# PRETTY FUN AWESOME SUBSTANCES –

## NAVIGATING PFAS REGULATIONS WITH THE SUPPORT OF AN IN-HOUSE LAB

SEPTEMBER 4, 2025

**Trinity River Authority of Texas**
*Enriching the Trinity basin as a resource for Texans*

# Background on PFAS

# What is PFAS?

Unfortunately it ***does not*** stand for Particularly Fun Awesome Substances

Per- and polyfluoroalkyl substances

- Takes thousands of years to degrade naturally
- Some classified as carcinogenic
- Found all over the world
- Primarily categorized as long chain and short chain compounds

# Background

- Bad Boys of PFAS
  - PFOA and PFOS
- Are there other PFAS compounds of concern?
  - Depends on who is asking
  - Where you are looking at
  - What you are looking in

# Background

| Concentration Expressions | Abbreviations | Equivalents |
|---|---|---|
| **Part Per Million** | ppm | mg/L or mg/kg or µg/g |
| **Parts Per Billion** | ppb | µg/L or µg/kg or ng/g |
| **Parts Per Trillion** | ppt | ng/L or ng/kg or pg/g |

- How do we measure it?
  - With great difficulty
  - Drinking Water is only “approved” method
  - Wastewater/Solids Method is final but not “approved”

# Drinking Water

# Drinking Water

- UCMR 3 and 5
- Proposed NPDWR March 2023
- Final NPDWR April 2024
  - Published in the Federal Register on April 26, 2024
  - 5 pollutants with a MCL and Hazard Index MCL
    - Running Annual Average used for determining compliance

# Drinking Water

| Pollutant | MCL | PQL | Unit |
|---|---|---|---|
| PFOA | 4.0 | 4.0 | ng/L |
| PFOS | 4.0 | 4.0 | ng/L |
| PFHxS | 10.0 | 3.0 | ng/L |
| PFNA | 10.0 | 4.0 | ng/L |
| HFPO-DA (GenX Chemicals) | 10.0 | 5.0 | ng/L |
| PFBS | N/A | 3.0 | ng/L |
| Hazard Index | 1 | N/A | Unitless |

- Initial Monitoring complete by April 25, 2027
- Compliance Monitoring with reporting after April 25, 2027
- Final Compliance with MCLs by April 25, 2029

# Drinking Water

## Running Annual Average (RAA) calculation example

| Chemical | Quarter 1 | | Quarter 2 | | Quarter 3 | | Quarter 4 | |
|---|---|---|---|---|---|---|---|---|
| | Sample | Q1 Formula | Sample | Q2 Formula | Sample | Q3 Formula | Sample | Q4 Formula |
| HFPO-DA (ppt) | 5 ppt | 5 ppt/10 ppt = 0.5 | 5 ppt | 5 ppt/10 ppt = 0.5 | Not detected | 0 ppt/10 ppt = 0 | Not detected | 0 ppt/10 ppt = 0 |
| PFBS (ppt) | 5 ppt | 5 ppt/2000 ppt = 0.0025 | 5 ppt | 5 ppt/2000 ppt = 0.0025 | Not detected | 0 ppt/2000 ppt= 0 | 5 ppt | 5 ppt/2000 ppt = 0.0025 |
| PFNA (ppt) | Not detected | 0 ppt/10 ppt = 0 | Not detected | 0 ppt/10 ppt = 0 | 4 ppt | 4 ppt /10 ppt = 0.4 | Not detected | 0 ppt/10 ppt = 0 |
| PFHxS (ppt) | 3 ppt | 3 ppt/10 ppt = 0.3 | Not detected | 0 ppt/10 ppt = 0 | 4 ppt | 4 ppt /10 ppt = 0.4 | 6 ppt | 6 ppt/10 ppt = 0.6 |
| Hazard Index (unitless) | 0.5 + 0.0025 + 0 + 0.3 = 0.8025 | | 0.5 + 0.0025 + 0 + 0 = 0.5025 | | 0 + 0 + 0.4 + 0.4 = 0.8 | | 0 + 0.0025 + 0 + 0.6 = 0.6025 | |

**Running Annual Average** = $\left(\frac{0.8025 + 0.5025 + 0.8 + 0.6025}{4}\right) = 0.6769 = 0.7$

The Hazard Index Running Annual Average result is 0.7 (rounded to one significant digit). Because this result does not exceed 1, the water system has not exceeded the MCL. Therefore, no violation of the Hazard Index MCL has occurred.

# Drinking Water

## PQL being applied with real world data for the RAA

| Running Annual Average - With Full Results | | | | |
|---|---|---|---|---|
| Compound | Calculated Level | Concentration | Hazard Index | Limit |
| perfluoroctanoic acid (PFOA) | 2.57 | ng/L | | 4.0 |
| perfluorooctane sulfonic acid (PFOS) | 3.55 | ng/L | | 4.0 |
| perfluorohexane sulfonic acid (PFHxS) | 0.38 | ng/L | | 10 |
| hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt | 0.00 | ng/L | | 10 |
| perfluorononanoic acid (PFNA) | 0.19 | ng/L | | 10 |
| perfluorohexane sulfonic acid (PFHxS) | 0.38 | ng/L | 0.05985375 | 1.0 |
| hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt | 0.00 | ng/L | | |
| perfluorononanoic acid (PFNA) | 0.19 | ng/L | | |
| perfluorubutane sulfonic acid (PFBS) | 6.21 | ng/L | | |

| Running Annual Average - NPDWR Calculated* | | | | |
|---|---|---|---|---|
| Compound | Calculated Level | Concentration | Hazard Index | Limit |
| perfluoroctanoic acid (PFOA) | 0.00 | ng/L | | 4.0 |
| perfluorooctane sulfonic acid (PFOS) | 1.05 | ng/L | | 4.0 |
| perfluorohexane sulfonic acid (PFHxS) | 0.00 | ng/L | | 10 |
| hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt | 0.00 | ng/L | | 10 |
| perfluorononanoic acid (PFNA) | 0.00 | ng/L | | 10 |
| perfluorohexane sulfonic acid (PFHxS) | 0.00 | ng/L | 0.00310375 | 1.0 |
| hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt | 0.00 | ng/L | | |
| perfluorononanoic acid (PFNA) | 0.00 | ng/L | | |
| perfluorubutane sulfonic acid (PFBS) | 6.21 | ng/L | | |
| *Annual Averages are calculated using only the values that equal to or exceed their PQL. | | | | |

# Drinking Water

- What is TRA doing about the NPDWR?
  - Enhanced monitoring campaign to gather additional data sets
    - Raw and Produced water monitoring
    - TCWSP – bimonthly sampling
    - HRWSS, LRWSS, TCRWSS – quarterly monitoring
  - Developed compliance calculator with automated notifications

# Drinking Water

- What is TRA doing about the NPDWR?
  - Conducting PFAS Treatability Study
    - Collecting PFAS and Water Quality samples
    - Evaluating potential raw water contamination sources
    - Evaluate potential treatment technology
    - Pilot testing potential treatment solutions

# Drinking Water

- Lessons Learned
  - Designate a SME for your organization
  - Understand the rule and the impact(s) to the organization
  - Invest in testing services
  - Develop sampling protocols and verify them
  - Plan for data management resources/systems
  - Third-party support for treatment options

# Drinking Water – UPDATE

- May 14, 2025 announced changes to the NPDWR forthcoming
  - Keep MCL at 4 ng/L for PFOA & PFOS
  - Rescind all other MCLs and the Hazard Index
  - Extend Final Compliance with MCLs to 2031
  - Proposed Rule Update Fall 2025
  - Final Rule Update Spring 2026
- Enhanced Communication and Outreach
- Holding polluters accountable

# Other PFAS Regulations

# Wastewater & Biosolids

- Effluent Guidelines Program Plan 15
- POTW Influent PFAS Study
  - 27 Texas POTWs impacted by this
- EPA Draft Sewage Sludge Risk Assessment
  - Risk from use or disposal of sewage sludge by land application
    - Unrealistic conditions
    - 1 ppb for PFOA and PFOS

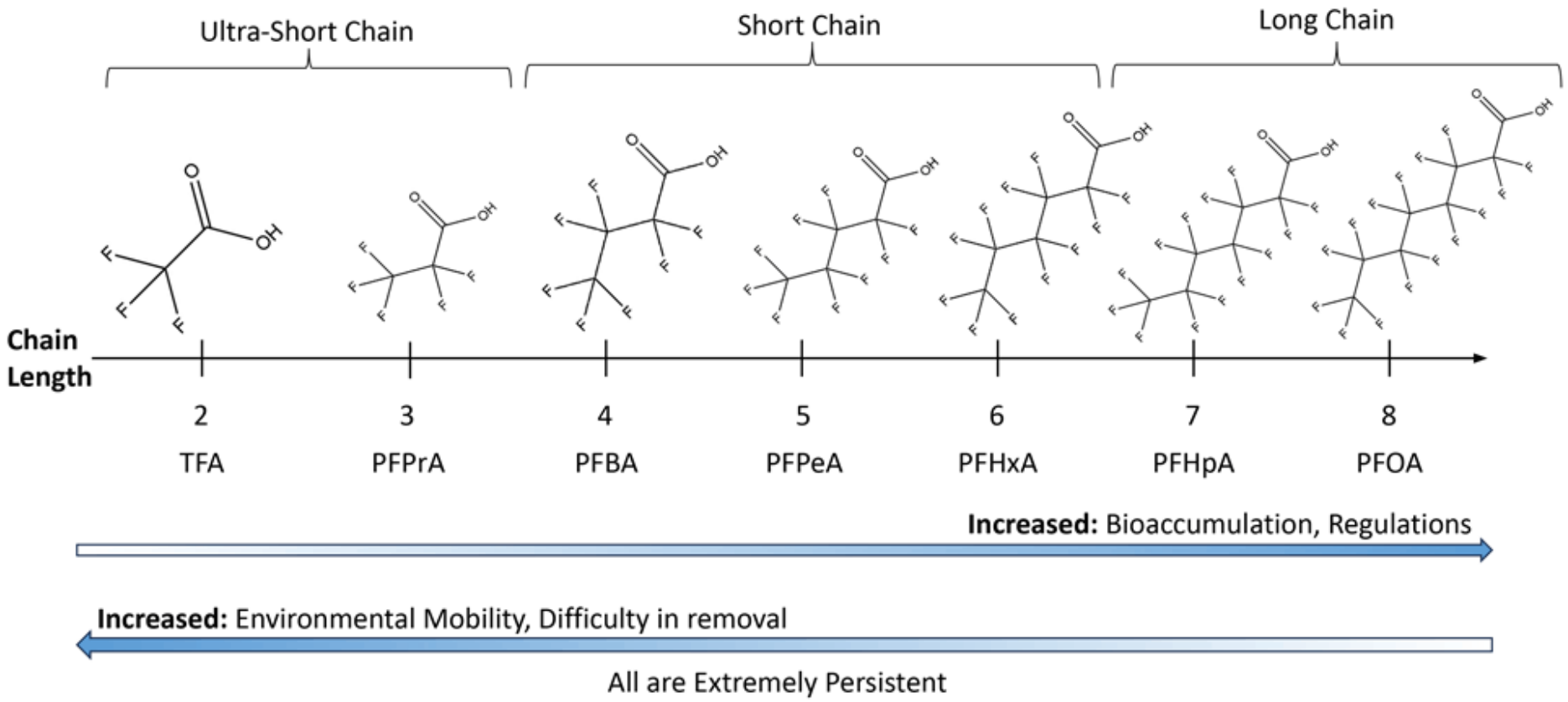
# Wastewater & Biosolids

- CERCLA
  - PFOA & PFOS designated hazardous substances effective July 8, 2024
  - Releases of a pound or more in any 24-hour period

| Plant Effluent Flow (MGD) | Effluent PFOA Result (ng/L) | Mass Load of PFOA in Plant Effluent (ppd) | Effluent PFOS Result (ng/L) | Mass Load of PFOS in Plant Effluent (ppd) |
|---|---|---|---|---|
| 165.89 | 23 | 0.03182102 | 20 | 0.027670452 |
| 171.13 | 7.8 | 0.011132349 | 6.4 | 0.009134235 |
| 135.494 | 8.6 | 0.009718172 | 5.7 | 0.006441114 |
| 144.34 | 5.9 | 0.007102394 | 12 | 0.014445547 |

# PFAS in the Lab

# What is PFAS?


Ultra-Short Chain
Short Chain
Long Chain
Chain Length
2
3
4
5
6
7
8
TFA
PFPrA
PFBA
PFPeA
PFHxA
PFHpA
PFOA
Increased: Bioaccumulation, Regulations
Increased: Environmental Mobility, Difficulty in removal
All are Extremely Persistent

# How do we measure PFAS?

Instrumentation!

These instruments are so sensitive, measuring in parts per trillion (ppt or ng/L) is roughly the equivalent of:

- Identifying a drop of blood in 15 Olympic-sized swimming pools
- Measuring thirty seconds out of every million years
- Finding a hat in the state of Texas

# PFAS Instrumentation

## There are three main components:

Extraction unit for SPE/clean-up (Solid Phase Extraction)

Evaporation unit for concentration

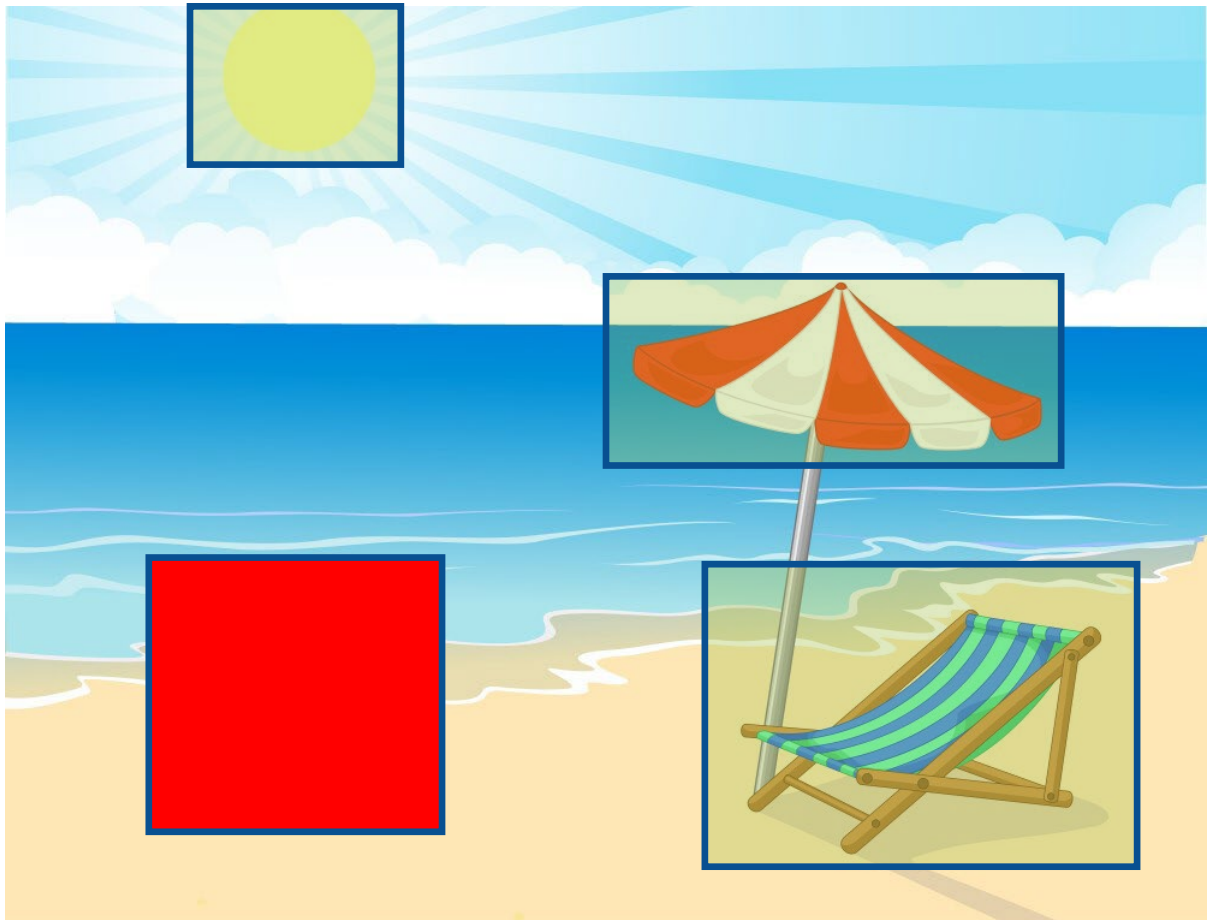
LC-MS/MS

- Liquid Chromatography
- Tandem Mass Spectrometer

# What does an LC-MS/MS do?

- 1 cup butter
- ¾ cup granulated sugar
- ¾ cup brown sugar
- 2 eggs
- 2 tsp vanilla
- 2 ¼ cup flour
- 1 tsp baking soda
- ½ tsp salt
- 2 cups chocolate chips

# The Magic of MRM



# PFAS Methodology

What methods are commonly used for measuring PFAS?

- EPA 537.1 and EPA 533
- EPA 1633
- EPA 1621
- ASTM D8421

# EPA 537.1

- Emphasis on long-chain PFAS compounds
- Originally written in 2008, 537.1 was release in 2018 with v2.0 was released in 2020
  - The update included four “replacement” PFAS compounds that had replaced PFOA and PFOS in many manufacturing processes
- Uses **internal standard technique** to measure concentration
- Uses surrogates to monitor extraction efficiency and matrix interferences
- Measures 18 compounds, four of which are not in EPA 533

# EPA 533

- Emphasis on short-chain PFAS
- Published in 2019 as part of the EPA's PFAS Action Plan
- Uses **isotope dilution technique** to measure concentration
- This method is an evolution of EPA 537.1
- Measures 25 compounds
- Included 7 more compounds than 537.1 due to their increased usage in manufacturing processes
- Does not cover four compounds found in 537.1 due to these compounds were dropped by manufacturers in favor of others found in this method

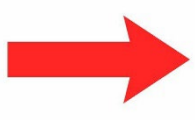
# EPA 1633

- Introduced in 2021, this method covers all non-potable waters, soils, biosolids, and tissues; a catch-all method
- A combination of both prior methods, uses both internal standard technique and isotope dilution technique
- Measures 40 compounds (24 via ID and 16 via IS)
- Finalized in 2024

# EPA 1621

## A screening method to estimate total organofluorine compounds

Trap PFAS in carbon



Combust trapped PFAS ≥ 1000 °C

Measure via ion chromatography

# ASTM D8421

No initial SPE clean-up, more of a direct injection

1. 1:1 ratio of sample and methanol
2. Filter
3. Measure

# Questions?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