PFAS Regulatory State of the Union & Wastewater Characterization

June 1, 2022

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PFAS Practice Leader
Eurofins Environment Testing America

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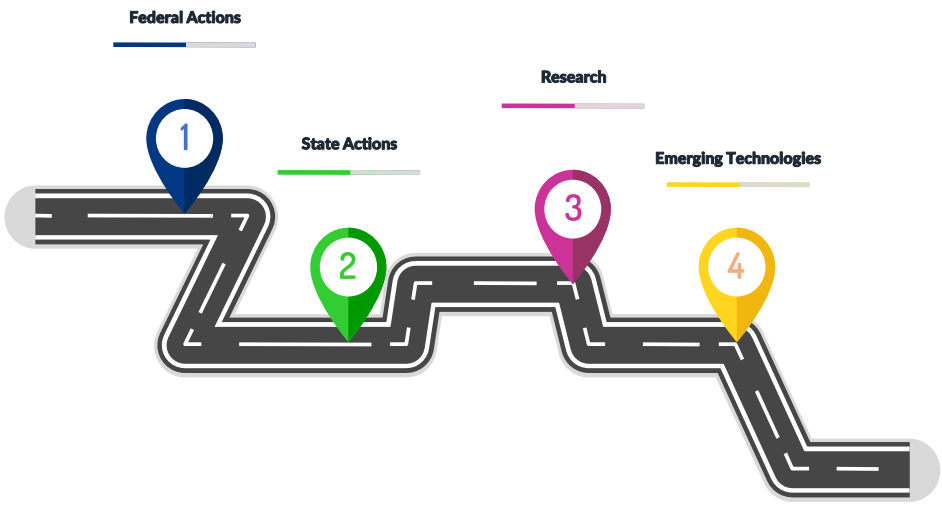
2022

Topics



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FEDERAL ACTIONS

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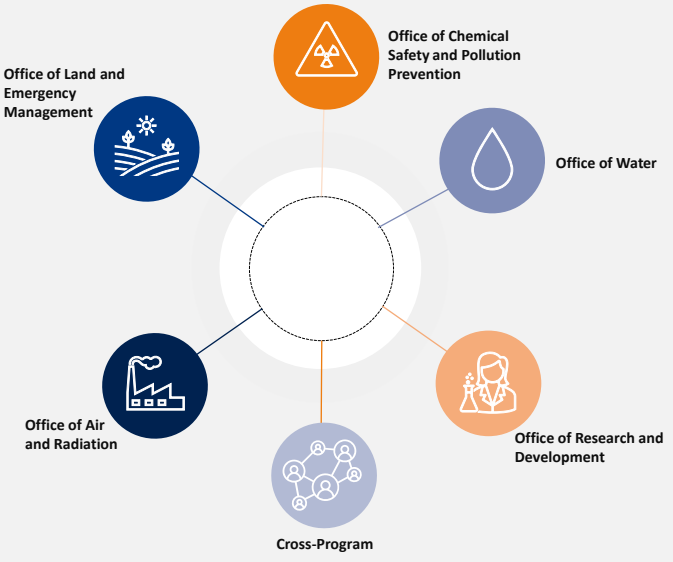
PFAS STRATEGIC ROADMAP

RESEARCH
increase understanding of PFAS exposures and toxicities, human health and ecological effects

RESTRICT
proactively prevent PFAS from entering air, land, and water at levels that can adversely impact human health and the environment

REMEDIATE
Broaden and accelerate the cleanup of PFAS contamination to protect human health and ecological systems



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TASK FORCE
Identify FFF & Monitor health effects

INCINERATION
Moratorium until guidance is in place

PROCUREMENT
Study items procured containing PFAS

REMEDIATION SCHEDULE
For PFAS release sites

2022 NATIONAL DEFENSE AUTHORIZATION ACT (NDAA)

The Fiscal Year 2022 NDAA; S. 1605 was signed into law with funding for addressing PFAS with a focus on AFFF and Drinking Water

Temporary Moratorium on Incineration of PFAS Materials
until DoD publishes guidance, or the EPA publishes a final rule regarding destruction and disposal

Creation of a PFAS Task Force
to identify an effective alternative to PFAS AFFF and monitor health aspects of exposure to PFAS

Directs GAO to Audit DoD Procurement
of items containing PFAS, and the feasibility of prohibiting said items

Completion of Remediation Schedule
and cost estimates submitted within 270 days for DoD sites identified as having a release of PFAS

https://www.govinfo.gov/app/details/BILLS-117s1605enr

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HAZARDOUS SUBSTANCES - CERCLA

EPA Takes Steps to Designate PFOA and PFOS as Hazardous Substances Under CERCLA

Issue advance notice of proposed rulemaking on various PFAS under CERCLA

Implications include: cleanup actions, cost recovery, re-open closed sites, ASTM Phase I AAI

https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024

Proposed Rule
EPA Submits to OMB, 1/10/22

OMB Review
90 days on average

Comments
Public comment period expected Spring 2022

Final Rule
Summer of 2023

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HAZARDOUS CONSTITUENTS - RCRA

If existing data for the four PFAS constituents support listing any or all as RCRA hazardous constituents, EPA will propose to list the constituents in the Federal Register for public comment

In response to a petition from NM Gov. EPA is evaluating the existing toxicity and health effects data on four PFAS to determine if they should be listed as RCRA Hazardous Constituents

Those chemicals listed are subject to corrective action requirements under RCRA at hazardous waste treatment, storage, and disposal facilities.

https://www.epa.gov/newsreleases/epa-responds-new-mexico-governor-and-acts-address-pfas-under-hazardous-waste-law

https://www.jdsupra.com/legalnews/epa-announces-plans-for-waste-rules-3519848/

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PFOA

PFOS

PFBS

GenX

TOXICITY ASSESSMENTS

https://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=350051

https://www.epa.gov/chemical-research/human-health-toxicity-assessments-genx-chemicals

https://www.epa.gov/chemical-research/learn-about-human-health-toxicity-assessment-pfbs

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PFBS
Final, April 2021

GENX
Final, October 2021

PFBA, PFHxA
In Process

PFHxS, PFNA, PFDA
In the queue

TOXICITY ASSESSMENTS

Date	Status	Analyte	RfD (mg/kg/day)
2016	Final	PFOA/PFOS	0.00002
2021	*Released for Public Comment*	PFOA	0.0000000015
2021	*Released for Public Comment*	PFOS	0.0000000079
2021	Final	HFPO-DA (GenX)	0.000003
2021	Final	PFBS	0.00003
2021	*In Peer Review*	PFBA	0.01

https://iris.epa.gov/AtoZ/?list_type=alpha

https://sab.epa.gov/ords/sab/f?p=100:19:14408101720086:::RP,19:P19_ID:963

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PFOA & PFOS Revisited

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Preliminary Effluent Guidelines Program

Preliminary Plan 15

- Propose limits on PFAS for the chemical, plastics, and synthetic fiber manufacturers by summer 2023.
- Propose limits for the electroplating and metal finishing industries by summer 2024

NPDES News

https://www.epa.gov/eg/preliminary-effluent-guidelines-program-plan

March 17, 2021 ANPR
~30,000 comments to date

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Addressing PFAS Discharges in EPA-Issued NPDES Permits

- For federally-issued permits, EPA will include requirements to monitor for PFAS
- Monitoring should include each of the 40 PFAS parameters detectable by draft method 1633
- Draft 1621 can be used in conjunction with draft method 1633, if appropriate.

- This program will enable EPA to obtain comprehensive information on the sources and quantities of PFAS discharges and will use these data to inform the agency's ELG actions
- *EPA plans to issue additional guidance to state permit writers and local pretreatment authorities to address PFAS.*

https://www.epa.gov/eg/preliminary-effluent-guidelines-program-plan

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A Act
C Control
S Substances
T Toxic

TSCA SECTION 8(a)(7)

Proposed Rule to Require Reporting on PFAS Manufactured in the United States

EPA proposes to require certain persons that manufacture (including import) or have manufactured these chemical substances in any year since **January 1, 2011**, to electronically report information regarding PFAS uses, production volumes, disposal, exposures, and hazards.

Docket Number
EPA-HQ-OPPT-2020-0549

https://www.regulations.gov/document/EPA-HQ-OPPT-2020-0549-0001

https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/tsca-section-8a7-reporting-and-recordkeeping

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179 PFAS
100lbs for each PFAS

REPORTING
Annually on July 1st

EMISSIONS
Air, Water, Land Disposal

deMINIMIS
PFOA is 0.1%
All other PFAS are 1%

TOXICS RELEASE INVENTORY (TRI)

2020 TRI Factsheet: PFAS Chemicals

Data Source:
2020 National Analysis Dataset
(released October 2021)

2020 1st Reporting Year
39 Facilities, 5 Sectors, 43 PFAS

Industry Sectors Represented
Chemicals, Hazardous Waste, Food, Petroleum, Non-Metallic Mineral Product

Total Production-Related Waste Managed
841.4 thousand lbs

Total On & Off-site Disposal or Other Releases:
90% or 60.0 thousand lbs

https://www.epa.gov/chemicals-under-tsca/epa-releases-updated-2020-tri-data
https://www.epa.gov/toxics-release-inventory-tri-program/addition-certain-pfas-tri-national-defense-authorization-act

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4 NEW PFAS
Added Jan 24, 2022

LAWSUIT FILED
To Remove TRI Exemptions

RULEMAKING
"Chemicals of Special Concern"

MORE PFAS
Possible under NDAA 2020

TOXICS RELEASE INVENTORY (TRI)

What is to come...

The agency acknowledges the TRI exemptions "significantly limited the amount of data that EPA received."

PFBS & related salt, + 2 PFAS by CAS#

EPA plans to propose a rule removing de minimis exemption and list PFAS as "Chemicals of Special Concern"

Per NDAA 2020 triggers, additional PFAS will likely continue to be added to the TRI

Advocacy group files lawsuit to remove TRI exemptions

https://www.epa.gov/toxics-release-inventory-tri-program/addition-certain-pfas-tri-national-defense-authorization-act

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DRINKING WATER

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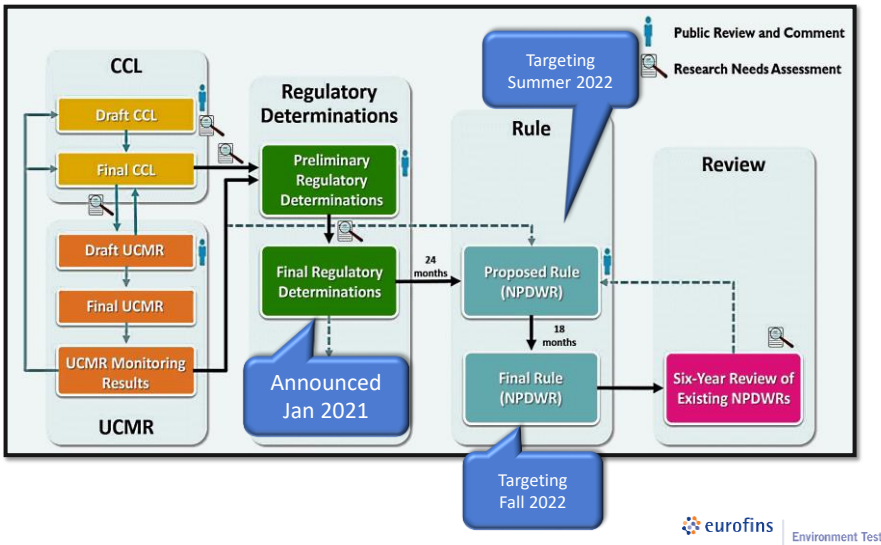
DRINKING WATER

PFAS Maximum Contaminant Levels (MCLs)



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DRINKING WATER

SDWA: UCMR 5
Unregulated Contaminant Monitoring Rule

Final Rule Adopted 2021
UCMR 5 period spans 2022–2026

29 PFAS Analytes
Includes all analytes from 537.1 & 533

Will occur 2023 - 2025
All PWS serving >10,000
All PWS serving 3,300-10,000
~800 Systems serving < 3,300

https://www.epa.gov/newsreleases/epa-announces-nationwide-monitoring-effort-better-understand-extent-pfas-drinking

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DRINKING WATER

SDWA: UCMR 5
PFAS Analyte List

533 Analytes					
PFBA	PFOA	PFDoA	PFHpS	8:2 FTS	9Cl-PF3ONS
PFPeA	PFNA	PFBS	PFOS	DONA	PFMPA
PFHxA	PFDA	PFPeS	4:2 FTS	HFPO-DA	PFMBA
PFHpA	PFUnA	PFHxS	6:2 FTS	11Cl-PF3OUdS	NFDHA
					PFEESA

537.1 Analytes
PFTA
PFTrDA
NMeFOSAA
NEtFOSAA

https://www.epa.gov/dwucmr/fifth-unregulated-contaminant-monitoring-rule

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STATE ACTIONS

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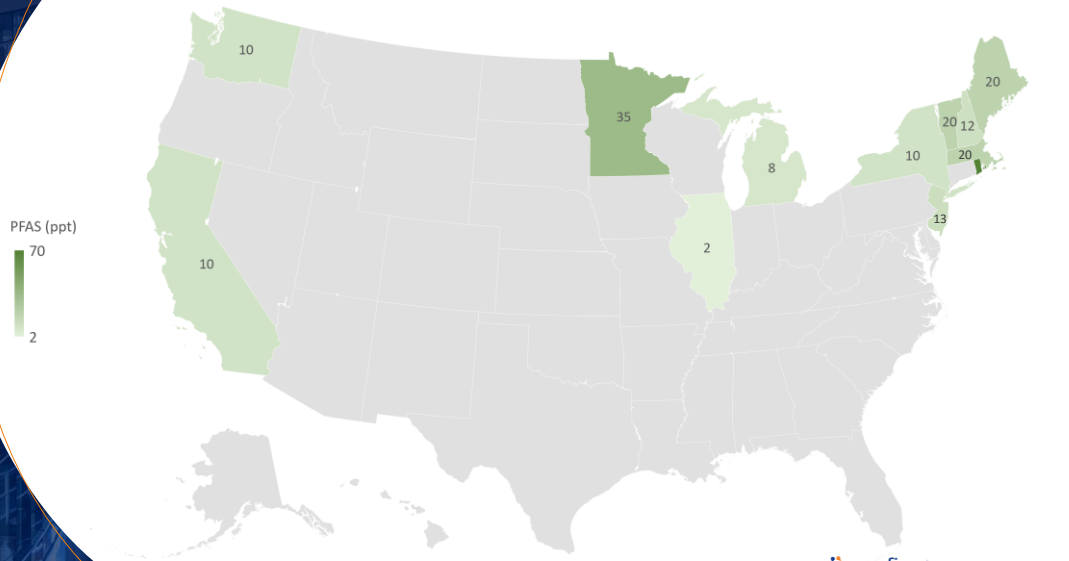
DRINKING WATER

STATE ACTIONS: DRINKING WATER LIMITS



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STATE ACTIONS: GROUNDWATER LIMITS

	FL	HI	MI	IL	PA
PFOA ppt	70	40	8	2	70
PFOS ppt	70	40	16	14	70
Ratified Y/N	N	N	Y	N	N
Comments	Sum of PFOA & PFOS	+ 16 other PFAS	+PFHxS/ GenX/PFBS/ PFHxA/PFNA	+ PFBS/ PFHxS/PFHxA	+ PFBS

CLEANUP

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SURFACE WATER & TISSUE

EMERGING

- Primarily focused on Potable Water
- Establish groundwater cleanup criteria
- Concerns about fish consumption
- Establish surface water criteria supportive of tissue limits
- Early stages of setting ambient air standards

CLEANUP

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AMBIENT AIR States Establish Limits

State	PFOA	PFOS	APFO	6:2FTS
NH	N/A	N/A	0.024ug/m3 (annual)	N/A
TX	0.005ug/m3 (annual)	0.01ug/m3 (annual)	0.01ug/m3 (annual)	N/A
MI	0.07ug/m3 (24hr)	0.07ug/m3 (24hr)	N/A	1.0ug/m3 (annual)
NY	0.0053ug/m3 (annual)	N/A	N/A	N/A
MN	0.07ug/m3 (24hr->8yr)	0.07ug/m3 (24hr->8yr)	N/A	N/A

http://www2.des.state.nh.us/OneStopPub/Air/330110016520060807TypeAOC.pdf

https://www.michigan.gov/documents/deq/deq-aqd-toxics-ITSLALPH_244167_7.pdf

https://www.dec.ny.gov/docs/air_pdf/dar1proposed.pdf

https://www.health.state.mn.us/communities/environment/risk/guidance/air/table.html#hbvsraas

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RESEARCH & SCIENTIFIC DEVELOPMENTS

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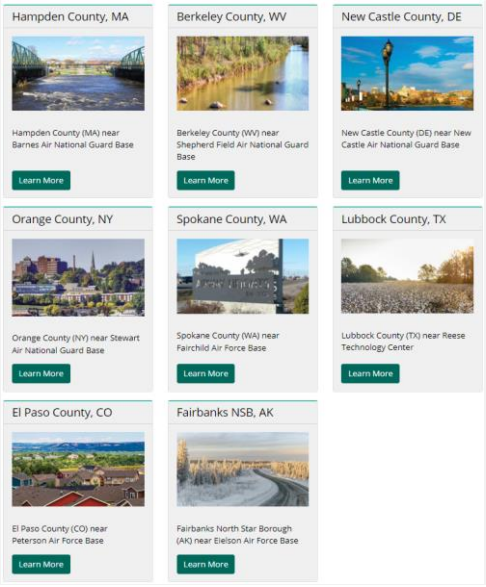
CDC RESEARCH

EXPOSURE STUDIES



- Drinking Water
- NHANES Human Serum
- Indoor Air / Dust

https://www.cdc.gov/exposurereport/pfas_early_release.html

https://www.atsdr.cdc.gov/pfas/activities/studies/multi-site.html

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EPA RESEARCH

ENVIRONMENTAL STUDIES

- Vapor Intrusion Pathway
- Source Air, Products of Incomplete Combustion (PICs)

https://www.epa.gov/chemical-research/status-epa-research-and-development-pfas

https://www.serdp-estcp.org/serdp-estcp/Program-Areas/Environmental-Restoration/ER19-1408/ER19-1408

https://www.epa.gov/sites/default/files/2019-09/documents/technical_brief_pfas_incineration_ioaa_approved_final_july_2019.pdf

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EPA RESEARCH

BIOSOLIDS

- The EPA expects to complete a risk assessment of PFOA and PFOS in biosolids by the winter of 2024 to determine if regulations are needed

https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024

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EPA Draft Methods

EPA Draft 1633

- Targeted Analysis of 40 PFAS
- Non-Potable Water, Soil & Tissue
- LCMSMS, SPE, Isotope Dilution
- Multi-Lab Validation Underway

EPA Draft 1621

- Adsorbable Organic Fluorine (AOF)
- Proxy analysis for 'Total PFAS'
- Single lab validation complete; multi-lab validation has not begun

EPA METHODS

https://www.epa.gov/cwa-methods/cwa-analytical-methods-and-polyfluorinated-alkyl-substances-pfas

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LCMSMS/GCMSMS Analysis

Compounds Included in EPA Draft 1633 (RLs = 2-5ng/L)		Target Compounds Not Part of EPA Draft 1633 (RLs = 2-5ng/L)	
Perfluorobutanoic acid (PFBA)	NEtFOSA	10:2 FTS	EVE Acid
Perfluoropentanoic acid (PFPeA)	NMeFOSA	6:2 FTCA	PFO5DA
Perfluorohexanoic acid (PFHxA)	NMeFOSAA	8:2 FTCA	PMPA
Perfluoroheptanoic acid (PFHpA)	NEtFOSAA	10:2 FTCA	PEPA
Perfluorooctanoic acid (PFOA)	NMeFOSE	6:2 FTUCA	MTP
Perfluorononanoic acid (PFNA)	NEtFOSE	8:2 FTUCA	PS Acid
Perfluorodecanoic acid (PFDA)	4:2 FTS	10:2 FTUCA	Hydro-PS Acid
Perfluoroundecanoic acid (PFUnA)	6:2 FTS	PFECHS	R-PSDA
Perfluorododecanoic acid (PFDoA)	8:2 FTS	PFPrS	Hydrolyzed PSDA
Perfluorotridecanoic acid (PFTriA)	9Cl-PF3ONS	PFPrA	R-PSDCA
Perfluorotetradecanoic acid (PFTeA)	11Cl-PF3OUdS	PFMOAA	6:2 diPAP
Perfluorobutanesulfonic acid (PFBS)	DONA	PFECAG	8:2 diPAP
Perfluoropentanesulfonic acid (PFPeS)	HFPO-DA (GenX)	PFO4DA	6:2/8:2 diPAP
Perfluorohexanesulfonic acid (PFHxS)	3:3 FTCA	PFO3OA	10:2 diPAP
Perfluoroheptanesulfonic Acid (PFHpS)	5:3 FTCA	PFO2HxA	10:2 FTOH (RL=1ug/L)
Perfluorooctanesulfonic acid (PFOS)	7:3 FTCA	R-EVE	8:2 FTOH (RL=1ug/L)
Perfluorononanesulfonic acid (PFNS)	NFDHA	NVHOS	7:2 FTOH (RL=1ug/L)
Perfluorodecanesulfonic acid (PFDS)	PFMBA	Hydro-EVE Acid	6:2 FTOH (RL=1ug/L)
Perfluorododecanesulfonic acid (PFDoS)	PFMPA	Perfluoro-n-octadecanoic acid (PFODA)	4:2 FTOH (RL=1ug/L)
Perfluorooctanesulfonamide (FOSA)	PFEESA	Perfluoro-n-hexadecanoic acid (PFHxDA)	

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Where to Begin?

WHAT WILL THE DATA BE USED FOR

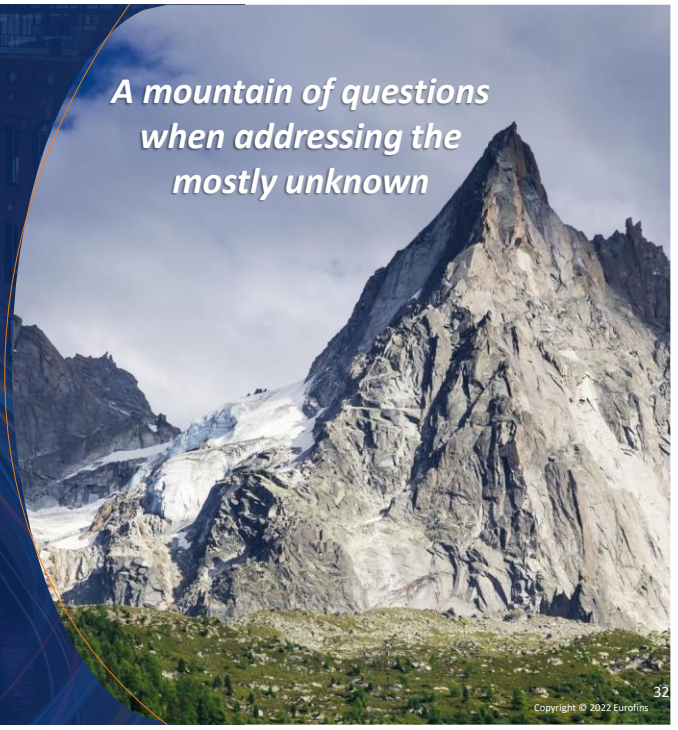
Developing a Conceptual Site Model

Determining the extent of contamination

Investigating sources of contamination

Assessing human health impacts

Implementing a remediation plan



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CONVENTIONAL TOOLS

TARGETED ANALYSIS

The analysis of specific target analytes with known CAS numbers and analytical reference standards

- EPA Standard Methods
- User-Defined Methods
  - Regulatory derived target analyte lists
  - Laboratory derived target analyte lists

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EPA Methods

EPA 537.1

EPA 533

EPA 8327

EPA Draft 1633

User-defined Methods

"537 Modified"

ASTM D7979 Mod

Laboratory SOP

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EMERGING TECHNOLOGIES

NON-TARGETED ANALYSES

The analysis of analytes without known CAS numbers or analytical reference standards, or the analysis of a proxy analyte(s)

- Draft or Non-Standard Methods
- User-Defined Methods
  - Program specific targets
  - Screening applications
  - Litigation derived targets

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TOP Assay
Total Oxidizable Precursors

AOF/EOF
Adsorbable Organic Fluorine
Extractable Organic Fluorine

NTA
Non-Target Analysis

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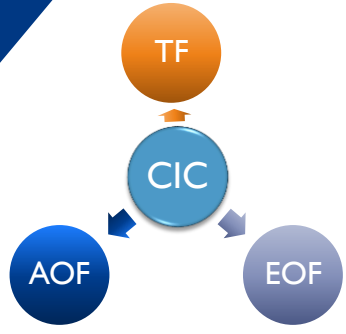
Total Oxidizable Precursors
TOP Assay

	Pre-TOP	Post-TOP	
PFOA	13	14	ng/L
PFHxA	11	42	ng/L
PFPA	15	40	ng/L
PFHpA	ND	6.3	ng/L
PFBA	ND	46	ng/L
Total PFCA	39	148.3	ng/L
Total PFCA Difference		109.3	ng/L



CIC: Combustion Ion Chromatography

Total Organofluorine Analysis

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Non-Target Analysis

LC-QToF-MS

Liquid Chromatography
Quadrupole Time of Flight
Mass Spectrometry

Targeted Analysis

Suspect Screening Analysis

Non-Targeted Analysis

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STUDY OBJECTIVES

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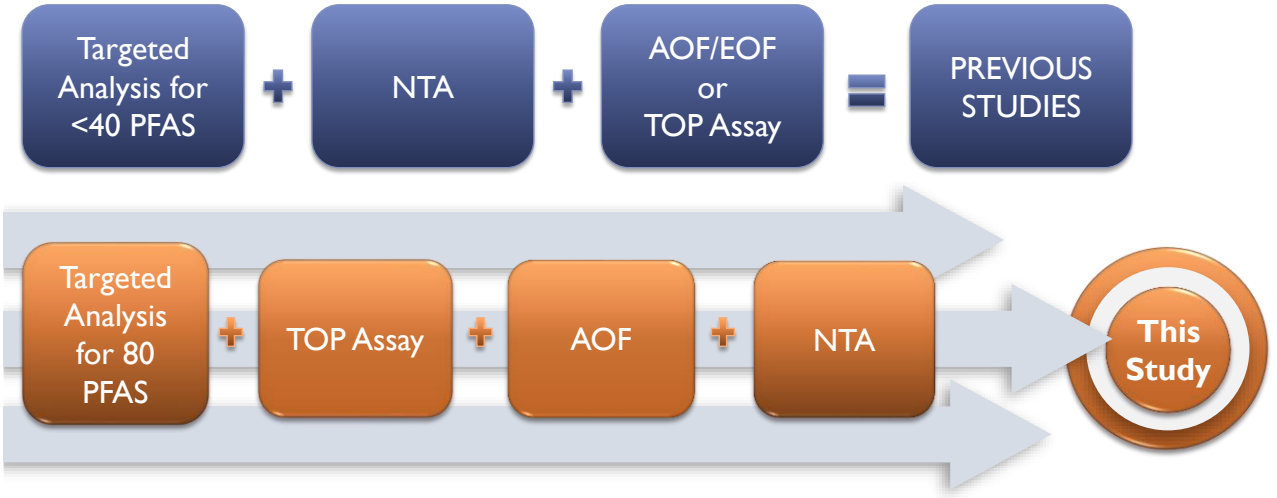
Study Goals



Fluorine Mass Balance in Marine Mammals from the Northern Hemisphere - A combination of targeted, total (organo)fluorine, and non-targeted analysis K. Spaan et al
Detection and Transformations of Poly- and Perfluoroalkyl Acids Downstream from Fire Training Areas in Groundwater-fed Coastal Watersheds B. Ruyle et al
Characterization of Per- and Polyfluoroalkyl Substances (PFAS) in Firefighting Training Areas across Eastern Canada M. Liu et al

Wastewater Samples

Private WWTP

Site 1

1. Influent
2. Influent Duplicate
3. Effluent
4. Effluent Duplicate

POTW

Site 2

1. Influent
2. Influent Duplicate
3. Effluent
4. Effluent Duplicate

POTW

Site 3

1. Influent
2. Influent Duplicate
3. Effluent
4. Effluent Duplicate

INDUSTRIAL

Site 4

1. Eff (Aerospace)
2. Eff (Aerospace) Dup
3. Eff (Circuit Board)
4. Eff (Circuit Board) Dup
5. Eff (Landfill)
6. Eff (Landfill) Dup
7. Eff (Dairy)
8. Eff (Dairy) Dup
9. Eff (Com Laundry)
10. Eff (Com Laundry) Dup
11. Eff (Car Wash)
12. Eff (Car Wash) Dup

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METHODS EMPLOYED

Targeted PFAS by LCMSMS & GCMSMS
FTOHs by GCMSMS
TOP Assay by LCMSMS
AOF by CIC
NTA by LC-QTOF-MS

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User-Defined LCMSMS	User-Defined GCMSMS	TOP Assay	Adsorbable Organic Fluorine (AOF)	Non-Target Analysis (NTA)
75 PFAS Compounds	5 Fluorotelomer Alcohols (FTOHs)	Total Oxidizable Precursors	Total Organic Fluorine	Non-targeted compounds
RLs: 2ppt-5ppt	RLs: 1ppb	RLs: 2ppt-5ppt	RLs: 1ppb	>1ppb
LCMSMS with confirmation ion	GCMSMS	LCMSMS with confirmation ion	Combustion Ion Chromatography (CIC)	LC-QToF-MS: Data independent acquisition
Isotope Dilution	Internal Standard with FTOH labeled standard	Isotope Dilution	External Standard	SWATH: HRMS/MS data are collected on parent and daughter ions independent of intensity threshold
SPE WAX	Solvent Extraction	SPE WAX	Carbon Sorbent	Direct Injection

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LCMSMS/GCMSMS Analysis

Compounds Included in EPA Draft 1633 (RLs = 2-5ng/L)		Compounds Not Part of Draft 1633 (RLs = 2-5ng/L)	
Perfluorobutanoic acid (PFBA)	NEtFOSA	10:2 FTS	PFPeA
Perfluoropentanoic acid (PFPeA)	NMeFOSA	6:2 FTCA	EVE Acid
Perfluorohexanoic acid (PFHxA)	NMeFOSAA	8:2 FTCA	PFO5DA
Perfluoroheptanoic acid (PFHpA)	NEtFOSAA	10:2 FTCA	PMPA
Perfluorooctanoic acid (PFOA)	NMeFOSE	6:2 FTUCA	PEPA
Perfluorononanoic acid (PFNA)	NEtFOSE	8:2 FTUCA	MTP
Perfluorodecanoic acid (PFDA)	4:2 FTS	10:2 FTUCA	PS Acid
Perfluoroundecanoic acid (PFUnA)	6:2 FTS	PFECHS	Hydro-PS Acid
Perfluorododecanoic acid (PFDoA)	8:2 FTS	PFPrS	R-PSDA
Perfluorotridecanoic acid (PFTriA)	9Cl-PF3ONS	PFPrA	Hydrolyzed PSDA
Perfluorotetradecanoic acid (PFTeA)	11Cl-PF3OUdS	PFMOAA	R-PSDCA
Perfluorobutanesulfonic acid (PFBS)	DONA	PFECAG	6:2 diPAP
Perfluoropentanesulfonic acid (PFPeS)	HFPO-DA (GenX)	PFO4DA	8:2 diPAP
Perfluorohexanesulfonic acid (PFHxS)	3:3 FTCA	PFO3OA	6:2/8:2 diPAP
Perfluoroheptanesulfonic Acid (PFHpS)	5:3 FTCA	PFO2HxA	10:2 diPAP
Perfluorooctanesulfonic acid (PFOS)	7:3 FTCA	R-EVE	10:2 FTOH (RL=1ug/L)
Perfluorononanesulfonic acid (PFNS)	NFDHA	NVHOS	8:2 FTOH (RL=1ug/L)
Perfluorodecanesulfonic acid (PFDS)	PFMBA	Hydro-EVE Acid	7:2 FTOH (RL=1ug/L)
Perfluorododecanesulfonic acid (PFDoS)	PFMPA	Perfluoro-n-octadecanoic acid (PFODA)	6:2 FTOH (RL=1ug/L)
Perfluorooctanesulfonamide (FOSA)	PFEESA	Perfluoro-n-hexadecanoic acid (PFHxDA)	4:2 FTOH (RL=1ug/L)

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RESULTS

Summary of Results
Comparison Across Methods

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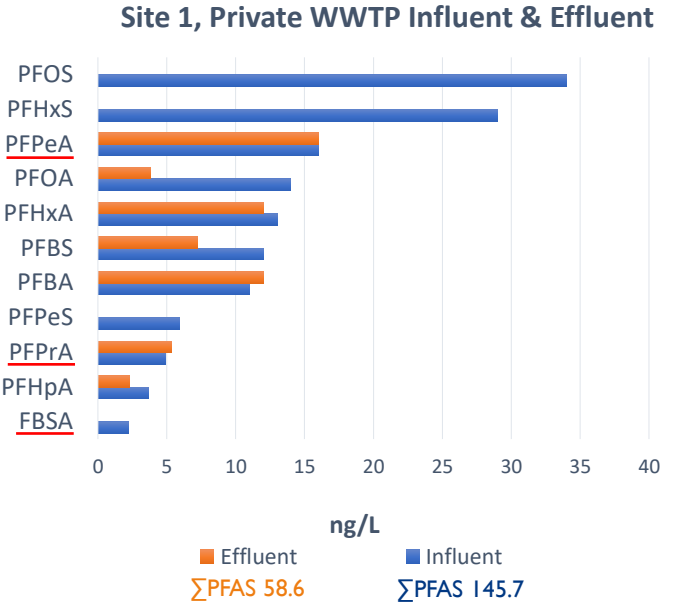
Site 1
Private WWTP

Sample	AOF (ng/L)	TOP Assay – PFCA Difference (ng/L)
Influent	1,300	110
Influent Dup	1,300	120
Effluent	1,500	220
Effluent Dup	1,100	230

FTOHs are all non-detect @ 1,000 ng/L



AOF Equivalent for these samples is 63%

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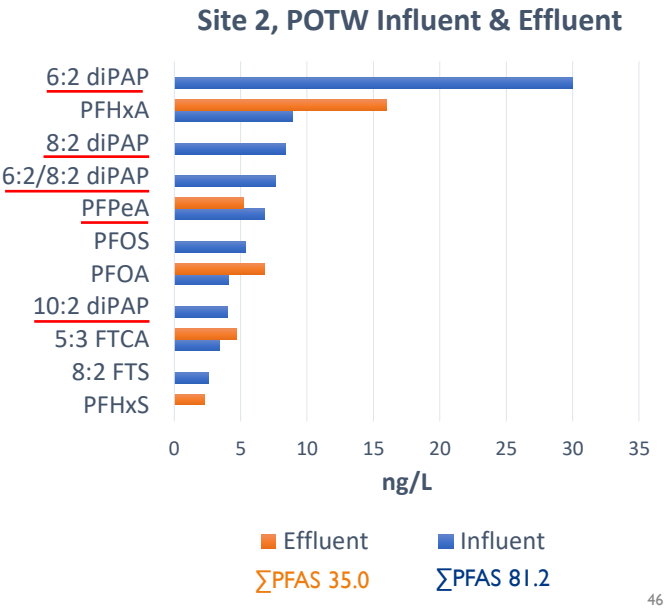
Site 2 POTW

Sample	AOF (ng/L)	TOP Assay – PFCA Difference (ng/L)
Influent	ND @ 10,000	Not available
Influent Dup	ND @ 10,000	Not available
Effluent	2,400	Not available
Effluent Dup	2,800	Not available

FTOHs are all non-detect @ 1,000 ng/L



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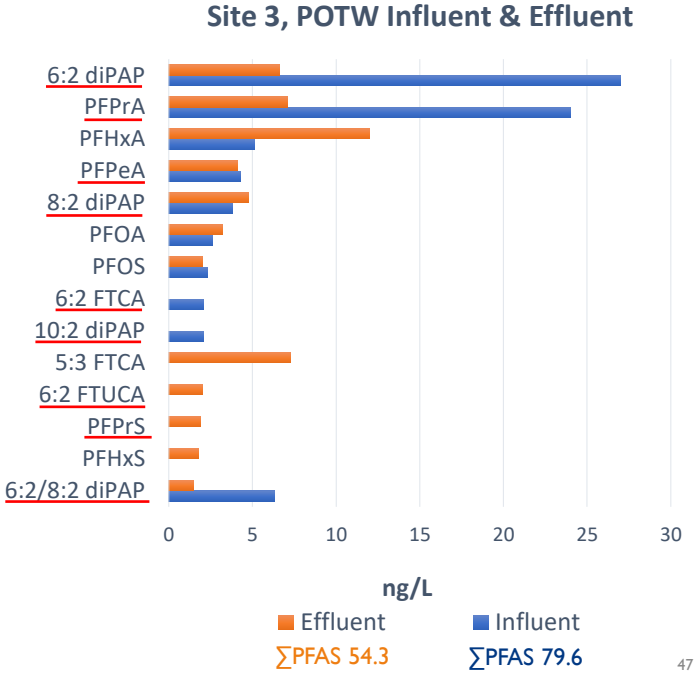
Site 3 POTW

Sample	AOF (ng/L)	TOP Assay – PFCA Difference (ng/L)
Influent	5,200	170
Influent Dup	4,600	170
Effluent	3,100	94
Effluent Dup	1,800	85

FTOHs are all non-detect @ 1,000 ng/L



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Sample	AOF (ng/L)	TOP Assay – PFCA Difference (ng/L)
Effluent (Circuit Board 1)	2,300	7.1
Effluent (Circuit Board 2)	3,300	140
Effluent (Aerospace)	3,700	43
Effluent (Landfill)	1,400	100

Sample	AOF (ng/L)	TOP Assay – PFCA Difference (ng/L)
Effluent (Circuit Board 1)	2,300	7.1
Effluent (Circuit Board 2)	3,300	140
Effluent (Aerospace)	3,700	43
Effluent (Landfill)	1,400	100

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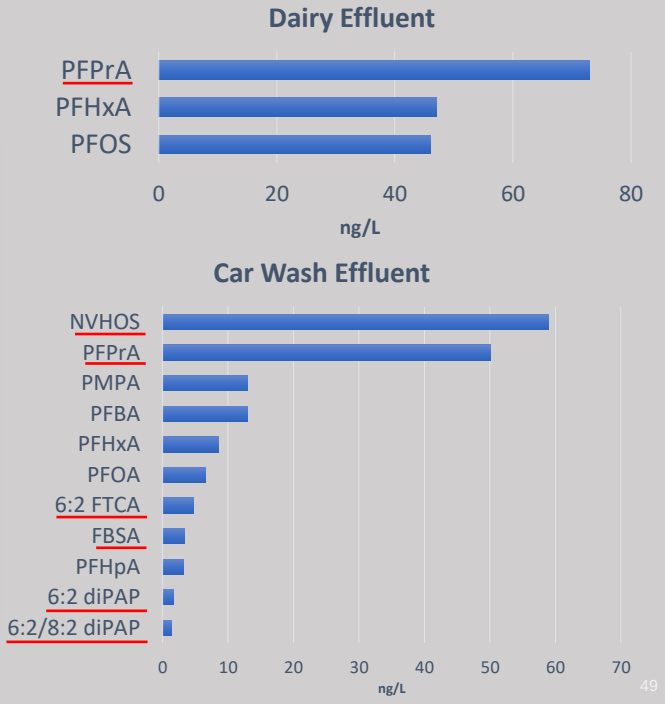
Site 4 – Industrial Discharge

Sample	AOF (ng/L)	TOP Assay – PFCA Difference (ng/L)
Effluent Dairy	33,000	360
Effluent Car Wash	ND @ 1,000	84



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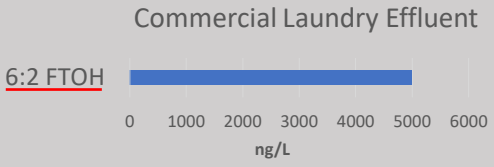
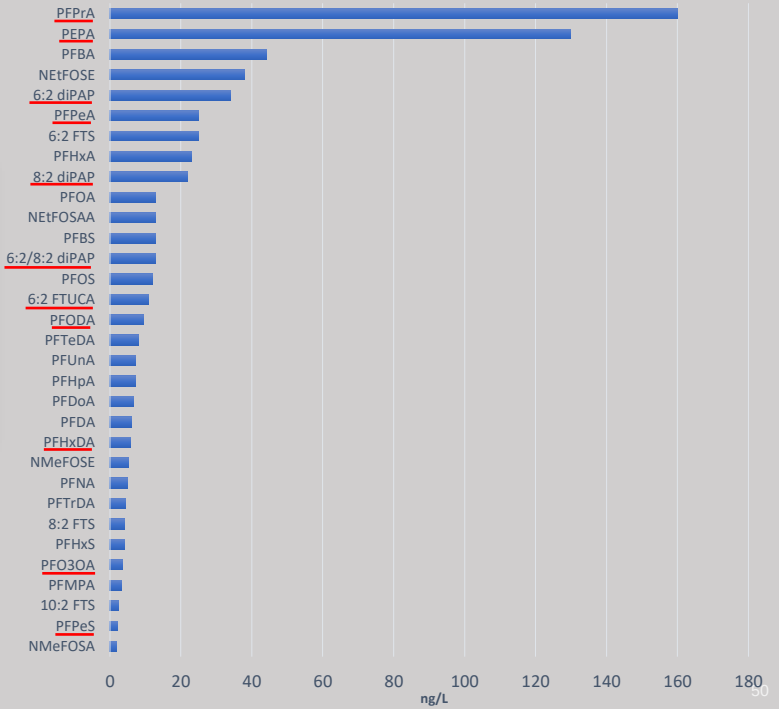
Site 4 – Industrial Discharge

Sample	AOF (ng/L)	TOP Assay – PFCA Difference (ng/L)
Effluent Commercial Laundry	39,000	6,100





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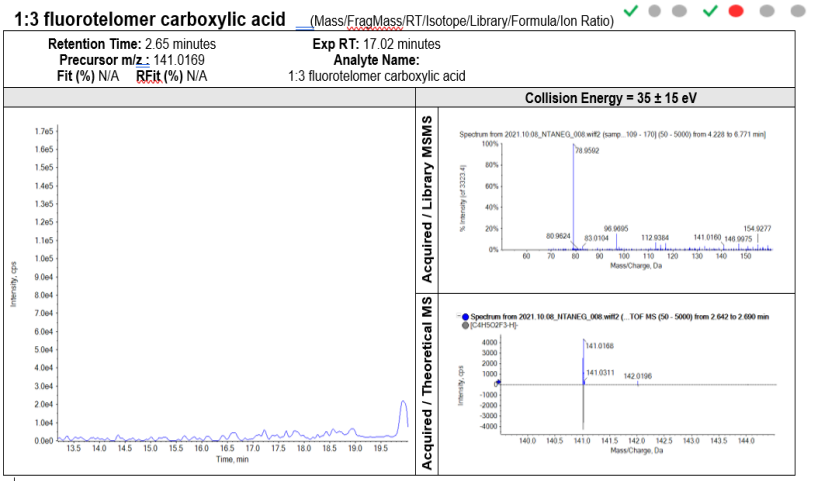
What did the NTA tell us?

Sites	Detections
Sites 1, 2, & 3	1:3 fluorotelomer carboxylic acid – Moderate to High Confidence
Site 1	N-dimethyl ammonio propyl perfluorohexane sulfonamido propanoic acid - Low Confidence / Possible identification of a group



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CONCLUSIONS

Not all tools are necessary for every job

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Results

Consistent across samples:

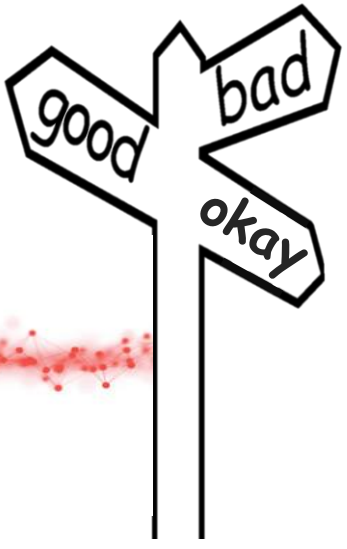
Low level detections (i.e. <70ppt)

~10-15 PFAS compounds detected

~Half the compounds captured by Draft 1633, the other half not captured by Draft 1633

TOP Assay conversion >100ng/L

AOF at 1000-5000ng/L range



Not so good correlation:

Significant AOF & TOP Assay detections with minimal detections in the target analysis

AOF indicates presence of PFAS where TOP Assay does not

Infrequent correlation or occurence:

Minimal detections in target analysis with equally minimal detections in AOF and TOF

NTA illuminates a novel compound from PFAS 'dark matter' in several samples

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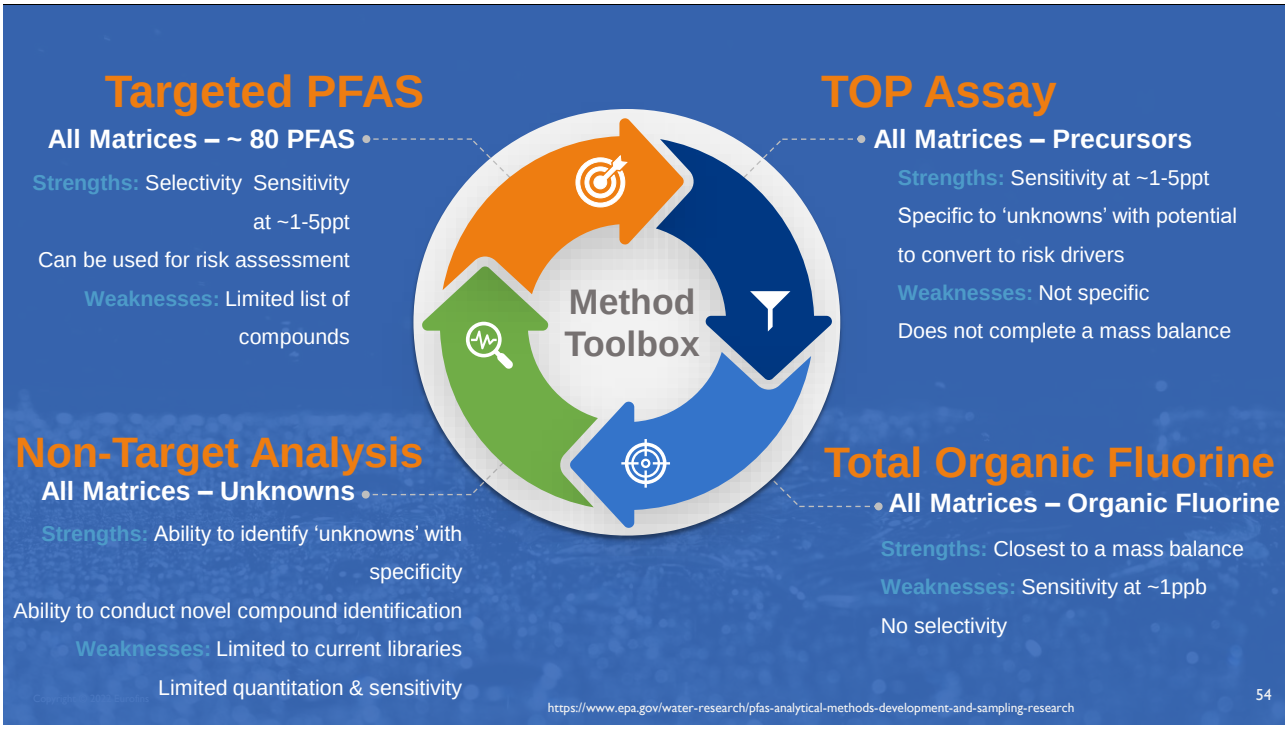
Targeted PFAS
All Matrices – ~ 80 PFAS
Strengths: Selectivity Sensitivity at ~1-5ppt
Can be used for risk assessment
Weaknesses: Limited list of compounds
TOP Assay
All Matrices – Precursors
Strengths: Sensitivity at ~1-5ppt
Specific to 'unknowns' with potential to convert to risk drivers
Weaknesses: Not specific
Does not complete a mass balance
Method Toolbox
Non-Target Analysis
All Matrices – Unknowns
Strengths: Ability to identify 'unknowns' with specificity
Ability to conduct novel compound identification
Weaknesses: Limited to current libraries
Limited quantitation & sensitivity
Total Organic Fluorine
All Matrices – Organic Fluorine
Strengths: Closest to a mass balance
Weaknesses: Sensitivity at ~1ppb
No selectivity
https://www.epa.gov/water-research/pfas-analytical-methods-development-and-sampling-research
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