EPA United States Environmental Protection Agency

Sustainable and Healthy Communities: Chemicals of Immediate Concern (PFAS)

Identification and Characterization of PFAS Sites and Sources

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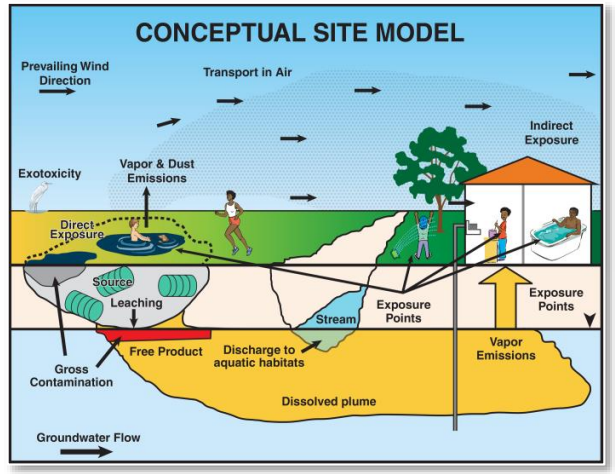
Sustainable and Healthy Communities (SHC)

Provide technical solutions, tools, information, and other resources in three topic areas critical to fulfilling the Agency's mission to protect the environment and safeguard public health:

1. **Contaminated Sites: Accelerating Clean-Ups**
2. **Waste and Materials Management: Reducing the Burden of Contamination**
3. **Healthy and Resilient Communities: Revitalizing Communities from Contamination and Natural Disasters/Extreme Events**

PFAS research organized into 3 outputs

1. **Identification and Characterization of PFAS Sites and Sources**
2. **Remediation and Treatment to Manage PFAS in the Environment**
3. **Methodology for Estimating PFAS Multi-media Human Exposure to Identify Locations of High Potential Exposure**



Identification and Characterization of PFAS Sites and Sources

Research will

- **Develop sampling and analysis methods for identifying and characterizing PFAS sources such as**
  - **Source zones contaminating groundwater**
  - **Land applied materials including wastewater treatment residuals**
  - **Landfills**
- **Characterize environmental sources of PFAS at sites**
- **Provide technical support to Regions, states, and communities.**

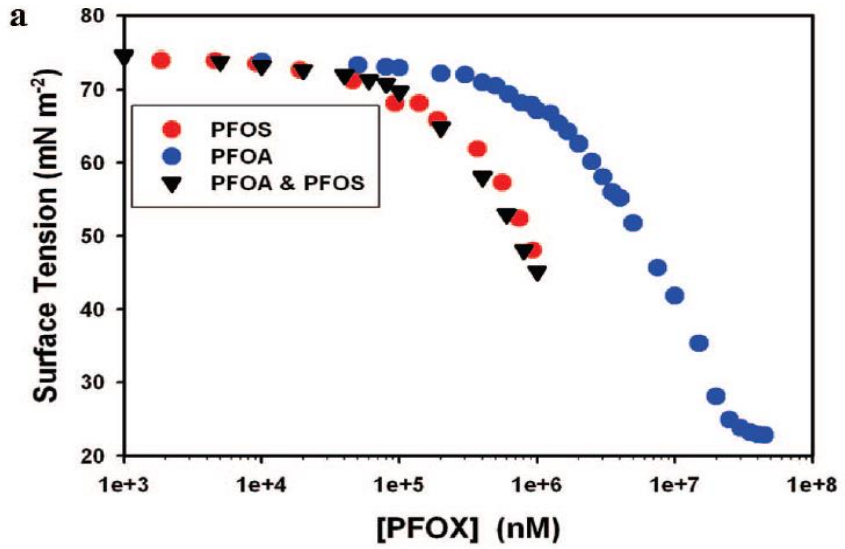
Characterizing Source Zones Contaminating Groundwater

Research Questions

- Do the surfactant properties of PFAS affect fate and transport in the environment?
- What techniques are available to quickly measure PFAS in the environment?
- How well do analytical methods for PFAS perform?
- Are sampling methods adequate to measure PFAS in environmental media?

Fate and Transport of PFAS

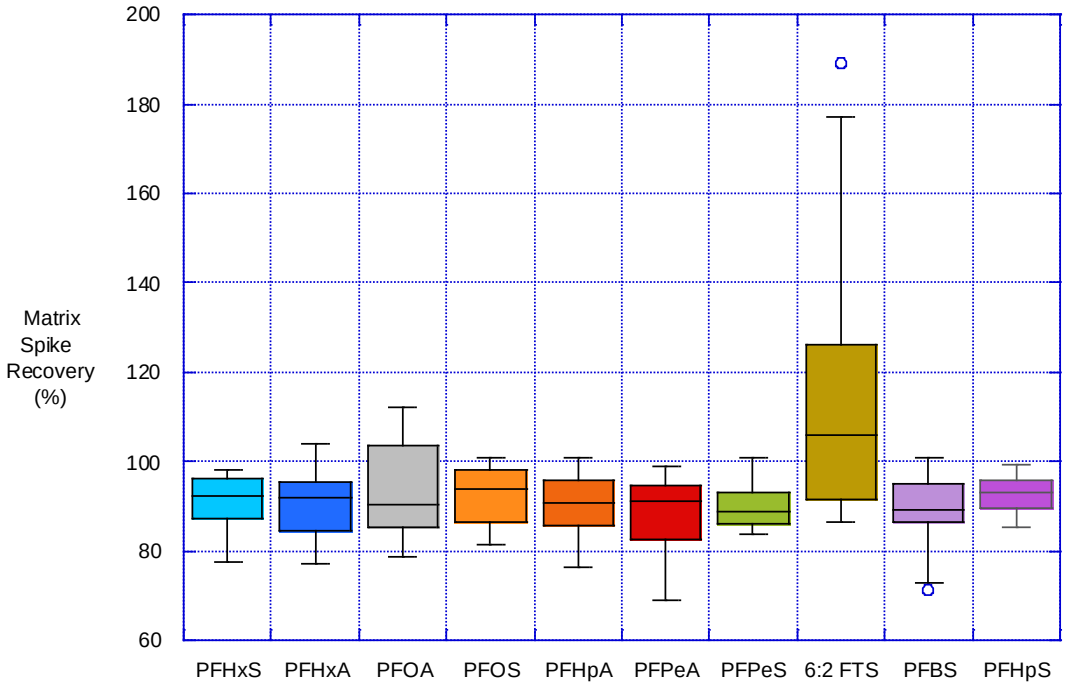
- PFAS compounds have surfactant properties, which may result in:
  - Fluid-fluid interfacial partitioning;
  - Impacts to surface/interfacial tension, which in turn impact fluid distributions; and
  - Enhanced NAPL transport due to the formation of micelles.
- These features are important to immiscible fluid flow problems, such as:
  - PFAS transport and retention through the vadose zone, and
  - Transport of NAPL and PFAS compounds as co-contaminants.



(Vecitis et al., 2008)

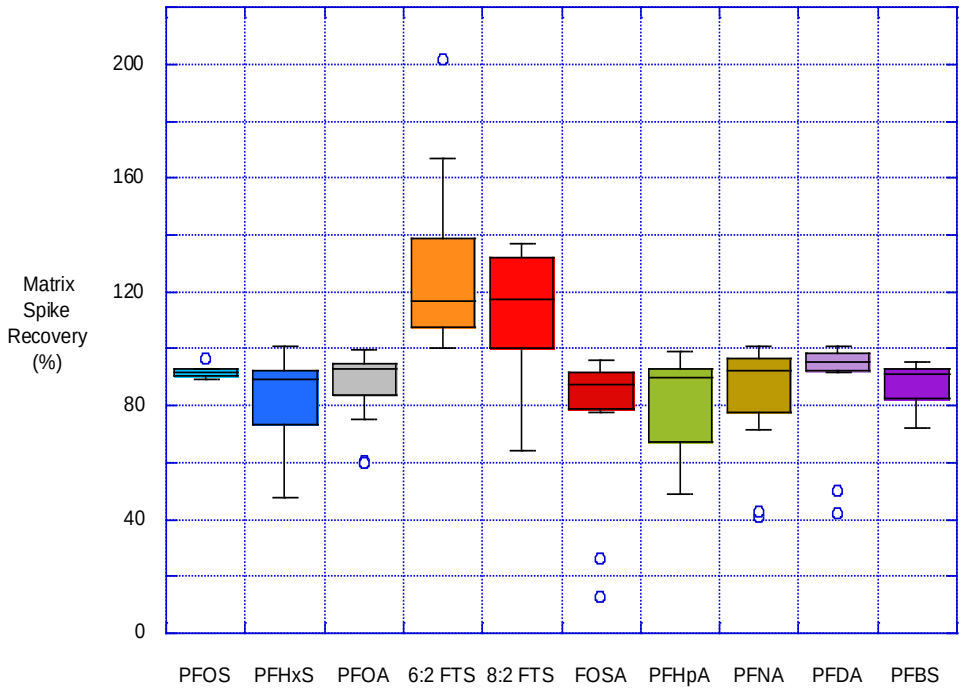
Performance of Analytical Methods
PFAS by Direct Injection, LC/MS/MS

Environmental Waters

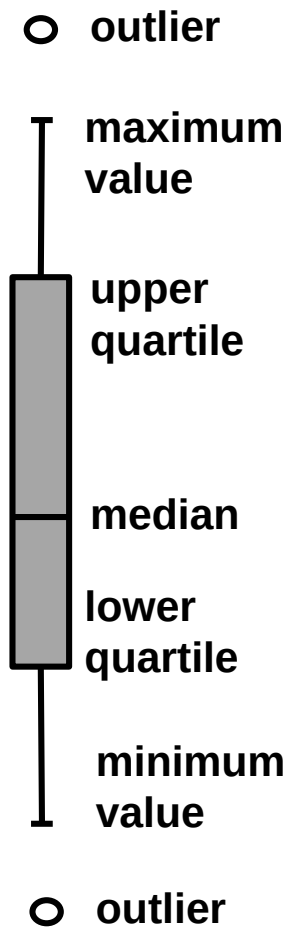


N= 25 to 29

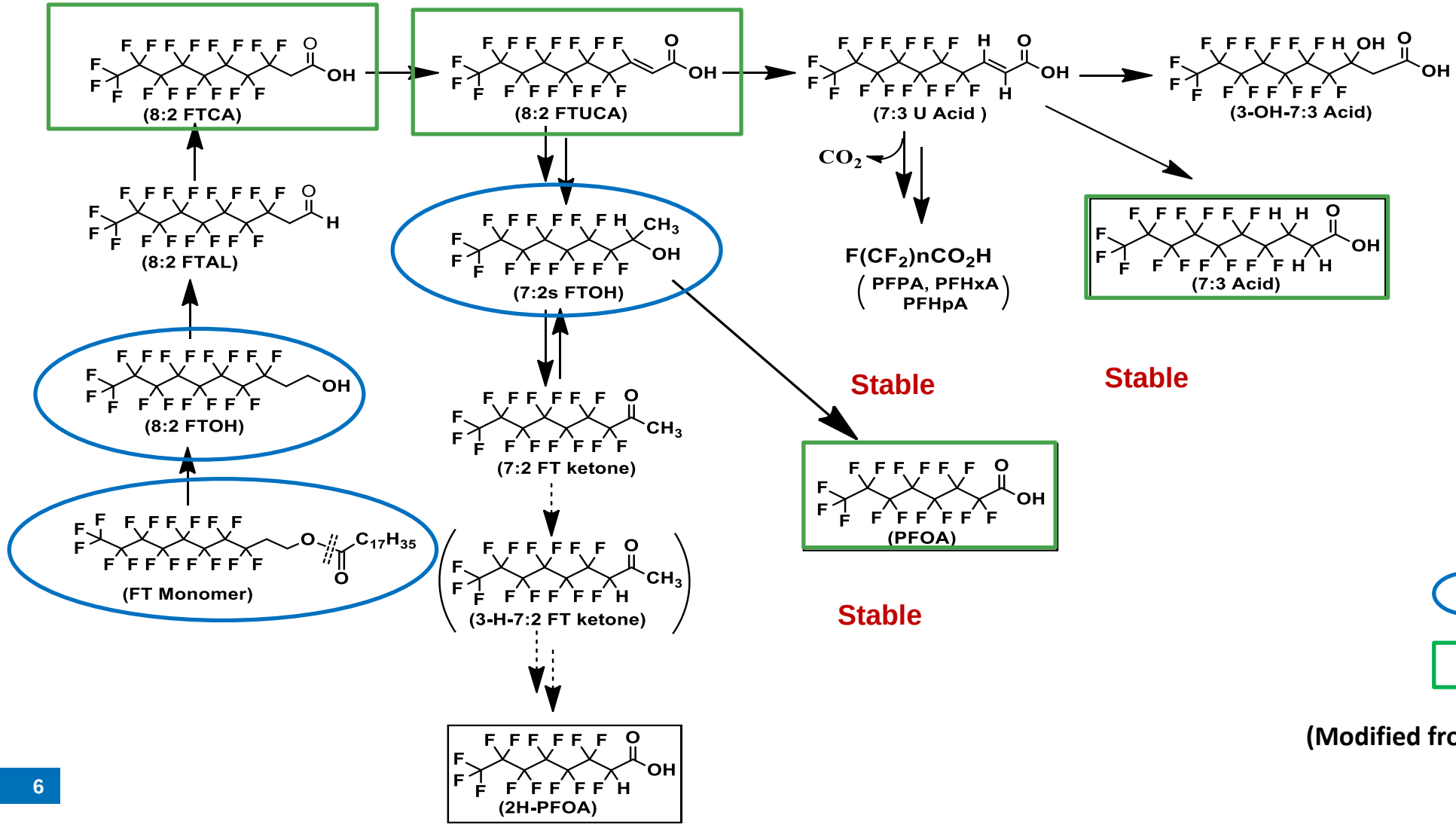
Soils and Sediments



For most PFAS N= 11 to 14
N PFOS = 6



Transformation to form PFOA



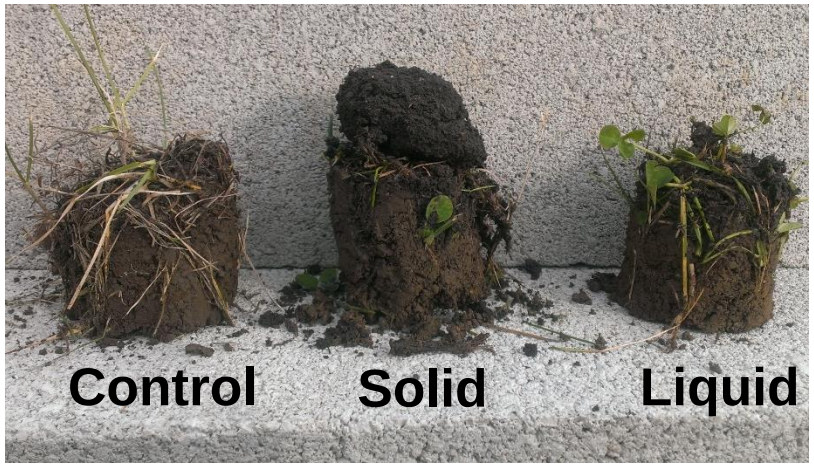
(Modified from Wang et al., 2009)

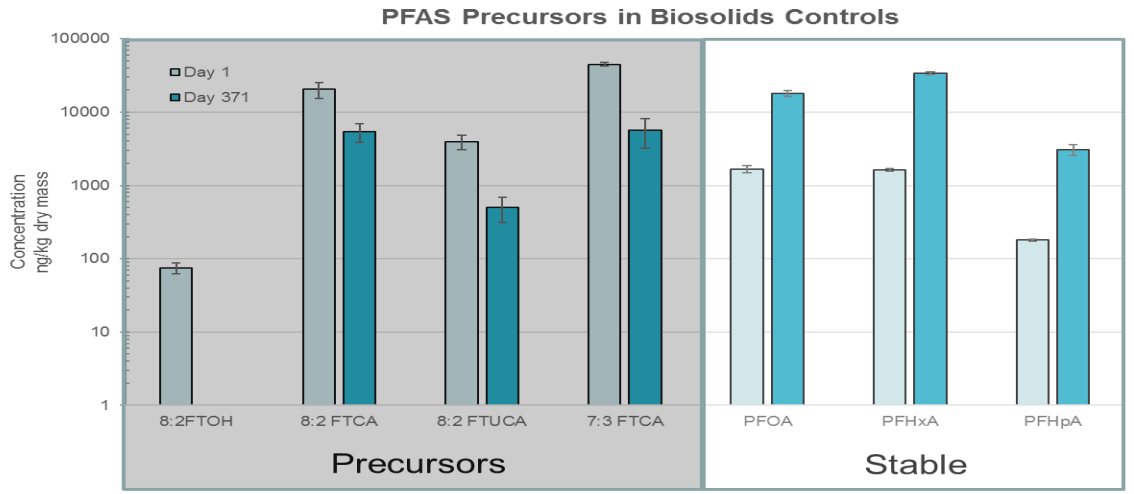
Land Applied Materials

- Problem: Lack of knowledge regarding end-of-life management of PFAS-containing consumer and industrial products
- Action:
  - Characterize end-of-life PFAS disposal streams (e.g. municipal, industrial, manufacturing, recycled waste streams)
  - Evaluate efficacy of materials management technologies (e.g. land application, landfilling, incineration) to manage end-of-life disposal
  - Evaluate performance and cost data with collaborators to manage these materials and avoid environmental PFAS releases
- Results: Provide technologies, data and tools to manage end-of-life streams
- Impact: Responsible officials will be able to manage effectively end-of-life disposal of PFAS-containing products

Land Applied Materials

- **Action: Evaluate different application methods for liquid and solid biosolids, and evaluate natural attenuation for various analytes including PFAS**
- **Results**
  - **Precursor concentrations were similar to PFAA concentrations**
  - **Precursor concentrations decreased with time**
  - **Stable PFAAs increased over 371 days commensurate to the expected metabolic pathways from precursor material**





Future work: PFAS Fate and Transport

Conduct research on land application / drinking water connection: Connect land applied biosolids to groundwater quality

- PFAS fate and transport from biosolids land application by measuring PFAS concentrations through the soil horizons to groundwater

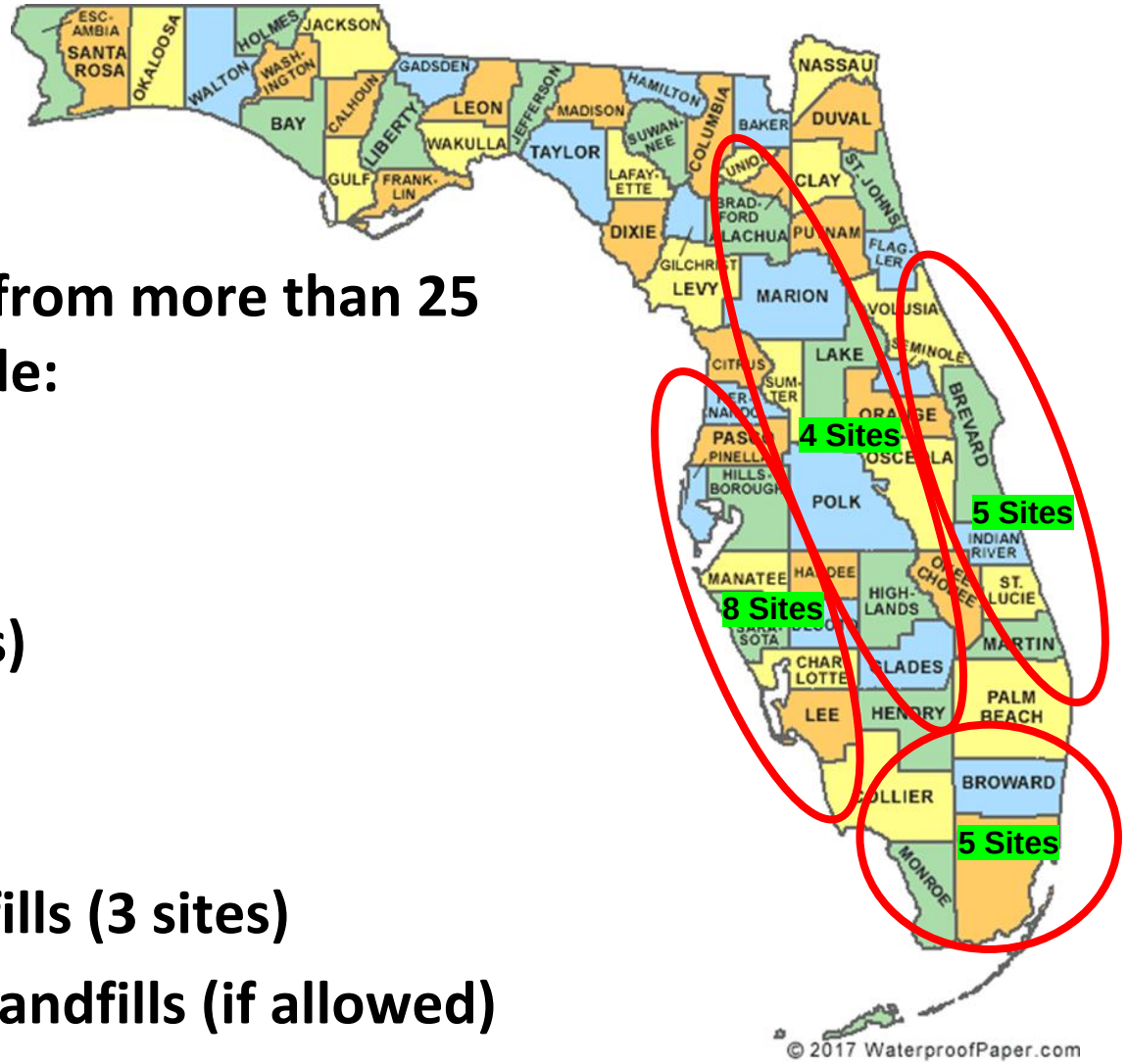
- Models to characterize PFAS infiltration, unsaturated zone processes, and transport of PFAS to source waters (surface and groundwater)

Materials Management

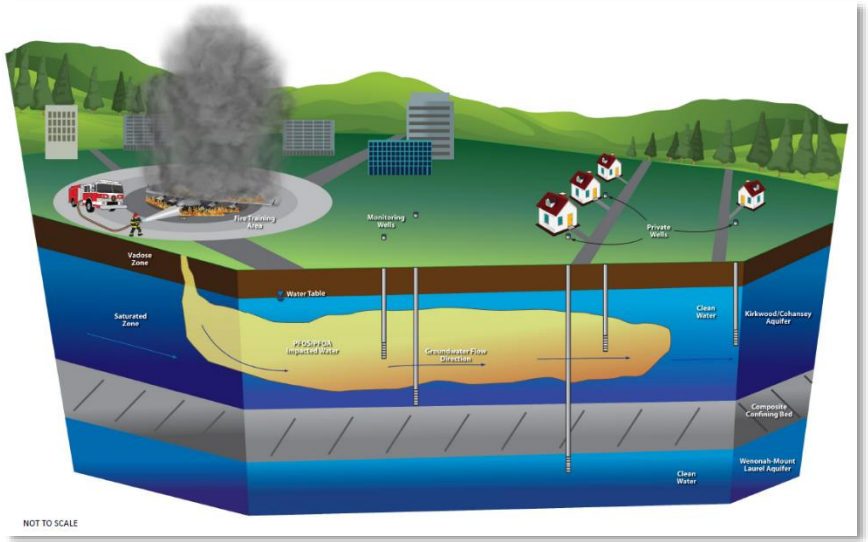
- Problem: Lack of knowledge regarding end-of-life management of PFAS-containing consumer and industrial products
- Action:
  - Develop appropriate methods for appropriate media (liquids and solids)
  - Characterize end-of-life PFAS recycled and disposal streams (e.g. municipal, industrial, manufacturing, recycled waste streams)
  - Evaluate efficacy of materials management technologies (e.g. recycling, land application, landfilling, incineration) to manage end-of-life disposal
  - Evaluate performance and cost data with collaborators to manage these materials and avoid environmental PFAS releases
- Results: Provide technologies, data and tools to manage end-of-life streams
- Impact: Responsible officials will be able to manage effectively end-of-life disposal of PFAS-containing products

RCRA Waste Facilities

- **Action: collect and analyze PFAS in leachate from more than 25 RCRA landfill sites in Florida. The sites include:**
  - **Municipal solid waste landfills**
    - **MSW landfill leachate (~20 sites)**
    - **MSW landfill gas condensate (~6 sites)**
    - **Onsite leachate treatment (3 types)**
  - **Ash monofills (Leachate) (6 sites)**
  - **Construction and demolition debris landfills (3 sites)**
  - **Groundwater and surface water around landfills (if allowed)**



Technical Support



- ORD has knowledge and expertise related to the analysis and treatment of PFAS for various medias. As more interest is focused on PFAS, ORD is a resource for states, Program Offices, Regions, Tribes, and Communities as they face these challenges.
- Groundwater and Engineering Technical Support Centers providing technical input to a variety of Superfund sites regarding PFAS issues

For More Information

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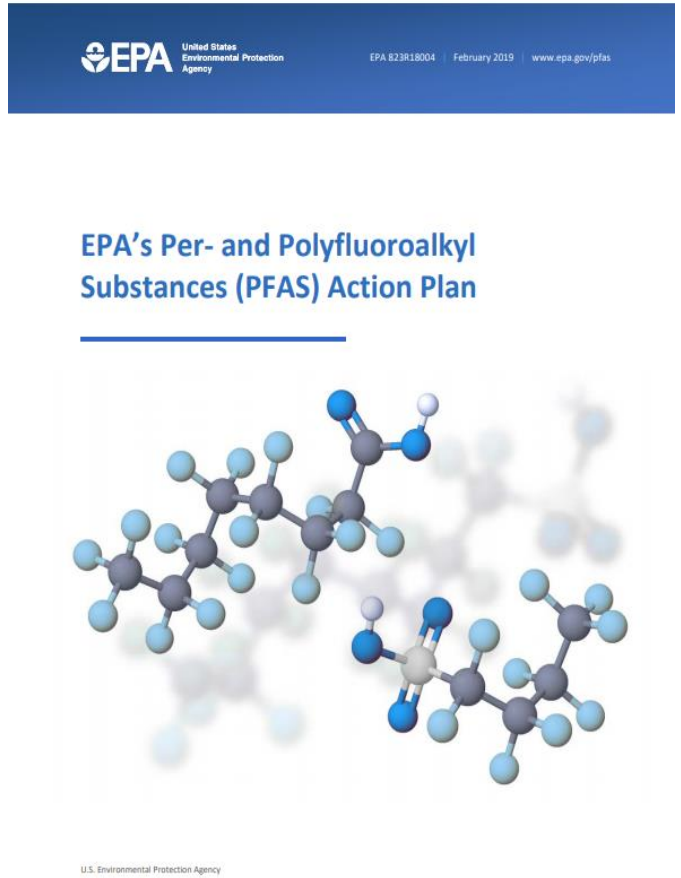
Ron Herrmann – *Land Applied Materials*



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