PFAS Considerations for Drinking Water and Wastewater

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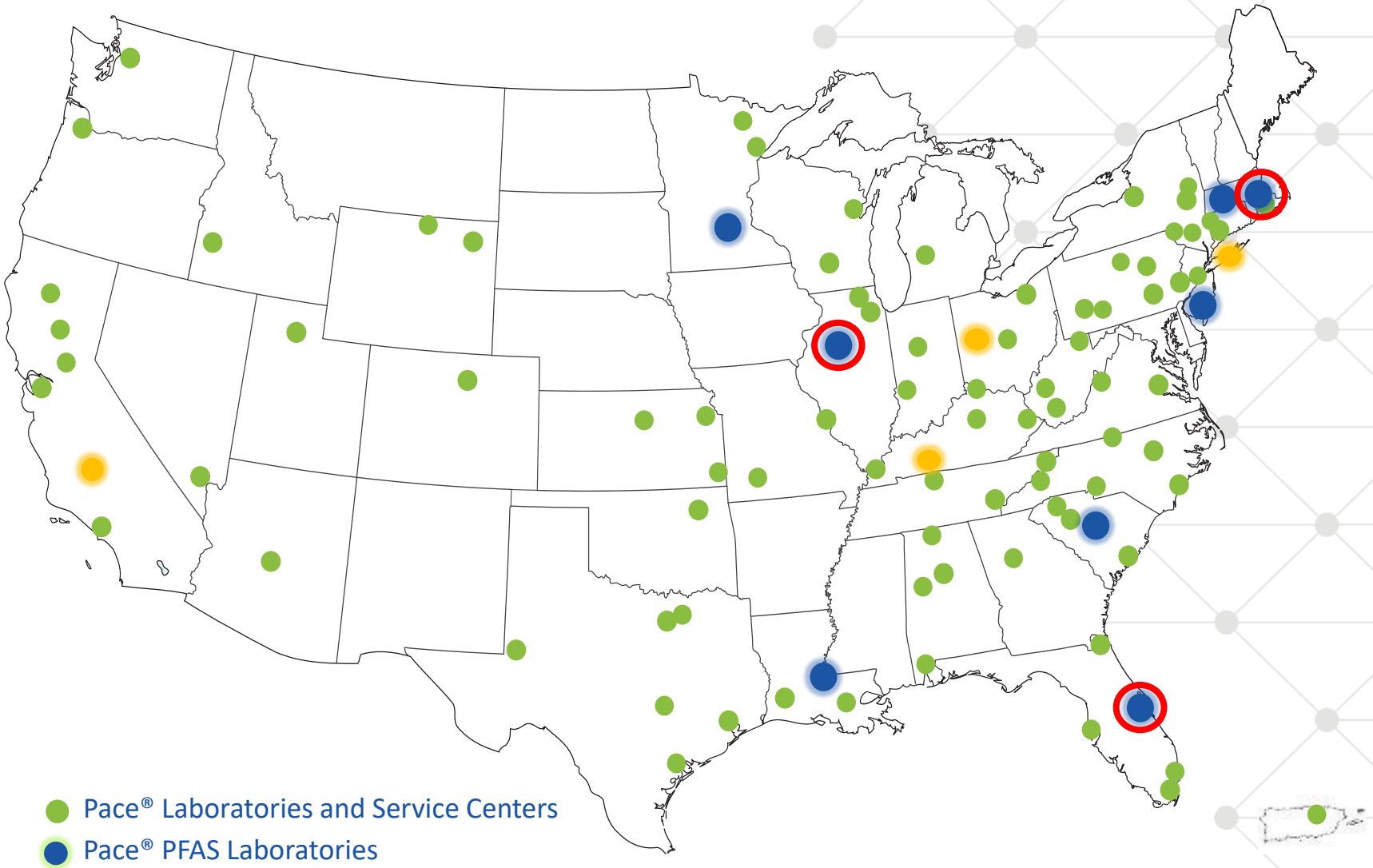

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- Pace® UCMR & Drinking Water Laboratories

PFAS OVERVIEW

- CHEMISTRY,SOURCES & RECEIVERS
- TEST METHODS
- REGULATORY UPDATE
- FIELD SAMPLING & RESOURCES
- TAKEAWAYS

Why test for PFAS?

At least 12 military bases contaminating water supply with toxic PFAS

The Guardian

Testing by the Department of Defense revealed dangerous levels of the contaminants, drawing concern from public health advocates

NEWS

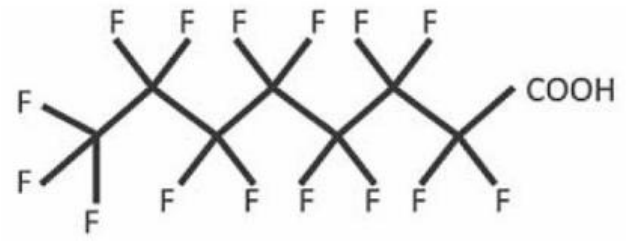
Hundreds of Hawaii residents rely on bottled water ever since 'forever chemicals' were found in their wells

More than 50 Maine farms impacted by PFAS, but state officials see 'glimmer of hope'

maine public

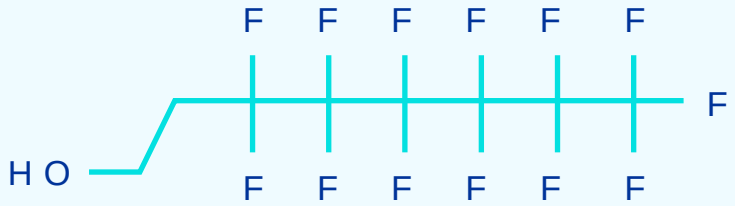
Sources: https://www.theguardian.com/us-news/2022/jun/06/military-bases-contaminating-water-supply-pfas
https://www.nbcnews.com/health/health-news/hawaii-residents-use-bottled-water-forever-chemicals-rcna82670
https://www.mainepublic.org/environment-and-outdoors/2023-02-01/more-than-50-maine-farms-impacted-by-pfas-but-state-officials-see-glimmer-of-hope

CLASSES OF PFAS-Per and Polyfluorinated Alkyl Substances



PERFLUOROALKYL

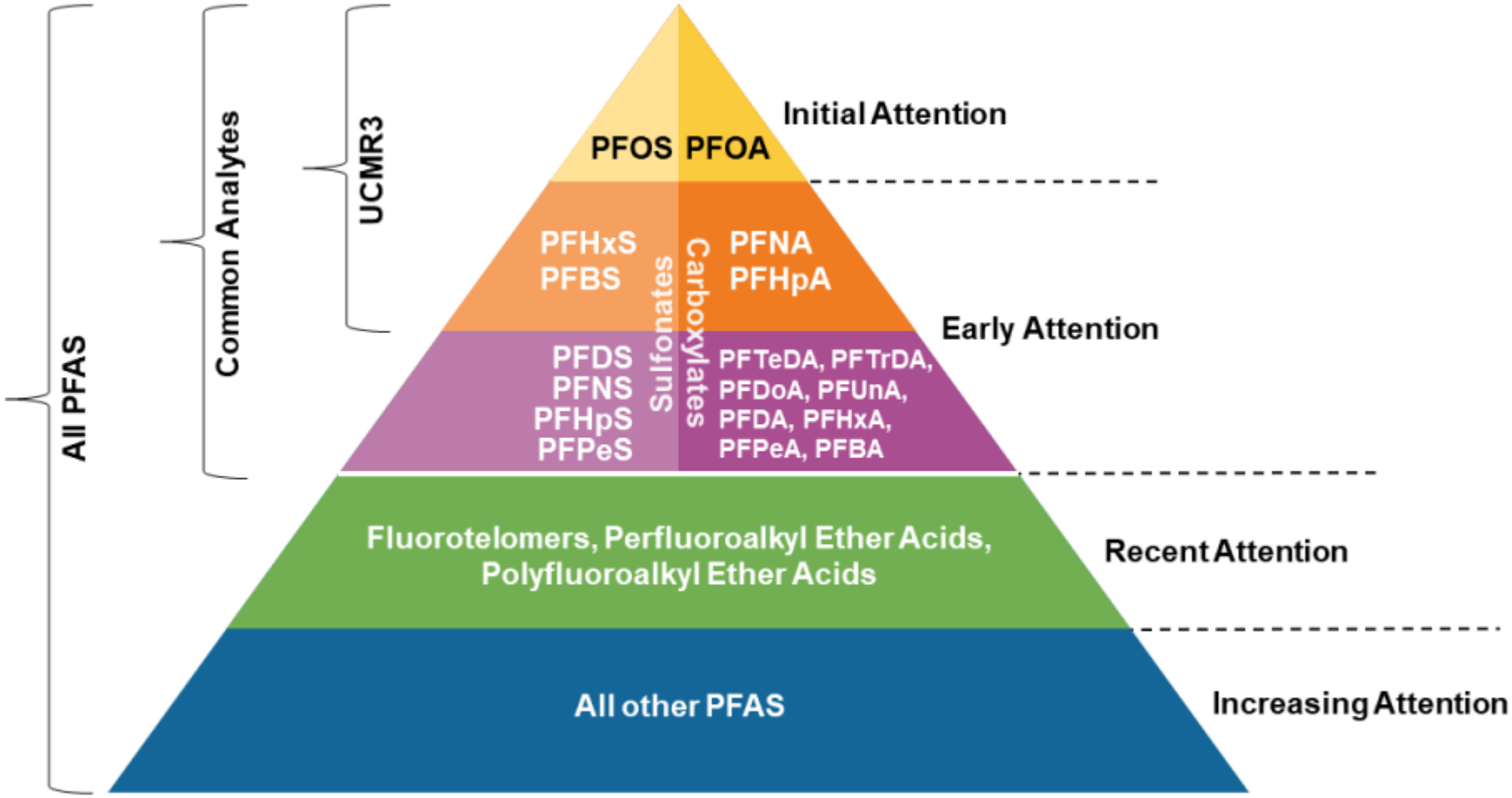
- All hydrogens on the carbons are replaced by fluorine
- Strongest chemical bond in nature
- Difficult to treat
- PFCAs and PFSAs



POLYFLUOROALKYL

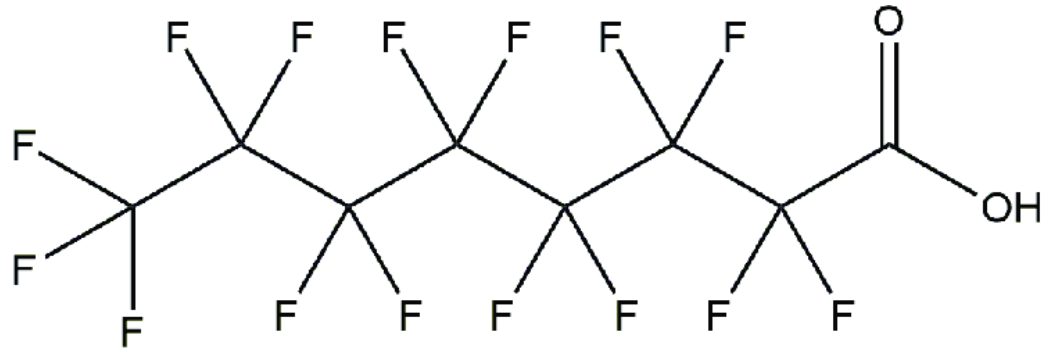
- Non-fluorine atom (usually H or O) attached to at least one, but not all, carbon atoms in the tail
- Creates a “weak link” susceptible to biotic or abiotic degradation
- More susceptible to treatment
- Fluorotelomers
- AKA precursors

Which target compounds to focus on?

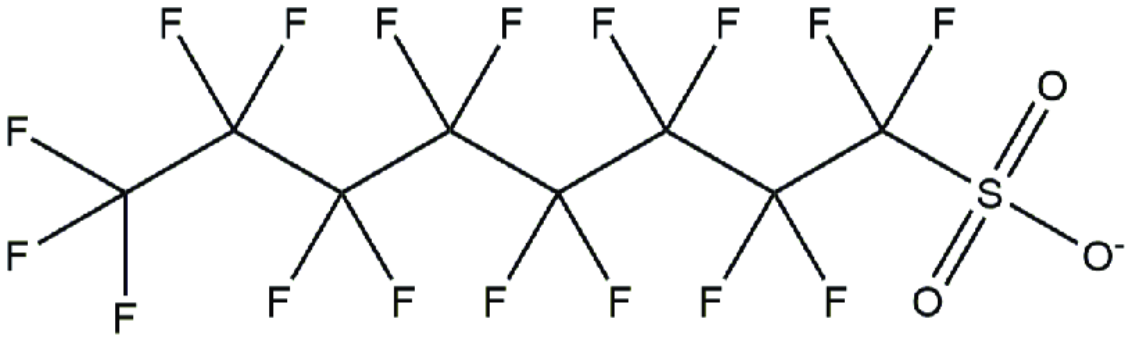


ITRC, 2022

The Two Most Widely Study PFOA and PFOS



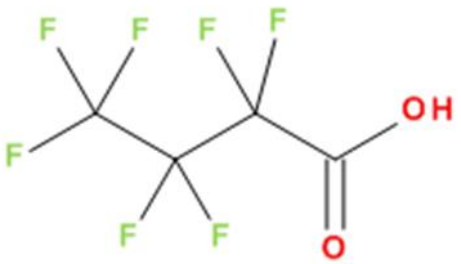
Perfluorooctanoic acid (PFOA)



Perfluorooctane sulfonate (PFOS)

- Let's Talk about Bonding C-F
- Who made them?
- What are their uses?
- Why they are so good at what they are made for?
- Known Adverse Health effects.

Replacement PFAS



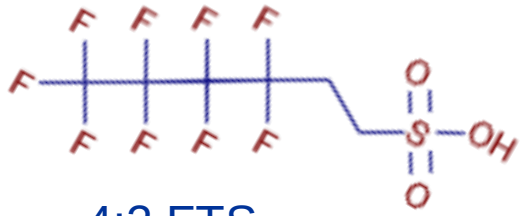
PFBA

PFBS

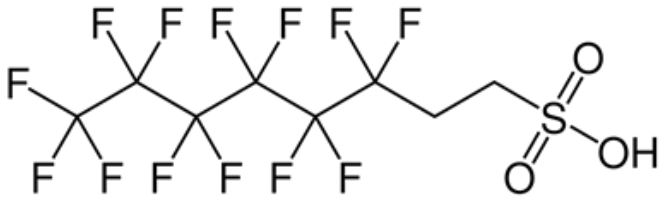
6:2 Fluorotelomer acrylate

- Industry Claims they are safer
- Precursors are still longer chain C8
- PFBA-food packaging and film
- PFBS-surfactants/repellents, metal plating, pesticides, and flame retardants

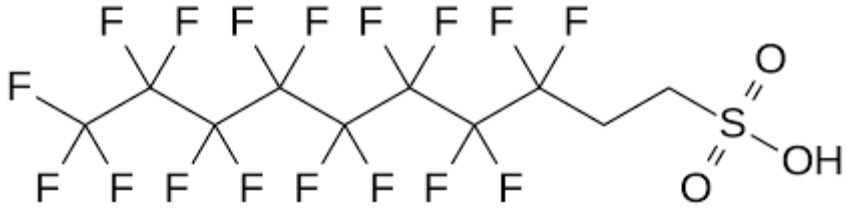
Polyfluorinated PFAS



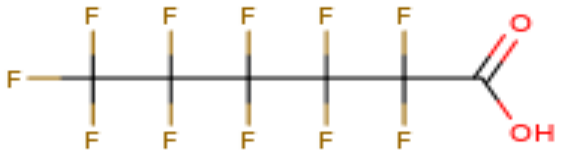
4:2 FTS

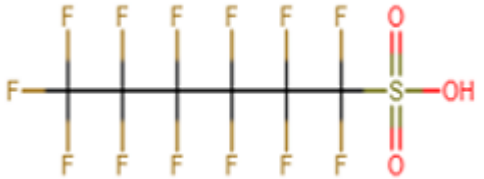


6:2 FTS (C8)



8:2 FTS

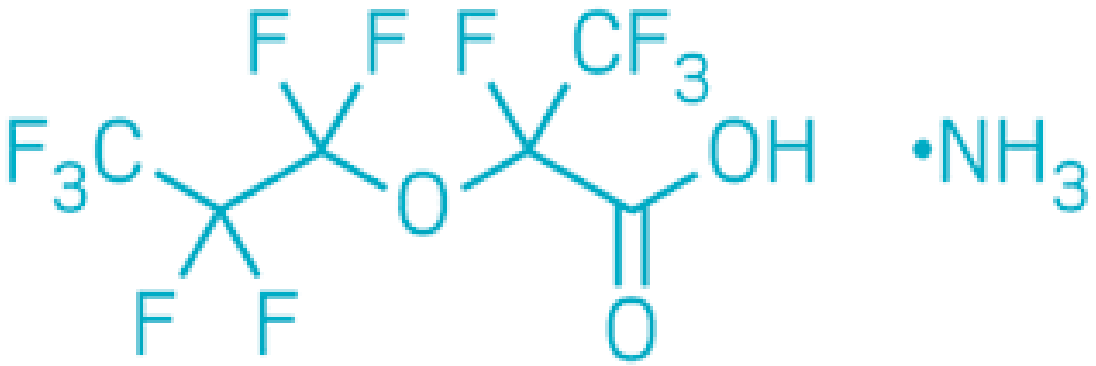




GenX in the Lower Cape Fear River Basin

AKA HFPO-DA (Dimer Acid)

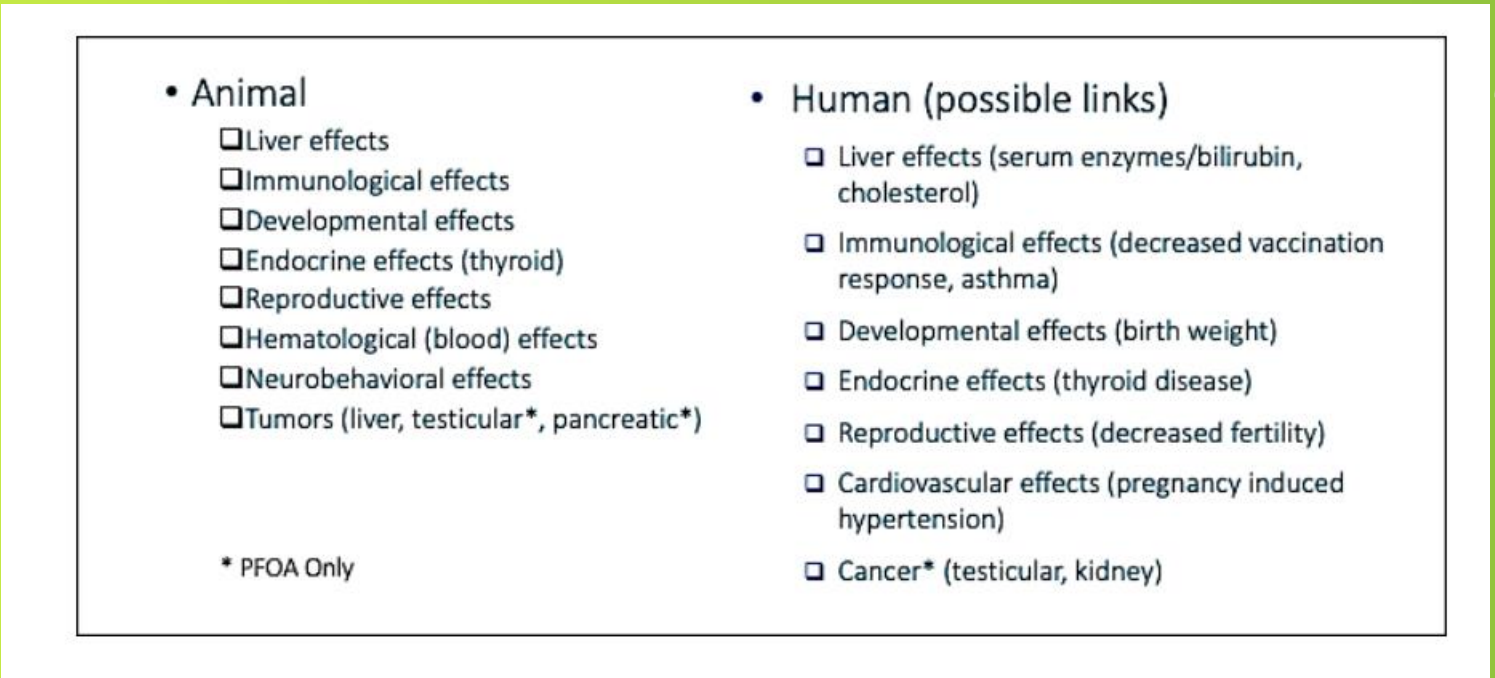
Dupont 2007 as a replacement product for PFOA



GenX

Adverse Health Effects of PFAS-PFOA and PFOS

ITRC (Interstate and Regulatory Technology Council) List



- Animal
  - ❑ Liver effects
  - ❑ Immunological effects
  - ❑ Developmental effects
  - ❑ Endocrine effects (thyroid)
  - ❑ Reproductive effects
  - ❑ Hematological (blood) effects
  - ❑ Neurobehavioral effects
  - ❑ Tumors (liver, testicular*, pancreatic*)

* PFOA Only

- Human (possible links)
  - ❑ Liver effects (serum enzymes/bilirubin, cholesterol)
  - ❑ Immunological effects (decreased vaccination response, asthma)
  - ❑ Developmental effects (birth weight)
  - ❑ Endocrine effects (thyroid disease)
  - ❑ Reproductive effects (decreased fertility)
  - ❑ Cardiovascular effects (pregnancy induced hypertension)
  - ❑ Cancer* (testicular, kidney)

https://pfas-1.itrcweb.org/7-human-and-ecological-health-effects-of-select-pfas/

WHAT ARE PFAS?

A large, diverse group of manufactured compounds that have been used for decades in industries and hundreds of industrial applications and consumer products.

- Oil/Water/Grease properties
- Entirely man-made
- Bioaccumulative
- Hydrophilic
- Have documented health impacts

AEROSPACE

AUTOMOTIVE

APPAREL & TEXTILES

FOOD PACKAGING

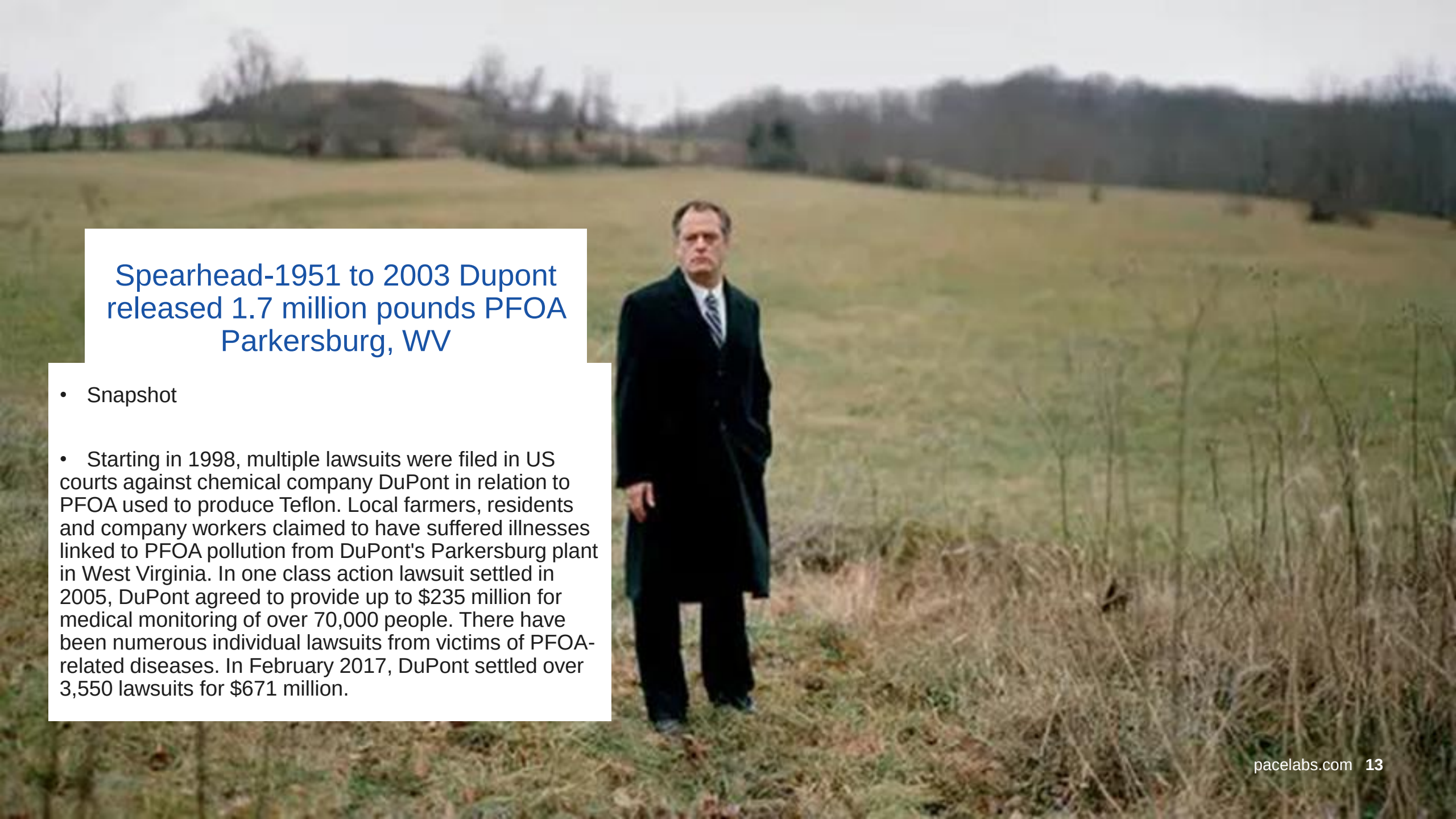
FIRE-FIGHTING FOAMS

NON-STICK COATINGS/ COOKWARE

WIRE

CARPETING

METAL PLATING



Spearhead-1951 to 2003 Dupont released 1.7 million pounds PFOA Parkersburg, WV

- Snapshot

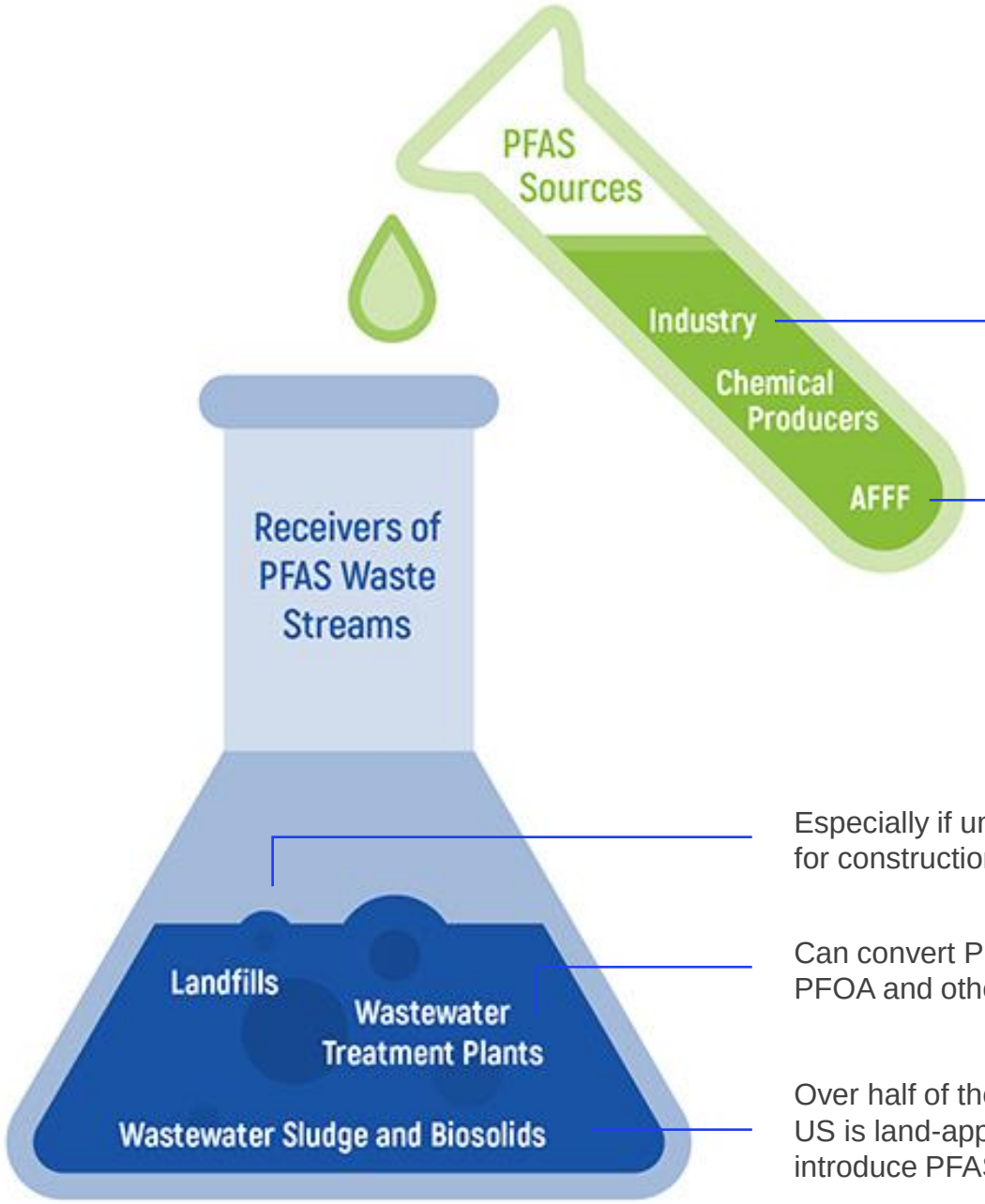
- Starting in 1998, multiple lawsuits were filed in US courts against chemical company DuPont in relation to PFOA used to produce Teflon. Local farmers, residents and company workers claimed to have suffered illnesses linked to PFOA pollution from DuPont's Parkersburg plant in West Virginia. In one class action lawsuit settled in 2005, DuPont agreed to provide up to $235 million for medical monitoring of over 70,000 people. There have been numerous individual lawsuits from victims of PFOA-related diseases. In February 2017, DuPont settled over 3,550 lawsuits for $671 million.

THE PFAS PUZZLE

- Lack of federal regulation
- Non-uniformity of state regulations or test methods
- Lack of environmental test methods
- Variety of compound lists
- Thousands of PFAS compounds
- Low DLs vs. contaminated matrices
- Ultra restrictive field sampling guidance

THE PFAS LIFECYCLE

- Industry is the most common source of PFAS contamination - both the manufacturers of PFAS chemicals and those that use them in the products they make.
- PFAS do not degrade naturally, chemicals can remain in the surrounding soil for decades.



- Textile manufacturing
- Certain paper food wrapping
- Metal plating & etching
- Wire manufacturing
- Pesticides
- Personal care products
- Non-stick cookware

Department of Defense and other users of AFFF (Aqueous film forming foam)

Especially if unlined, such as those used for construction and demolition debris

Can convert PFAS precursors into PFOA and other PFAAs

Over half of the sludge produced in the US is land-applied as biosolids and may introduce PFAS into the food chain

PFAS IN WWTP BIOSOLIDS

- PFAS have been found in domestic sewage sludge
- More than half of the sludge produced in the United States is applied to agricultural land as biosolids
- Application of biosolids as a soil amendment can result in a transfer of PFAS to soil
- PFAS can enter the food chain using biosolids-amended soil
- PFAS concentrations can be elevated in surface and groundwater in the vicinity of agricultural fields that received PFAS contaminated biosolids

Burlington, N.C. Wastewater Treatment Plants Being Sued for PFAS Pollution

The Southern Environmental Law Center issued a notice with the intent to sue Burlington, N.C. for per- and polyfluoroalkyl substances (PFAS) pollution in Haw River and Jordan Lake.

"Families in Pittsboro and other downstream communities deserve to know that the water that comes out of their taps is safe" said Geoff Gisler, senior attorney at the SELC. "The Haw River is an incredible resource; stopping this preventable pollution will take us one step closer to making it as clean as it is beautiful."

Burlington must take immediate steps to redress these violations, including, but not limited to:

- Preventing the direct discharge of PFAS and 1,4-dioxane from its wastewater treatment plants by:
  - Managing its pretreatment program to require industrial facilities to disclose and remove these chemicals before their industrial wastewater enters Burlington's treatment plants; *and/or*
  - Installing treatment technology at its treatment plants that is capable of removing PFAS and 1,4-dioxane; *and*
  - Monitoring its wastewater to ensure these chemicals are not present prior to discharge into surface waters.

- Managing its sludge disposal so that contaminated sludge does not harm human health or the environment.

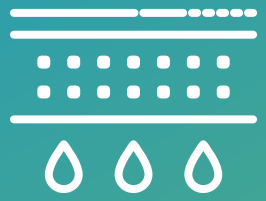
https://www.wwdmag.com/contaminants/news/10938252/burlington-nc-wastewater-treatment-plants-being-sued-for-pfas-pollution

PFAS OVERVIEW

- SOURCES & RECEIVERS
- TEST METHODS
- REGULATORY UPDATE
- FIELD SAMPLING & RESOURCES
- TAKE-AWAYS

CHOOSING THE RIGHT TEST METHODS

Drinking water



Groundwater, surface water, & leachate

Wastewater, sludge & biosolids

AFFF – concentrate & diluted

Soil, sediment, solid waste & other solids

Air & emissions

Biota – plant & animal tissue

Selected industrial & consumer products

EPA 537.1

- First Published DW Method
- Reports 18 PFAS
- Used for Compliance
- FRB Required
- MS/MSD are part of QC
- Does not use Isotope Dilution

EPA 537.1 (18) DW only	
Acronym	**CAS Number**
PFHxA	307-24-4
PFHpA	375-85-9
PFOA	335-67-1
PFNA	375-95-1
PFDA	335-76-2
PFUnA	2058-94-8
PFDoA	307-55-1
PFTrDA	72629-94-8
PFTA	376-06-7
PFBS	375-73-5
PFHxS	355-46-4
PFOS	1763-23-1
NMeFOSAA	2355-31-9
NEtFOSAA	2991-50-6
HFPO-DA	13252-13-6
ADONA	919005-14-4
9Cl-PF3ONS	756426-58-1
11Cl-PF3OUdS	763051-92-9

EPA 533

- Uses Isotope Dilution
- Accounts for analyte losses
- 25 PFAS reported
- Addition of source identifiers such as:
  - NFDHA (food packaging)
  - PFEESA (replacement)
  - PFMOPrA (manufacturing)
  - PFMOB (manufacturing)
- Requires FRB
- MS/MSD for QC

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

USEPA reports 25 from EPA 533 and 4 that do not overlap from EPA 537.1

ANALYTE	537.1	533
PFEESA		•
HFPOA-DA/Gen X	•	•
NFDHA		•
PFOS	•	•
PFUdA	•	•
N-MeFOSAA	•	
PFPeA		•
PFPeS		•
6:2 FTS		•
N-EtFOSAA	•	
PFHxA	•	•
PFDoA	•	•
PFOA	•	•
PFDA	•	•
PFHxS	•	•
PFBA		•
PFBS	•	•
PFHpA	•	•
PFHpS		•
PFNA	•	•
PFTeDA	•	
PFMOPrA		•
8:2 FTS		•
PFTrDA	•	
9Cl-PF3PONS	•	•
4:2 FTS		•
11Cl-PF3OUdS	•	•
PFMOBA		•
ADONA	•	•

Draft Method EPA 1633

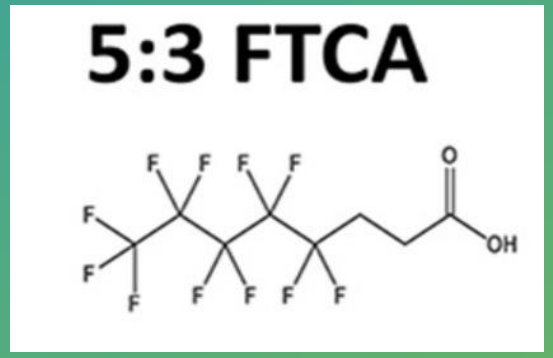
- EPA announced the method Sept 2021
- Eight matrices - wastewater, surface water, groundwater, soils, biosolids, tissue, leachate, and sediment
- Single lab validation, 2022 and on multi-lab validation
- We are on Draft 3
- EPA/DOD combined effort
- DM 1633 should phase out” 537Modified” methods
- DM 1633 will be finalized for aqueous matrices such as leachate ahead of solids
- DM 1633 being added to NPDES permits and some municipal landfill groundwater monitoring programs

Image copied from: Cincinnati Enquirer

40 PFAS Compounds in Draft 1633

Analyte	Analyte
PFBA	8:2 FTS
PFPeA	PFOSA
PFHxA	N-MeFOSAA
PFHpA	N-EtFOSAA
PFOA	HFPO-DA
PFNA	PFMOPrA
PFDA	ADONA
PFUnDA	9Cl-PF3ONS
PFDoDA	11Cl-PF3OUdS
PFTrDA	**3:3 FTCA**
PFTeDA	**5:3 FTCA**
PFBS	**7:3 FTCA**
PFPeS	N-EtFOSA
PFHxS	N-EtFOSE
PFHpS	NFDHA
PFOS	N-MeFOSA
PFNS	N-MeFOSE
PFDS	PFDoS
4:2 FTS	PFEESA
6:2 FTS	PFMOBA

- 1633 will help unify PFAS lists
- All 29 PFAS from UCMR 5 are included in this method
- Can aid drinking water plants in source identification of PFAS present in their raw and finished product



5:3 fluorotelomer carboxylic acid (FTCA) is a common and often dominant constituent of PFAS found in landfills and is released from carpet in model anaerobic landfill reactors. This compound could prove to be an indicator of PFAS in the environment originating from landfills (Lang et al. 2017[63], 2016[64]).

Draft EPA 1633 LOQ/LOD for Aqueous and Solid Matrices

	Water, ng/L		Soil, µg/kg	
Acronym	RL	MDL	RL	MDL
PFBA	4	0.55	0.8	0.14
PFPeA	2	0.29	0.4	0.06
PFHxA	1	0.12	0.2	0.08
PFHpA	1	0.16	0.2	0.03
PFOA	1	0.16	0.2	0.04
PFNA	1	0.17	0.2	0.04
PFDA	1	0.18	0.2	0.04
PFUnA	1	0.18	0.2	0.03
PFDoA	1	0.17	0.2	0.04
PFTrDA	1	0.20	0.2	0.03
PFTeDA	1	0.17	0.2	0.03
PFBS	1	0.10	0.2	0.03
PFPeS	1	0.12	0.2	0.03
PFHxS	1	0.17	0.2	0.03
PFHpS	1	0.11	0.2	0.02
PFOS	1	0.26	0.2	0.05
PFNS	1	0.22	0.2	0.04
PFDS	1	0.15	0.2	0.03
PFDoS	1	0.34	0.2	0.03
PFOSA	1	0.15	0.2	0.05

	Water, ng/L		Soil, µg/kg	
Acronym	RL	MDL	RL	MDL
NEtFOSA	1	0.14	0.2	0.06
NMeFOSA	1	0.15	0.2	0.03
NEtFOSE	10	2.36	2	0.44
NMeFOSE	10	1.52	2	0.40
NEtFOSAA	1	0.28	0.2	0.03
NMeFOSAA	1	0.19	0.2	0.05
4:2 FTS	4	0.63	0.8	0.15
6:2 FTS	4	0.95	0.8	0.14
8:2 FTS	4	0.54	0.8	0.13
PFMPA	2	0.32	0.4	0.04
PFMBA	2	0.30	0.4	0.04
HFPO-DA	4	0.89	0.8	0.10
NFDHA	2	0.49	0.4	0.06
ADONA	4	0.57	0.8	0.10
PFEESA	2	0.48	0.4	0.05
9Cl-PF3ONS	4	0.73	0.8	0.08
11Cl-PF3OUdS	4	0.94	0.8	0.11
3:3FTCA	5	1.48	1	0.21
5:3FTCA	25	1.88	5	1.11
7:3FTCA	25	2.56	5	1.00

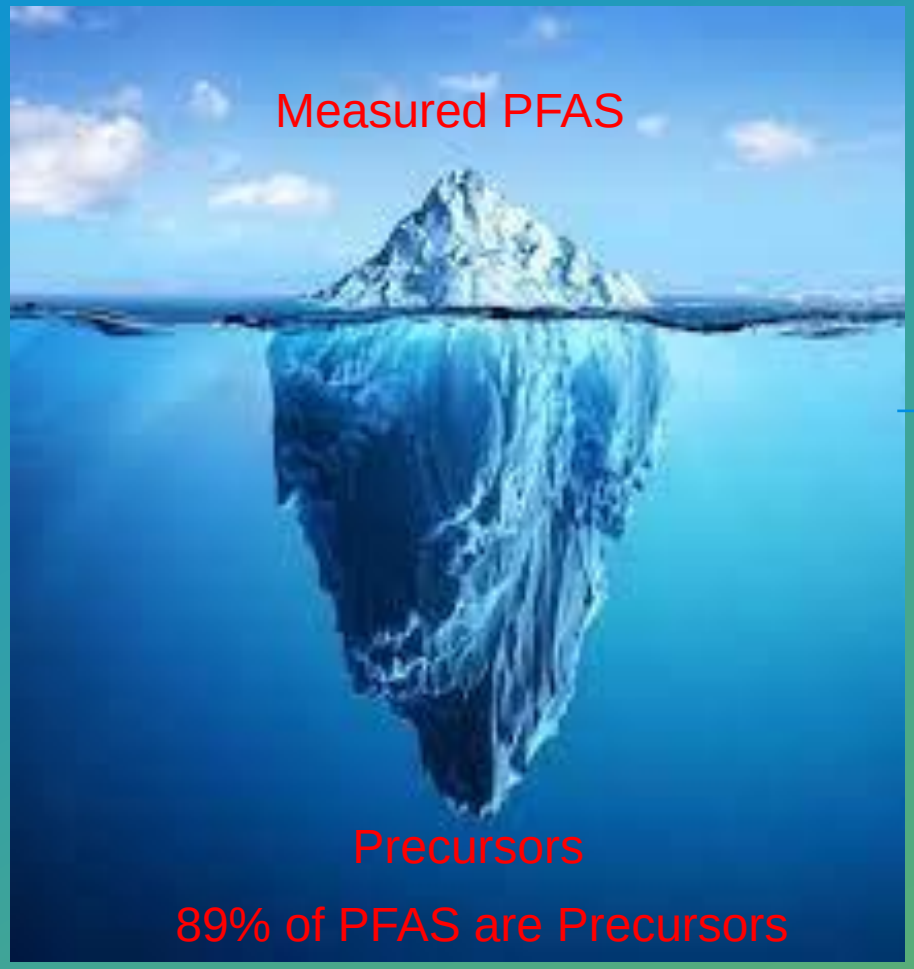
Note:
Leachate RLs are 5×
Biosolids RLs are 10×

PFAST®

EPA 8327/ASTM D8421

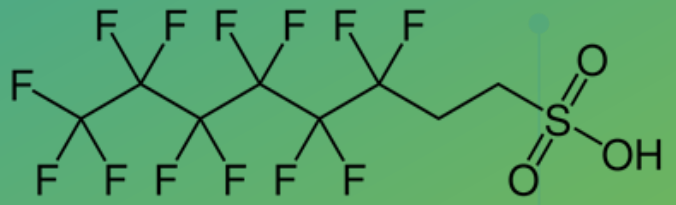
- LOQ ~10 ppt
- Pricing is a plus
- Faster on average TAT
- Currently 10 PFAS Compounds- which include your heavy hitters
  - PFOA, PFOS, PFBS
- List to expand to 40+ PFAS 2023
- Useful for pilot studies, bench scale remediation technologies, destruction technologies
- SW-846 8327 and ASTM D8421 needs vary by regulatory agency
- D8421 44 compounds, all DM 1633 40 are included in this list

TOP (Total Oxidizable Precursor) Assay



Heat/Oxidation

- Under TOP Assay conversion occurs of known and unknown precursors to terminal PFAS (PFCA)
- Degradation of any precursor would be to an equal or shorter chain length

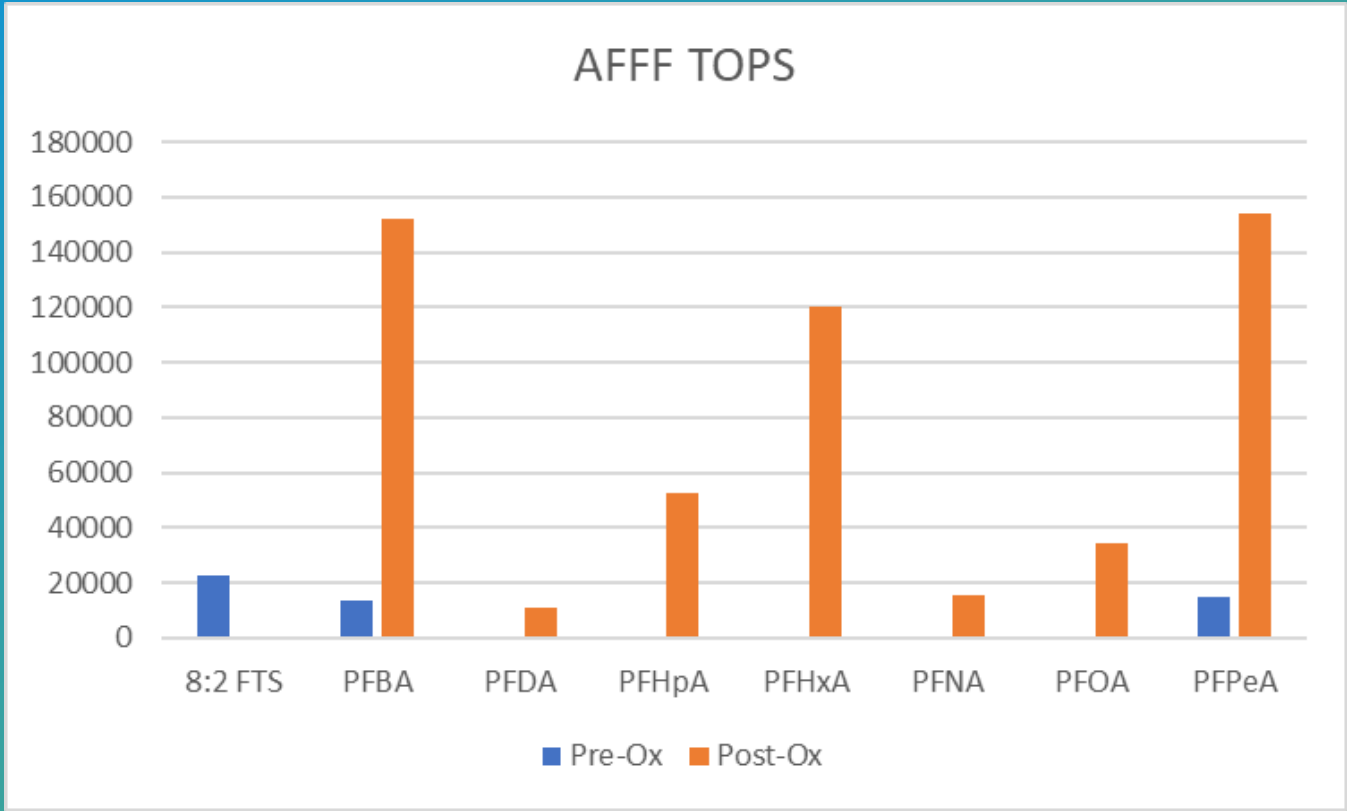


6:2 FTS

PFHxA

https://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/

TOPS Table Pre-Ox and Post-Ox



	Pre-Ox	Post-Ox
8:2 FTS	22300	0
PFBA	13700	152000
PFDA	0	10900
PFHpA	0	52600
PFHxA	0	120000
PFNA	0	15500
PFOA	0	34500
PFPeA	14900	154000
Total	50900	539500

What is Fluorine?

Fluoride vs Fluorine

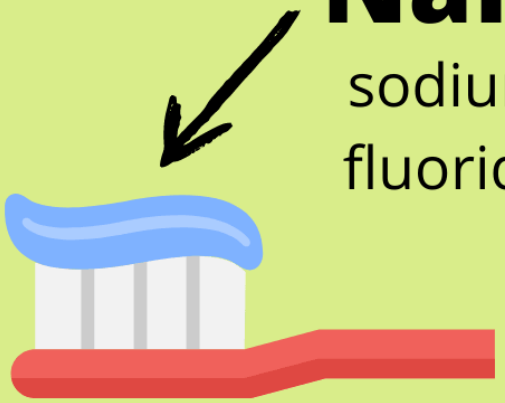
Fluoride is either the fluorine ion or a compound containing fluorine.

F^-

fluoride ion

NaF

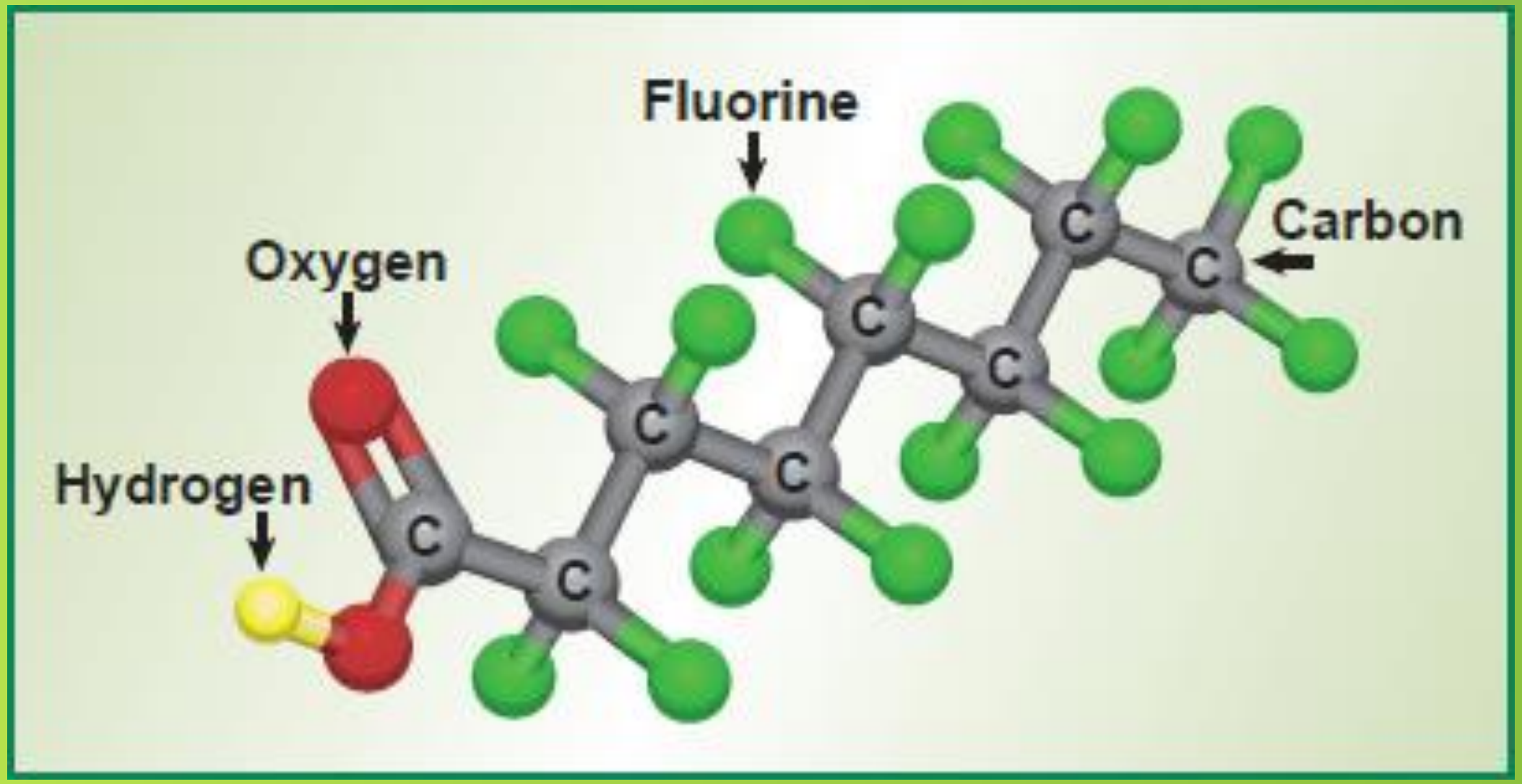
sodium fluoride



Fluorine is an element on the periodic table.

sciencenotes.org

What is Organofluorine?



What is True-TOF®?

True-TOF® is a capability that Pace has brought to market that involves the use of a novel combustion-ion chromatography (CIC) platform developed by Metrohm. The technology involves a built-for-purpose CIC (Profiler^{F}) that was developed solely for organofluorine testing. Pace partnered with Metrohm and was the first commercial testing laboratory to offer this service.

The advantage of the True-TOF® method is that it allows Pace to simultaneously quantify total fluorine, or TF (combusted at high temperature) and inorganic fluoride (IF) using two parallel IC modules. Subtracting the TF from the IF gives you the True-TOF® value.

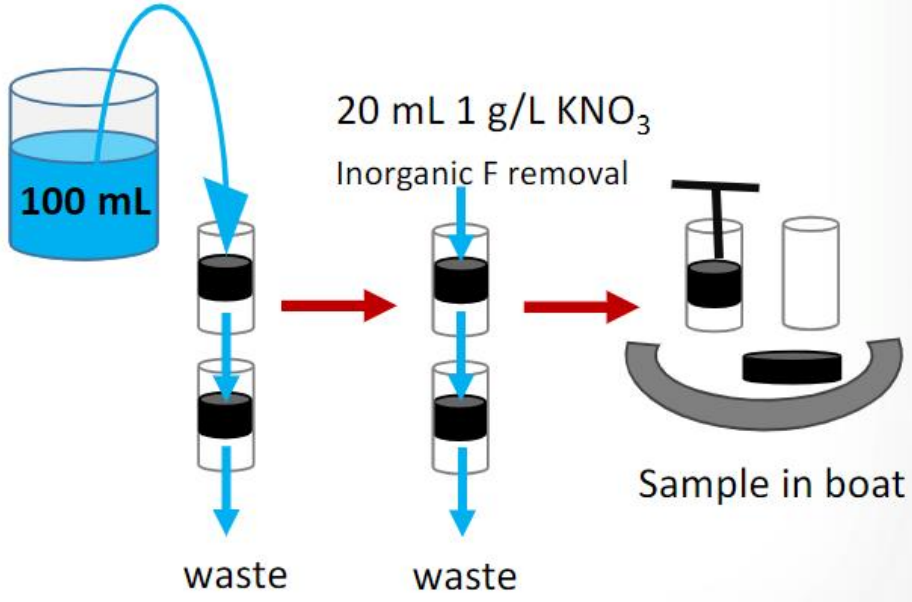
LOQ_a = 50 ppb OR 30%IF Conc.
VOLUME = 10 mL

Approach – AOF/CIC

EPA 1621

How:

- Screening method adsorbs contaminants onto granular activated carbon, removal of inorganic fluoride with nitrate solution, followed by combustion of the carbon
- Organofluorine compounds are converted to fluoride in the combustion process and measured by ion chromatography



Method Detection Limit: 1.4 - 2.2 µg/L

AOF Results for Industrial Discharge

Sample ID	AOF (ug/L)	SUM PFAS (ng/L)	SUM PFAS (ug/L)	SUM PFAS as F (ug/L)	SUM PFAS as % of AOF	AOF FACTOR
Discharge A	970	450	0.45	0.288	0.03%	3368
Discharge B	47	204	0.204	0.13056	0.28%	360
Discharge C	6.3	99	0.099	0.06336	1.01%	99
Discharge D	14	368	0.368	0.23552	1.68%	59

- Sum of PFAS is from 1633 data
- Sum of PFAS as F is 1633 total X 0.64 The 0.64 is the average percent of all 40 PFAS where the weight comes from Organic Fluorine.
- As you can see from Discharge A our results is 970 ppb for AOF but our Sum of PFAS as F is 0.288 ppb. This shows we are only accounting for 0.03% of Organic Fluorine when looking at the 1633 results.
- AOF considers all Precursors and PFAS we can't measure along with other compounds herbicides , pesticides , pharmaceutical, etc. that contain Organic Fluorine.

PFAS OVERVIEW

- SOURCES & RECEIVERS
- TEST METHODS
- REGULATORY UPDATE
- FIELD SAMPLING & RESOURCES
- TAKEAWAYS

2003
Phase-out of PFOA/PFOS production

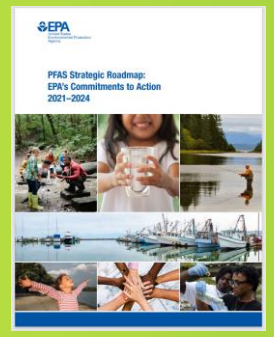
2009
Provisional Drinking Water Health Advisories for PFOA and PFOS (400 ng/L)

2013-2015
Third Unregulated Contaminant Monitoring Rule for six PFAS

2016
Lifetime Health Advisories for PFOS and PFOA (70 ng/L)

2018
PFAS National Leadership Summit

2021
EPA Releases PFAS Road Map



June 2022
New Lifetime Health Advisories for PFOA, PFOS, PFBS, GenX

Future Timeline, dates subject to change

2022
Draft PFAS National Primary Drinking Water Regulation

2023-2025
UCMR5 PFAS Sampling (29 PFAS)

2023
Final PFAS National Primary Drinking Water Regulation

2023
Final Rule CERCLA Designation for PFOA, PFOS

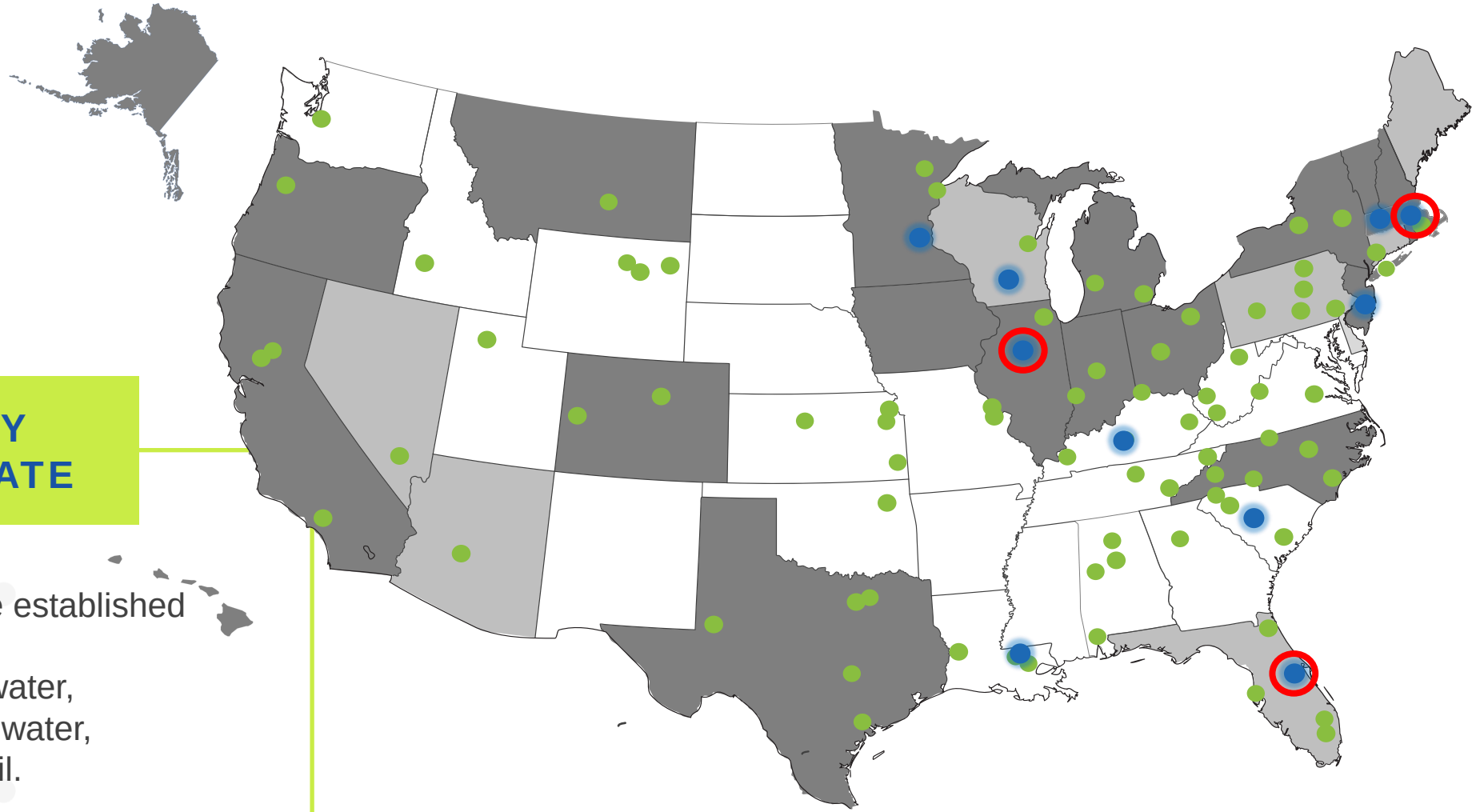
2024
Risk Assessment of PFAS in Biosolids

2024-2028
Regulatory Enforcement

REGULATORY UPDATE: STATE

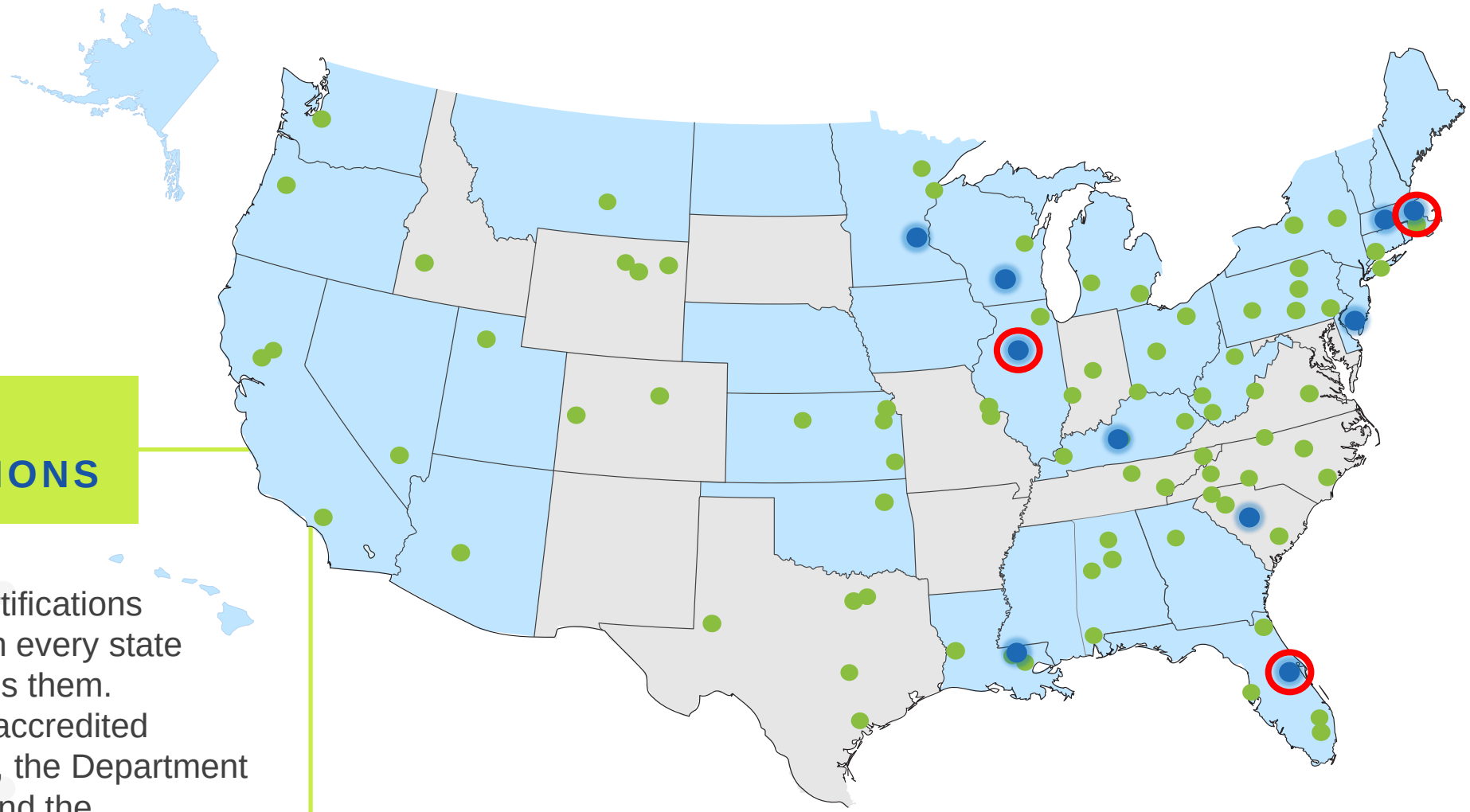
So far, 30 states have established standards/guidance for PFAS in drinking water, groundwater, surface water, wastewater and/or soil.

Source: https://pfas-1.itrcweb.org/



PFAS CERTIFICATIONS

Pace® maintains certifications and accreditations in every state that offers or requires them. We're also certified/accredited by TNI NELAC, ISO, the Department of Defense (DoD), and the Department of Energy (DOE).



PFAS Certified

PFAS Certification not available/required for non-DoD Projects

Pace® PFAS lab

Pace® laboratories & service centers

Pace® UCMR Laboratories

Pace® Gulf Coast and SC are PFAS DoD ELAP accredited throughout the US.

REGULATORY UPDATE: FEDERAL

- PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024
- Whole-of-agency approach
- Set timelines for specific actions and establishing new policies
- EPA Goals
  - Research – Invest, Development, Innovation
  - Restrict – Prevent PFAS land, air, water
  - Remediate – clean up contamination, human and ecological health

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

REGULATORY UPDATE: FEDERAL

- Restrict discharge on industrial releases of PFAS, NPDES (Winter 2022)
- Enhanced reporting under Toxics Release Inventory (TRI) (Spring 2022) ✓
- Restrict PFAS industrial discharges Effluent Limitations Guidelines (ELGs – Plan 15) (2022, ongoing) ✓
- Finalize risk assessment for PFOA/PFOS in biosolids (Winter 2024)
- Propose rule – PFOA/PFOS as hazardous substances (Spring 2022) ✓

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

REGULATORY UPDATE: FEDERAL

- GenX Toxicity report released 25-Oct-21 ✓
- Finalized UCMR 5 Rule 27-Dec-21✓
- PFBA Toxicity report released 22-Dec-22 ✓
- Establish a national drinking water MCL PFOA/PFOS 14-Mar-23 ✓
- Total of 5 PFAS toxicity reports: PFOA, PFOS, PFBS, GENX, PFBA ✓
- PFHxA, PFHxS, PFNA, and PFDA to follow (Fall 2021, ongoing)

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

REGULATORY UPDATE: FEDERAL

- EPA Issues Guidance to States to Reduce Harmful PFAS Pollution – 6-Dec-22
- Memorandum: Addressing PFAS Discharges in National Pollutant Discharge Elimination System (NPDES) Permits and Through the Pretreatment Program and Monitoring Programs
- Methods: Draft Method EPA 1633 and Draft Method EPA 1621
- NPDES permits
- POTW: Effluent, influent, and biosolids monitoring
- Pretreatment monitoring
- EPA recommends using draft method 1633 to analyze biosolids POTWs for the presence of 40 PFAS chemicals – Quarterly

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

Maine PFAS IN BIOSOLIDS

- Maine required all sludge to be screened (PFOA, PFOS, PFBS) starting in Mar 2019
- Maine developed PFAS screening level for beneficial use for sludge and sludge-derived compost intended for land application
- Introduced H.P. 1417 in Jan 2022 - Soil screening levels: PFOA 2.5 ng/g, PFOS 5.2 ng/g, and PFBS 1,900 ng/g
- L.D. 1911 signed into law Apr 2022
- Ban on land application of sludge and sludge-derived compost from municipal, industrial, or commercial treatment plant

Source: https://www.maine.gov/dep/spills/topics/pfas/Maine-PFAS-Screening-Levels-Rev-6.28.21.pdf
https://www.crops.org/news/science-news/getting-solid-soil-response-biosolids-application/

Michigan PFAS IN BIOSOLIDS

- Michigan EGLE - Required PFAS Sampling Prior to Land Application each year if land applying Apr 2022
  - PFOS ≥ 125 µg/kg - Biosolids are deemed to be industrially impacted and cannot be land applied
  - PFOS 50 -125 µg/kg - immediately notify EGLE, WRD staff, investigate sources, reduce land application to less than 1.5 dry tons/acre
  - PFOS 20 - 50 µg/kg - EGLE recommends investigating sources, increased monitoring (annually)
  - PFOS ≤ 20 µg/kg – may land apply, communicate with landowners/farmers

Source: https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Programs/WRD/Biosolids/PFAS-Biosolids-Interim-Strategy-2022.pdf
https://www.crops.org/news/science-news/benefits-biosolids-spread-across-decades-research

PFAS and USEPA Health Advisories (HAs) June 15, 2022 – EPA issued new HA levels for PFOA, PFOS, GenX and PFBS

- PFAS compounds of importance under the USEPA HAs – PFOA, PFOS, GenX, PFBS

In chemical and product manufacturing

- GenX (PFOA) – Chemours and DuPont
  - GenX replacement C6, PFOA Teflon C8
- PFBS (PFOS) – 3M
  - PFBS C4, PFOS Scotchgard C8

Source: https://www.epa.gov/sdwa/drinking-water-health-advisories-has

HEALTH ADVISORY LEVELS vs. REPORTING LIMITS

- How do the new Health Advisory levels correlate to current EPA test methods and their detection limits which are higher?
- GenX and PFBS – no problem
- PFOA and PFOS – challenging considerations

Chemical	Lifetime Health Advisory Level, ppt	Minimum Reporting Level, ppt (EPA 533 under UCMR 5)	Typical Lab Reporting Limit, ppt (EPA 533)	Typical Lab Method Detection Limit, ppt (EPA 533)
PFOA	0.004 (Interim)	4	2	0.32
PFOS	0.02 (Interim)	4	2	0.36
GenX	10 (Final)	5	2	0.8
PFBS	2,000 (Final)	3	2	0.44

Source: https://www.epa.gov/sdwa/drinking-water-health-advisories-has

On 14-Mar-23 EPA Proposed PFAS National Primary Drinking Water Regulation Maximum Contaminant Levels (MCLs)

Pace ANALYTICAL SERVICES

Proposed National Primary Drinking Water Regulation (NPDWR)

Compound	Proposed MCLG	Proposed MCL (enforceable levels)
PFOA	Zero	4.0 parts per trillion (also expressed as ng/L)
PFOS	Zero	4.0 ppt
PFNA	1.0 (unitless) Hazard Index	1.0 (unitless) Hazard Index
PFHxS		
PFBS		
HFPO-DA (commonly referred to as GenX Chemicals)		

https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas

Hazard Index Calculation

- Divide the measured individual PFAS concentrations by the Health Based Water Concentration (HBWC) - the level at which no adverse health effects are expected
- Sum the ratios to determine HI for that sampling event
- Average the HI value for each sampling event collected in the year (Running Annual Average)
- Note: PFOA and PFOS do not have a HI because their MCLGs are set to zero

Compound	Health Based Water Concentrations, ppt (MCLG)
HFPO-DA (GenX)	10
PFBS	2000
PFNA	10
PFHxS	9

$$Hazard\ Index = \left(\frac{[GenX]}{10\ ppt}\right) + \left(\frac{[PFBS]}{2000\ ppt}\right) + \left(\frac{[PFNA]}{10\ ppt}\right) + \left(\frac{[PFHxS]}{9\ ppt}\right)$$

UCMR 5 - BACKGROUND

UCMR - The Unregulated Contaminant Monitoring Rule of the SDWA

- Every 5 years EPA uses the Unregulated Contaminant Monitoring Rule (UCMR) to collect data on up to 30 contaminants that are suspected to be present in drinking water and do not have health-based standards set under the Safe Drinking Water Act
- UCMR is not a compliance monitoring program, the data is studied to consider adding contaminants to the regulated list with enforceable limits
- Two PFAS are examples of this – PFOA and PFOS

Source: USEPA UCMR 5: https://www.epa.gov/dwucmr/fifth-unregulated-contaminant-monitoring-rule

UCMR 5 - BACKGROUND

Changes from UCMR 4 to UCMR 5

- Addition of all systems that serve 3,300 – 10,000 consumers – compelled by AWIA 2018
- EPA is intent on paying for testing for all systems that serve 3,300 – 10,000 consumers in its "small systems" contract with 800 randomly selected smaller systems, "subject to the availability of appropriations"
- Addition of systems more than doubles the number required to participate to approximately 10,300

Source: USEPA UCMR 5: https://www.epa.gov/dwucmr/fifth-unregulated-contaminant-monitoring-rule

UCMR 5 – TESTING & SAMPLING

UCMR 5 contaminants and sampling

- 29 PFAS compounds by EPA 537.1 and EPA 533 – each sample will be required to include 1 Field Reagent Blank per method
- Lithium by EPA 200.7
- Sampling at the Entry Point To the Distribution System (EPTDS, EP, POE) only

Source: USEPA UCMR 5: https://www.epa.gov/dwucmr/fifth-unregulated-contaminant-monitoring-rule

EPA proposes to use CERCLA 102(a) authority to designate PFOA and PFOS as hazardous substances

- **precedent setting**
- focus of public comment
- “not intended to target pass through sources like Landfills”
- Final Rule August 2023

Potential Rulemaking is considered “economically significant”

- “Economic Assessment of the Potential Costs and Other Impacts of the Proposed Rulemaking to Designate Perfluorooctanoic Acid and Perfluorooctanesulfonic Acid as Hazardous Substances”.
- EPA is also soliciting additional input of specific economic factors for which they do not have robust information.

- Reporting obligations when there is a release of PFOA or PFOS above the reportable quantity (1 lb over 24 hour period)
- Obligations on the US Government when it transfers certain properties
- Obligation on DOT to under the Hazardous Materials Transportation Act

Effluent Guidelines Program (Plan 15)

- Describes analyses, studies, and rulemakings related to effluent limitations guidelines and pretreatment standards (ELGs)
- Rulemaking – ELGs for the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) category to address PFAS
- Rulemaking – Metal Finishers, chromium electroplating, mist/fume suppressants
- 2 of 3 studies focus on PFAS, Textile Mills and POTW influent
- Adding Landfills that discharge leachate/wastewater directly into surface water

53

PFAS OVERVIEW

- SOURCES & RECEIVERS
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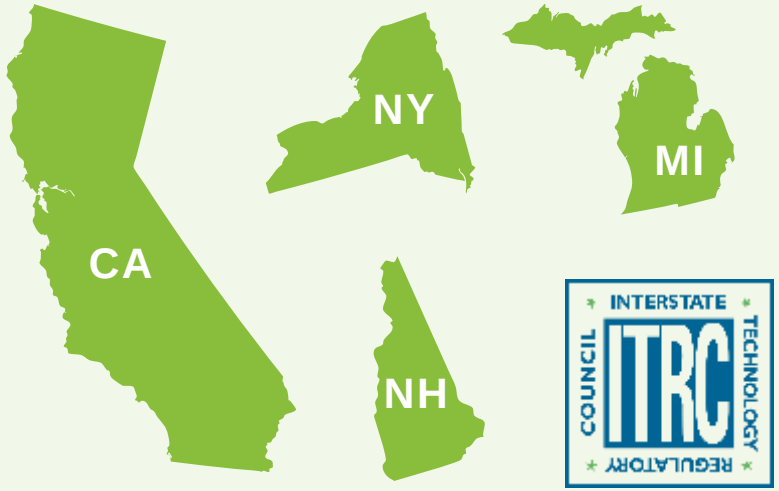
- TAKEAWAYS

SAMPLING GUIDANCE

- Traditional sampling materials contain PFAS: clothing, sunscreen, bug repellant, footwear, sampling equipment, waterproof notebooks
- PFAS reporting limits – single digit ppt levels
- More potential for field sampling activity to cause sample contamination
- Take measures to limit sample to PFAS exposure in the field
- Field quality control samples have heightened importance
- Mich EGLE field sampling - https://www.michigan.gov/pfasresponse/investigations/sampling-guidance



Numerous states and organizations have published stringent SOPs for drinking water, non-potable water, and soil

links available at the Pace PFAS webpage

Why is additional training necessary?

- These items contain PFAS and may contaminate your samples

FIELD SAMPLING

- Clothing and Hygiene
- No clothing or boots containing Gore-Tex™
- Safety boots must be made from polyurethane or PVC
- No materials containing Tyvek®
- Do not use fabric softener on clothing to be worn in field
- Do not use cosmetics, moisturizers, hand cream, or other related products the day of sampling
- Do not use unauthorized sunscreen or insect repellant
- Wet weather wear - made of polyurethane and PVC only
- Wash hands and put on powderless nitrile gloves
- No food or drink at the sampling site
- Sharpies® - jury is still out

FIELD QC SAMPLES

FIELD BLANK/FIELD REAGENT BLANK (FB/FRB)

meant to validate that field sampling activity did not cause sample contamination

EQUIPMENT/ RINSATE BLANK (EB)

meant to validate cleanliness of sampling equipment before sampling and between sampling points

TRIP BLANK (TB)

meant to validate that samples were not cross-contaminated in route to lab

SAMPLING REQUIREMENTS

Repack the Cooler

- Place sealed ziplip bags of samples and FRBs into large cooler liner bag
- Fill large cooler liner bag with ice
- Samples must be received at lab 2-10°C – within 48 hrs
- Samples must be received at lab 2-6°C – after 48 hrs
- If sampling on hot days and POE water is warm – consider keeping samples on ice overnight, drain cooler, and repack with ice
- LOTS of ice

PFAS OVERVIEW

- SOURCES & RECEIVERS
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CONTEXT AND TAKEAWAYS

- PFAS are now well down the path to become regulated in drinking water and wastewater – consider budgeting now
- PFAS will soon be required for solid waste facilities and selected wastewater dischargers
- 6 PFAS MCLs have been proposed
- UCMR 5 is finalized and requires sampling 2023-2025 and may lead to additional PFAS set with MCLs
- Carefully consider detection limits, upstream sources, consumer perception, financial and legal implications, treatment options
- Not all labs are created equal – regulated parameters and unregulated parameters like PFAS and UCMR
- Pace® Analytical is your source the most current information and truly full-service lab testing

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QUESTIONS?

THANK YOU

Additional resources:

- PFAS.com
- PACELABS.COM | Search: PFAS

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