PFAS Overview & Data Usability Considerations

June 2025

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VP of Product, PFAS Practice Leader

Eurofins Environment Testing

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PFAS OVERVIEW UNDERSTANDING THE FAMILY OF CHEMICALS

PFAS Family

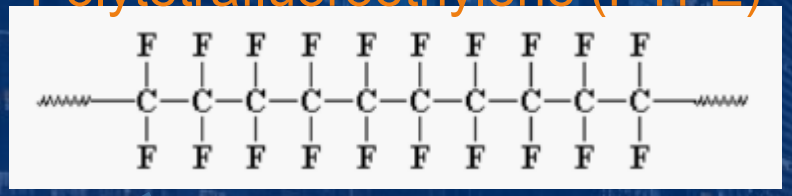
PFAS

Per- and Polyfluoroalkyl Substances

Completely & Incompletely Fluorinated

Polymers

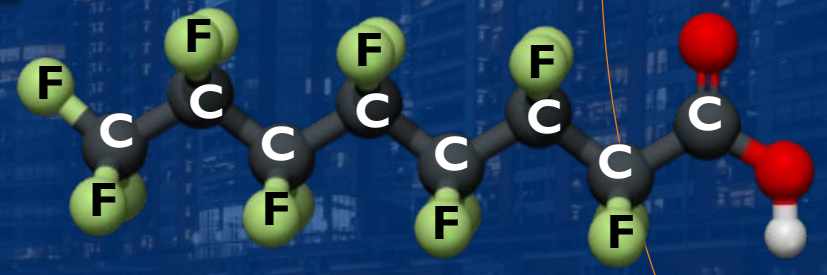
Polytetrafluoroethylene (PTFE)



10s to 100s of thousands of repeating monomers

Non-Polymer

Per- and Polyfluorinated



PFAAs

Perfluoroalkyl Acids

PFSAs

Perfluorinated sulfonic acids

PFOS

PFCAs

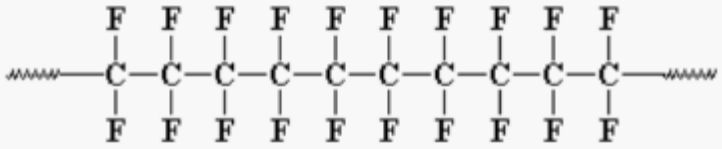
Perfluorinated carboxylic acids

PFOA

Polymer vs. Non-Polymer

10s to 100s of thousands of repeating monomers

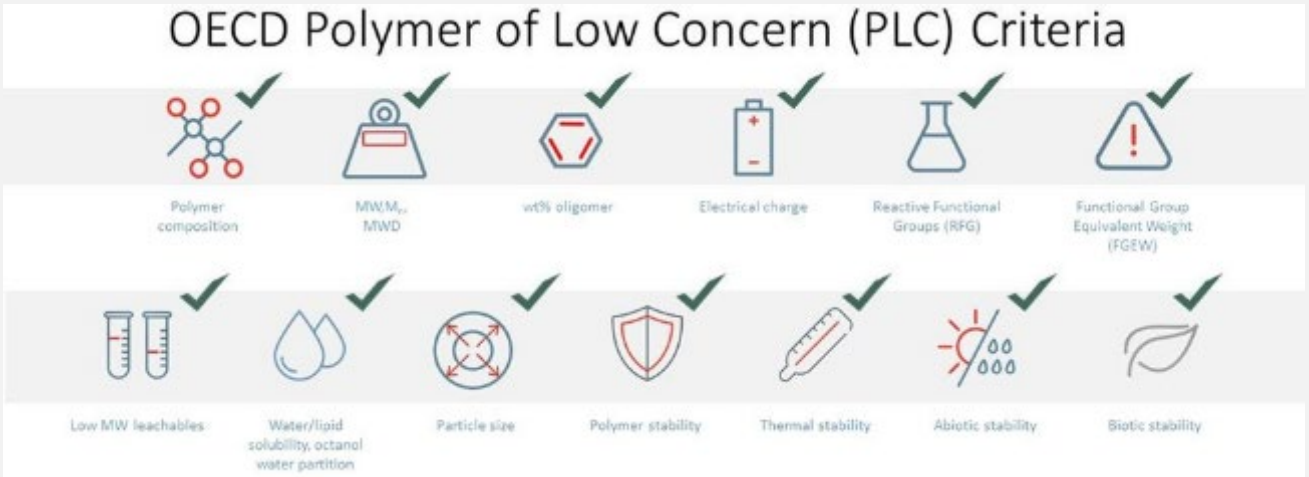
Polytetrafluoroethylene (PTFE)



polymer
chemistry

By The Editors of Encyclopaedia Britannica • Edit History

polymer, any of a class of natural or synthetic substances composed of very large molecules, called macromolecules, that are multiples of simpler chemical units called monomers.

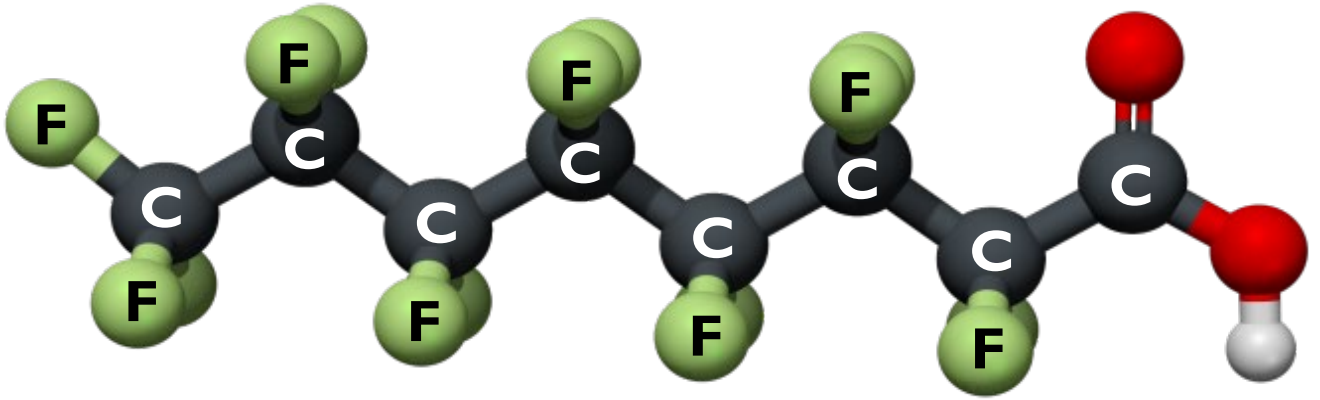


Polymers are large, stable, inert polymeric molecules that are too large to cross biological membranes and are therefore non-bioavailable and non-bioaccumulative

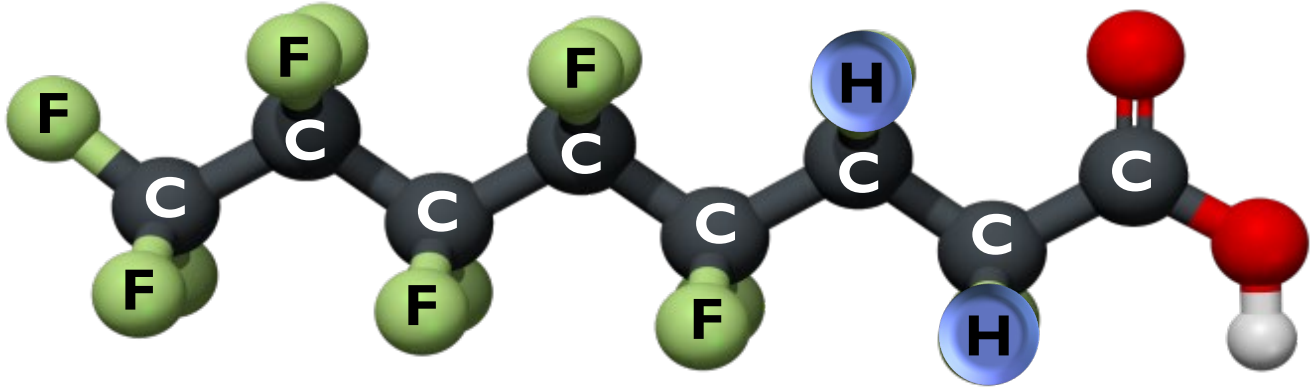
https://pslc.ws/macrog/ptfe.htm

Per and Poly?

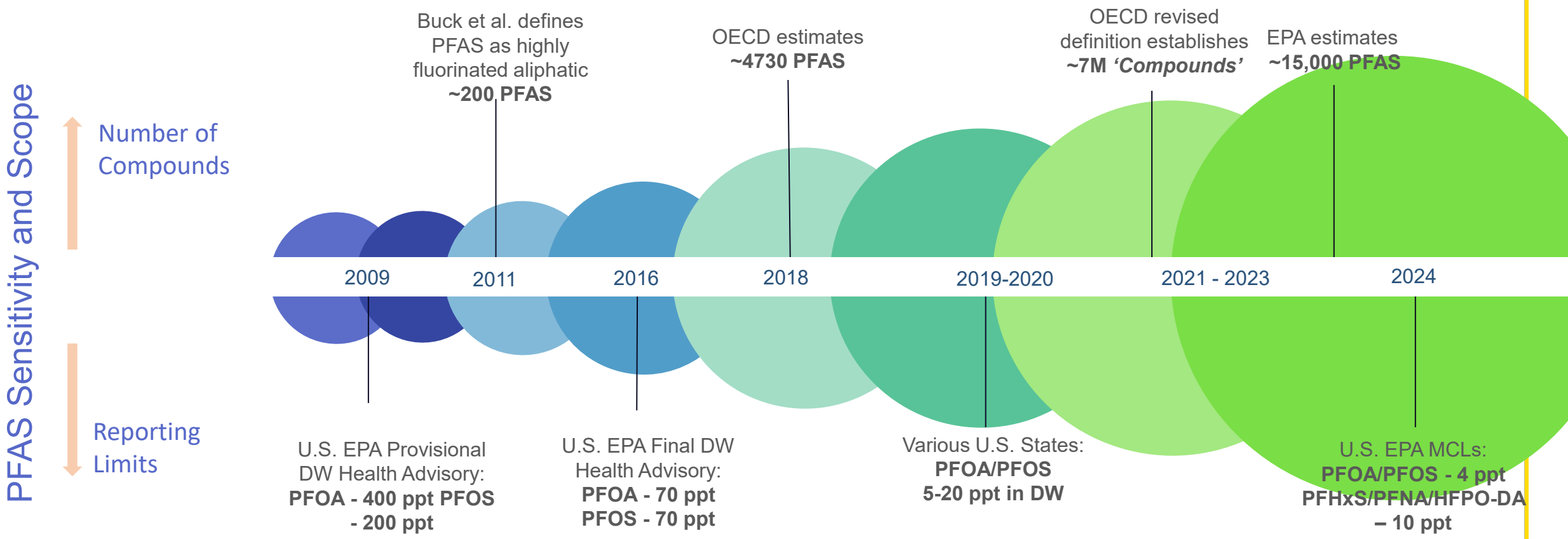
Perfluorinated = Completely Fluorinated



Polyfluorinated = Incompletely Fluorinated

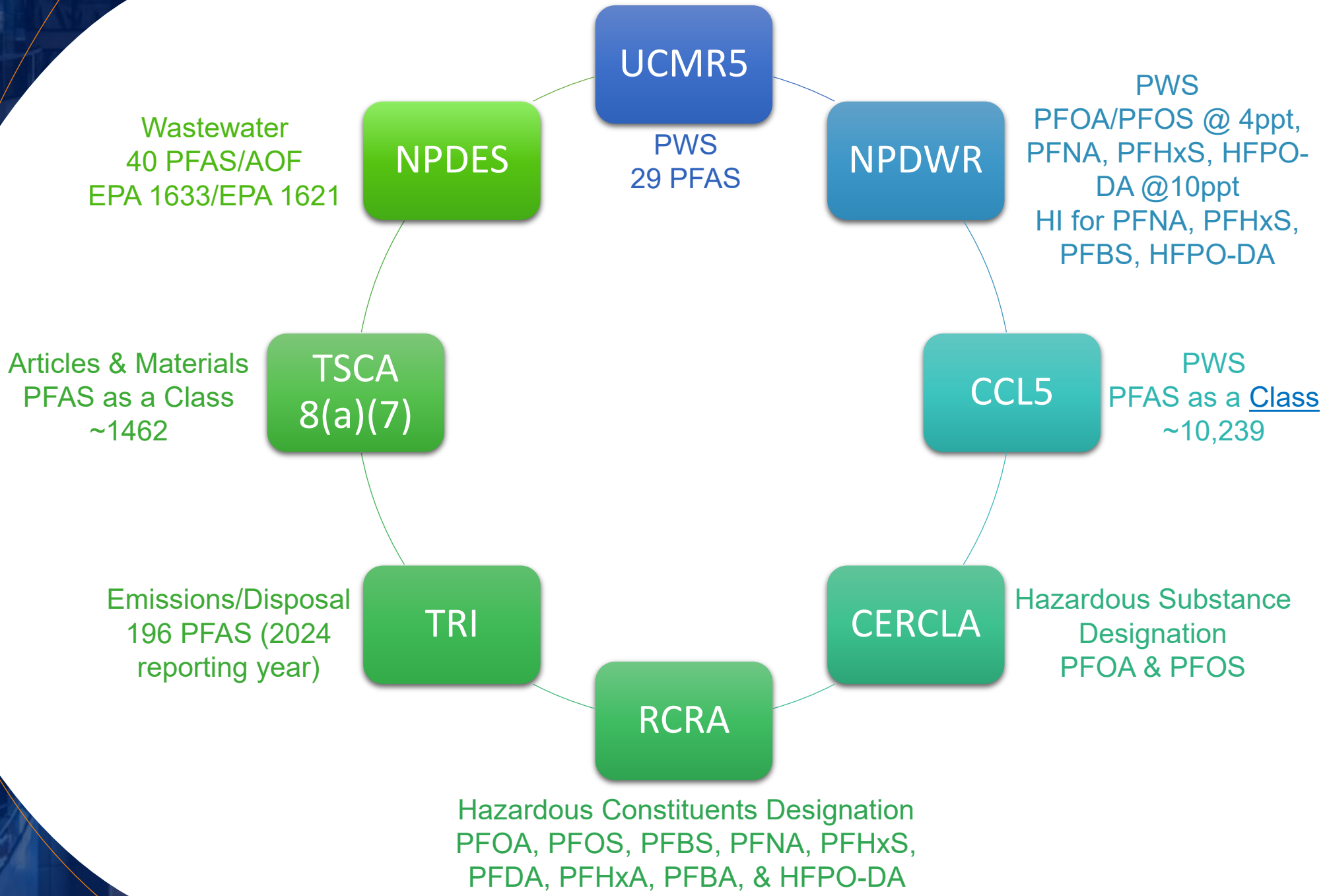


Defining PFAS: Evolution of the Science



Source – PubChem Classification Browser (nih.gov)

VARIED APPROACH



ANALYTICAL OPTIONS & CONSIDERATIONS

THE WHY

Why are we generating these data?

What needs to be or becomes actionable about these data?

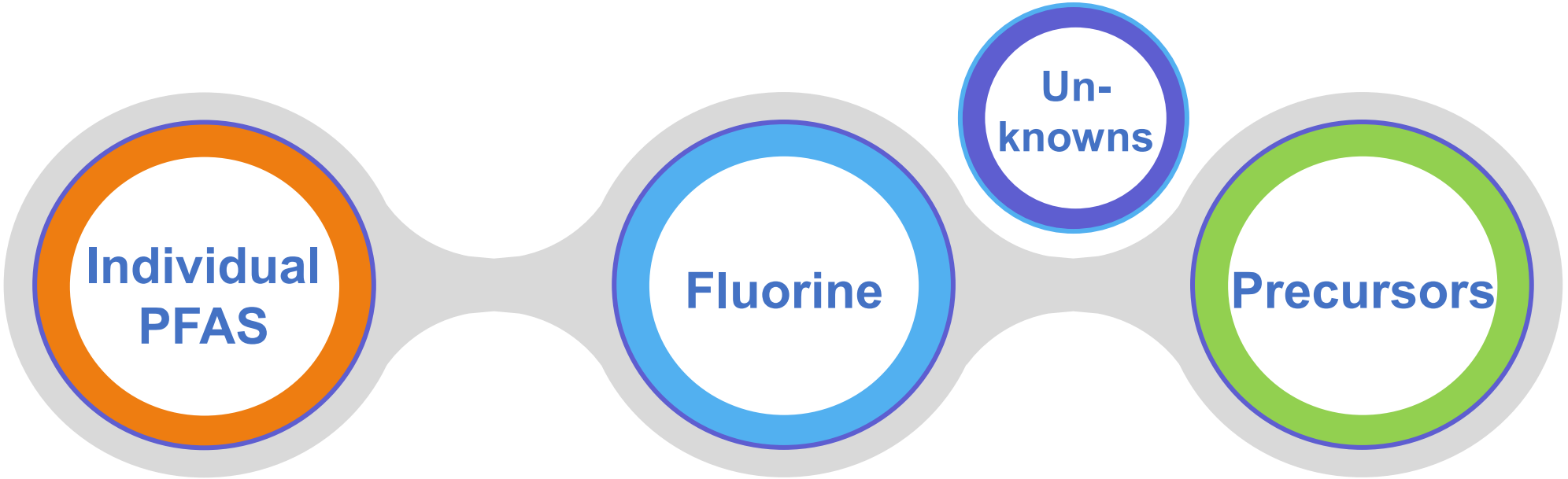
THE HOW

Which kind of data will answer our questions?

How representative are those data?

What analytical tools are available to us?

Analyzing for PFAS We've got options



Targeted PFAS by LC/MS/MS
537.1 & 533
8327, 537M, 1633A

Up to 100+ non-polymer
PFAS compounds

Fluorine by CIC
CIC-TOF & EPA 1621

Total Fluorine
Extractable Organic Fluorine (EOF)
Adsorbable Organic Fluorine (AOF)

Precursors by LC/MS/MS
"TOP Assay"

Unknown PFAA
precursors

CONVENTIONAL TOOLS

TARGETED ANALYSIS

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

- EPA Standard Methods
- ASTM Methods
- User-Defined Methods

  - Regulatory derived target analyte lists
  - Laboratory derived target analyte lists
  - Site-specific target analyte lists

EPA Methods

EPA 537.1(2020)

EPA 533 (2019)

EPA 8327 (2021)

EPA 1633A (2024)

User-defined Methods

"537 Modified"

"1633A Modified"

Laboratory SOP

NON-TARGETED TECHNOLOGIES

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

TOP Assay

Total Oxidizable Precursors

AOF/EOF/TF

Adsorbable Organic Fluorine
Extractable Organic Fluorine
Total Fluorine

NTA

Non-Target Analysis


DRINKING WATER

PFAS Maximum Contaminant Levels (MCLs)

Biden-Harris Administration Finalizes First-Ever National Drinking Water Standard to Protect 100M People from PFAS Pollution

As part of the Administration's commitment to combating PFAS pollution, EPA announces $1B investment through President Biden's Investing in America agenda to address PFAS in drinking water

April 10, 2024

•PFOA, PFOS, PFHxS, PFNA, HFPO-DA:

Regulate PFOA and PFOS at 4 ppt and PFHxS, PFNA & HFPO-DA at 10 ppt.

•PFNA, PFHxS, PFBS, and HFPO-DA:

Limit any mixture containing one or more of these chemicals using a hazard index calculation.

• $1 billion in newly available funding:

To help states and territories implement PFAS testing and treatment at public water systems

https://www.epa.gov/newsreleases/biden-harris-administration-proposes-first-ever-national-standard-protect-communities

Published in CFR 4/26/24. Final rule is effective on June 25, 2024.

Unregulated Contaminants Monitoring Rule UCMR5

Before conducting your own assessment of the data, please review the UCMR 5 Data Summary Instructions for Accessing Results, and UCMR 5 Data Finder Walkthrough below. The UCMR 5 Data Finder allows people to easily search for, summarize, and download the available UCMR 5 analytical results. Results can be filtered using multiple data fields, including PWS, state,

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

What a difference a decade makes…

SCOPE

2023–2025
4 analytes (537.1)
25 analytes (533)
All PWS serving > 3,300
~800 Systems serving < 3,300

Represents ~35% of total results to be reported

RESULTS TO DATE (from PWS w/ full set)

PFOS Avg >MCL in 7.9% of PWS
PFOA Avg >MCL in 6.4% of PWS
HFPO-DA >MCL in one PWS
PFNA >MCL in three PWS
HI Avg >MCL in 0.7% of PWS
4 analytes from 537.1, only one detection

EPA PFAS Methods

Drinking Water

533	537.1
Drinking Water	Drinking Water
Branched/Linear Isomers -YES	Branched/Linear Isomers -YES
Compounds: 14 the same / 15 unique	Compounds: 14 the same / 4 unique
SPE WAX	SPE SDVB
Hold Time: 28/28 days	Hold Time: 14/28 days
LCMSMS with confirmation ion	LCMSMS - no confirmation ion
Isotope Dilution	Internal standard
Recovery Correction - YES	Recovery Correction – NO
RLs: Not defined	RLs: 2ppt - 40ppt

WASTEWATER

AND BIOSOLIDS

Effluent Guidelines Program

Program Plan 15

- ✓ EPA intends to initiate a Publicly Owned Treatment Works (POTW) influent study of PFAS
- ✓ Information Collection Request (ICR) initiated.
- ✓ Public comments closed May 28, 2024. *EPA reopened public comments as of Oct 10th for additional 30 days*
- ✓ Collect data in *2025-2026*
- ✓ The sampling and analysis via *EPA Methods 1633 and 1621*

https://www.govinfo.gov/content/pkg/FR-2024-03-26/pdf/2024-06408.pdf

Addressing PFAS Discharges in State-Issued NPDES Permits

EPA issues guidance to state permit writers and pretreatment authorities to address PFAS in 2022 and 2025

- Monitoring to include 40 PFAS by 1633A
- 1621 for AOF can be used if appropriate

EPA United States Environmental Protection Agency

Implementing Case-by-Case Technology-Based Effluent Limitations in NPDES permits for Pollutants of Emerging Concern

A "How-To" for NPDES Permit Writers

Tools and Resources

Example Permit Language, State and Local PFAS Strategies, and Other PFAS Permitting Resources

BMP and Source Reduction Resources

- Fact Sheet: Pollution Prevention Strategies for Industrial PFAS Discharges (pdf) (713.1 KB)

https://www.epa.gov/npdes/industrial-wastewater#pfas

EPA Method for NPW/Solids

EPA 1633A

Final version released in Dec 2024, NOT PROMULGATED

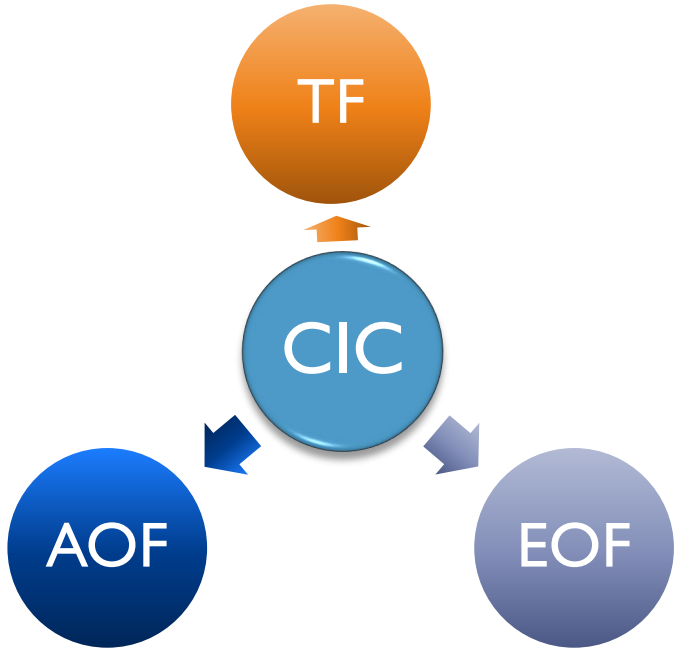
- Targeted Analysis of 40 PFAS
- Non-Potable Water, Soil, Sediment, Biosolids, Leachate, Tissue
- WAX Solid Phase Extraction (SPE)
- LCMSMS with Isotope Dilution Quantitation
- Detection limits: 0.4-10 ng/L (aqueous) / 0.05-2 ng/g (solids)
- Multi-Lab Validated

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

EPA Method 1621

Final version released in Dec 2024, NOT PROMULGATED

- Adsorbable Organic Fluorine (AOF)
- Screening analysis for 'Total PFAS'
- Applies to aqueous samples
- Method Detection Limit: 1.5 µg F-/L



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


SITE CHARACTERIZATION

CERCLA Hazardous Substances PFOA & PFOS

Effective July 8, 2024

"Pursuant to section 102(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), EPA is designating PFOA and PFOS, including their salts and structural isomers, as hazardous substances"

EPA has the authority to:

- Order investigation and remediation, including cost recovery;
- Re-open closed sites;
- Private parties will have a cause of action for cost recovery; and
- PFOA/PFOS included in the scope of Phase 1s to satisfy "All Appropriate Inquiries Rule"

EPA-HQ-OLEM-2019-0341

LCMSMS/GCMSMS Analysis

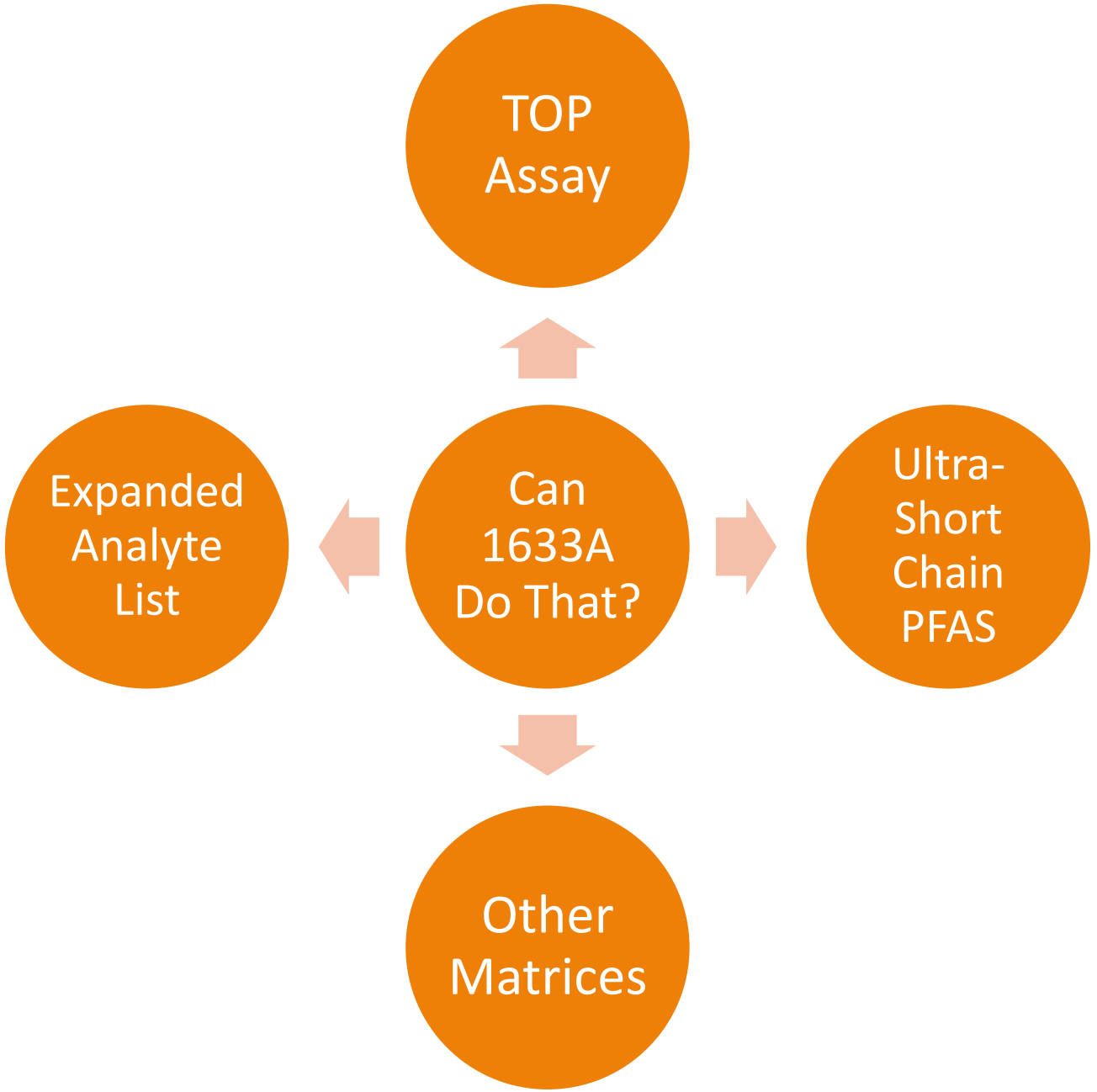
Compounds Included in EPA 1633A

- Perfluorobutanoic acid (PFBA)
- Perfluoropentanoic acid (PFPeA)
- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid (PFNA)
- Perfluorodecanoic acid (PFDA)
- Perfluoroundecanoic acid (PFUnA)
- Perfluorododecanoic acid (PFDoA)
- Perfluorotridecanoic acid (PFTriA)
- Perfluorotetradecanoic acid (PFTeA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluoropentanesulfonic acid (PFPeS)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluoroheptanesulfonic Acid (PFHpS)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluorononanesulfonic acid (PFNS)
- Perfluorodecanesulfonic acid (PFDS)
- Perfluorododecanesulfonic acid (PFDoS)
- Perfluorooctanesulfonamide (FOSA)
- NEtFOSA
- NMeFOSA
- NMeFOSAA
- NEtFOSAA
- NMeFOSE
- NEtFOSE
- 4:2 FTS
- 6:2 FTS
- 8:2 FTS
- 9Cl-PF3ONS
- 11Cl-PF3OUdS
- DONA
- HFPO-DA (GenX)
- 3:3 FTCA
- 5:3 FTCA
- 7:3 FTCA
- NFDHA
- PFMBA
- PFMPA
- PFEESA

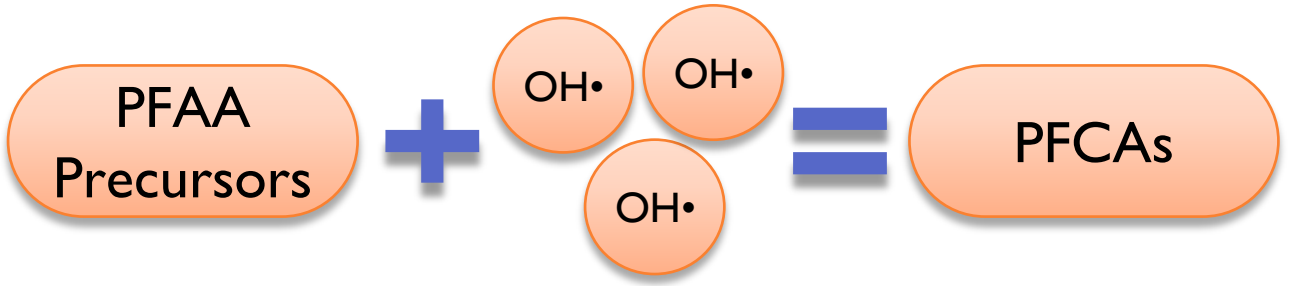
Target Compounds Not Part of EPA 1633A

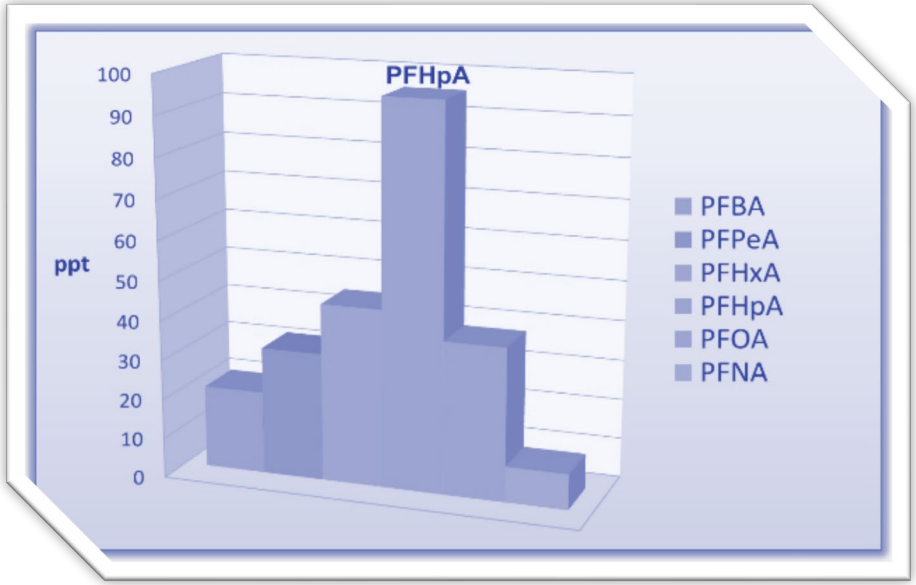
- 10:2 FTS
- 6:2 FTCA
- 8:2 FTCA
- 10:2 FTCA
- 6:2 FTUCA
- 8:2 FTUCA
- 10:2 FTUCA
- PFECHS
- PFPrS
- PFPrA
- PFMOAA
- PFECAG
- PFO4DA
- PFO3OA
- PFO2HxA
- R-EVE
- NVHOS
- Hydro-EVE Acid
- Perfluoro-n-octadecanoic acid (PFODA)
- Perfluoro-n-hexadecanoic acid (PFHxDA)
- EVE Acid
- PFO5DA
- PMPA
- PEPA
- MTP
- PS Acid
- Hydro-PS Acid
- R-PSDA
- Hydrolyzed PSDA
- R-PSDCA
- 6:2 diPAP
- 8:2 diPAP
- 6:2/8:2 diPAP
- 10:2 diPAP
- 10:2 FTOH (RL=1ug/L)
- 8:2 FTOH (RL=1ug/L)
- 7:2 FTOH (RL=1ug/L)
- 6:2 FTOH (RL=1ug/L)
- 4:2 FTOH (RL=1ug/L)

Scope of 1633A Testing



TOP Assay "Total Oxidizable Precursors"





TOP conversion of precursor 8:2 FTS into its terminal end products

TOP Assay: How Robust Is It?

Add reverse surrogate to be certain enough oxidizing radicals were produced

Complex Matrices

- Oxidant consumed by the matrix itself; not enough hydroxyl radicals for complete oxidation

Unmeasurable Transformation Products

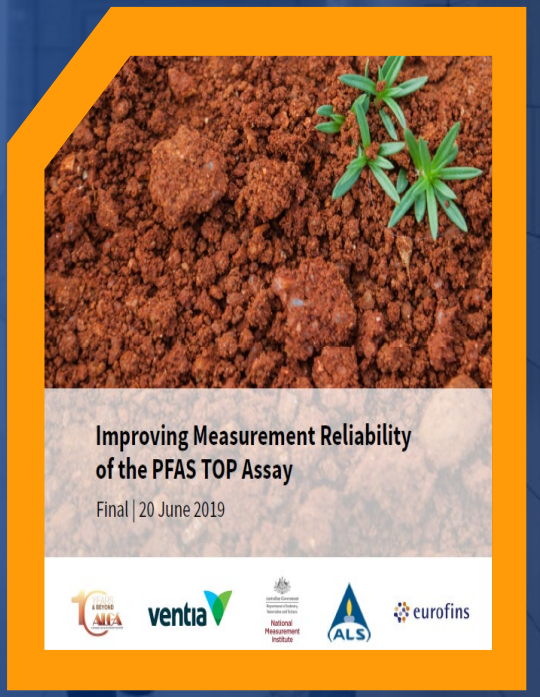
- GenX with an ether functional group would not convert to PFCA
- <C4 that is not captured by conventional LCMSMS targeted analysis

Requires development of an ultra-short method

Under evaluation by EPA with a goal to complete development work in 2024, then validate and publish a standardized SW-846 method

SERDP DOD · EPA · DOE

ESTCP



EPA PFAS Destruction & Disposal Guidance

Public comment period closed 10/15/24

- ✓Updated guidance release April 2024
- ✓Same methods: landfilling, underground injection control (UIC), thermal treatment and the wildly unpopular interim storage
- ✓Addresses utilization of analytical tools for demonstration of mineralization of PFAS in Appendix A
- ✓Significant data gaps remain

https://www.epa.gov/pfas/interim-guidance-destroying-and-disposing-certain-pfas-and-pfas-containing-materials-are-not

OTM-45 & OTM-50

- EPA Published OTM-45 for Semivolatile and Particulate-bound PFAS from Source Air Emissions
- EPA Published OTM-50 for Volatile PFAS from Source Air Emissions

Source Air

EPA OTM-45
EPA OTM-50
Method 0010

Ambient Air

Modified
TO-13A/TO-10A / LCMSMS

Vapor

Modified
TO-17 / GCMSMS

Expanded List

LC-MS/MS
100+ PFAS

Ultra-Shorts

LC-MS/MS
C1-C4

Neutrals

GC-MS/MS
Fluorotelomers

Blood

LC-MS/MS
45 PFAS in whole blood or serum


AFFF

Transition to Fluorine Free Foams

FLUORINE-FREE FOAM (F3) LIQUID CONCENTRATE FOR LAND-BASED, FRESH WATER APPLICATIONS

In accordance with

DEPARTMENT OF DEFENSE SPECIFICATION MIL-PRF-32725

TYPE 3 (3%)

DO NOT MIX WITH OTHER FOAM CONCENTRATES

This fire extinguishing concentrate is for use by dilution with fresh water in fixed or mobile systems at volume proportions of 3% (i.e., 3 gallons concentrate to 97 gallons of fresh water) at the time of use. This concentrate is not compatible and cannot be mixed in tanks with other foam concentrates including other MIL-PRF-32725 concentrates. The concentrate shall not be stored at temperatures below 35 °F or at temperatures above 120 °F.

https://aboutblaw.com/6pN

Federal Aviation Administration

National Part 139 CertAlert

AdvisoryCautionary**Non-Directive**Advisory**Cautionary**Non-Directive**Advisory**Cautionary**Non-Directive**

Date: 9/13/2023 **No. 23-07**

To: Airport Operators, FAA Airport Certification Safety Inspectors, ARFF Departments and Mutual Aid Providers

Subject: Availability of Fluorine Free Foam (F3) on the Navy's Qualified Products List (QPL)

https://www.faa.gov/airports/airport_safety/aircraft_rescue_fire_fighting/f3_transition

DoD needs more time to safely replace AFFF with F3 at 1,500 facilities and 6,000 mobile assets

Qualified Products Database

Main | Search | Reports | Help

Governing Spec: **MIL-PRF-32725(1)**

The Qualified Product List for the following governing specification was last updated on **28-MAR-2024**

QA	FSC	QPL Number	Governing Spec	Doc Date	Doc Status	Title	QPL Notes
SH	4210	QPL-32725	MIL-PRF-32725	17-AUG-2023	Active	Fire Extinguishing Agent, Fluorine-Free Foam (F3) Liquid Concentrate, for Land-Based, Fresh Water Applications	Preamble Footnotes

https://qpldocs.dla.mil/search/parts.aspx?qpl=4513&param=MIL-PRF-32725&type=26144

"the deadline to end the use of AFFF on military installations is now extended to October 1, 2025."


PRODUCTS

STATE LEGISLATION

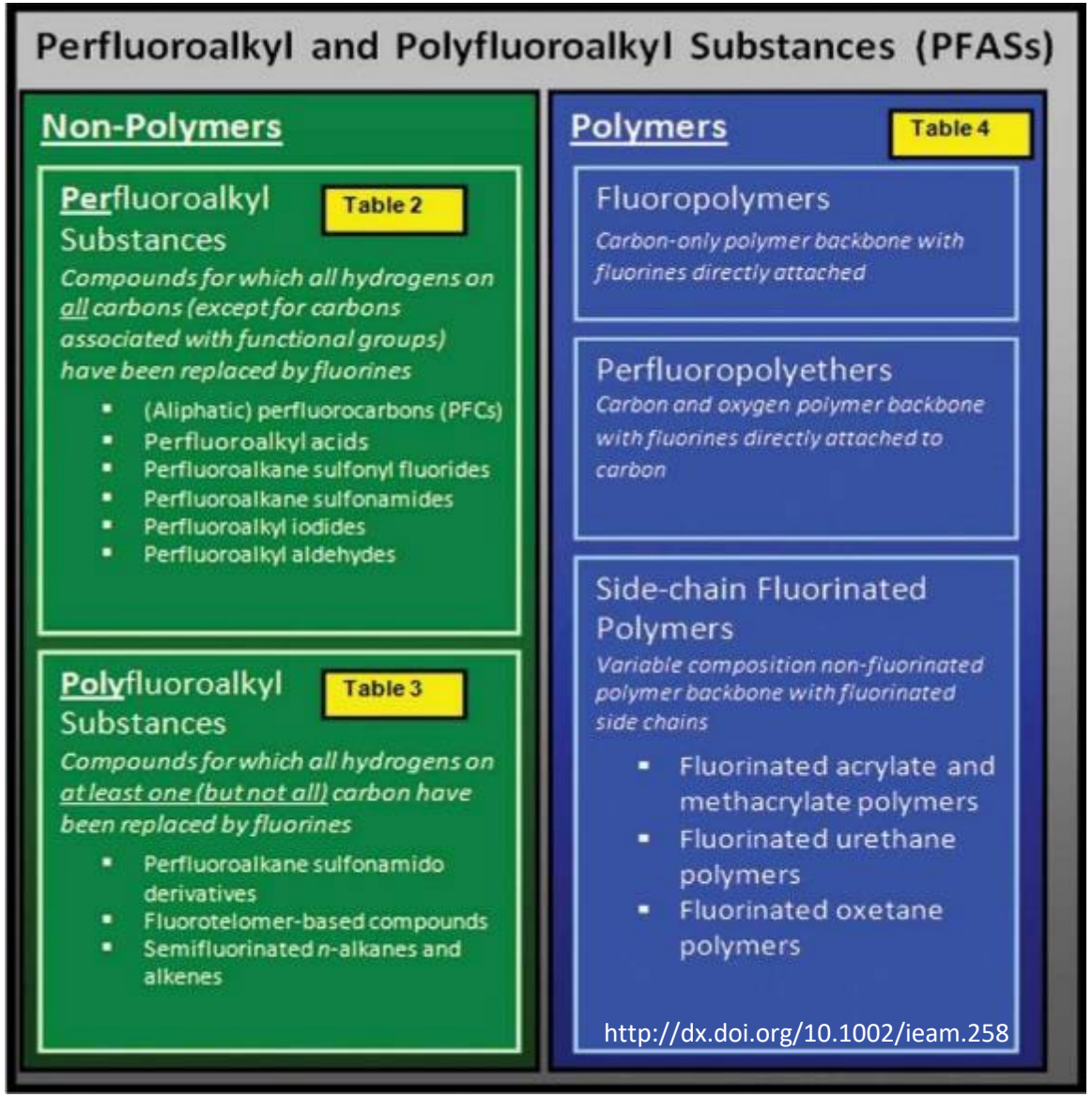
SCOPE OF STATE LEGISLATIVE ACTIONS

"PFAS means any member of the class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom"

AFFF	Textiles	Juvenile Products	Food Packaging	Misc
• Prohibits use for training • Restricts use, capture and disposal after incident • Prohibits the manufacture or sale of PFAS containing foams	• Carpeting, rugs, upholstered furniture, textile furnishings, fabric treatments • Requires disclosure about protective equipment	• Booster seats, changing pads, crib mattress, nursing pillow, infant carrier, mouthable products	• Bans manufacture, sale or distribution of wraps, liners, plates, boxes, plant-based food packaging	• Cosmetics • Cleaning products • Requires disclosure about cookware

- **POLYMER**
  Inert, Non-soluble, Non-toxic, Non-bioavailable

NON-POLYMER
Water-soluble, Mobile, Bioavailable, Toxic



Used in the production of

Targeted PFAS

All Matrices – ~ 100 PFAS

Strengths: Selectivity Sensitivity at ~1-20ppt

Can be used for risk assessment

Weaknesses: Limited list of compounds

TOP Assay

All Matrices – Precursors

Strengths: Sensitivity at ~1-20ppt

Specific to 'unknowns' with potential to convert to risk drivers

Weaknesses: Not specific

Does not complete a mass balance

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

Potential for high bias from inorganic fluorine & low bias from sample prep

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THANK YOU

TARYN MCKNIGHT
VP of Product and PFAS Practice Leader

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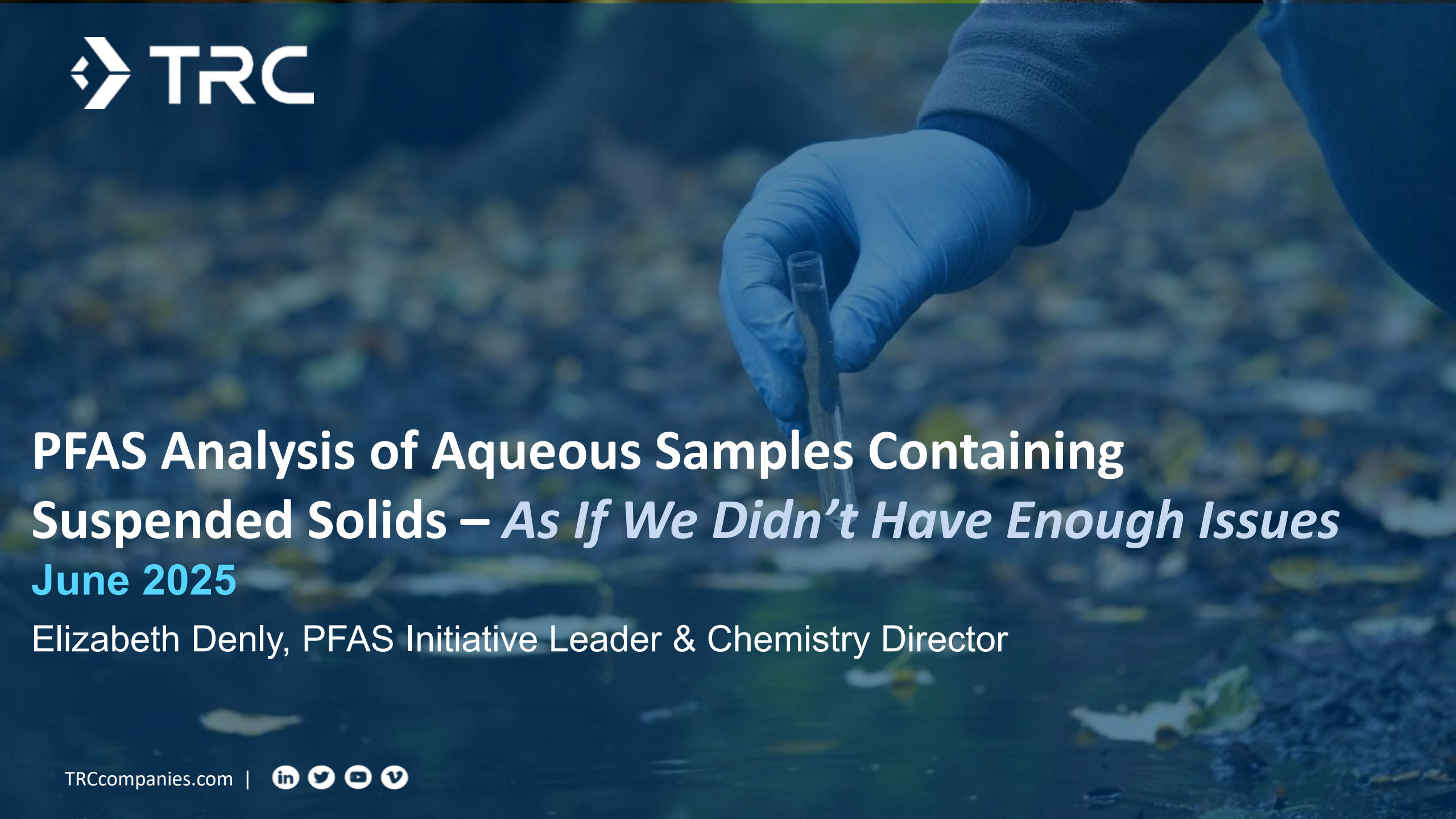


PFAS Analysis of Aqueous Samples Containing Suspended Solids – *As If We Didn't Have Enough Issues*

June 2025

Elizabeth Denly, PFAS Initiative Leader & Chemistry Director

Today's Learning Objectives

- Suspended Solids in Aqueous Samples
  - How do Sampling Methods Affect our Data?
  - What Role Does The Analytical Laboratory Play?
- Laboratory Study Evaluating Options for Sample Preparation & Analysis

Solids in Aqueous Samples

Fate & Transport: Sorption of PFAS to particulates or solids. Longer-chain PFAS and PFSAs tend to absorb more to solids/particulates.

Aqueous samples with high levels of solids

- PFAS concentrations may vary or not be representative
- Resulting fingerprints or signatures may vary or not be representative

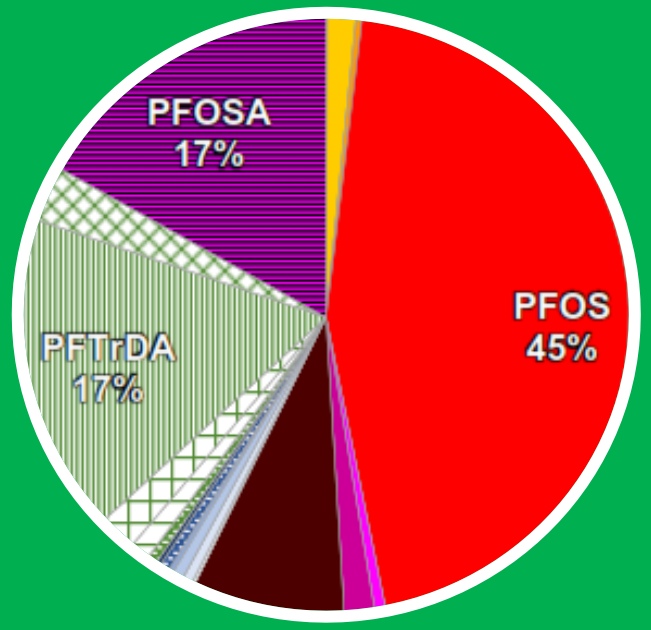
PFAS concentrations and PFAS signatures on samples with elevated solids can be dependent on how lab handles sample.

Example PFSAs: PFHxS, PFHpS, PFOS
PFSA = Perfluorosulfonic Acids

Example Longer chain PFCAs: PFOA, PFNA, PFDA
PFCAs = Perfluorocarboxylic Acids

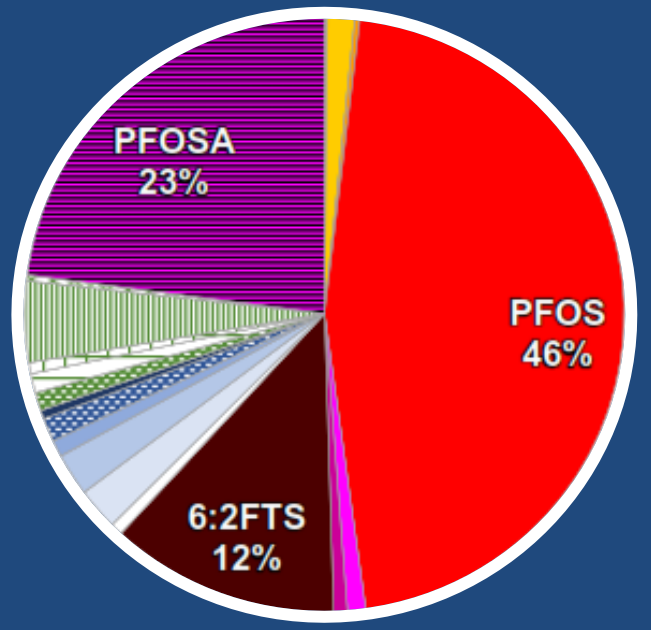
Fire Training Area Surface Soil – Exposed to Elements for > 20 Years

SOLVENT EXTRACTION
Surface Soil
Total = 289.84 ug/kg



31 ug total PFAS mass extracted from 100 g of soil

WATER EXTRACTION (SPLP)
Surface Soil
Total = 4359.5 ng/L



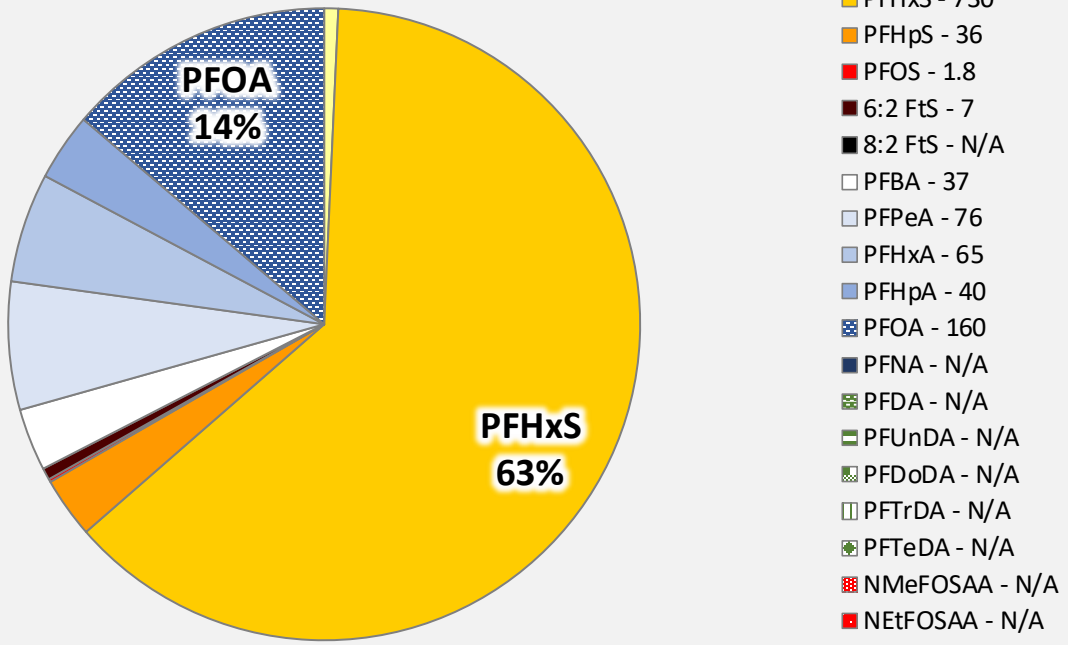
10 ug total PFAS mass leached from 100 g of soil

- 30% of PFAS mass flushed off soil during SPLP mixing
- Well installation will also disturb soil and increase flushing of PFAS from smear zone soils into sampled water

High Biased PFAS Results – Turbidity (AFFF Source)

Turbidity 1000 NTU

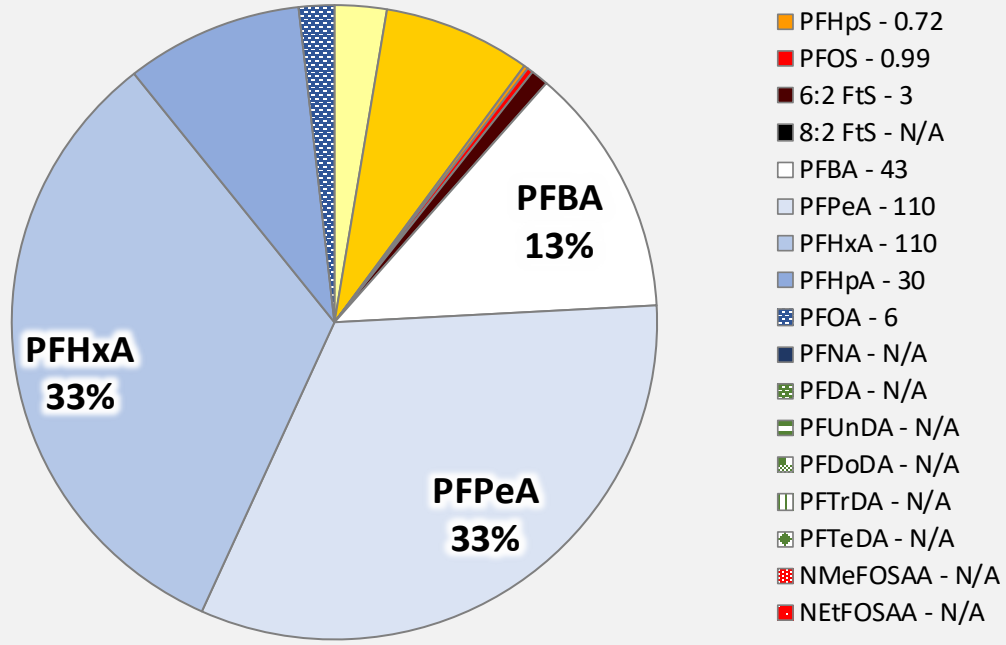
Total – 1,161 ng/L



Total PFAS	1,161 ppt
PFHxS	730 ppt
PFOA	**160 ppt**

Turbidity 25 NTU

Total – 338 ng/L



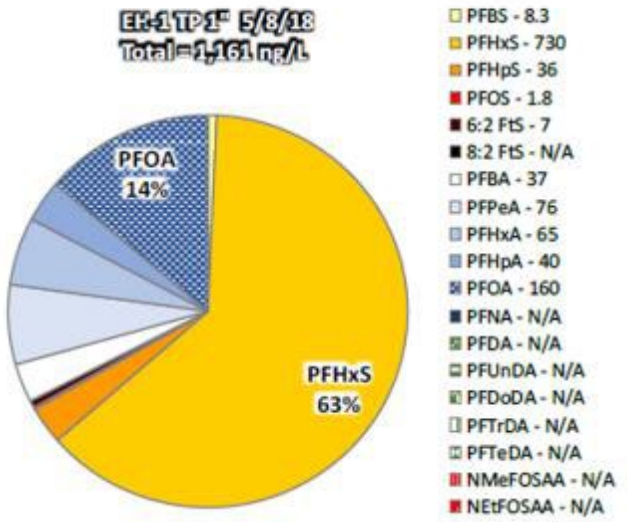
Total PFAS	338 ppt
PFHxS	25 ppt
PFOA	6 ppt

PFOA MCL
10 ppt

PFAS Concentrations and PFAS Signatures Affected by Turbidity

From Turbid to Clear (>10 NTU) to (< 10 NTU)

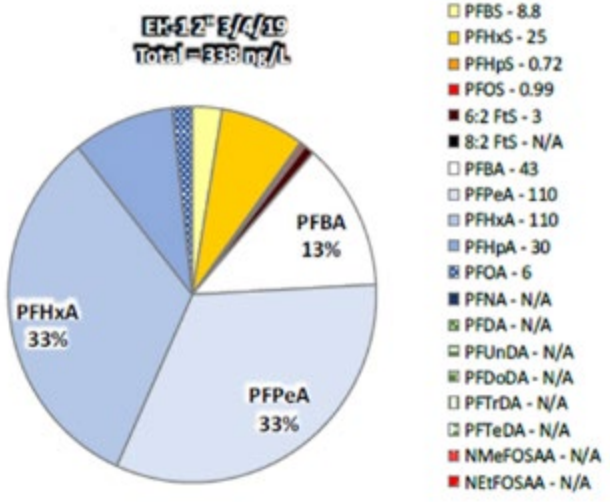
Sample from 1" temporary well turbid



PFOA	160 ppt
PFHxS	730 ppt
Total	1,161 ppt

>1000 NTU

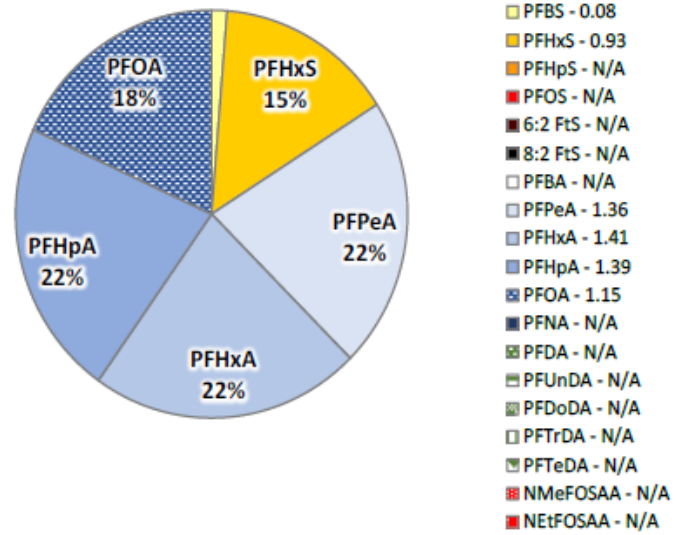
Sample from 2" developed MW clear



PFOA	6 ppt
PFHxS	25 ppt
Total	338 ppt

25 NTU

Sample from 2" grab sampler

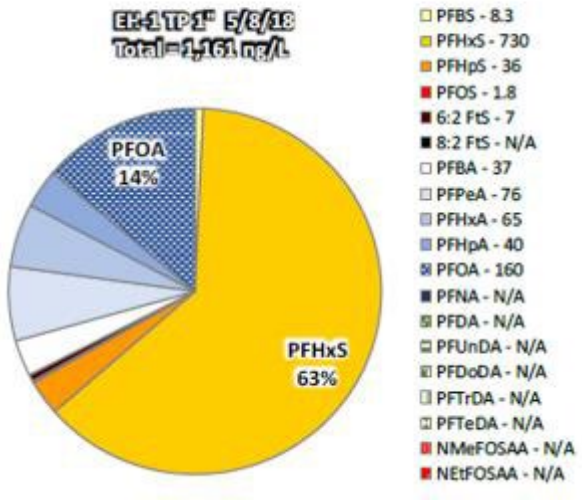


PFOA	1.1 ppt
PFHxS	1.0 ppt
Total	7.0 ppt

2 NTU

From Turbid/Clear Shallow Well to Downgradient Well (< 10 NTU): Strong Case for MNA

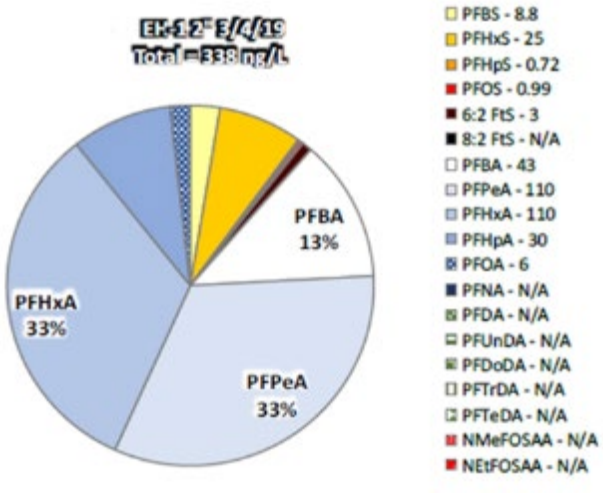
Sample from 1" temporary well turbid



PFOA	160 ppt
PFHxS	730 ppt
Total	1,161 ppt

>1100 NTU

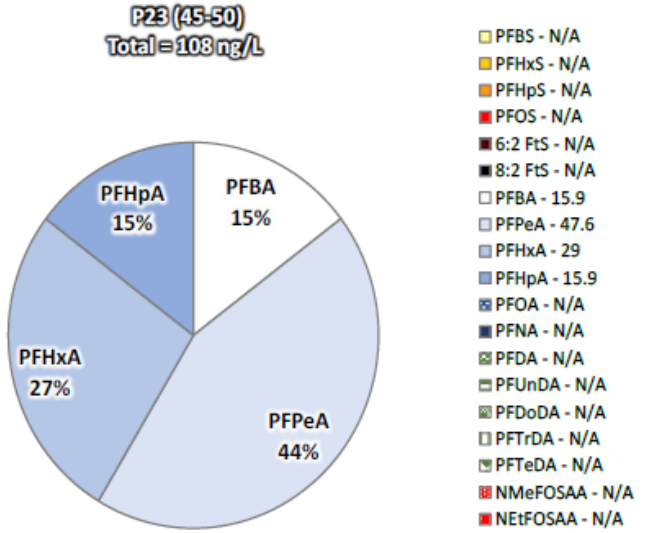
Sample from 2" developed MW clear



PFOA	6 ppt
PFHxS	25 ppt
Total	338 ppt

25 NTU

Sample from 2" grab sampler



300 ft downgradient

PFOA	ND
PFHxS	ND
Total	108 ppt

3 NTU

PFAS MNA - slow partitioning from smear zone to dissolved phase followed by dilution

What Method Should Be Used For Collecting Groundwater Samples?

- Low-flow sampling preferred
  - Purge a minimum of one well volume under low flow sampling.
- Avoid bailers
- Hydrasleeves may be okay
- Temporary wells may not be representative

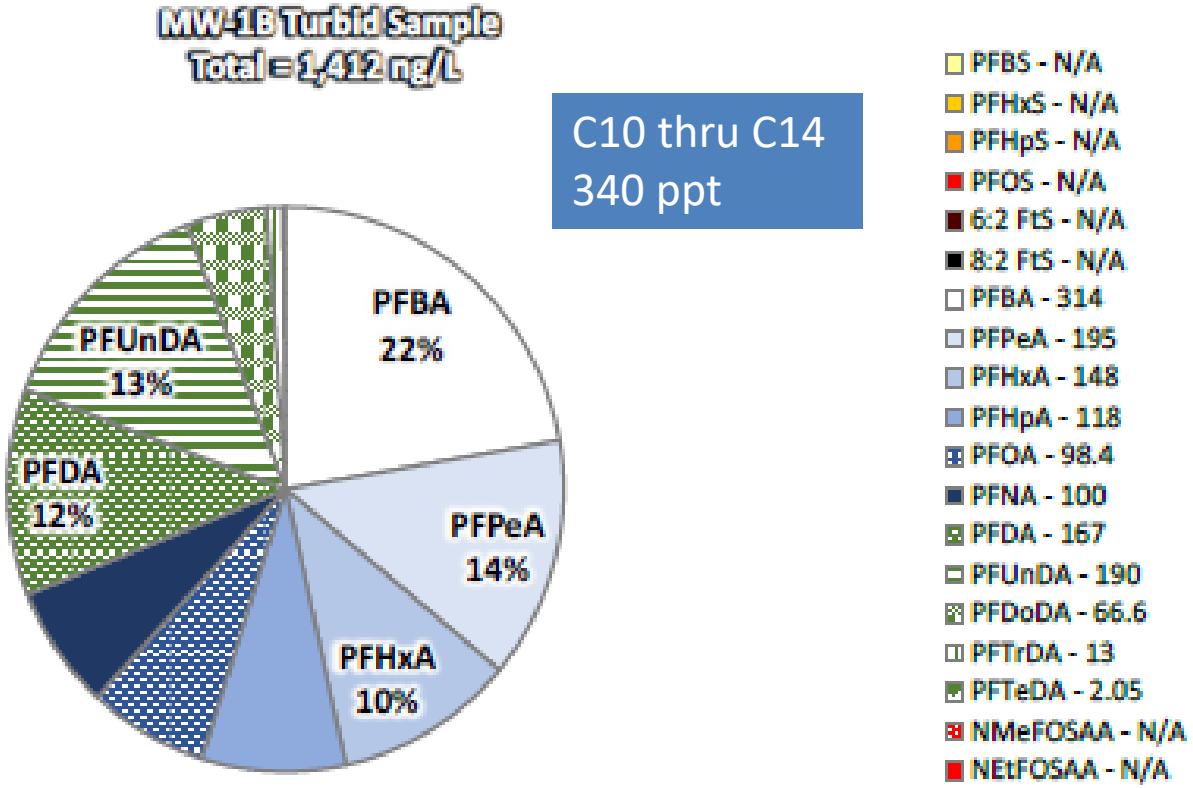
Fate & Transport: Partitioning of PFAS to surface in wells. Accumulation of PFAS at air/water interface.

Minimize particulates. Turbidity goal of ≤ 10 NTUs.

1. Decrease purge rate to help reduce turbidity.
2. Change pump intake depth but stay within the screened interval.
3. Consider re-development of well replacement if turbidity <25 NTUs cannot be achieved.

High Biased PFAS Results – (PFCA Manufacture)

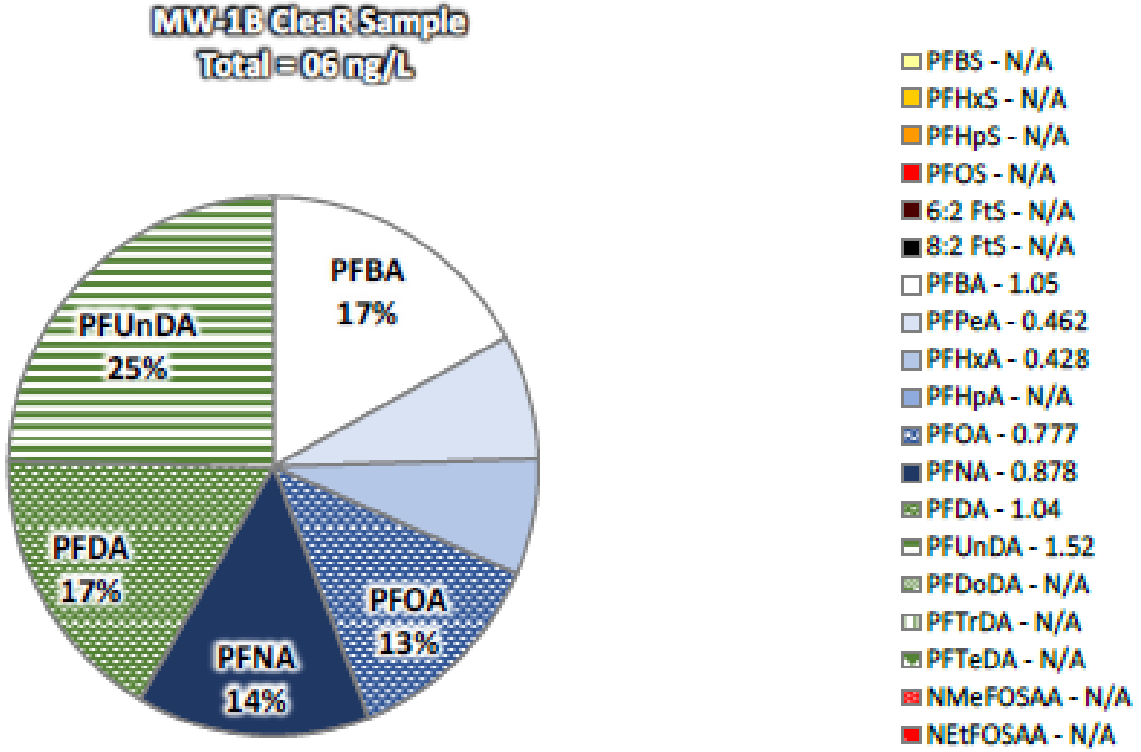
Turbidity 830 NTU



C10 thru C14
340 ppt

Total PFAS 1,412 ppt
PFOA 160 ppt
PFNA 100 ppt

Turbidity 18 NTU



Total PFAS	6.0 ppt
PFOA	0.777
PFNA	0.878

PFOA & PFNA MCLs as low as 10 ppt

Collection and Analysis of Representative Aqueous Samples Impact of TSS - Focus GW & SW

- PFAS can be directly adsorbed to TSS and/or collection of a sample containing TSS
- Turbid samples may also be an indication of a sample containing micelles
- Groundwater
  - Under typical GW conditions the migration of suspended solids or emulsions is very limited if not at all
  - Turbid samples probably are not representative of migrating groundwater and can be biased high by orders of magnitude compared to a clear sample from the same location
- Surface water
  - Suspended solids and micelles can readily migrate in surface water
  - Sampling and analysis of turbid samples is representative of PFAS SW migration
  - Critical to analyze entire sample and not filter out and discard solids

From Final EPA Method 1633: Surface Water

- If collecting samples to characterize PFAS in water body, collect samples from below surface to avoid enrichment in surface layer.
- If purpose of sampling is to make worst-case assessment of transfer of PFAS from water body to atmosphere or biota in contact with surface layer, include the surface layer during sampling.

Lake or Pond (Stagnant water body) → Collect SW 1-2' below surface

Catch Basin or Shallow Outfall (Flowing water body) → Collect SW 0.5' below surface

How Do Labs Deal With Solids in Aqueous Samples?

Potential Lab Procedural Solutions vs Project Objectives

"Total" PFAS measurement of aqueous samples; may be acceptable or needed in certain instances depending on project objectives

Total:

- Lab centrifuges sample to separate aqueous and particulate phases.
- Lab extracts aqueous phase.
- Lab extracts remaining particulate phase and combines extract with aqueous phase extract.

Dissolved:

- Lab centrifuges sample to separate aqueous and particulate phases.
- Lab extracts aqueous phase only.

Collect samples for TSS or measure turbidity if sampling for compliance and to assist in PFAS data evaluation.

Survey of 4 Labs Performing EPA Method 1633: How Do You Deal With Aqueous Samples with Elevated Suspended Solids?

1633

- Requires TSS analysis or visual comparison
- Recommends 50 mg solids in total volume (500 mL) of processed sample
- If >50 mg, prepare 2nd SPE cartridge, use smaller bottle size to avoid subsampling, centrifuging
- Subsampling to be avoided whenever possible

1

- TSS > 100 mg/L subsampled and diluted
- Not all labs in network use centrifugation; based on analyst judgment
- Extract solids and aqueous separately only on client request

2

- TSS analysis not performed
- Use entire volume; no subsampling
- Have not had issues because using larger SPE cartridges
- Solids routinely included in final result

3

- TSS > 100 mg/L subsampled and diluted
- TSS determined thru visual inspection
- Extract solids and aqueous separately only on client request

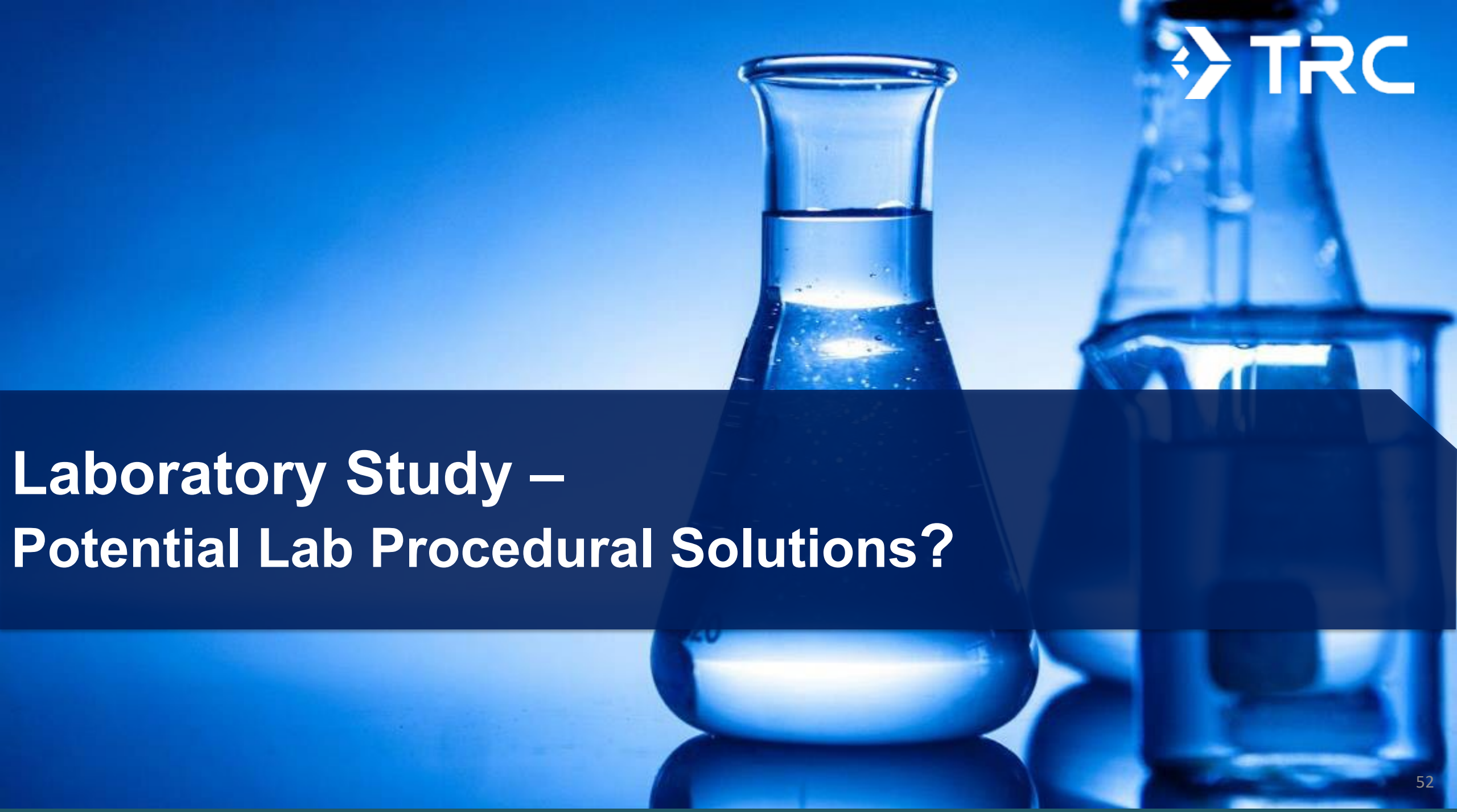
4

- TSS determined thru visual inspection
- 1 lab in network: will subsample or use smaller sample bottle (e.g., 60 mL)
- 1 lab in network: let sample settle and decant; noted centrifuging is time consuming
- Extract solids and aqueous separately only on client request

What Should We Be Asking Our Labs For?

	Drinking Water	Groundwater	Surface Water	Wastewater	Pore Water
Compliance					
Delineation					
Remedial Design					
Risk Assessment					
Permitting					
Fate & Transport					

“Total” or “Dissolved” Measurement?

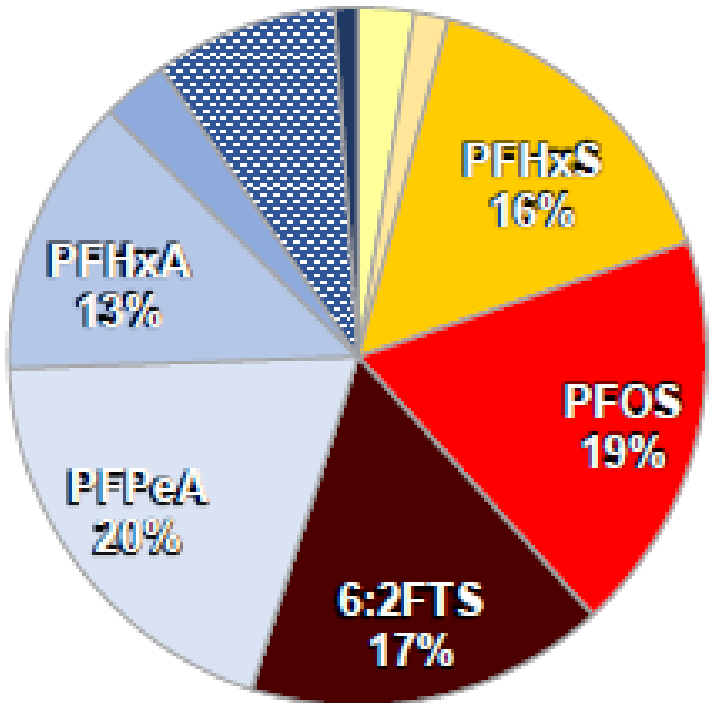


Laboratory Study –
Potential Lab Procedural Solutions?

- Purpose – Evaluate 1633 turbid sample preparation gap
  - Effect of sample turbidity on PFAS extraction and analysis
- Procedure: Prepared each sample using 3 different methods
  1. Sample spiked with EIS, no centrifuging, extract as is
  2. Sample spiked with EIS, centrifuged
     - Aqueous phase extracted and analyzed
     - Solid phase extracted and analyzed
  3. Sample spiked with EIS, centrifuged
     - Aqueous phase extracted
     - Solid phase extracted
     - Extracts combined for 1 analysis

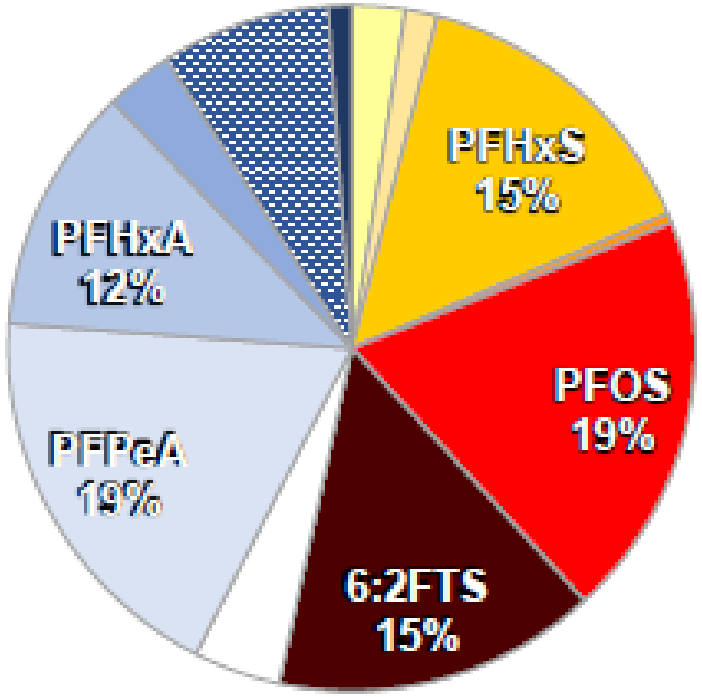
Clear Samples PFAS Results

Clear Full
Total = 425.3 ng/l



PFOS 81 ng/L
*extracted as is

Clear Aqueous
Total = 439.5 ng/l



PFOS 83 ng/L
*centrifuged

Fingerprints are identical: an indication of little to no preferential partitioning of longer chained PFAS or PFSAs to suspended solids.

Turbid Sample PFAS Results

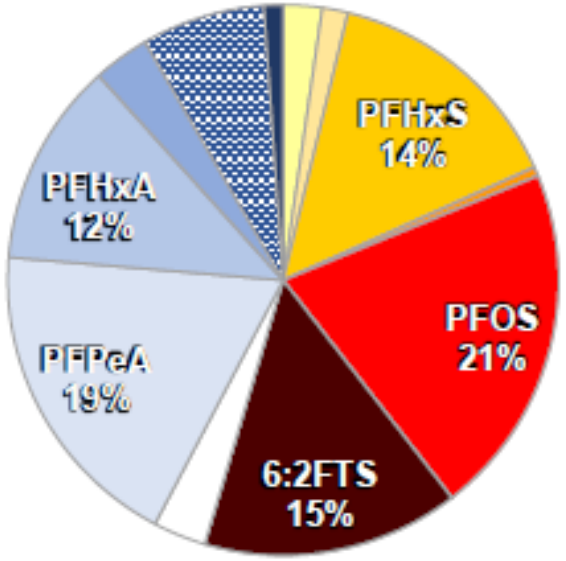
Fingerprints are identical: very minor selective partitioning of PFOS to suspended solids

PFOS 101 ng/L
*extracted as is

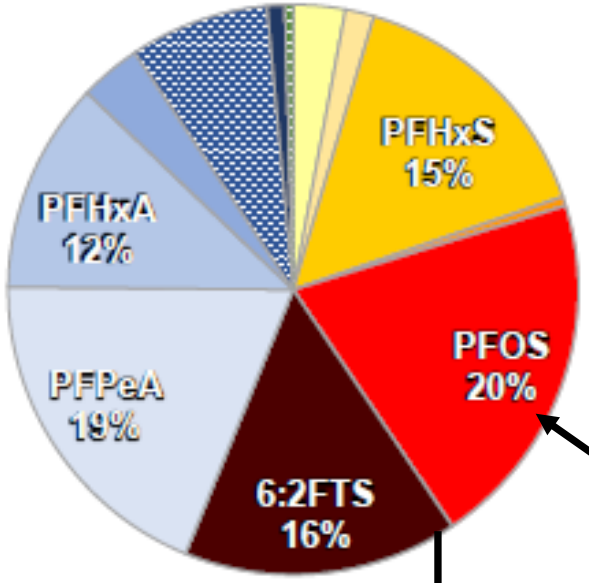
PFOS 84 ng/L
*centrifuged

PFOS 99 ng/L
*aqueous & solid extracted & combined

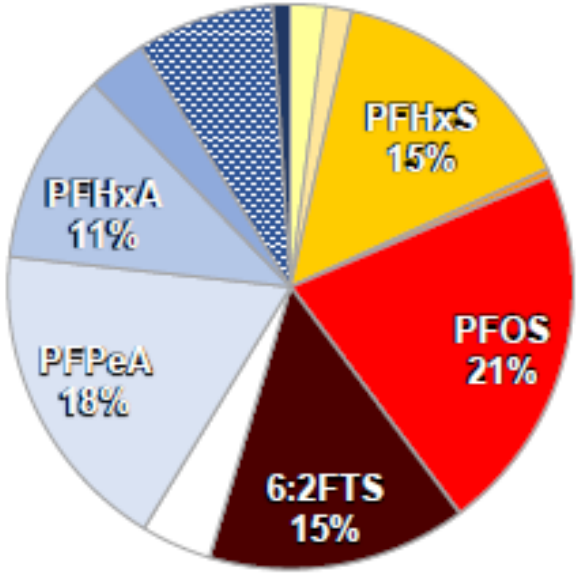
Turbid Full
Total = 483.3 ng/l



Turbid Aqueous
Total = 442.4 ng/l



Turbid Mixed
Total = 471.4 ng/l



Solids PFOS concentration: 3.3 ug/kg on 1 gram of solids so 3.3 ng of PFOS on solids

PFOS 84 ng/L + 3.3 ng = 87.3 ng/L

Alpha/TRC Lab Study Results Conclusions

- The removal of suspended solids from the sample had no effect on the PFAS analytical results
- Turbid samples
  - Minor partitioning of PFOS to suspended solids
  - All sample aliquots would be considered representative of the outfall
- Based on our experience, the impact of suspended solids on aqueous samples is a factor of sample location relative to source location
  - Suspended solids lead to biased high results near source areas (microemulsions captured in sample)
  - Downgradient plumes / SW results are less impacted by suspended solids (PFAS is probably present as dissolved molecules)

Questions?

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