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PFAS REGULATIONS AND TREATMENT

Midwest Air & Waste Management Association

2024 Environmental Technical Conference

07 May 2024

AGENDA

PFAS Regulations Overview/Updates

PFAS Waste Types/Management

PFAS Treatment

Questions?

GEOSYNTEC'S PFAS PRACTICE

- 402 PFAS projects in the past 3 years
- PFAS points of contact in branch
- Federal, industrial and municipal clients

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PFAS REGULATIONS OVERVIEW/UPDATES

STATE OF REGULATIONS

DRINKING WATER

- Maximum Contaminant Limits (MCLs)
- MCL Goals (MCLGs)
- Hazard Index

CERCLA

- PFOA and PFOS, plus precursors
- “Categories of PFAS”

RCRA

- Proposed Rule in Federal Register Feb. 2024
- Nine PFAS as COCs
- Expand definition of “hazardous waste”

TSCA/TRI

TSCA Reporting

- Final Rule
- Manufactures and importers must report PFAS

TRI Reporting

- Requires reporting of 196 PFAS compounds
- Not subject to *de minimis* exemption

FEDERAL DRINKING WATER REGULATION

PFAS	Individual MCL	Hazard Index MCL*	Health-Based Water Concentration
PFOA	4.0 ppt	--	--
PFOS	4.0 ppt	--	--
PFHxS	10 ppt	1 (unitless)	10 ppt
PFNA	10 ppt		10 ppt
HFPO-DA (GenX Chemicals)	10 ppt		10 ppt
PFBS	--		2,000 ppt

MCL = Maximum Contaminant Level;
ppt = parts per trillion; *for mixtures of ≥ 2 PFAS

FEDERAL DRINKING WATER REGULATION

How do I calculate the Hazard Index?

The Hazard Index is made up of a sum of fractions. Each fraction compares the level of each PFAS measured in the water to the highest level below which there is no risk of health effects. EPA is currently developing an online calculator to assist water systems in determining their Hazard Index result. The online calculator will perform the calculation explained in this fact sheet.

Step 1. Divide the measured concentration of Gen X by its health-based value of 10 ppt.

Step 2. Divide the measured concentration of PFBS by its health- based value of 2000 ppt.

Step 3. Divide the measured concentration of PFNA by its health-based value of 10 ppt.

Step 4. Divide the measured concentration of PFHxS by its health-based value of 10 ppt.

Step 5. Add the ratios from steps 1, 2, 3 and 4 together.

Equation:

$$\text{Hazard Index (1 unitless)} = \left(\frac{[\text{HFPO} - \text{DA}_{\text{ppt}}]}{[10\ \text{ppt}]}\right) + \left(\frac{[\text{PFBS}_{\text{ppt}}]}{[2000\ \text{ppt}]}\right) + \left(\frac{[\text{PFNA}_{\text{ppt}}]}{[10\ \text{ppt}]}\right) + \left(\frac{[\text{PFHxS}_{\text{ppt}}]}{[10\ \text{ppt}]}\right)$$

Source: EPA

PROPOSED VS. FINAL - FEDERAL DRINKING WATER REGULATION

- Health-Based Water Concentration of PFHxS
  - 9 ppt → 10 ppt
- PFOA & PFOS MCLs
  - 4 ppt → 4.0 ppt
- Hazard Index MCL for PFHxS, PFNA, GenX & PFBS
  - 1.0 → 1
- Hazard Index
  - Mixtures of ≥ 1 PFAS → mixtures of ≥ 2 PFAS
- Final Regulation Includes Individual MCLs for PFHxS, PFNA & GenX

CERCLA

- On April 19, 2024, EPA announced the designation of PFOA and PFOS as hazardous substances under CERCLA
  - PFOA and PFOS salts and structural isomers also included
- Will go into effect 60 days after Federal Register publication
- “When released into the environment, [hazardous substances] may present substantial danger to the public health or welfare or the environment”
- In April 2023, EPA issued an Advance Notice of Proposed Rulemaking seeking input on potentially listing the following PFAS as hazardous substances:
  - PFBS, PFHxS, PFNA, GenX, PFBA, PFHxA, and PFDA
  - Precursors to PFOA, PFOS, and the PFAS listed above
  - Categories of PFAS

CERCLA - ENFORCEMENT

Focus on parties that "significantly contributed to the release of PFAS into the environment"

- Manufactured PFAS
- Used PFAS in manufacturing
- Federal facilities
- Other industrial parties

Does ***not*** intend to pursue:

- Community water systems
- Publicly owned treatment works
- Municipal separate storm sewer systems
- Publicly owned/operated municipal solid waste landfills
- Publicly owned airports
- Local fire departments
- Farms where biosolids are applied

CERCLA – OTHER IMPACTS

Release Notifications

- Releases of hazardous substances at or above their reportable quantities (RQs) within a 24-hour period must be immediately reported to the National Response Center
- A default RQ of one pound has been established for PFOA and PFOS
- Impacted communities must also be notified of releases

Environmental Due Diligence

- Phase I ESAs are used to obtain certain CERCLA liability protections and identify Recognized Environmental Conditions (RECs)
- Previously, PFAS could be considered non-scope considerations and/or Business Environmental Risks (BERs) in Phase I ESAs
- As hazardous substances, PFOA/PFOS releases now must be considered when identifying RECs as part of the Phase I ESA process

RCRA

- In February 2024, EPA proposed to list 9 PFAS as RCRA hazardous constituents, including: PFOA, PFOS, PFBS, PFHxS, PFNA, GenX, PFBA, PFHxA, and PFDA
- Would allow EPA and states to pursue RCRA corrective actions such as PFAS investigation and cleanup at hazardous waste treatment, storage, and disposal facilities
- EPA has identified 1,740 facilities that could be impacted by this rule
  - E.g., NAICS 334 (computer and electronic product manufacturing), 335 (electrical equipment, appliance, and component manufacturing)
- The Proposed Rule would ***not*** list PFAS as a RCRA hazardous waste under 40 CFR section 261.11(a)(3), and the EPA has ***not*** proposed to make PFAS a RCRA listed or characteristic waste

TSCA

- TSCA 8(a)(7) reporting and recordkeeping requirements
- Requires PFAS manufacturers and ***importers*** of PFAS products to submit information to EPA dating back to January 1, 2011
- "Known to or reasonably ascertainable"
  - "…all information in a person's possession or control, plus all information that a ***reasonable*** person similarly situated might be expected to possess, control, or know." (40 CFR 705.3)
- Most entities have until May 2025 to fulfill their reporting obligations
  - Small manufacturers/importers (40 CFR 704.3) have until November 2025

TSCA

Reporting and Recordkeeping Requirements

- Names, chemical identities, and molecular structures
- Categories of use
- Amounts used
- Byproducts from use or disposal
- Environmental and health effects
- Individuals exposed, “reasonable estimates” of individuals who will be exposed, and durations of exposure
- Methods of disposal

TSCA SIGNIFICANT NEW USE RULE

- Significant New Use Rule (SNUR) finalized in January 2024
- Disallows use of 329 “inactive” PFAS
  - Inactive = not manufactured/processed in 2006
- Proposed uses of inactive/new PFAS requires EPA review through Significant New Use Notices (SNUNs) and Premanufacture Notices (PMNs)
- EPA framework published in June 2023
  - “Framework for TSCA New Chemicals Review of PFAS PMNs and SNUNs”

TRI

- Annual reporting required for designated facilities that use TRI chemicals
  - E.g., NAICS 334 (computer and electronic product manufacturing), 335 (electrical equipment, appliance, and component manufacturing)
- Reporting required on chemical waste management:
  - Environmental releases
  - Recycling
  - Energy recovery
  - Treatment
  - Disposal
  - Chemical waste reduction

TRI

- 196 PFAS are included on the TRI Chemical List for Reporting Year 2024
- TRI Chemical List updated annually per 2020 NDAA
- For Reporting Year 2024, *de minimis* exemption no longer available, which could be used when PFAS used in small concentrations/quantities:
  - 0.1% for PFOA and 1% for other listed PFAS
- The *de minimis* exemption is also eliminated for supplier notifications to downstream facilities (40 CFR 372.45)

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PFAS WASTE TYPES/MANAGEMENT

PHASES OF PFAS WASTE

Destruction and Disposal Technology, by Physical Phase of Materials	Examples of PFAS-Containing Materials (within the Scope of the FY 2020 NDAA) That Could Be Managed Using These Technologies

Solid phase:
Landfill disposal
Thermal treatment
	• Drinking water, groundwater, and wastewater treatment residuals
	  ◦ Biosolids/sewage sludge
	  ◦ Spent GAC
	  ◦ Ion exchange resins
	• Air waste stream treatment residuals
	  ◦ Spent GAC
	  ◦ Fly ash
	• Contaminated soil
	• End-of-life products (e.g., textiles)
	• Solidified liquid wastes

Liquid phase: Underground injection Thermal treatment	• Sewage sludge (liquid) • Landfill leachate • AFFF (spent or concentrate) • End-of-life products (e.g., spent cleaning solvents) • Pollution control residuals (e.g., concentrates) from PFAS production and use
Gas phase: Thermal treatment	• Landfill gas (LFG) • Emissions from manufacture, use, or destruction of PFAS

Source: *Interim Guidance on the Destruction and Disposal of Perfluoroalkyl and Polyfluoroalkyl Substances and Materials Containing Perfluoroalkyl and Polyfluoroalkyl Substances – Version 2 (2024).* USEPA. Interim Guidance for Public Comment. April 8, 2024

EPA DESTRUCTION AND DISPOSAL GUIDANCE

Underground Injection Wells

Class I Wells -

- Inject waste below the lowest drinking water aquifer
- Four subcategories:
  - Municipal wastewater
  - Radioactive waste
  - Non-hazardous industrial waste
  - Hazardous waste

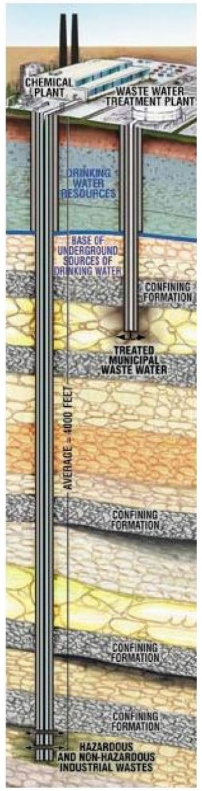

Figure 3-3. Class I wells.

Landfills

- Waste containing PFAS is no longer accepted by many non-RCRA landfills
- Any amount of PFAS puts waste in a special handling category
  - Placement in a hazardous waste landfill or mixed RCRA landfill
  - Incineration
  - On-site reuse (may not be viable due to pending Federal regulations)
- Placement in a non-hazardous waste landfill may depend on client risk tolerance as well as landfill management

Thermal Treatment

PFAS Destruction –

- Requires temperatures greater than 1,400 °C to break the C-F bond
- Thermal treatment may cause Products of Incomplete Combustion (PICs)
  - Complete destructions results in HF and CO_2 gas as the terminal products

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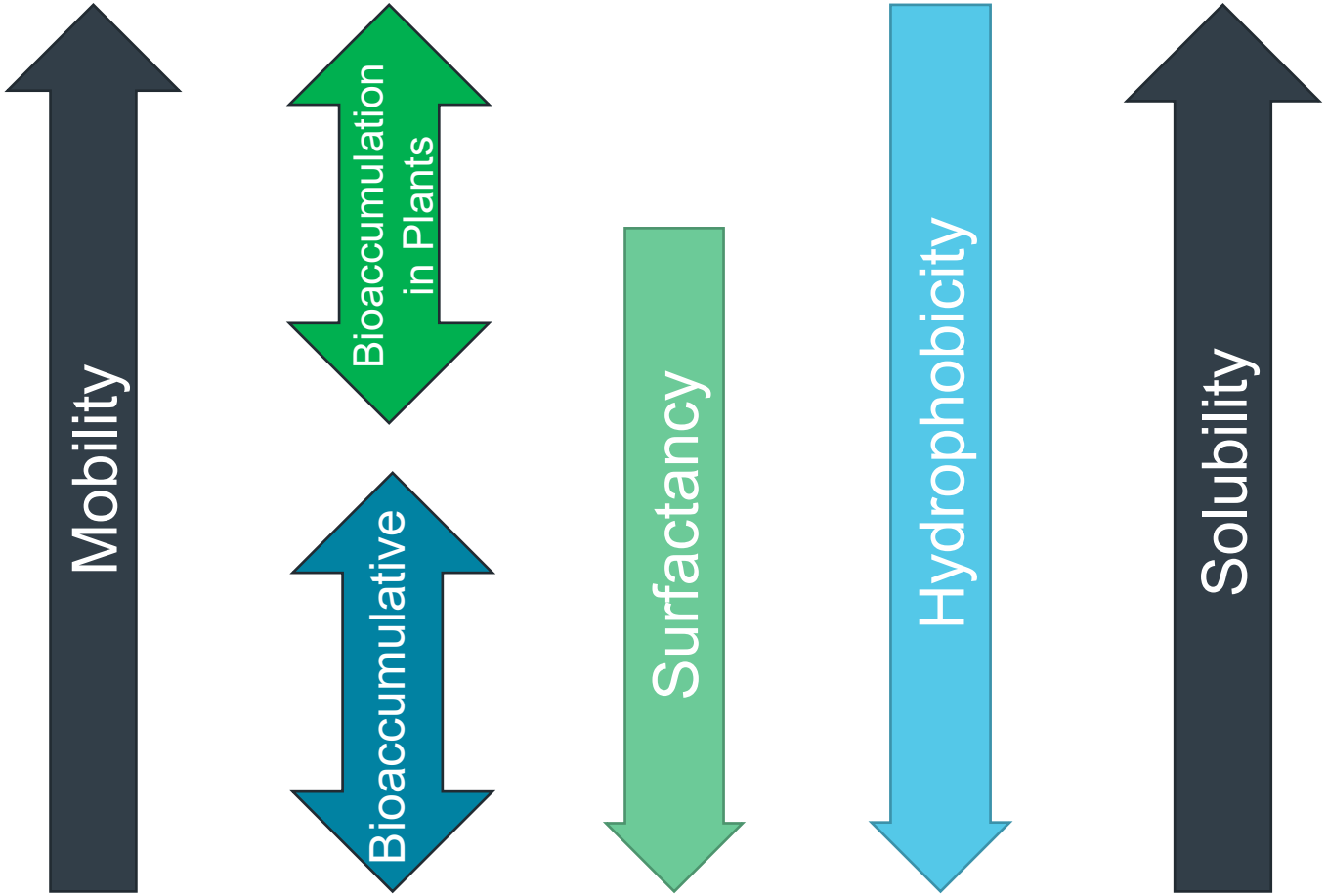
PFAS TREATMENT

PFAS ≈ ORGANIC CHEMISTRY + FLUORINE

PFAS Attribute	General Outcome
Molecule Size (# of Carbons)	Smaller ≈ more mobile, harder to treat
Linear v. Branched	Branched ≈ more mobile
Degree of fluorination	Fewer fluorenes ≈ more mobile
Functional Groups	
- *Charge*	*Charged ≈ more mobile*
- *Transformations*	*Degrade into terminal PFAS*

NGWA, PFAS Fate and Transport 2021

PFAS CHAIN LENGTHS



C2 Perfluoroethanoic acid (PFEA)
C3 Perfluoropropanoic acid (PFPrA)
Ultrashor C1-C3

C4 Perfluorobutanoic acid (PFBA)
C5 Perfluoropentanoic acid (PFPeA)
C6 Perfluorohexanoic acid (PFHxA)
C7 Perfluoroheptanoic acid (PFHpA)
Short C4-C7

C8 Perfluorooctanoic acid (PFOA)
C9 Perfluorononanoic acid (PFNA)
C14 Perfluorotetradecanoic acid (PFTeDA)
Long >C8

ESTABLISHED TREATMENT TECHNOLOGIES

Granular Activated Carbon (GAC)

- More effective on longer chain PFAS
- PFAS adsorption impacted by TOC, pH and contact time
- Generates solid waste

Ion exchange Resin (IX)

- Can effectively remove long and short chain PFAS
- Regeneration available, but most often single use
- Competition from sulfate, iron, manganese, bicarbonate, and chloride, TOC
- Generates solid waste

Combination of GAC followed by IX

- High O&M costs
- May require significant pretreatment

ESTABLISHED TREATMENT TECHNOLOGIES

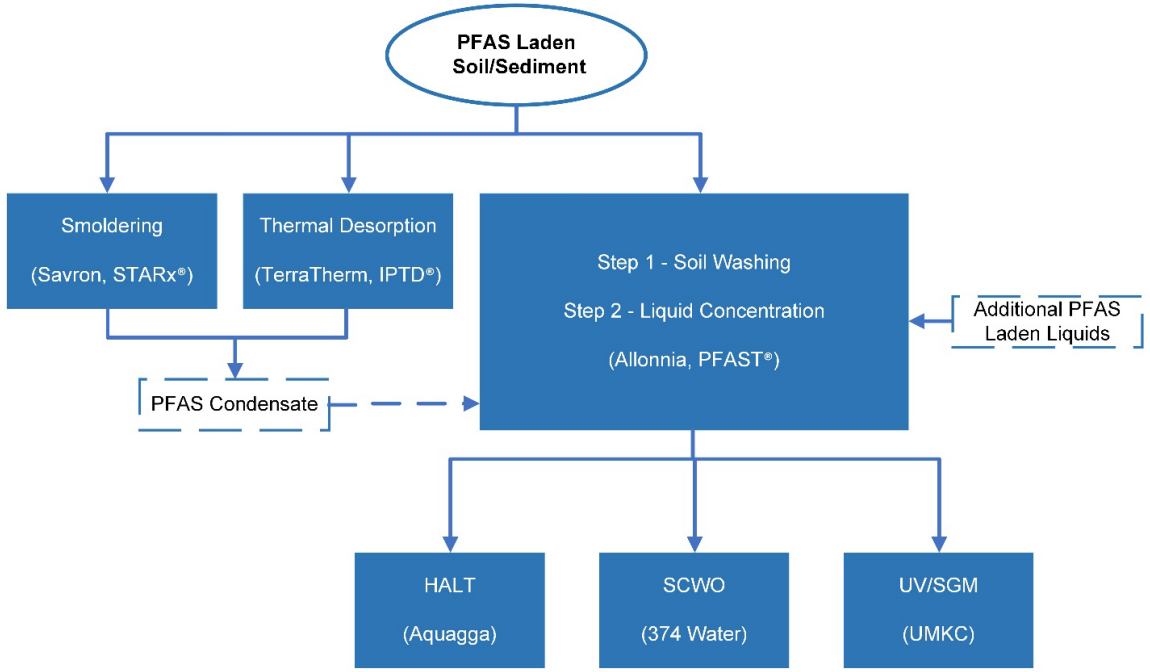
Reverse Osmosis (RO) or Nanofiltration

- Effective for both long and short chain PFAS compounds
- Requires significant pretreatment to reduce negative impact on membrane performance
- Generates liquid waste with high concentration of PFAS that requires disposal
- High capital and energy costs

Reverse Osmosis or Nanofiltration (RO or NF)

Source: OCWD PFAS Workshop 2022

DEVELOPING PFAS DESTRUCTION & REMOVAL TECHNOLOGIES



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PFAS NEWSLETTER

EPA Finalizes National Primary Drinking Water Regulation for Six PFAS

On April 10, 2024, the U.S. Environmental Protection Agency (EPA) finalized a National Primary Drinking Water Regulation (NPDWR) for six PFAS:

- Perfluorooctanoic acid (PFOA)
- Perfluorooctane sulfonic acid (PFOS)
- Perfluorohexane sulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX chemicals)
- Perfluorobutane sulfonic acid (PFBS)

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CONTACT INFORMATION

Questions?

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