va. 2020).
[156] "Precautionary principles are the foundations for policy when it has to deal with weakly understood causes of potential catastrophic or irreversible events, and where protective decisions require certain and costly policy interventions that may not solve the problem that they are designed to correct." JAYDEE HANSON, ENCYCLOPEDIA OF THE ANTHROPOCENE: PRECAUTIONARY PRINCIPLE: CURRENT UNDERSTANDINGS IN LAW AND SOCIETY 361 (Dominick A. Dellasala & Michael I. Goldstein eds., 2018).
[157] *See* Ian Cousins et al., *The precautionary principle and chemicals management: The example of perfluoroalkyl acids in groundwater*, 94 ENV'T INT. 331 (2016), https://doi.org/10.1016/j.envint.2016.04.044.

There are multiple ways that Virginia could build on its ban of PFAS-laden firefighting foam for training and testing purposes,[158] and implement a precautionary approach to address PFAS that would allow the Commonwealth to ensure the health of its citizenry while staying ahead of federal requirements – if, and when, they are implemented. The Commonwealth could set a binding health advisory limit for known PFAS compounds (like New Jersey); have DEQ and VDH develop and implement drinking and groundwater regulations for PFAS as a class (like pending legislation in Vermont); and promote best PFAS alternative practices, products, and chemicals.

D. CONCLUSION

The thousands of PFAS compounds are united by their similar structures and properties that allow them to persist and move quickly through the environment. Although the hazards of exposure continue to be documented, the vast majority of the class remains unknown and unstudied. In the absence of strong federal guidance, many states have initiated testing, remediation, and litigation to address the mounting issue. While a handful of the most egregiously affected citizens have brought successful claims against companies, PFAS is a prevalent nationwide problem that is not abating soon. Decades of manufacture have created a problem in nearly every state that requires containment and prevention. Virginia has the opportunity to take advantage of the groundwork and research done by other states to address PFAS while retaining the ability to be on the cutting edge of dealing with this issue.

[158] VA. CODE § 9.1-207.1(B) (2019).

APPENDIX 1

Adopted PFAS Legislation by State as of March 20, 2020[159]

Arizona	SB 1526: Prohibits the use of PFAS-containing firefighting foam for training purposes. (Adopted in 2019)
California	AB 1879: Establishes a process to identify, prioritize and evaluate chemicals of concern in consumer products, determine how best to limit exposure or reduce the level of hazard, and establishes green chemistry challenge grants and a Green Ribbon Science Panel (Adopted in 2008) AB 756: Requires public water systems to monitor for PFAS. (Adopted in 2019)
Colorado	HB 19-1279: Prohibits the sale of PFAS-containing firefighting foam in certain circumstances, prohibits the use of PFAS foam for training, requires manufacturers to disclose if protective equipment they produce includes PFAS, and requires the Department of Health to conduct a survey to determine the amount of PFAS foam currently held, used, and disposed by fire departments. (Adopted in 2019)
Georgia	HB 458: Prohibits the use of PFAS-containing firefighting foam for testing purposes. (Adopted in 2019)
Kentucky	SB 104: Prohibits the use of PFAS-containing firefighting foam for training purposes. (Adopted in 2019)
Maine	LD 2048: Identifies chemicals of high concern, and requires reporting on usage and replacement with safer alternatives. (Adopted in 2008) LD 1129: Selects up to seventy chemicals as Chemicals of High Concern based upon likely exposure to children or fetuses and uses this list to designate Priority Chemicals which will require reporting and disclosure when used in children's products. (Adopted in 2011) LD 1433: Prohibits the sale of food packaging with intentionally added toxic heavy metals, PFAS, or phthalates. (Adopted in 2019)
Minnesota	HF 2123: Generates a list of chemicals of high concern and priority chemicals, along with participation in Interstate Chemicals Clearinghouse. (Adopted in 2009) HF 2209: Bans manufacture and sale of organohalogen flame retardants in residential upholstered furniture, children's products, residential textiles, and mattresses. Prohibits the use of PFAS-containing firefighting foam for training purposes. (Adopted in 2019) SF 321: Bans manufacture and sale of halogenated, phosphorus-based, nitrogen-based, and nanoscale flame retardants in residential upholstered furniture, children's products, and residential and business textiles. Prohibits the manufacture and sale of PFAS-containing firefighting foam. (Adopted in 2019)

[159] SAFER STATES, *supra*, note 58. In addition to these enacted bills, there are currently 142 bills in progress in state legislatures. *Id.*

New Hampshire	SB309: Requires the commissioner of the department of environmental services to adopt a state drinking water standard, and ambient and surface groundwater standards for perflurochemicals.(Adopted in 2018) HB 737: Establishes a commission to investigate and analyze the environmental and public health impacts relating to releases of perfluorinated chemicals in the air, soil, and groundwater in Merrimack, Bedford and Litchfield. (Adopted in 2019) SB 257: Prohibits the manufacture, sale, use, and purchase of firefighting foams containing PFAS. (Adopted in 2019)
New York	A 445: Prohibits the manufacture, sale, and distribution for use of firefighting foam containing PFAS. (Adopted in 2019)
North Carolina	S99: State budget included funding for university research to monitor for PFAS in rivers, provisions for alternative water supplies for residents near a factory that has contaminated nearby wells, and funding for studies of downstream impacts. (Adopted in 2018)
Oregon	SB 478: Establishes a list of high priority chemicals of concern for children's products, posts the list online, requires manufacturer disclosure of these chemicals, and requires their eventual removal. Authorizes participation in the Interstate Chemicals Clearinghouse. (Adopted in 2015)
Vermont	S 239: Establishes a process for identifying chemicals of high concern; prohibits sale or distribution of consumer products containing priority chemicals. (Adopted in 2014) S10: Creates liability and penalties for contaminating water supplies with perfluorinated chemicals. (Adopted in 2017) S 49: Sets Maximum Contaminant Levels for 5 PFAS chemicals in water of 20ppt each and cumulatively, requires testing for PFAS chemicals, and requires landfills to treat leachate to remove PFAS chemicals. (Adopted in 2019)
Virginia	H 2762: Prohibits the use of PFAS-containing firefighting foam for training purposes. (Adopted in 2019)
Washington	HB2658: Prohibits the manufacture and sale of food packaging containing PFAS chemicals and requires the Department of Ecology to conduct an assessment on safer alternatives. (Adopted in 2018) HB2793: Prohibits the manufacture and sale of class B firefighting foam containing PFAS chemicals. (Adopted in 2018) HB 1194: Directs the Department of Ecology to identify and take regulatory action on consumer products that are a significant source of chemicals that are a concern for sensitive populations and species. Prioritizes PCBs, PFAS, organohalogen flame retardants, phthalates, and phenolic compounds (BPA, APEs) for initial consideration. (Adopted in 2019) HB 2265: Eliminates exemptions from restrictions on use of PFAS-containing firefighting foam. (Adopted in 2020)