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THE TIDAL WAVE HAS LANDED! PFAS CONSIDERATIONS AS PART OF YOUR BROWNFIELDS REDEVELOPMENT PROJECT

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AGENDA

Overview of PFAS

Legal Considerations with PFAS at Brownfields Sites

Environmental Due Diligence and PFAS

Site Assessment at Brownfields with a Focus on PFAS

Redevelopment Considerations with PFAS

OVERVIEW OF PFAS

- Manmade “miracle compounds”
 - Carbon-fluorine bonds
 - Developed after 1930
 - Use expanded from 1950s through early 2000s
 - Family of over ~10,000 chemicals
- Resist oil, water, heat, and reduce friction
- Used in countless products
- Varying structures all with C-F bond
 - Perfluoroalkyl acids (e.g., PFOA, PFOS, etc.)
 - Fluorotelomers (e.g., 6:2 FTOH, 6:2 FTS, etc.)
 - Fluoropolymers (e.g., PTFE, etc.)

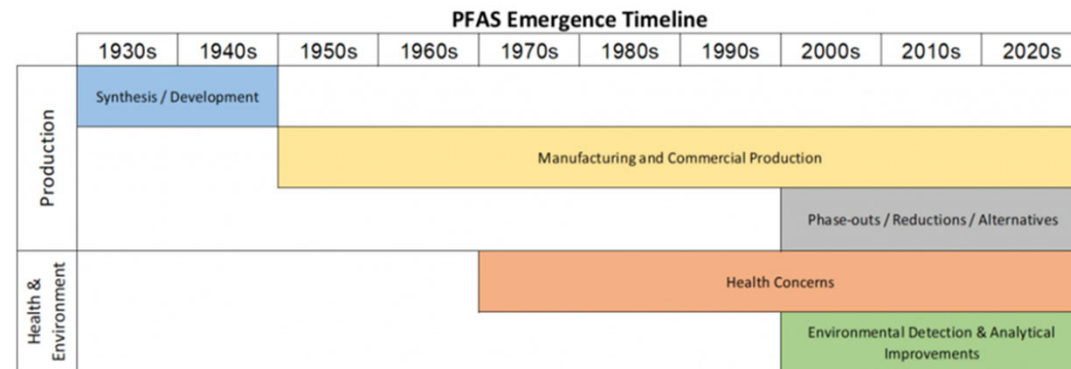


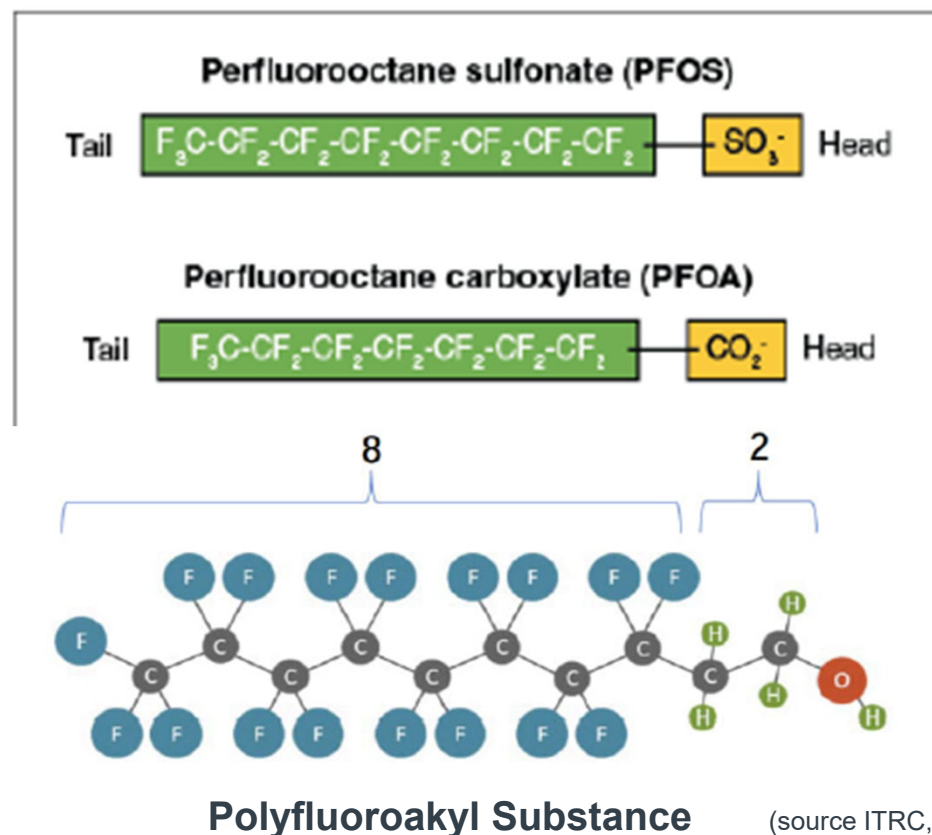
Figure 2-1. General timeline of PFAS emergence and awareness.

Graphic provides general indication of PFAS emergence and awareness by decade. Specific activities and events are described in more detail within this chapter. “Reductions/alternatives” refers to reduction in production/use and includes other PFAS that have replaced legacy chemistry.

Source: J Hale, Kleinfelder via ITRC, 2023

CHEMISTRY

- **Perfluoroalkyl substances**
 - All carbon atoms are bonded to fluorine atoms
 - e.g., perfluoroalkyl acids (e.g., PFOA, PFOS)
- **Polyfluoroalkyl substances**
 - At least one carbon is bonded to something other than a fluorine atom
 - e.g., fluorotelomer-based compounds
 - Other carbon linkages are weaknesses in molecule, open to chemical and biological degradation
- **Hydrophobic (water-hating) AND lipophobic (oil-hating)**
- **Relatively low volatility and high solubility**

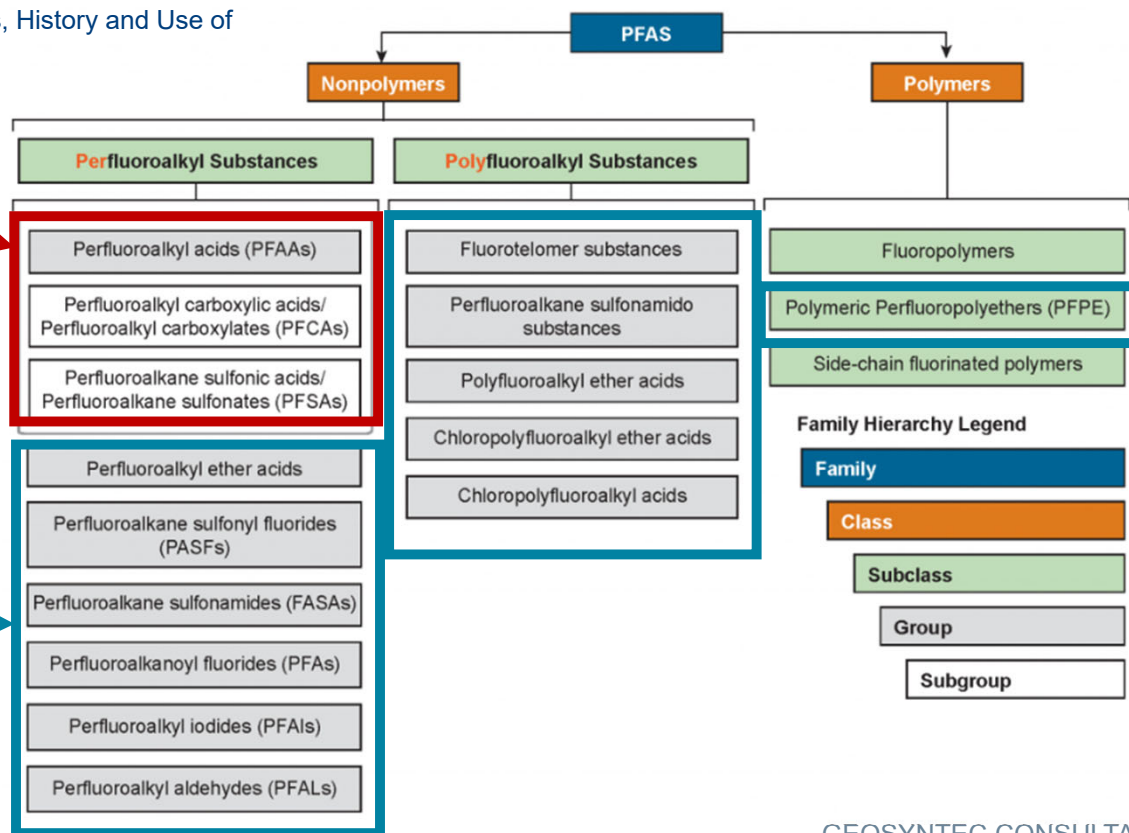


Which PFAS?

Source: IRTC, 2022. PFAS Chemistry and Naming Conventions, History and Use of PFAS, and Sources of PFAS Releases to the Environment

Mostly what we're interested in (e.g., PFOA, PFOS)

Potential Precursors



USES AND ENVIRONMENTAL SOURCES

- **Aqueous film forming foams (AFFF)**
 - Airports
 - Fire Training Facilities
 - Bulk Storage Facilities/Terminals/Refineries
 - Building Fire Suppression Systems
 - Gas Station Fire Suppression Systems
 - Military
- **Aerospace**
- **Alternative energy**
- **Automotive**
- **Chemical manufacturing**
- **Electronics**
- **Healthcare**
- **Landfills – leachate, odor and dust control**
- **Leather**
- **Medical**
 - Implants, patches and grafts
 - Low friction coatings
- **Metal plating and etching**
- **Mining**
 - Odor and dust control, Enhanced recovery
- **Paints, varnishes, sealants, waxes and polishes**
- **Paper coatings**
- **Personal care products**
 - Cosmetics, bug spray, sunscreen, dental floss
- **Performance chemicals**
 - Building and construction – weather resistant coatings
 - Hydraulic fluids
 - Fuels
 - Industrial surfactants
 - Oil and gas – enhanced recovery
- **Pharmaceuticals**
- **Photolithography**
- **Plastics**
 - Polymer manufacturing, Resins
- **Semiconductors**
- **Stain repellants**
- **Textiles**
 - Weather resistant apparel and equipment
 - Stain resistant fabrics
- **Wastewater treatment plants**
 - Effluent
 - Biosolids
- **Wire manufacturing and coating**



PFAS Conceptual Site Model

- **General sources to the environment**
 - PFAS production and synthesis
 - Industrial waste/wastewater discharges and disposal
 - Degradation of materials and consumer products
 - Leachate discharges
 - Biosolids application
- **Pathways to the environment**
 - Stack emissions
 - Discharges to WWTPs
 - Stormwater and runoff
 - Direct releases to soil and groundwater
 - Land application
 - Leaching to groundwater

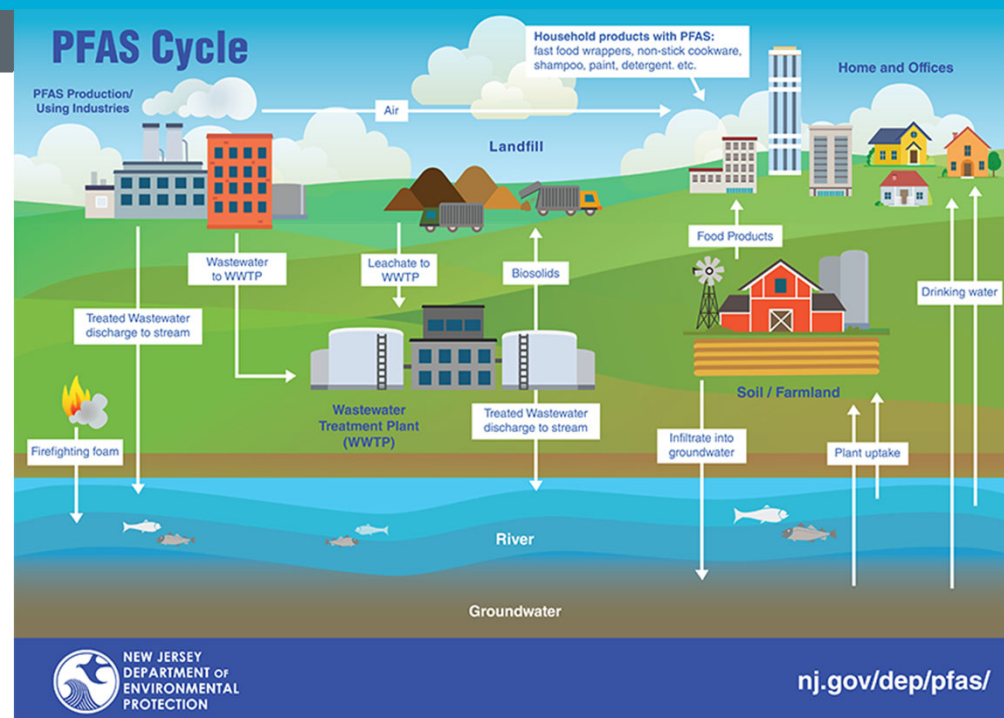


Image source: <https://www.nj.gov/dep/pfas/about.html>



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LEGAL

PFAS LEGAL CONSIDERATIONS

- Rapidly changing legal framework – federal, state, and local
- EPA enforcement of new MCLs and HALs vs. administrative carve out for passive receivers
- Could there be a CERCLA statutory exemption? Senate Committee on Public Works and the Environment is evaluating
- Expand CERCLA exemption for voluntary cleanups under State Brownfields Program

STATUS OF FLORIDA REGULATIONS

- FDEP charged by Florida Legislature with setting new CTLs in 2025
 - Status uncertain
 - Enforcement policy uncertain
 - Drycleaning Voluntary Cleanup Programs
- Local Delegated Pollution Control Programs – Generally quiet with one notable but quite exception
 - Miami-Dade County DERM & Drycleaning Sites

Beware §24-31, Miami-Dade County Code: “Whenever a violation of this chapter occurs or exists, or has occurred or existed, any person, individually or otherwise, who has a legal, beneficial, or equitable interest in the facility or instrumentality causing or contributing to the violation, or who has a legal, beneficial, or equitable interest in the real property upon which such violation occurs or exists, or has occurred or existed, shall be jointly and severally liable for said violation regardless of fault and regardless of knowledge of the violation. This provision shall be construed to impose joint and severable liability, regardless of fault and regardless of knowledge of the violation, upon all persons, individually or otherwise, who, although said persons may no longer have any such legal, beneficial or equitable interest in said facility or instrumentality or real property, did have such an interest at any time during which such violation existed or occurred or continued to exist or to occur. This provision shall be liberally construed and shall be retroactively applied to protect the public health, safety, and welfare and to accomplish the purposes of this chapter.”



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PFAS AND DUE DILIGENCE



OVERVIEW OF DUE DILIGENCE



Usually the first step in the Brownfields Process



Follows the ASTM 1527 standard



Goal = AAI Protection

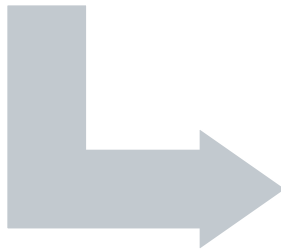
WHAT IS A RECOGNIZED ENVIRONMENTAL CONDITIONS (REC)?

RECs are (1) the presence of *hazardous substances or petroleum products* in, on, or at the subject property due to a release to the environment; (2) the likely presence of hazardous substances or petroleum products in, on, or at the subject property due to a release or likely release to the environment; or (3) the presence of hazardous substances or petroleum products in, on, or at the subject property under conditions that pose a material threat of a future release to the environment.

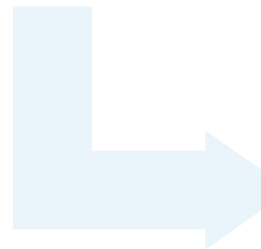
3.2.36 *hazardous substance, n*—a substance defined as a *hazardous substance* pursuant to CERCLA 42 U.S.C. § 9601(14), as interpreted by EPA regulations and the courts: “(A) any substance designated pursuant to section 1321(b)(2)(A) of Title 33, (B) any element, compound, mixture, solution, or substance designated pursuant to section 9602 of this title, (C) any *hazardous waste* having the characteristics identified under or listed pursuant to section 3001 of the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, (42 U.S.C. § 6921) (but not including any waste the regulation of which under RCRA (42 U.S.C. § 6901 *et seq.*) has been suspended by Act of Congress), (D) any toxic pollutant listed under section 1317(a) of Title 33, (E) any hazardous air pollutant listed under section 112 of the Clean Air Act (42 U.S.C. § 7412), and (F) any imminently hazardous chemical substance or mixture with respect to which the Administrator (of EPA) has taken action pursuant to section 2606 of Title 15. The term does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a *hazardous substance* under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).” (See Appendix X1.)

BEFORE JUNE 2024

Each of the PFAS and PFOA
were not considered hazardous
substances under CERCLA



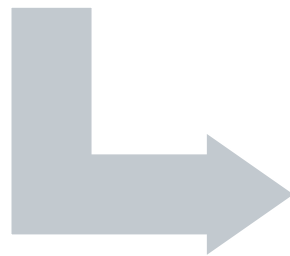
Non-scope Consideration
and/or Business
Environmental Risk



Easier on lenders and Non-
industry people to approve of
the development

AFTER JUNE 2024

PFAS and PFOA (and the four other compounds) are the only compounds considered hazardous substances under CERCLA



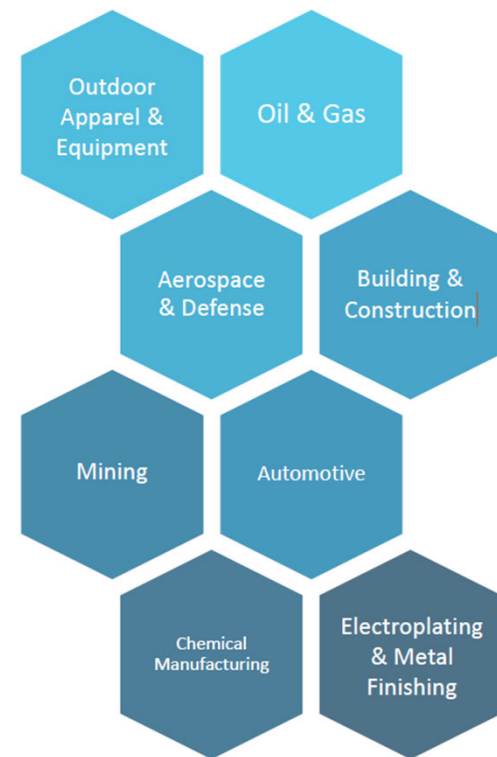
Findings and Classification needs to occur (REC is on the table)



Harder on lenders and non-industry professionals approve of the development

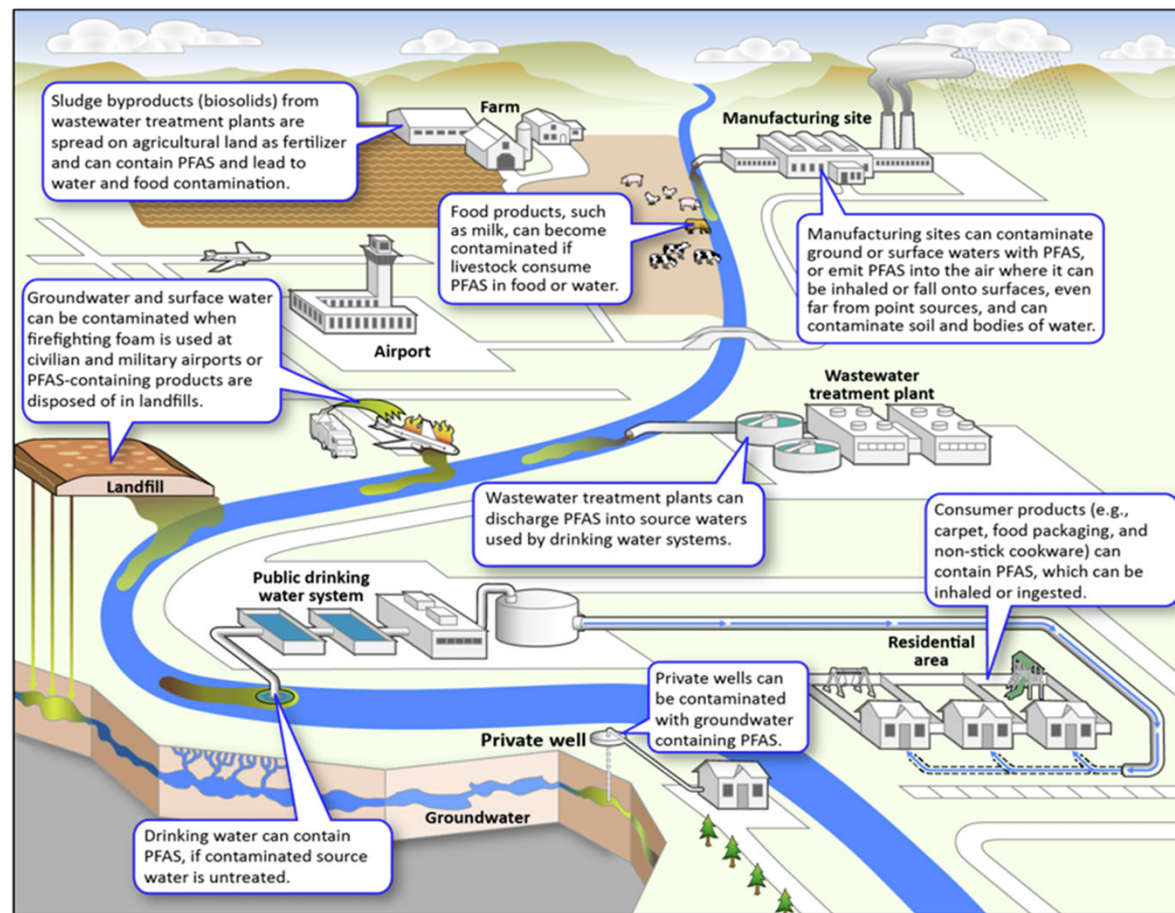
POTENTIAL PFAS USES AND INDUSTRIES

- Variety of applications and industries
- AFFF releases (fire training facilities and fire locations)
- Wastewater/sewage treatment plants + sludge disposal area
- Identify previous and current site usage with an understanding of PFAS sources
 - Understand timing of operations (synthesis started in 1930s/40s)
 - Identify pathways to the environment (releases, land application, air deposition, lagoons, etc.)



Source: FluoroCouncil (www.FluoroCouncil.org)

POSSIBLE ROUTES OF PFAS RELEASES



UNDERSTANDING THE PFAS DATABASES

- Becoming more robust and widely used
- Can serve as a useful starting point but you should not end there

PFAS NPL	Superfund Sites with PFAS Detections Information
PFAS FEDERAL SITES	Federal Sites PFAS Information
PFAS TSCA	PFAS Manufacture and Imports Information
PFAS RCRA MANIFEST	PFAS Transfers Identified in the RCRA Database Listing
PFAS ATSDR	PFAS Contamination Site Location Listing
PFAS WQP	Ambient Environmental Sampling for PFAS
PFAS NPDES	Clean Water Act Discharge Monitoring Information
PFAS ECHO FIRE TRAINING	Facilities in Industries that May Be Handling PFAS Listing
PFAS PART 139 AIRPORT	All Certified Part 139 Airports PFAS Information Listing
AQUEOUS FOAM NRC	Aqueous Foam Related Incidents Listing
PFAS	PFAS Contamination Site Listing
ASBESTOS	ASBESTOS
COAL ASH	Coal Ash Disposal Sites
Financial Assurance	Financial Assurance Information Listing
UIC	Underground Injection Wells Listing
AOP	Animal Operation Permits Listing
PCSRP	Petroleum-Contaminated Soil Remediation Permits
PFAS TRIS	List of PFAS Added to the TRI

PFAS/PFOA Contaminated Sites:

PFAS NPL

This list of National Priorities List (NPL) and related Superfund Alternative Agreement (SAA) sites where PFOA or PFOS contaminants have been detected in water and/or soil is provided by the U.S. Environmental Protection Agency (EPA). EPA Disclaimer with FOIA file: Inclusion on the list does not necessarily mean that drinking water has been affected, nor does inclusion mean that anyone at the site has been exposed or is at risk for detrimental health effects.

Government Publication Date: Jun 15, 2023

Federal Agency Locations with Known or Suspected PFAS Detections:

PFAS FED SITES

List of Federal agency locations with known or suspected detections of Per- and Polyfluoroalkyl Substances (PFAS), made available by the U.S. Environmental Protection Agency (EPA) in their PFAS Analytic Tools data. EPA outlines that these data are gathered from several federal entities, such as the Federal Superfund program, Department of Defense (DOD), National Aeronautics and Space Administration, Department of Transportation, and Department of Energy. The dates this data was extracted for the PFAS Analytic Tools range from March 2022 to April 2023. Sites on this list do not necessarily reflect the source/s of PFAS contamination and detections do not indicate level of risk or human exposure at the site. Agricultural notifications in this data are limited to DOD sites only. At this time, the EPA is aware that this list is not comprehensive of all Federal agencies.

Government Publication Date: Apr 24, 2023

PFAS Industry Sectors:

PFAS IND

This Per- and Poly-Fluoroalkyl Substances (PFAS) Industry Sectors dataset is made available via the U.S. Environmental Protection Agency's (EPA) PFAS Analytic Tools. The EPA developed the dataset from various sources that show which industries may be handling PFAS including: EPA's Enforcement and Compliance History Online (ECHO) records restricted to potential PFAS-handling industry sectors; ECHO records for Fire Training Sites identified where fire-fighting foam may have been used in training exercises; and 14 CFR Part 139 Airports compiled from historic and current records from the FAA Airport Data and Information Portal. Since July 2006, all certificated Part 139 Airports are required to have fire-fighting foam onsite that meet certain military specifications, which to date have been fluorinated (Aqueous Film Forming Foam). Limitations: Inclusion in this dataset does not indicate that PFAS are being manufactured, processed, used, or released by the facility. Listed facilities potentially handle PFAS based on their industrial profile, but are unconfirmed by the EPA. Keyword searches in ECHO for Fire Training sites may misidentify some facilities and should not be considered to be an exhaustive list of fire training facilities in the U.S.

Government Publication Date: Apr 16, 2023

BEFORE WE GO - SOME LEGAL CONSIDERATIONS

- Understand and calibrate the risk of the end-users; prepare for the short-term and long-term implications (regulatory, third-party liability, construction deltas)
- Understand and calibrate the regulatory environment and enforcement/collaboration posture of the agency
- Understand and calibrate the sensitivity of the investigation – “to high” vs. “too high”
- Liability Protection Structures
 - Brownfield Site Rehabilitation Agreement
 - Roll-forward of BSRA eligibility date for local governments
 - Environmental Insurance



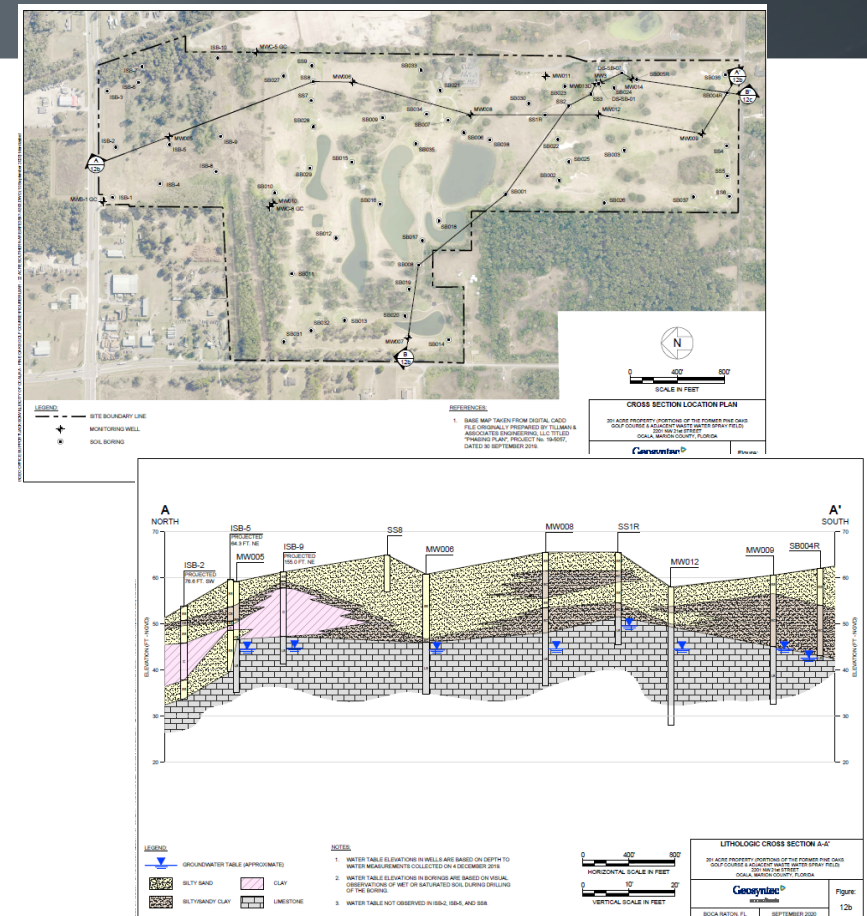


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ASSESSMENT

CONCEPTUAL SITE MODEL

- Chapter 62-780, FAC is still the driver for cleanup – RBCA incorporated into redevelopment
- Developing an initial Conceptual Site Model (CSM)
 - Environmental Due Diligence/**Source identification**
 - Evaluation of groundwater flow direction
 - Assessment of vertical and horizontal extent of impacts in affected media
 - Interpretation of hydrogeologic framework
 - Consideration of contaminant specific properties**

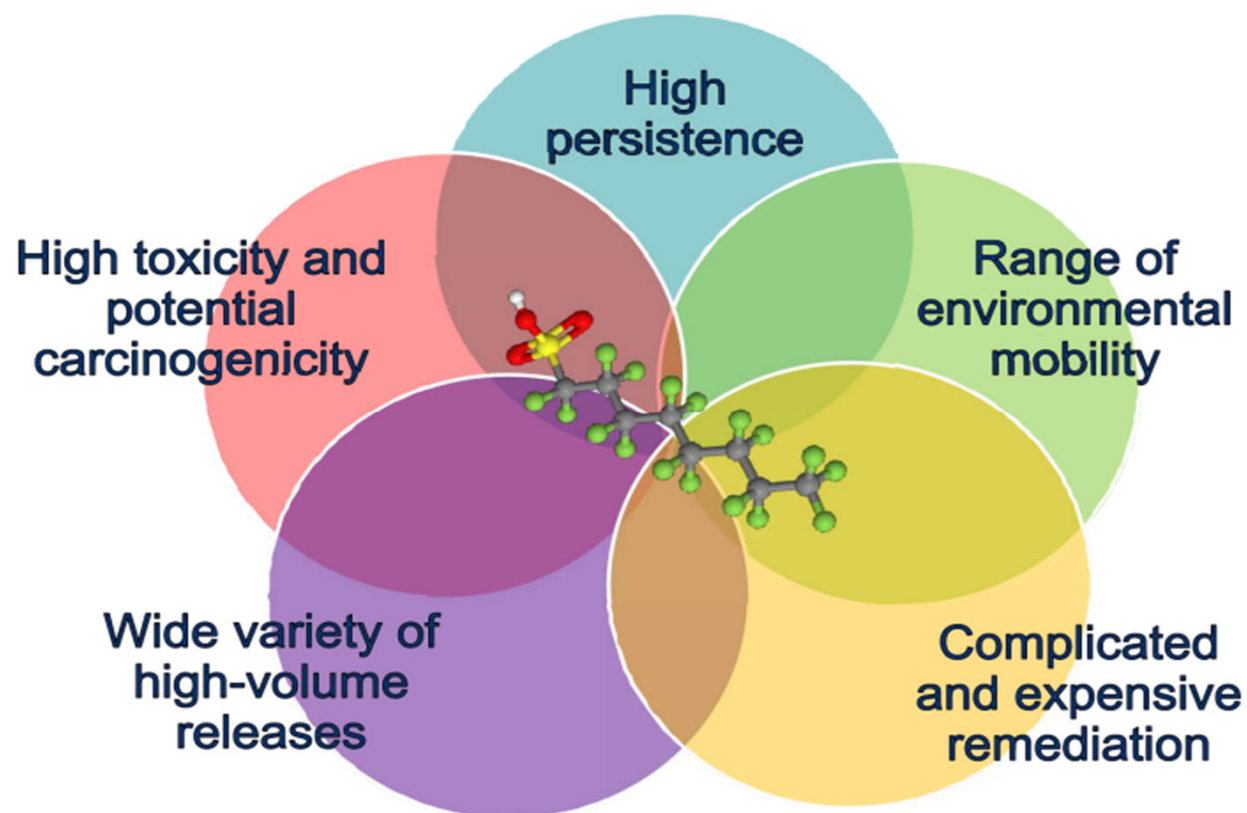


Site Investigation Strategies with PFAS in Mind

- Desktop review
 - Keyword searches of multiple documents
- Site visits and interviews
- Refining Conceptual Site Model (CSM) with PFAS
 - Highly mobile
 - Potentially large groundwater plumes
 - Potentially high concentrations in groundwater with little soil impacts
 - May be separate from other chemical plumes
 - Generally resistant to microbial degradation

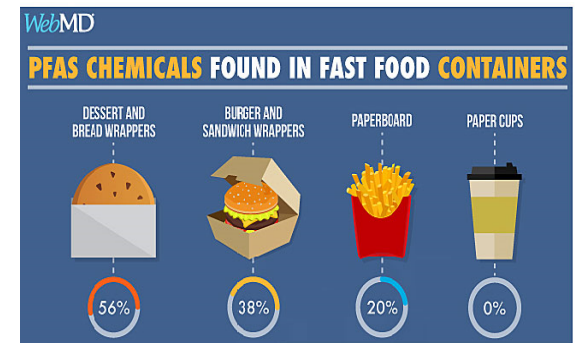


PERFECT STORM OF ENVIRONMENTAL CHALLENGES



WHY PFAS-SPECIFIC SOPS FOR DRILLING AND SAMPLING?

- Avoid cross-contamination, false positive results
 - PFAS potentially present in variety of commonly-used materials
 - Low method detection limits (low to sub ng/L)
- Current sampling guidance reflect abundance of precaution, rather than scientific findings
 - Guidance varies state by state, still in infancy
 - Rapid changes to state of knowledge, state and federal guidance and regulations



Challenges with PFAS Sampling



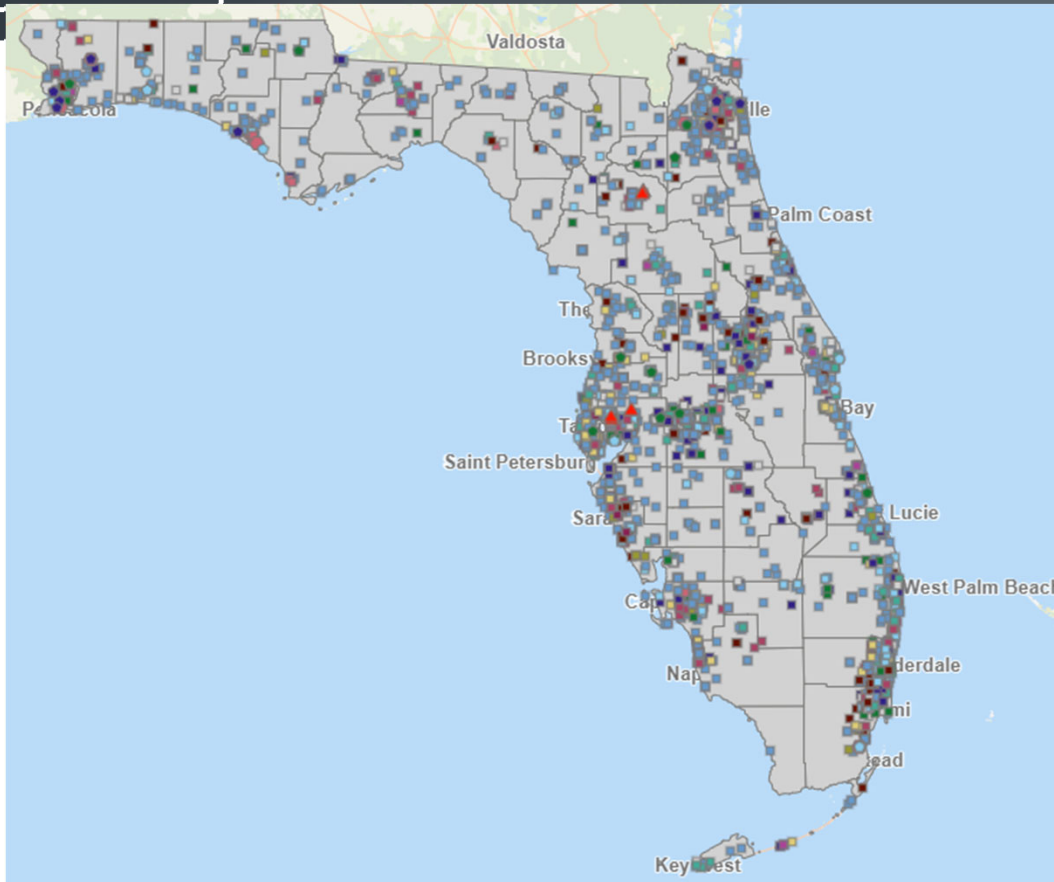
- Common in environmental sampling equipment and materials
 - Potential cross contamination
- Water source (decon and drilling)
- Waste disposal options
- Regular changes in SOPs due to new information
 - Affects data quality

Laboratory Selection

- Laboratory SOPs and methods
 - EPA Method 533
 - EPA Method 537.1
 - EPA Method 1633
 - DoD QSM
- Accreditations
- Experience
- Pricing
- Turnaround time



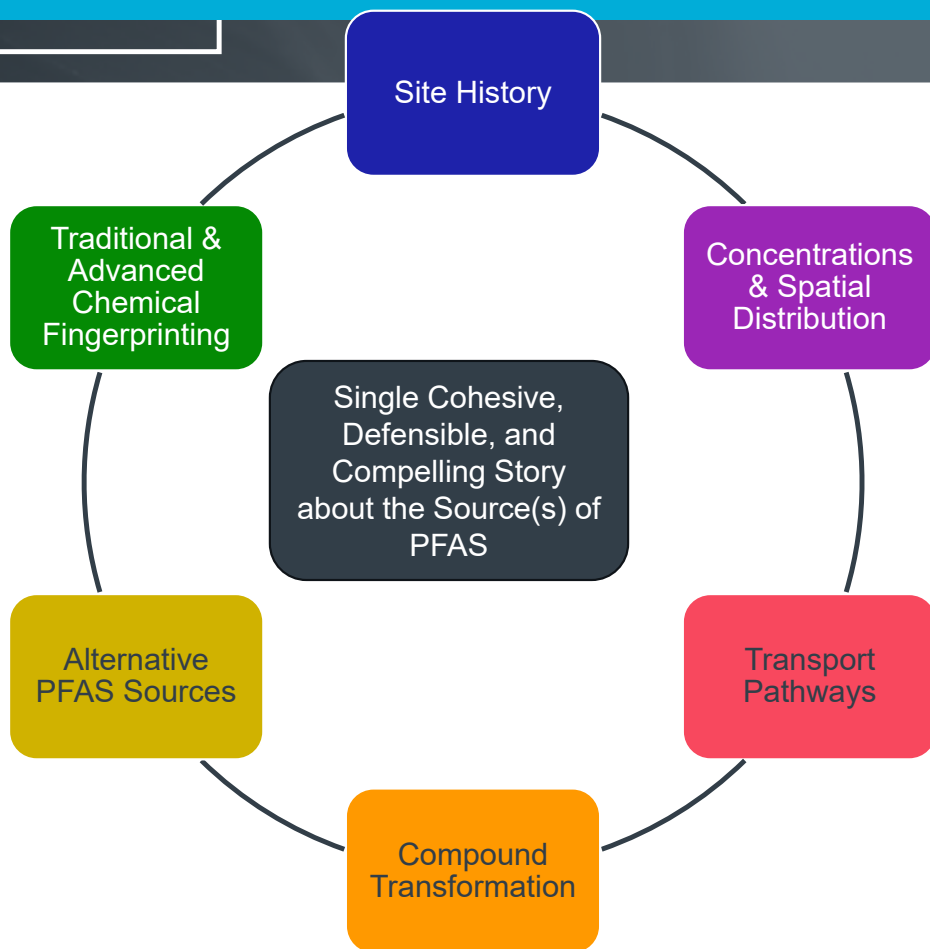
A Few Thoughts on Background Concentrations and PFAS



EPA Sites with Known or Suspected PFAS:

- PFAS Manufacturer or Importer (5)
- Water Discharger (327)
- Superfund Sites (6)
- Federal Sites (32)
- Flagged Industry Sectors (3,810 active and inactive)
- Known Spill Locations (67)

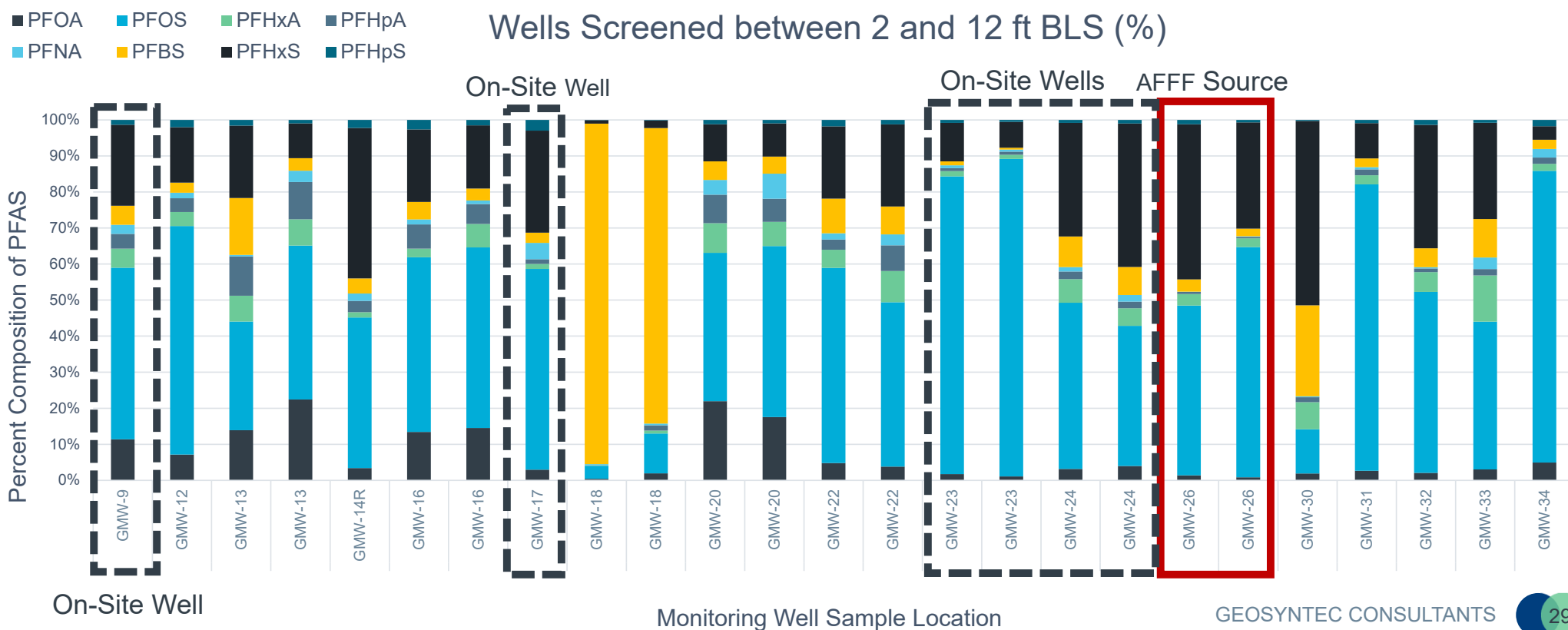
Forensic Techniques for PFAS



- The application of environmental forensics to PFAS presents unique challenges
- Forensics relies on a multiple lines of evidence approach
- It is possible to identify and differentiate PFAS contributions from multiple sources ("signatures" for each)
- Forensics can assist ongoing investigation and remediation strategies and limit liability

Distribution of PFAS Compounds in Groundwater

Traditional
Chemical
Fingerprinting





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REDEVELOPMENT CONSIDERATIONS

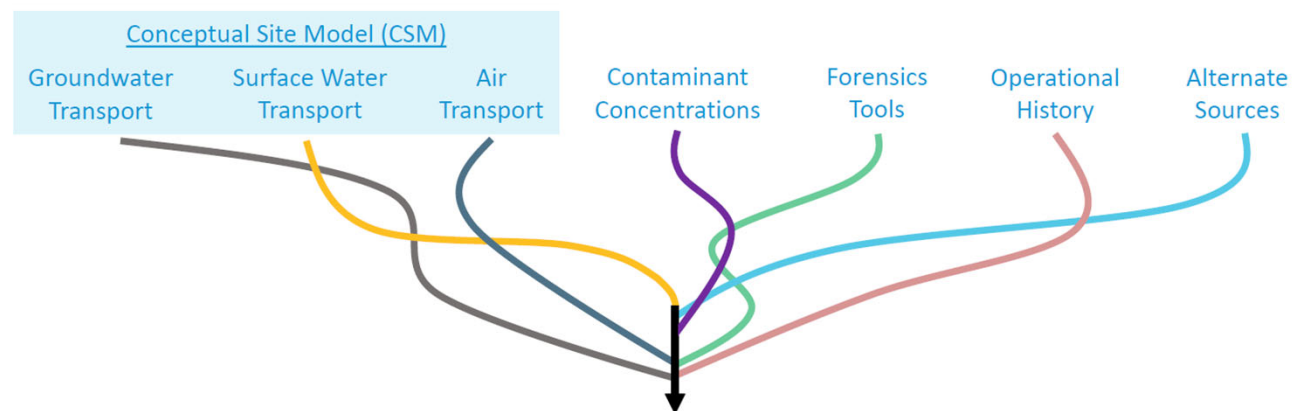
CHALLENGES FOR PFAS REDEVELOPMENT

1. Additional effort associated with assessment and cleanup of PFAS
2. Will my redevelopment reopen a closed site?
3. How am I going to pay for all of this?



LET'S DIVE INTO CHALLENGES ASSOCIATED WITH ASSESSMENT

- Easy to cross contaminate = higher than average cost for each PFAS sample collected
- Solutions = Develop a Conceptual Site Model (CSM) as part of assessment activities



Multiple lines of evidence telling a single cohesive, defensible, and compelling story about sources

ANTHROPOGENIC BACKGROUND CONCENTRATIONS

Media	Range of Total PFAS (ng/L)
Surface Water	4.4 – 169
Tap Water	1.6 – 242
Surficial Groundwater	0 – 146

Geosyntec compilation of Florida values from multiple literature sources.

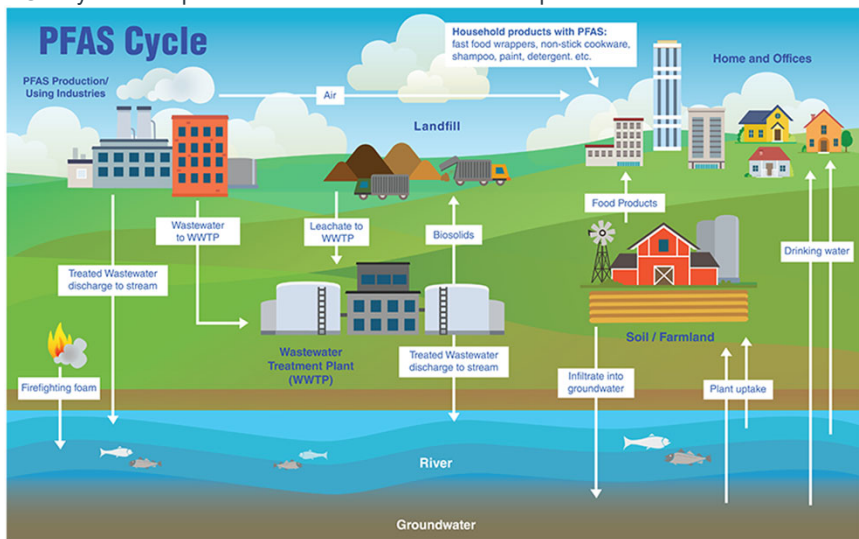


Image Source: NJDEP

- Anthropogenic background represents levels of PFAS at a site that would be present if local source(s) were absent
- Literature review of aqueous media in Central, Southern, Western, and Eastern FL
 - Not attributed to a specific source
- Higher concentrations typically correlate with higher population densities and more developed areas

LET'S DIVE INTO CHALLENGES ASSOCIATED WITH CLEANUP

- PFAS can be treated to below the MCLs
- Pre-treatment is key
- Multiple technologies available. Selection governed by:
 - Volumes to treat
 - Water quality (influent or effluent specifics)
 - PFAS species to treat



Carbon Adsorption:
granular activated carbon (GAC)



Ion Exchange
(IX) resin



Reverse Osmosis or Nanofiltration
(RO or NF)

REOPENER

Classic reopeners still exist HOWEVER
there is a grandfather provision



HOW AM I GOING TO PAY FOR THIS?

- Private Development – Follow the Florida Brownfield Model
 - VCTCs!!
- Municipal and EJ Funded Developments - US EPA Grants
 - Brownfields Grants
 - Emerging Contaminants Grant for Small or Disadvantaged Communities



FY 2024 BIL Emerging Contaminants in Small or Disadvantaged Communities Grant Allotments
Based on FY2024 Appropriations of \$945.7M

State/Territories	Allocation	State/Territories	Allocation
Alabama	\$25,707,000	New Hampshire	\$9,457,000
Alaska	\$9,457,000	New Jersey	\$33,570,000
American Samoa	\$9,457,000	New Mexico	\$9,457,000
Arizona	\$21,385,000	New York	\$41,487,000
Arkansas	\$9,457,000	North Carolina	\$29,322,000
California	\$82,961,000	North Dakota	\$9,457,000
Colorado	\$41,849,000	Northern Mariana Islands	\$9,457,000
Connecticut	\$9,457,000	Ohio	\$22,466,000
Delaware	\$9,892,000	Oklahoma	\$10,526,000
District of Columbia	\$9,457,000	Oregon	\$9,505,000
Florida	\$40,732,000	Pennsylvania	\$37,013,000
Georgia	\$25,826,000	Rhode Island	\$9,457,000
Guam	\$9,457,000	Puerto Rico	\$9,457,000
Hawaii	\$9,457,000	South Carolina	\$11,048,000
Idaho	\$9,457,000	South Dakota	\$9,457,000
Illinois	\$21,806,000	Tennessee	\$13,163,000
Indiana	\$12,848,000	Texas	\$55,125,000
Iowa	\$9,457,000	Utah	\$9,457,000
Kansas	\$9,457,000	US Virgin Islands	\$9,457,000
Kentucky	\$11,086,000	Vermont	\$9,457,000
Louisiana	\$12,765,000	Virginia	\$13,519,000
Maine	\$9,457,000	Washington	\$17,321,000
Maryland	\$9,458,000	West Virginia	\$9,457,000
Massachusetts	\$19,249,000	Wisconsin	\$13,224,000
Michigan	\$19,734,000	Wyoming	\$9,457,000
Minnesota	\$14,751,000		
Mississippi	\$10,023,000		
Missouri	\$12,457,000		
Montana	\$9,457,000		
Nebraska	\$9,457,000		
Nevada	\$9,457,000		

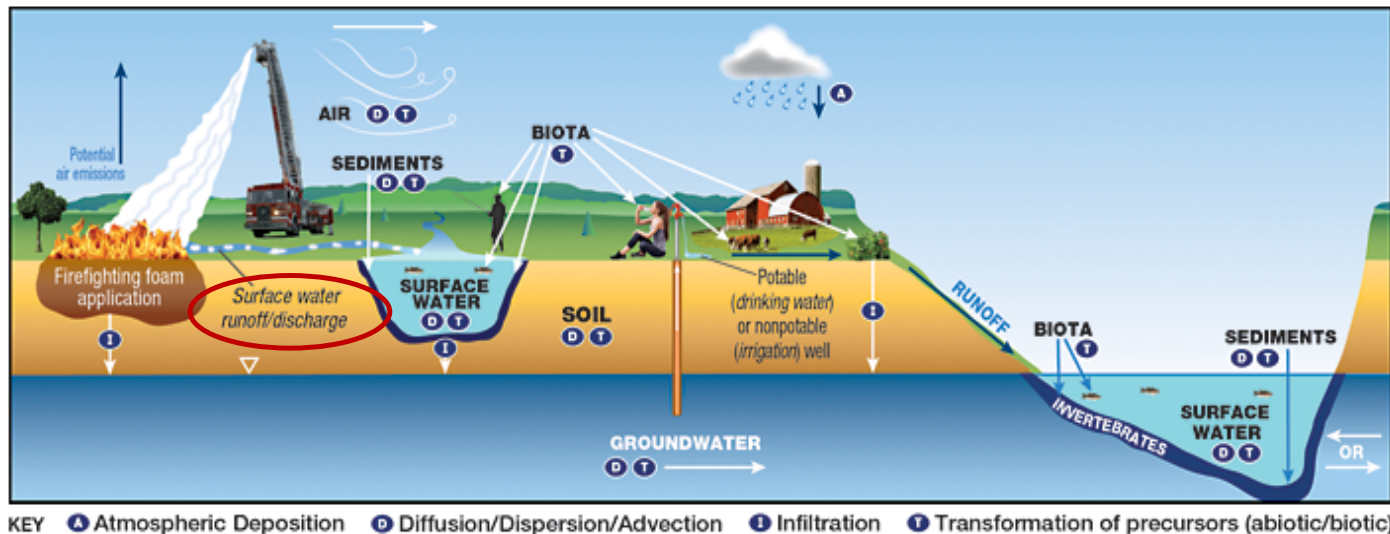
TYPES OF PROJECTS FUNDED BY EMERGING CONTAMINANTS GRANT

- Efforts to address emerging contaminants in drinking water that would benefit a small or disadvantaged community on a per household basis
- Technical assistance to evaluate emerging contaminant problems
- Programs to provide household water-quality testing, including testing for unregulated contaminants
- Local contractor training
- Activities necessary and appropriate for a state to respond to an emerging contaminant



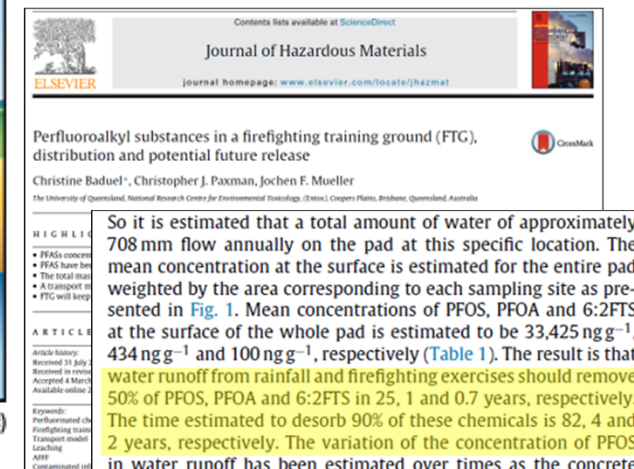
ONE FINAL THING – PFAS AND STORMWATER

Stormwater is an important – and potentially long-term – migration pathway for PFAS at sites with impacted surficial media



Source: ITRC

Groundwater-to-surface water (including through storm drains) is another important pathway, but not covered here



THANK YOU!

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