Emerging Compounds of Interest Per-(Poly)Fluoroalkyl Substances (PFAS)

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October 26, 2018

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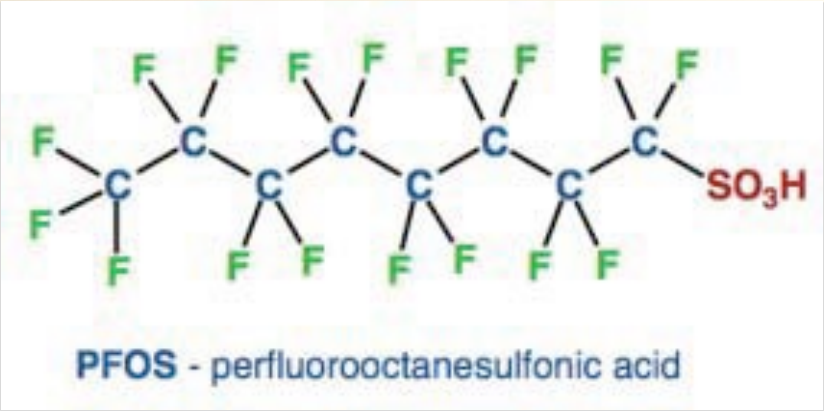
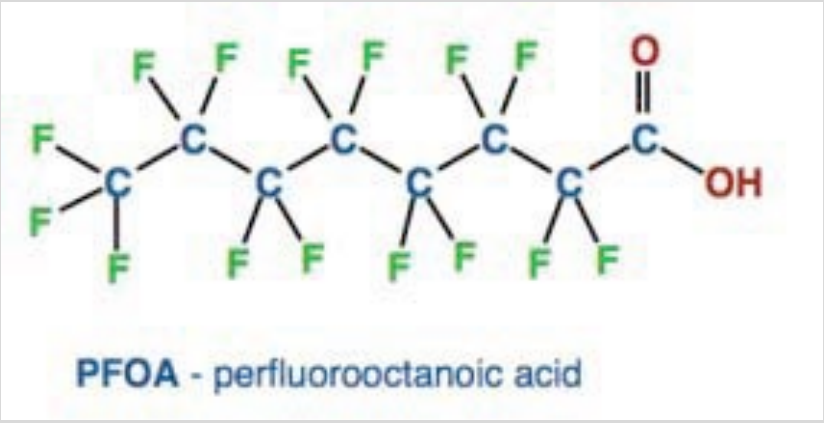
Overview

- Nomenclature
- History
- Composition
- Sources
- Regulatory Drivers by State
- Sampling
- Analytical Methods
- Community Concerns



PFOS - perfluorooctanesulfonic acid



PFOA - perfluorooctanoic acid

problem solved

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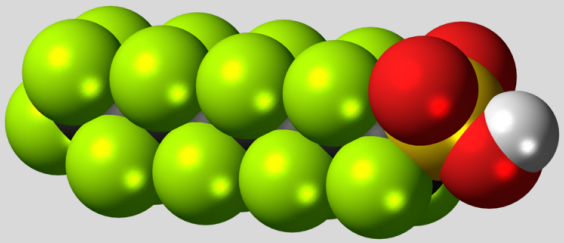
Nomenclature

PFC is not used – poorly defined
PFASs is not used - not needed
PFAS – Per and Poly is used

- PFAS
  - ***Per***fluorinated
    - Perfluoroalkyl Acids (PFAAs)
      - Perfluoroalkyl Carboxylic Acids (PFCAs)
      - Perfluoroalkyl Sulfonic Acids (PFSAs)
    - Perfluoroalkyl Sulfonamide Amino Carboxylates
    - Perfluoroalkyl Sulfonamido Amines
  - ***Poly***fluorinated
    - Fluorotelomer Alcohols
    - Fluorotelomer Sulfonates
    - Fluorotelomer Sulfonamido Betaines
    - Etc. Etc. Etc.



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History

US EPA launches investigation

DoD starts noticing PFOs in drinking water on bases

Canada bans PFOs

US EPA adds PFCs to 3rd UCMR and issues health advisory

EPA lifetime health advisory

1956 | 1970's | 1997 | 1999 | 2000 | 2000's | 2006 | 2008 | 2009 | 2012 | 2013 | 2016

SCOTCHGARD PROTECTOR

3M Detects PFO's in blood banks around the world

3M phases out US production

Partial EU ban

Included in Stockholm convention list.

UCMR 3 2013-2015

problem solved

Composition

Per - (Poly) Fluoroalkyl Substances (PFAS)

- Human-made compounds
- One of the strongest chemical bonds in nature C-F
- Bioaccumulative
- Stable in acids, bases, oxidants, heat
- High solubility
- Lipid and water repellent
- Used in many products

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Drilling & Mining Surfactants

Non-stick Coatings

Outdoor Gear

Electroplating

Carpet and fabric protector

Food Packaging

Cosmetics

problem solved

Sources

Aqueous Film Forming Foam (AFFF)

Developed in the 1960's by 3M for the U.S. Navy

- Primarily used on fuel-based fires
- Fire suppression systems
- Emergency response
- Fire fighting training

Sources

Aqueous Film Forming Foam (AFFF)
Air Force Bases….

- All installations with flying mission contain at least one fire training area (FTA)
  - < ~1990: unlined infrastructure
  - > ~1990: engineered facilities
- Hangars are designed with automatic fire suppression systems
- Emergency response actions
- Equipment maintenance and testing
- Waste management

Regulatory Health Advisory Levels

The most prominently studied compounds:
PFOS –3M : Scotchguard and AFFF
PFOA – Dupont : Surfactant in the manufacture of fluoropolymers

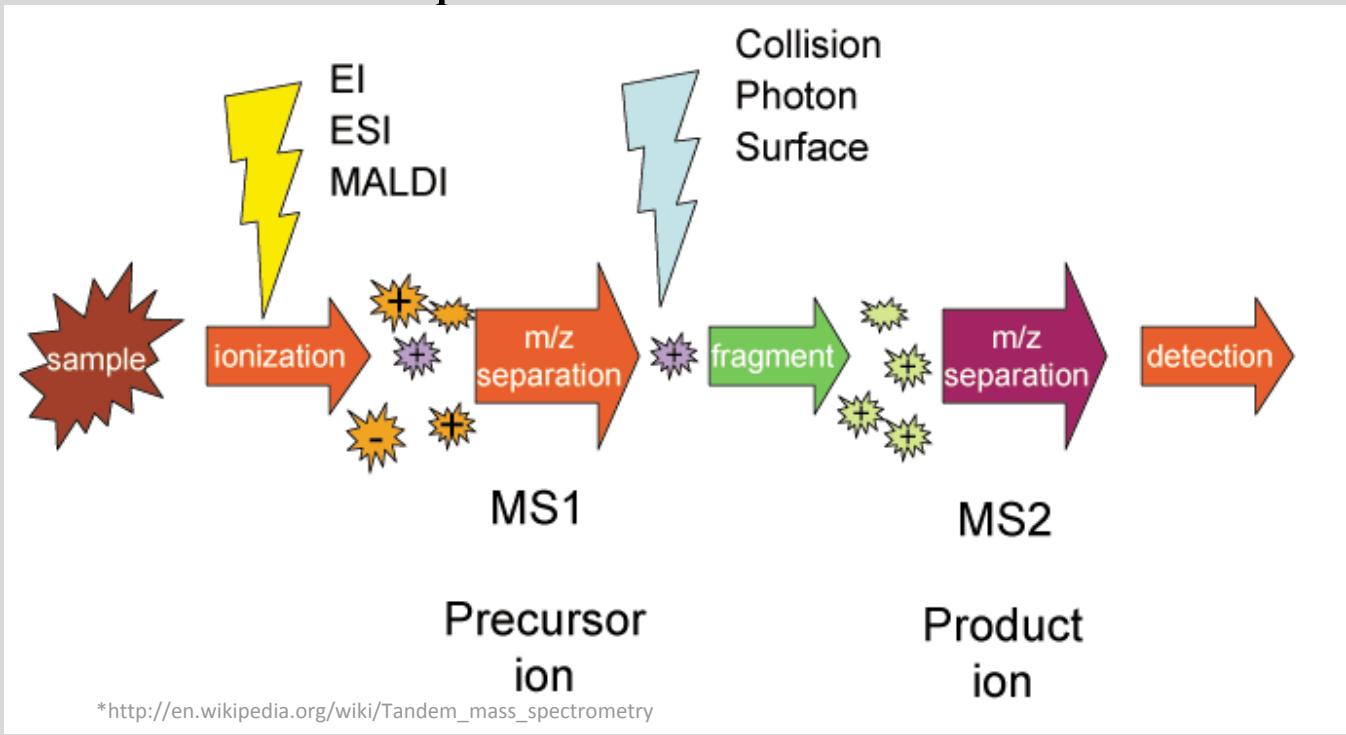
- Inconsistent Advisory Limits in the U.S.
  - EPA 70 ng/L each for PFOA and PFOS
  - 25 States from 13 ng/L (NJ) up to 300000 ng/L (OR)
  - 2017 - NCDEQ sets limit of 140 ng/L for GenX

Sampling – Avoid Specific Materials and Equipment

- Avoid Teflon®-containing materials
- LDPE or polypropylene containing materials (e.g., bags or containers used to transport samples)
- Paper products such as waterproof field books
- Water resistant, waterproof, stain-treated clothing or shoes including Gore-Tex™ and Tyvek® materials
- No cosmetics, moisturizers, sunscreen, insect repellants

Analytical Methods

All use LC/MS/MS with varying methods of sample preparation, instrument calibration and process control.



*http://en.wikipedia.org/wiki/Tandem_mass_spectrometry

Analytical Methods

- **EPA Method 537 Rev. 1.1 (1999)** - prescriptive analyte list
- **ISO Method 25101: 2009-** drinking water, surface and wastewater
- **ASTM Methods D7979-15 and D7968-14** address water, sludges and soils but have not yet been validated by EPA
- **No established method for soils**, frequently cited as **"Method 537 Modified" or lab SOP.**

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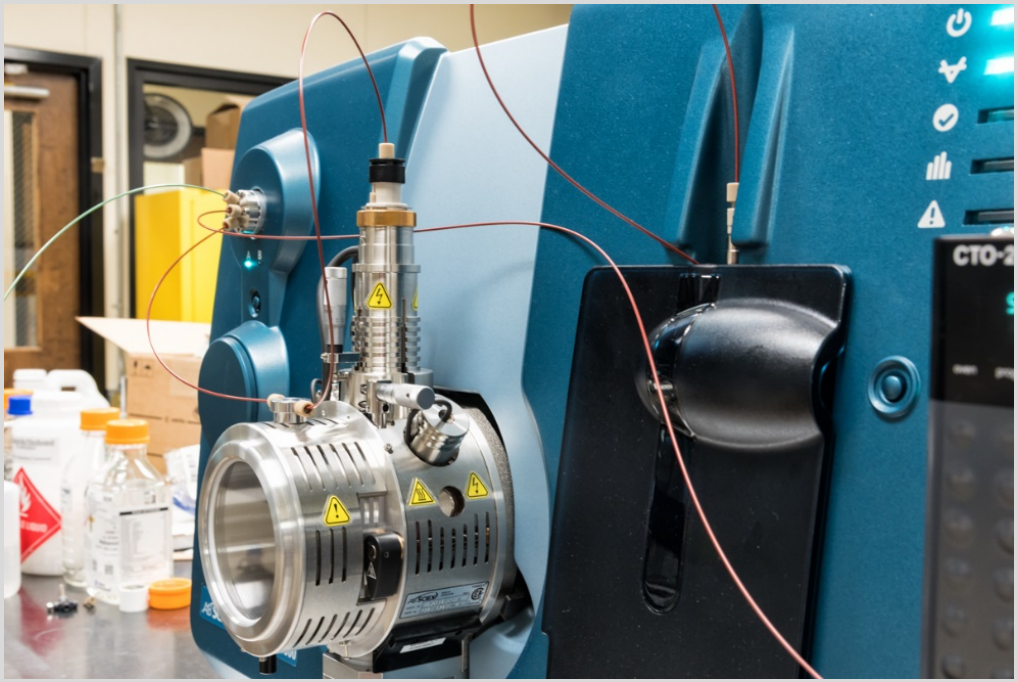
Analytical Methods – EPA Method 537



EPA Method 537 (1999) Rev 1.1

- Specific to drinking water
- Specific list of compounds
- Solid Phase Extraction (SPE)
- Internal Standard Calibration
- Calibration is forced through zero

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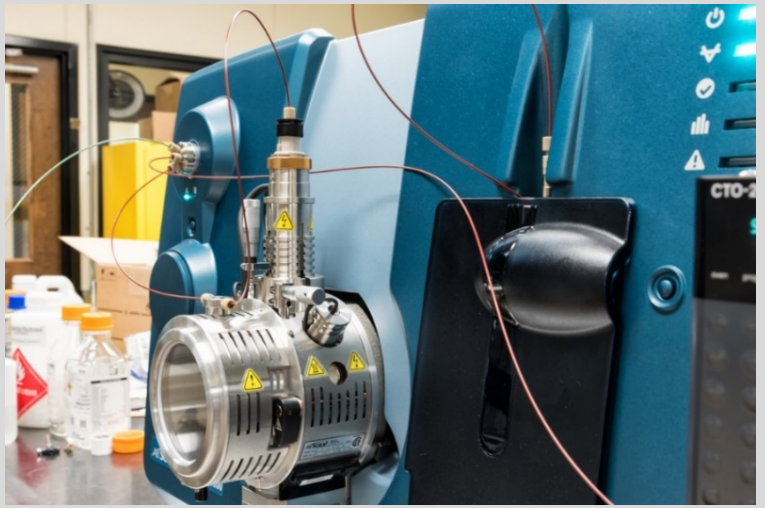
Analytical Methods – Non-Drinking Water

EPA Method 537 "Modified"

- Ground Water, Waste Water, Soils, Tissue, AFFF
- AB SCIEX Triple Quad 5500 LC/MS/MS System
- Lower limits of detection and quantitation
- 34 Compounds including **GenX**
- Isotope Dilution
- SPE for Liquid Samples
- Additional process control requirements



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GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: October 18, 2018

Company :
Address :

Contact: Mr.
Project: WWTP

Client Sample ID: Clarifier #2
Sample ID:
Matrix: Waste Water
Collect Date: 30-JUL-18 15:15
Receive Date: 31-JUL-18
Collector: Client

Project:
Client ID:

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Carbon Analysis												
SM 5310 B Total Organic/Inorganic Carbon "As Received"												
Total Organic Carbon Average		6.37	0.330	1.00	mg/L		1	TSM	08/01/18	2052	1786832	1
LCMSMS PFCs												
PFOA, PFOS by LC-MS/MS "As Received"												
Perfluorooctanoic acid (PFOA)		**1280**	**32.5**	**92.9**	**ng/L**	**0.0186**	**50**	**GXC1**	**08/03/18**	**1714**	**1788888**	**2**
Perfluorooctanesulfonate (PFOS)		**49000**	**1530**	**4640**	**ng/L**	**0.0186**	**2500**	**GXC1**	**08/03/18**	**1757**	**1788888**	**3**

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537 Modified	PFCs Extraction in Liquid	MXD2	08/03/18	0946	1788885

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	SM 5310 B	
2	EPA 537 Modified	
3	EPA 537 Modified	

Notes:

Column headers are defined as follows:
DF: Dilution Factor
DL: Detection Limit
MDC: Minimum Detectable Concentration
PF: Prep Factor
RL: Reporting Limit

Local Community Concerns

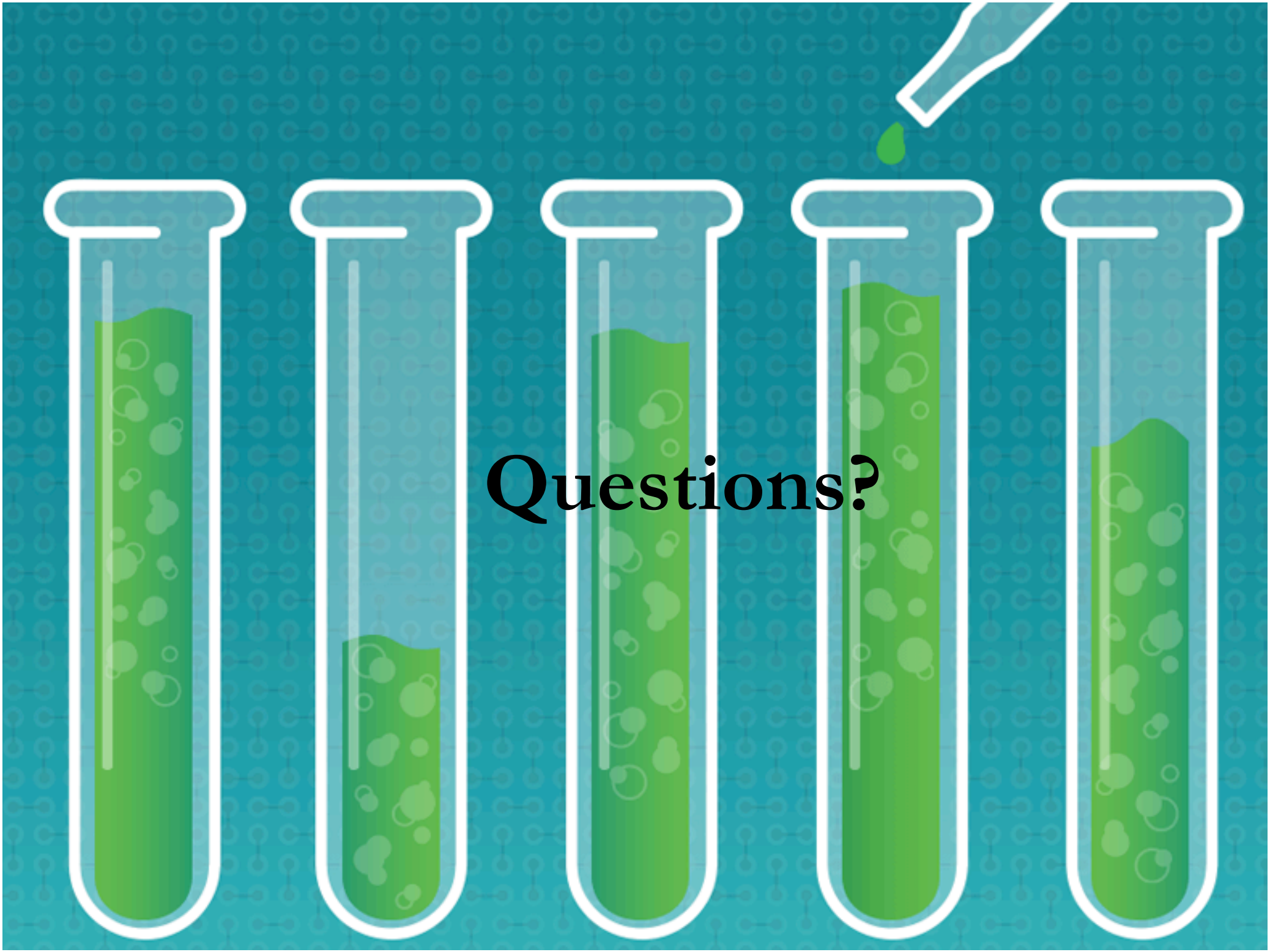
Mt. Pleasant S.C. – August 2017

- Private Resident Request for PFAS
- Positive Detection below EPA Advisory Limits
- Local News Releases
- Multiple Press Releases by the Municipality
- Additional Sampling
- Multiple Meetings Held
- Formation of the "Citizen's Water Academy"

What's next…

ITRC (Interstate Technology Regulatory Council)

- Environmental Regulators, Agency Representatives, Industry Experts, Community Stakeholders, and Academia
- PFAS Fact Sheets - Published Spring 2018
- Training Workshops –Federal, State, and non-profit agencies
- PFAS Technical and Regulatory Guidance document – 2019
- https://www.itrcweb.org/


Questions?

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