

# PFAS and Wastewater

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## Per- and polyfluoroalkyl substances (PFAS)

### Introduction

- One Water Perspective
- A little chemistry

### Breaking the Cycle

- Industrial pretreatment
- Federal limits
- Personal actions

# One Water Perspective



Manufacturing

Wastewater Treatment

PFAS Sources

PFAS Impacts

Consumer Products

Aviation Sites

Biosolids Application

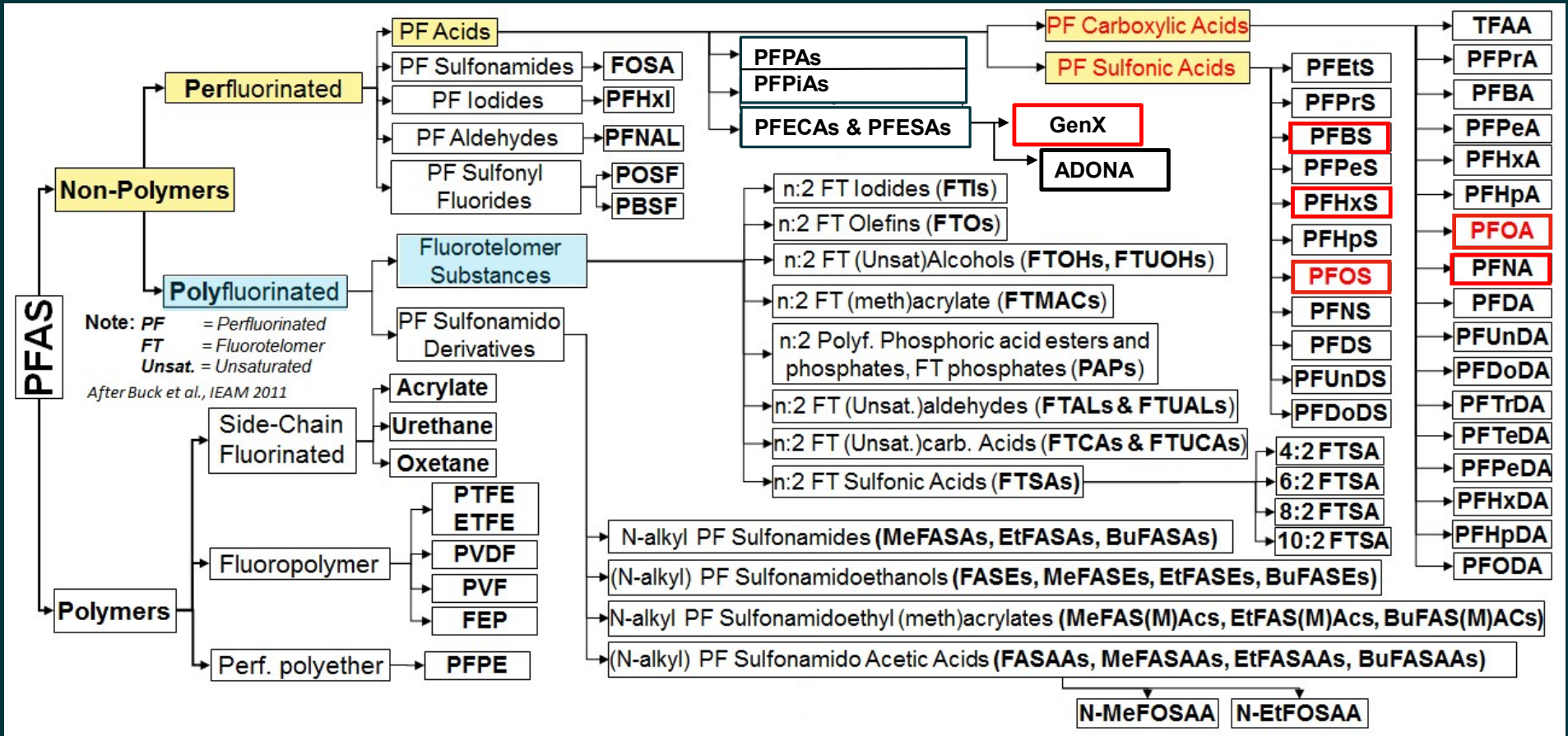
Landfills

Source Water

Domestic Use

Food Products

# PFAS Family Tree



# PFAS Fundamentals

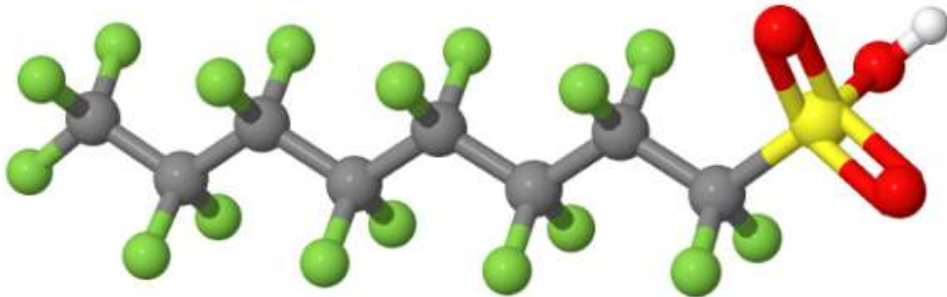
What are PFAS? **Per- and polyfluoroalkyl substances**

- Linear and branched chains of carbon bonded to fluorine in place of hydrogen

## Per-fluorinated compounds

Fully fluorinated carbon-chain "tail"

Functional group



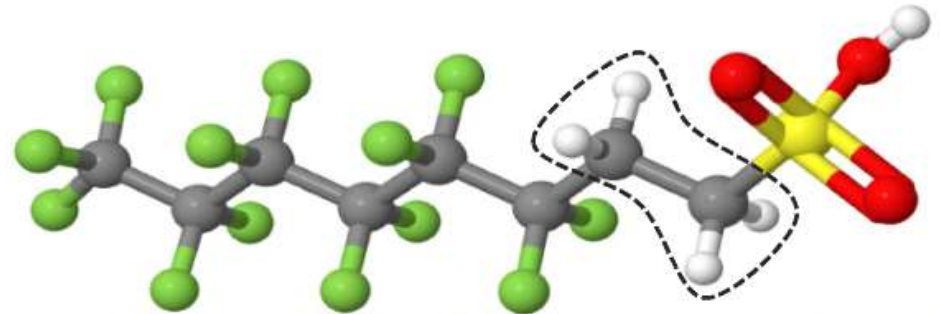
e.g. *Per*-fluorinated - PFOS

## Poly-fluorinated compounds

Fully fluorinated carbon-chain "tail"

Unfluorinated C2 "spacer"

Functional group



e.g. *Poly*-fluorinated - 6:2 Fluorotelomer sulfonic acid (6:2FTS)



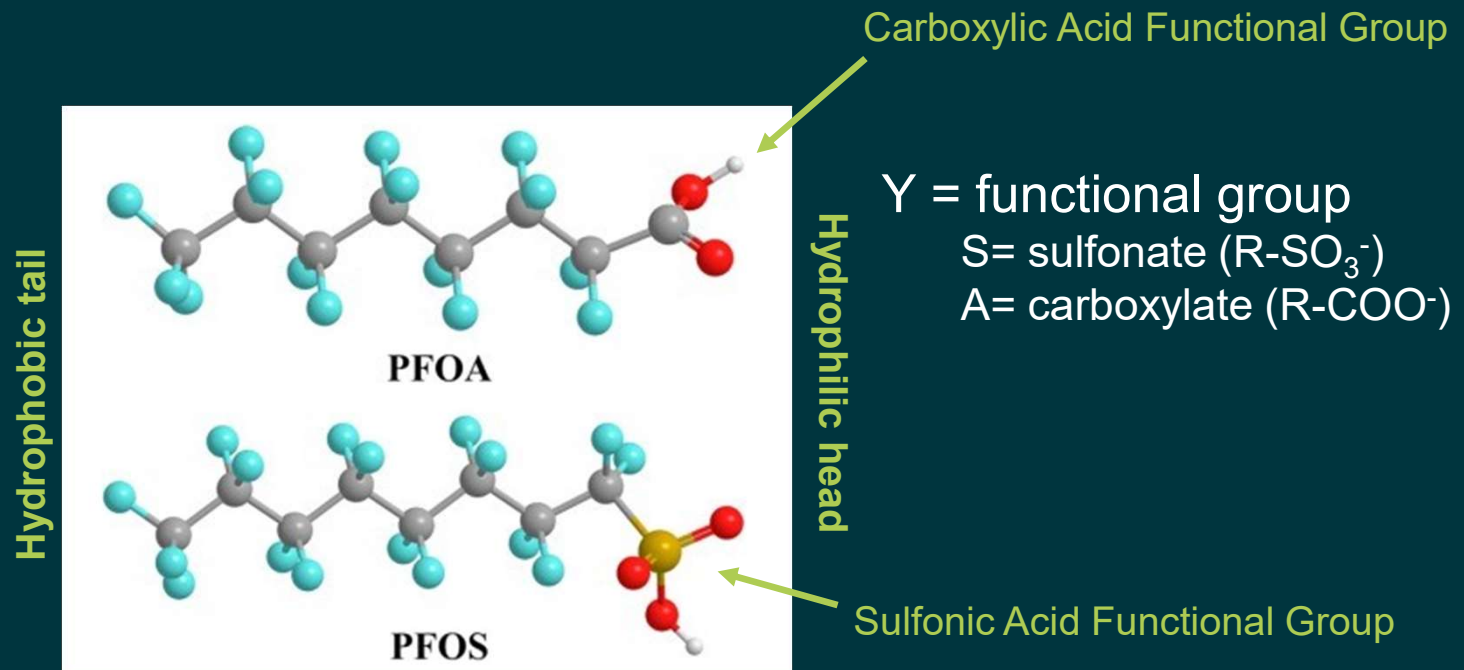
Perhaps the most important subgroup is the perfluoroalkyl acids (PFAAs)

PFX<sub>Y</sub>

PF = perfluoro-

X = # carbon atoms

- 3 Pr = propa-
- 4 B = buta-
- 5 Pe=penta-
- 6 Hx=hexa-
- 7 Hp=hepta-
- 8 O=octa-
- 9 N=nona-



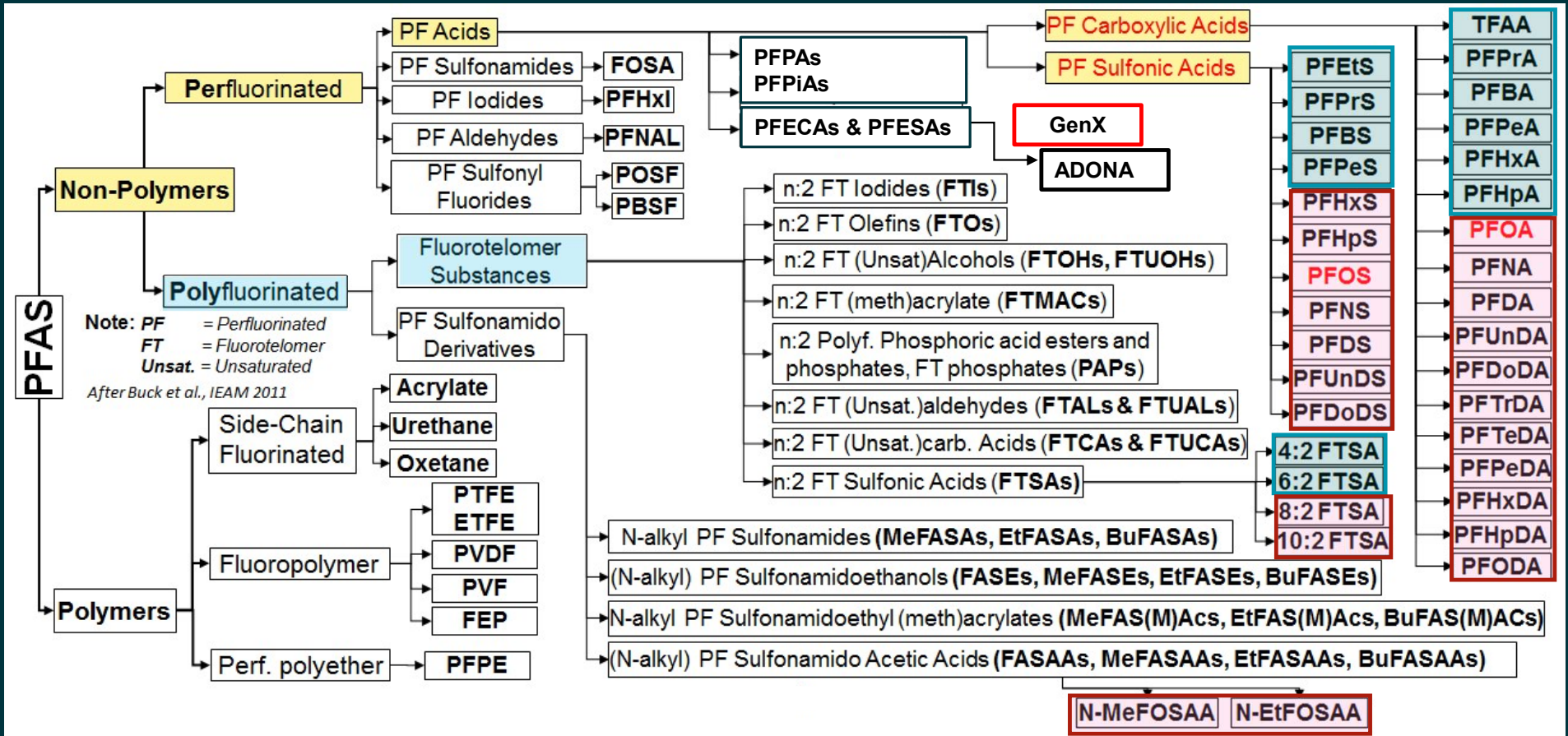
(Molecule graphics generated by [www.chemspider.com](http://www.chemspider.com))

Reference: <https://pfas-1.itrcweb.org/2-2-chemistry-terminology-and-acronyms/>

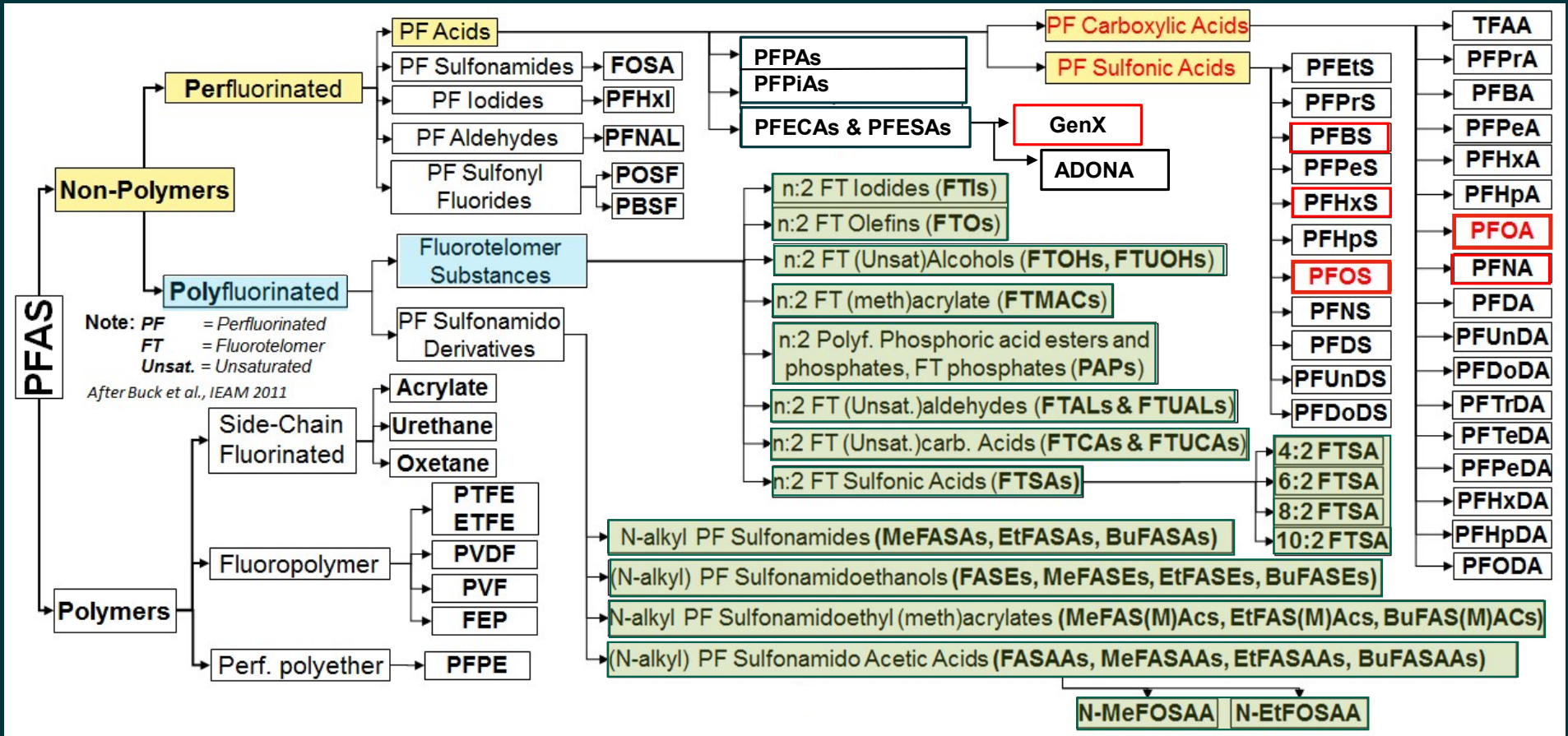
# PFAS Family Tree

Short Chain

Long Chain



# PFAS Family Tree





# PFAS Source Control

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## WDNR's Interim Strategy for Land Application of Biosolids with PFAS

### *Screening – Source Identification and Reduction – Communication*

#### **PFOS $\geq$ 150 $\mu\text{g}/\text{kg}$**

- Arrange alternative to land application and treat
- Investigate potential sources to develop a source reduction program

#### **PFOS $\geq$ 50 $\mu\text{g}/\text{kg}$ & $<$ 150 $\mu\text{g}/\text{kg}$**

- Investigate potential sources to develop a source reduction program
- Reduce land application rates to no more than 1.5 dry tons per acre (or submit an alternative risk mitigation strategy)

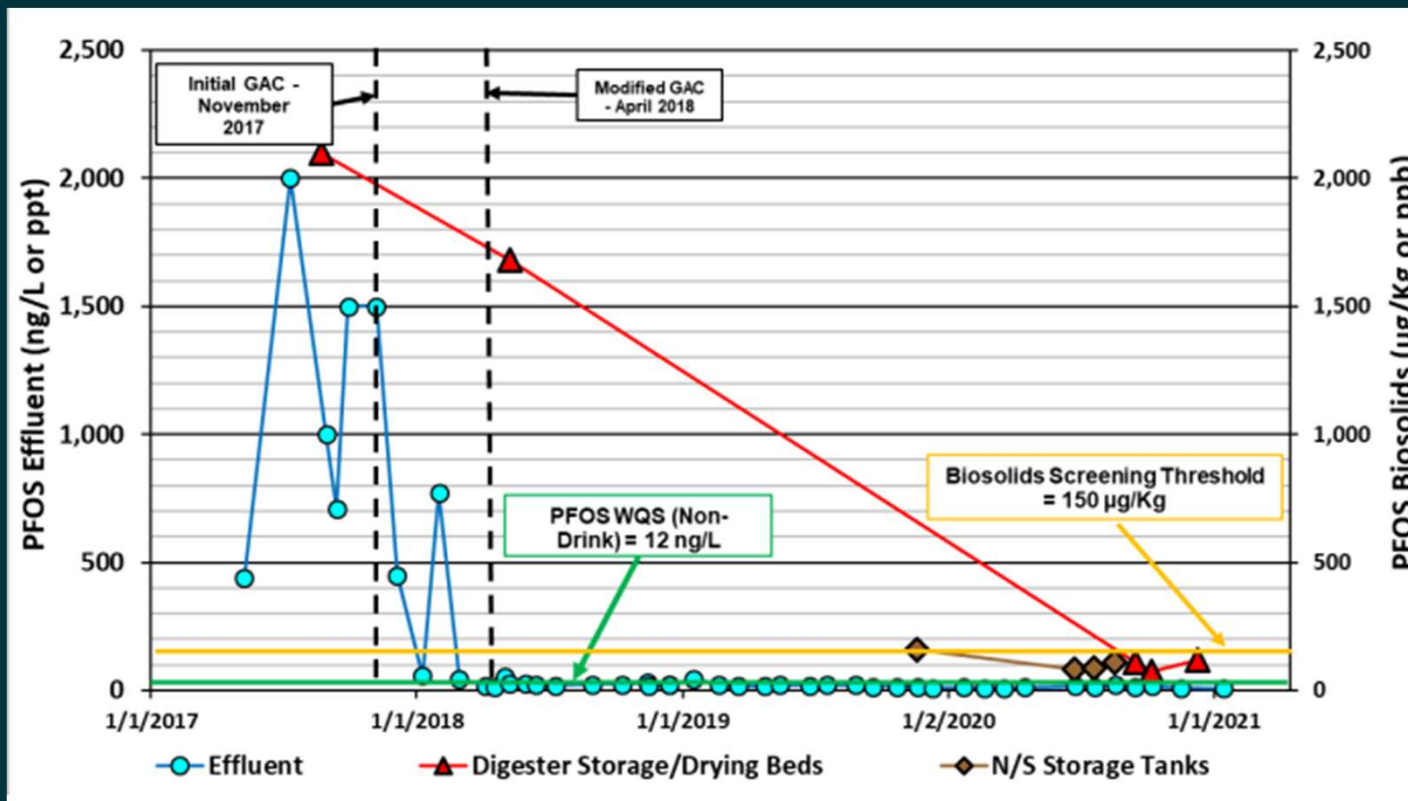
#### **PFOS $>$ 20 $\mu\text{g}/\text{kg}$ & $<$ 50 $\mu\text{g}/\text{kg}$**

- Consider investigating sources and sampling the WWTP effluent for PFAS

# PFAS Source Reduction – Michigan Case Study

WDNR Strategy based on MI WWTP Study by AECOM:

[https://www.michigan.gov/documents/egle/wrd-PFAS-Biosolids-Strategy\\_720326\\_7.pdf](https://www.michigan.gov/documents/egle/wrd-PFAS-Biosolids-Strategy_720326_7.pdf)



Source Reduction Strategies for Industrial Discharges Resulted in PFOS Decreases

# USEPA Actions Limiting PFAS Under Toxics Substance Control Act (TSCA)

**2002**

Publishes a **SNUR** requiring notification of future manufacture/ import of **13 PFAS** included in 3M's voluntary phase-out

Additional SNUR lists **75 PFAS**

**2007**

Publishes a **SNUR** for **183 PFAS** no longer manufactured, used, or imported into the US

**2020**

**Finalizes SNUR** requiring US **EPA review** prior to the use or import of **long-chain PFAS** used as coatings in textiles, carpet, furniture, electronics, and appliances

**2023 October**

Final rule TSCA Section 8(a)(7) requires **reporting of manufacture or import since Jan 1 2011 of ~1,462 PFAS** (excludes those processing waste)

**2006**

Creates the **2010 (95%)/2015 (100%) Stewardship Program** including **8 major PFAS manufacturers**

**2013 - 2015**

Issues rules requiring **all companies report** on manufacturer, use, or import of PFOA-related chemicals in any commercial articles

**2023 January**

Proposes a **SNUR** preventing resumed use of **inactive PFAS** on the **TSCA Inventory**, including **any substance limited in manufacture or use since 2006**

**2023 December**

Orders to Inhance Technologies LLC **not to produce PFAS** in the production of its fluorinated **high-density polyethylene HDPE** plastic containers

**SNUR** = Significant New Use Rule



# PFAS Under the Toxics Release Inventory

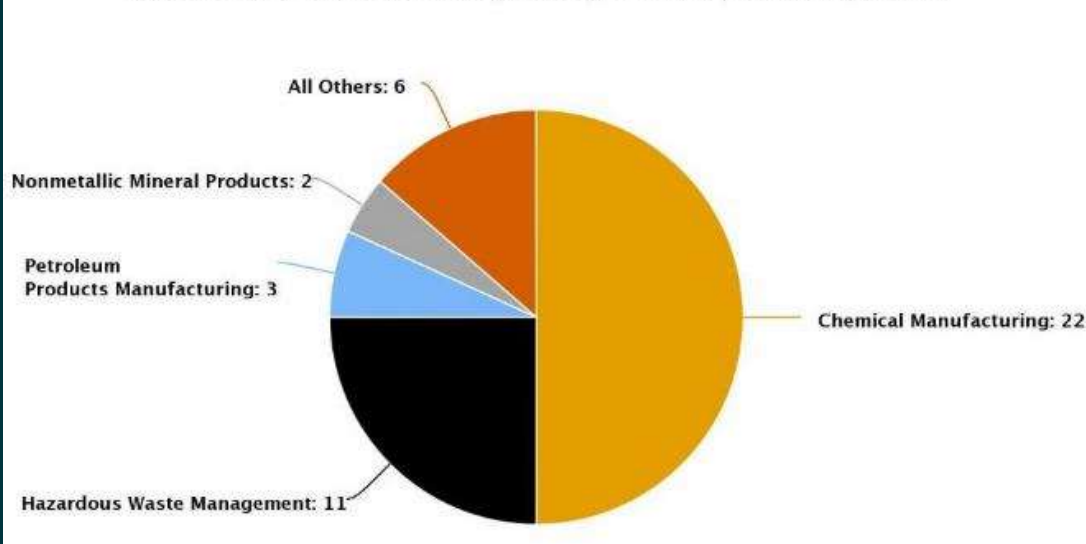


## Statutory Authority of the Toxics Release Inventory (TRI)

Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) §313

- Facilities in **certain industrial sectors** must **report** toxic chemical **releases to air, water, and land** and other waste management to federal, state, tribal, territorial, and/or local governments annually

Number of Facilities Reporting PFAS by Sector, 2021



2020: 172 PFAS added with 100-lb reporting threshold

2021: +4 PFAS based on a SNUR

2022: 180 PFAS were listed

PFOA's *de minimis* level is 0.1%; all other PFAS additions have a *de minimis* level of 1%.

2023: 189 PFAS are listed

*no de minimis level* for any PFAS

2024: 197 PFAS are listed

Source: USEPA TRI National Analysis, image obtained 9/2023

13 <https://www.epa.gov/trinationalanalysis/pfas>

## Resources: Consumer decisions to avoid PFAS

This is not an endorsement but is a listing of potential information resources

<https://www.consumerreports.org/toxic-chemicals-substances/how-to-avoid-pfas-a8582109888/>

<https://millionmarker.com/pages/resources#approved-products>

<https://pfascentral.org/pfas-free-products/>



Consumer  
Reports

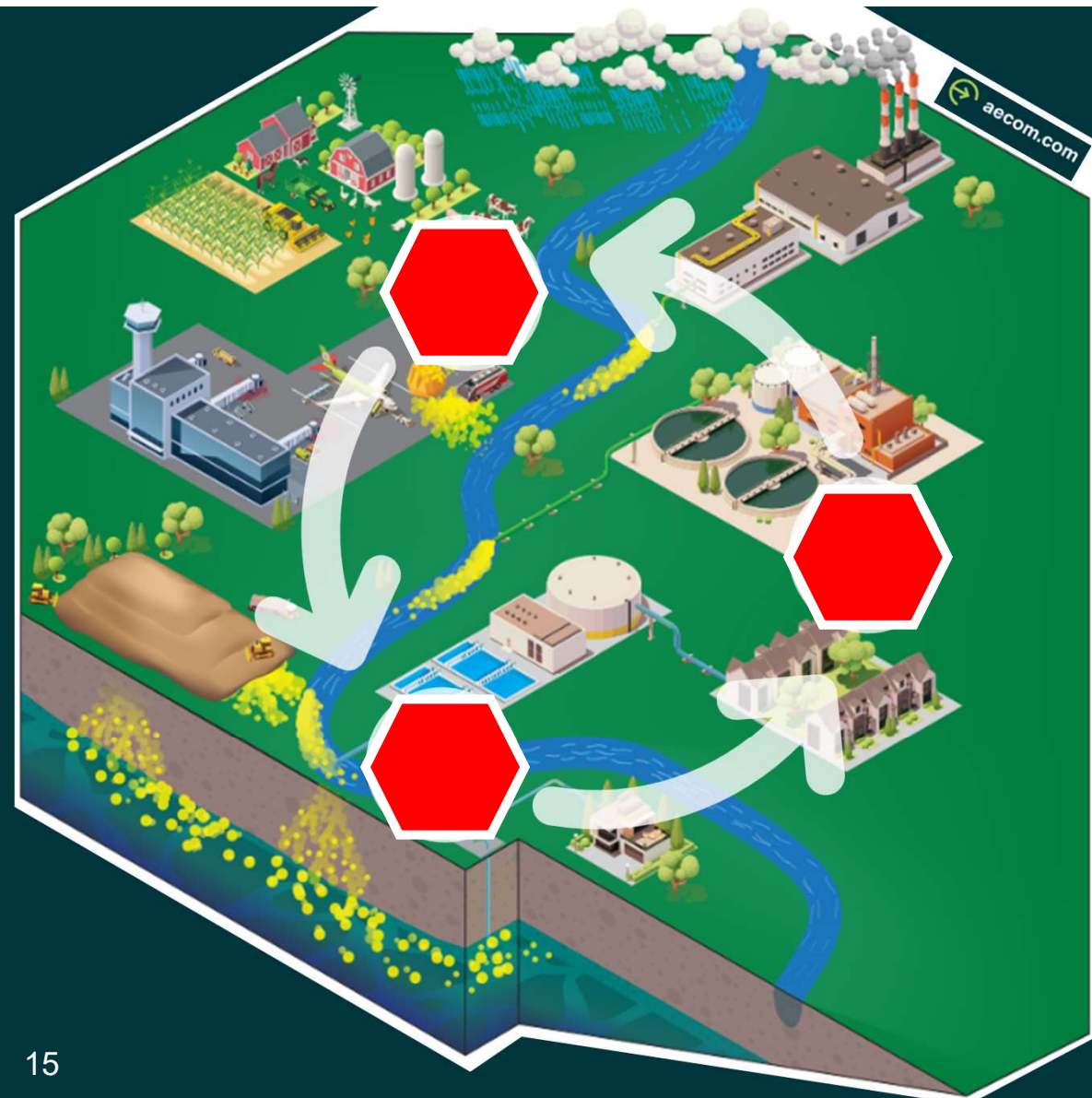


Million  
Marker



PFAS  
Central





## Breaking the PFAS Cycle

### Protect drinking water

- Design/build PFAS removal systems using separation technologies (GAC, IX-R, RO)
- Focus research on improved methods

### Protect water resources

- Eliminate sources
- Intercept in-situ

### Disrupt PFAS from discharges/ WWTPs

- Invoke industrial pretreatment
- Manage biosolids concerns

### Treat separated and removed PFAS-laden waste

- Manage disposal
- Focus on developing commercially effective destruction technologies





IDENTIFY. RESOLVE.

THANK YOU.

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