



Environment Testing  
TestAmerica

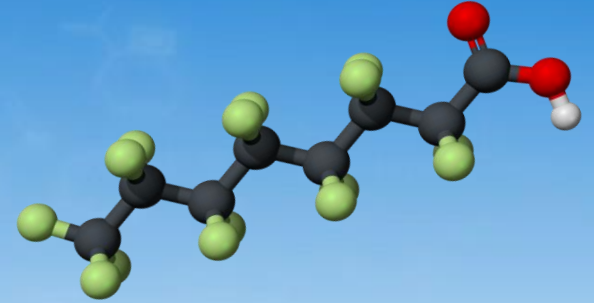
# PFAS Basics: An Introduction to the Chemistry, Sources, Regulation and Analysis

Presented by: **Karla Buechler** – Corporate Technical Director  
Eurofins TestAmerica

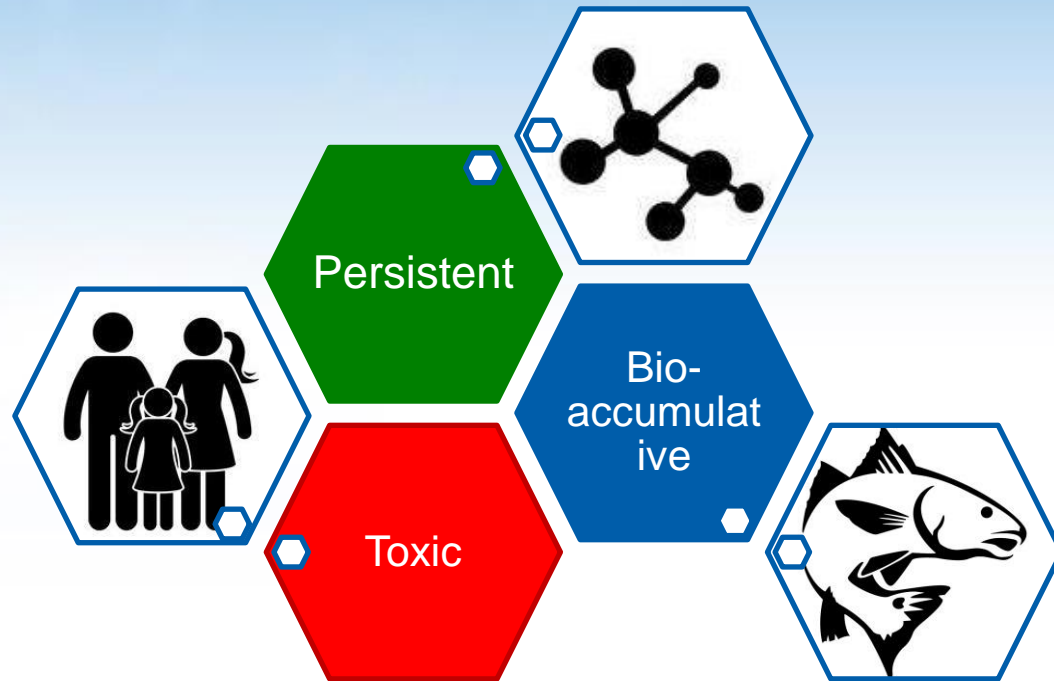


# What are PFAS?

Synthetic compounds formed from **carbon** chains with **fluorine** atoms attached

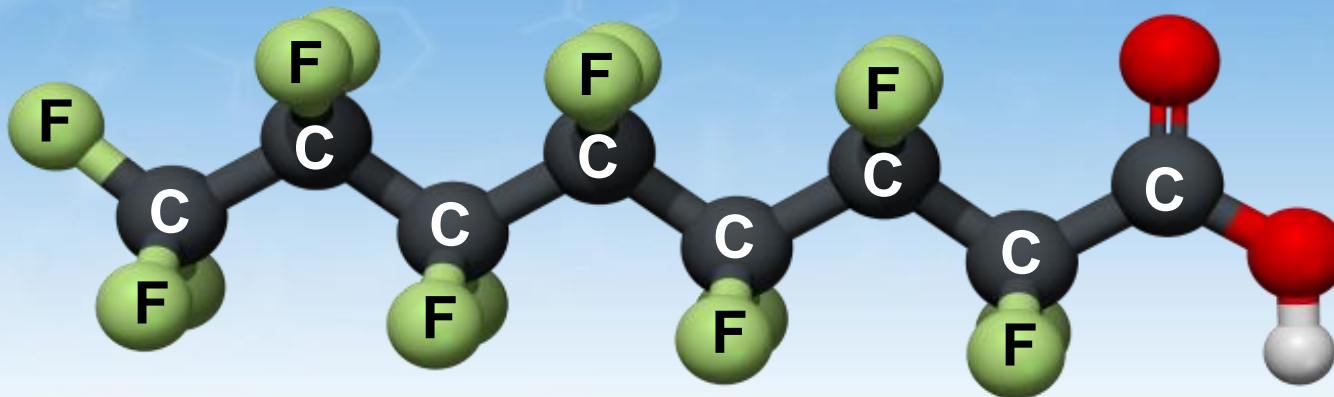


The **C-F bond** is one of the shortest and strongest in nature

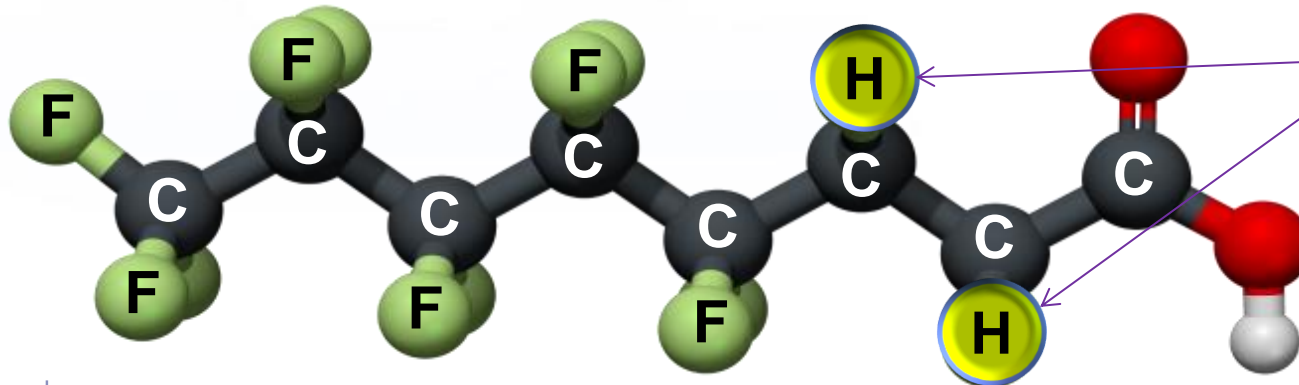


# Per and Poly?

**Perfluorinated = Completely Fluorinated**



**Polyfluorinated = Incompletely Fluorinated**



# Nomenclature

**PFAS**

Per- and Polyfluoroalkyl Substances

**Non-Polymer**

Per- and Polyfluorinated

**PFAAs**

Perfluoroalkyl Acids

**PFSAAs**

Perfluorinated sulfonic acids

**PFOS**

**PFCAs**

Perfluoroalkylcarboxylic acids

**PFOA**

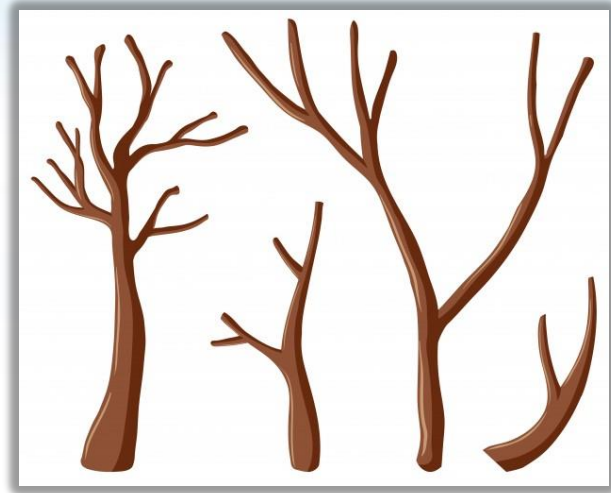
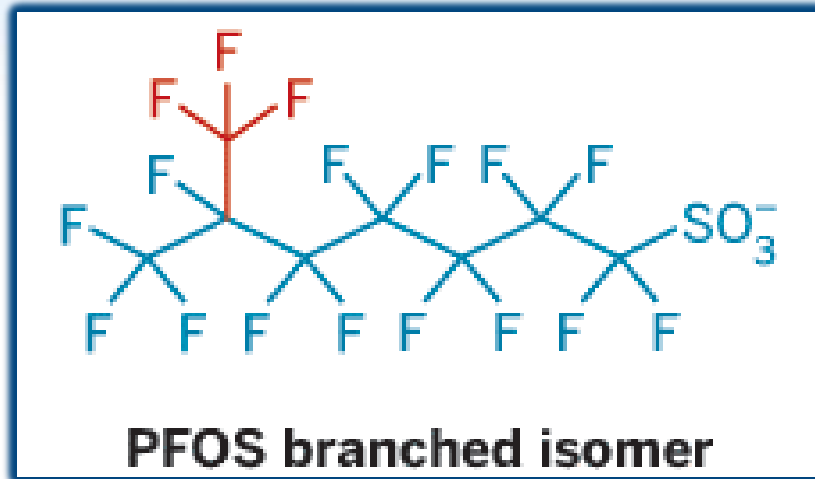
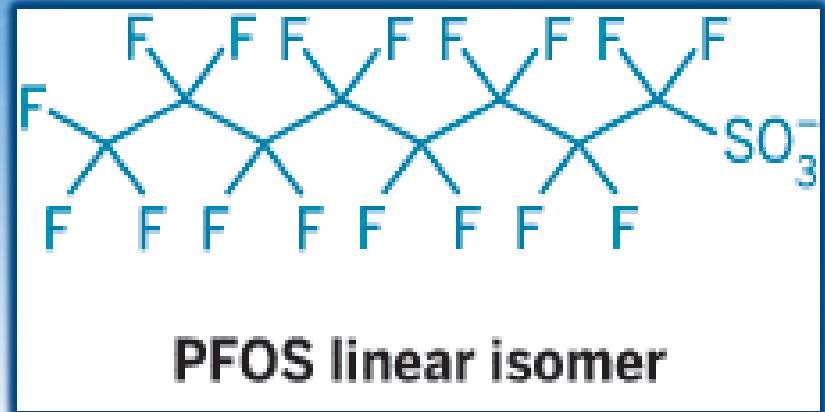
Completely &  
Incompletely  
Fluorinated

Completely  
Fluorinated

~~PFCs~~

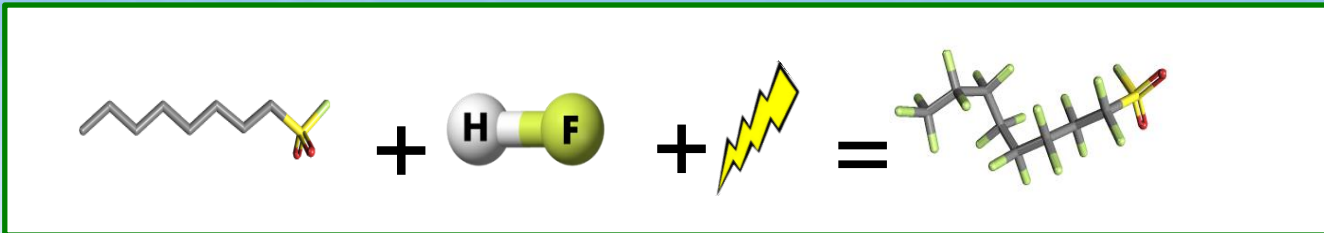
*you say*   
**TOMATO**  
 *I say*  
**TOMATO**

# Branched & Linear Isomers

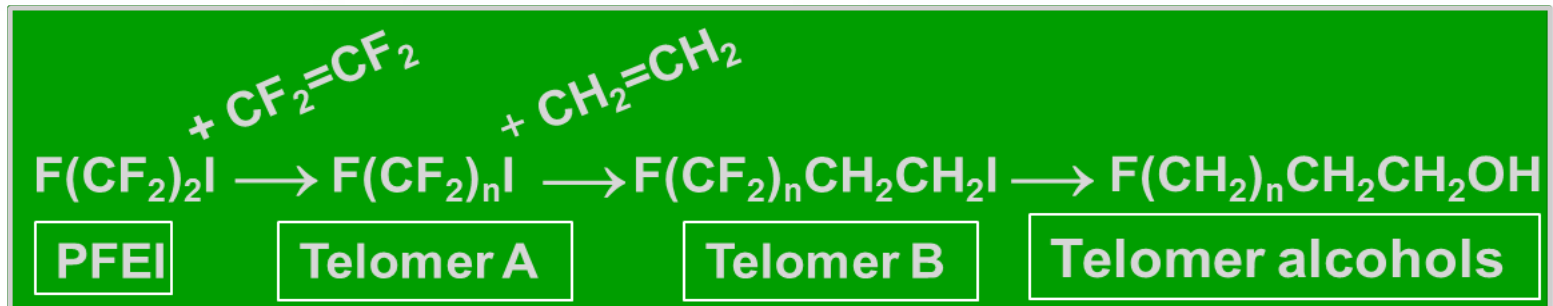


# PFAS Formation

**ECF Reaction** = B&L & Unintended PFAS (Precursors)



**Telomer Reaction:** Mostly L & unintended PFAS (Precursors)



# Where do they come from?

Raw Materials  
Industrial Chemicals

Fire Training  
Emergency Response

Stain Resistant,  
Water Repellant,  
Non-Stick Products

Manufacturing

AFFF

Consumer  
Products



# Example Uses



Automotive  
Textiles  
Carpet/Furniture  
Paper/Pulp  
Metal/Surface Finishers  
Paint  
Personal Care Products  
Chemicals  
Semiconductor  
Aerospace  
Mining  
Car Washes  
Stone Cutting/Sealing



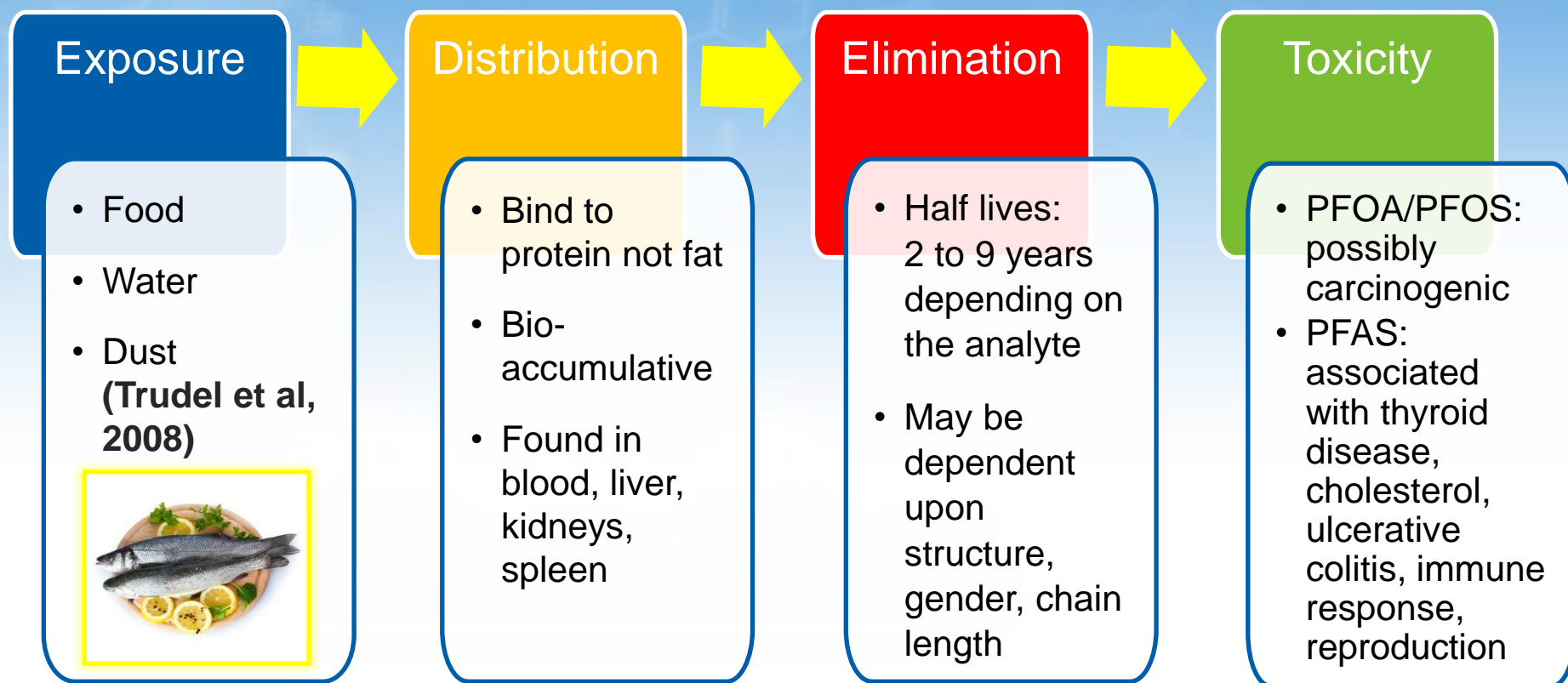
# Landfill Leachate

- Complex matrix
- Wide range of concentrations
- More short than long chains
- PFBA/PFBS/5:3FTCA dominant
- Can represent <1% of mass flow from WWTP
- Can be a minor source to aqueous environment



Polyfluoroalkyl compounds in landfill leachates Jan Buschab, et al  
National Estimate of Per- and Polyfluoroalkyl Substance (PFAS) Release to U.S. Municipal Landfill Leachate Lang JR, et al

# What is the risk?



# State Drinking Water Limits

State	PFOA ppt	PFOS ppt	Ratified Y/N	Comments
North Carolina	NA	NA	N	"GenX" 140 ppt
Nevada	667	667	N	
AK, AZ, AL, CO, ME, RI, WV	70	70	Varies	Adopted HAL from 2016
CT & MA	70	70	N	PFNA, PFHxA, PFHpA
Minnesota	35	15	Y/N	PFBA 700ppt PFBS 200ppt PFHxS 47ppt
Vermont	20	20	Y	PFNA, PFHxA, PFHpA
New Hampshire	12	15	N	PFNA 11ppt PFHxS 18ppt
California	14	13	N	
New Jersey	14	13	N/Y	PFNA 13 ppt
Michigan	8	16	N	PFNA 6ppt PFHxS 51ppt GenX 370ppt PFBS 420ppt PFHxA 400,000ppt
New York	10	10	N	

**USEPA  
Health Advisory Limit  
= 70 ppt**



# State GW/SW Limits

State	PFOA ppt	PFOS ppt	Ratified Y/N	Comments
Oregon	24,000	300,000	Y	PFNA/PFHpA/PFOA
North Carolina	2,000	NA	Y	
Texas	290	560	Y	PCLs for 16 PFCs
Maine	130	560	N	
AK, PA, RI, DE, IA, NH, CO	70	70	Varies	
Connecticut	70	70	N	PFNA/PFHxA/PFHpA
Wisconsin	20	20	N	
Minnesota	35	15	N	PFBA 700ppt PFBS 200ppt PFHxS 47ppt
Vermont	20	20	Y	PFNA, PFHxA, PFHpA
Massachusetts	20	20	N	PFNA, PFHxA, PFHpA, PFDA
New Hampshire	12	15	Y/N	PFNA 11ppt PFHxS 18ppt
Michigan	420	11	Y	SW; 70ppt GW
New Jersey	10	10	N/Y	13 ppt for PFNA



<https://pfas-1.itrcweb.org/fact-sheets/>

# EPA Method 537.1

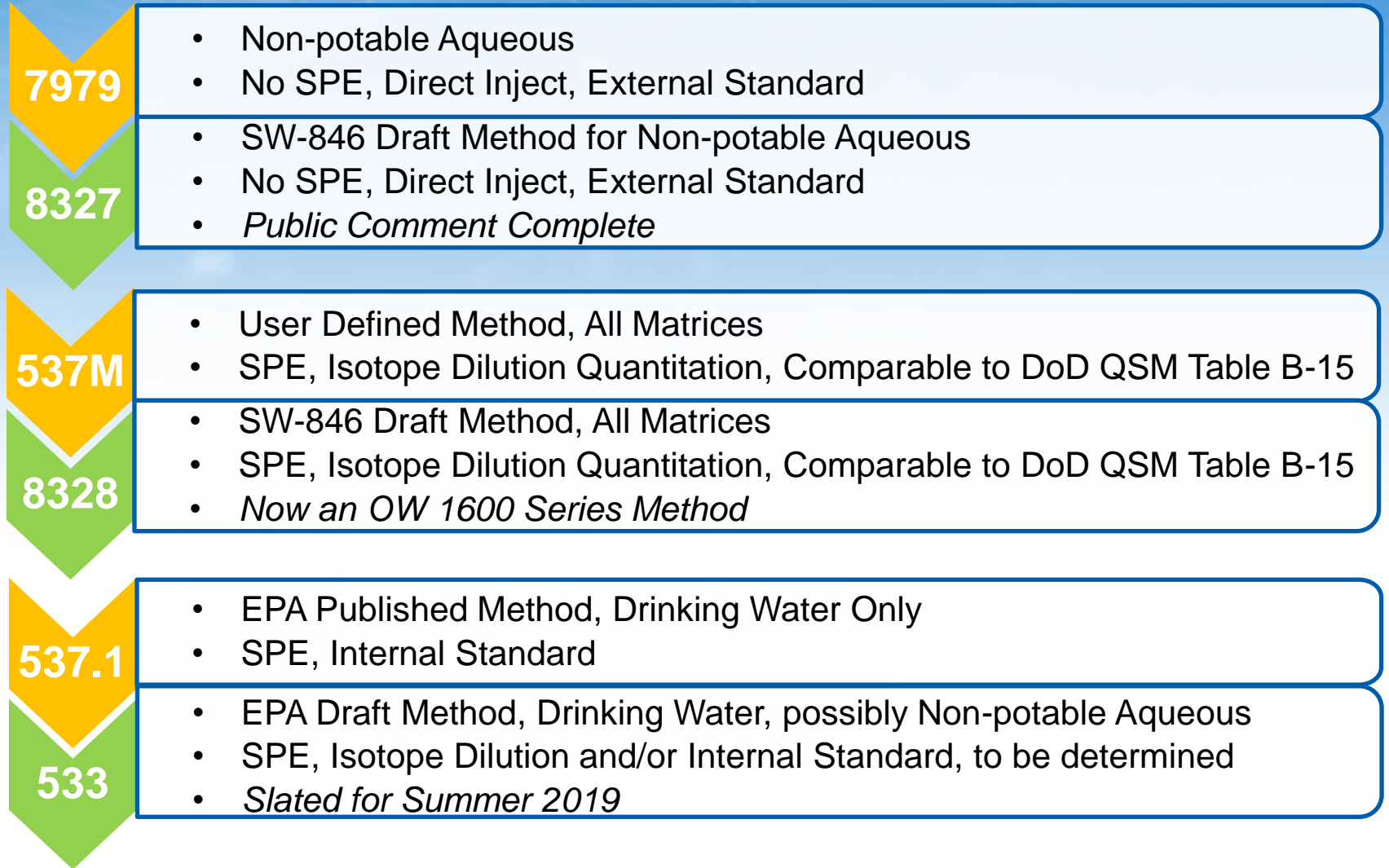
## “A Drinking Water Method Only”

**UPDATE  
TO 537  
REV 1.1**



Features	Method 537.1
Matrices	Drinking Water
<b>Analyte List</b>	<b>14 + 4 replacement chemicals</b>
Sample size	250 mls
Holding times	14 days for extraction
Aqueous Extraction	SPE SDVB
Analysis	LCMSMS - no confirmation ion
Includes Branched and Linear Isomers	Yes, for available standards
Quantitation	Internal standard
Reporting Limits	(2 ppt - 40 ppt)
Isotope Recovery Correction	No
LCS recovery limits	70-130

# Available vs. Future



# EPA DRAFT Target Analyte List

Analyte Description	CAS Number
Perfluorobutanoic acid (PFBA)	375-22-4
Perfluoropentanoic acid (PFPeA)	2706-90-3
Perfluorohexanoic acid (PFHxA)	307-24-4
Perfluoroheptanoic acid (PFHpA)	375-85-9
Perfluorooctanoic acid (PFOA)	335-67-1
Perfluorononanoic acid (PFNA)	375-95-1
Perfluorodecanoic acid (PFDA)	335-76-2
Perfluoroundecanoic acid (PFUnA)	2058-94-8
Perfluorododecanoic acid (PFDoA)	307-55-1
Perfluorotridecanoic Acid (PFTriA)	72629-94-8
Perfluorotetradecanoic acid (PFTeA)	376-06-7
Perfluorobutanesulfonic acid (PFBS)	375-73-5
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4
Perfluorohexanesulfonic acid (PFHxS)	355-46-4
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8
Perfluorooctanesulfonic acid (PFOS)	1763-23-1
Perfluorononanesulfonic acid (PFNS)	8789-57-2
Perfluorodecanesulfonic acid (PFDS)	335-77-3
Perfluorooctane Sulfonamide (FOSA)	754-91-6
N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	2355-31-9
N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	2991-50-6
4:2 FTS	757124-72-4
6:2FTS	27619-97-2
8:2FTS	39108-34-4
Adona	958445-44-8
HFPO-DA (GenX)	13252-13-6
F-53B	STL02459

EPA Draft  
Target Analyte List

Replacement Chemicals

# Managing Artifacts



Field Crew:  
personal care, clothing, food,  
visitors, notebooks, tarps

Sampling Equipment:  
bailers, pumps, tubing, valves



Sample Collection:  
wash hands, wear gloves, don't  
filter, include field QC





# Precursors



# PFCA Pattern – MeFOSA Precursor



# Conclusions

- Thousands of compounds with diverse properties
- Used extensively in many industries
- Persistent and bioaccumulative
- Largely unregulated yet litigious
- Future risk from precursors
- Sampling, analysis and data interpretation requires experienced teams



## Experience

- 20 Years of Experience
- Significant Investment in Method Development

## Capabilities

- Nations Largest LCMSMS Capacity
- Extensive Analyte List, TOP Assay & Replacement Chemicals

## Ease of Use

- Consistent and Defensible Data
- Seamless Data Deliverable
- Nationwide Coverage

**THE  
INDUSTRY  
LEADER**



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