Per- and Polyfluoroalkyl Substances (PFAS) Research & Development Activities

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New England State Commissioners' Visit to AED
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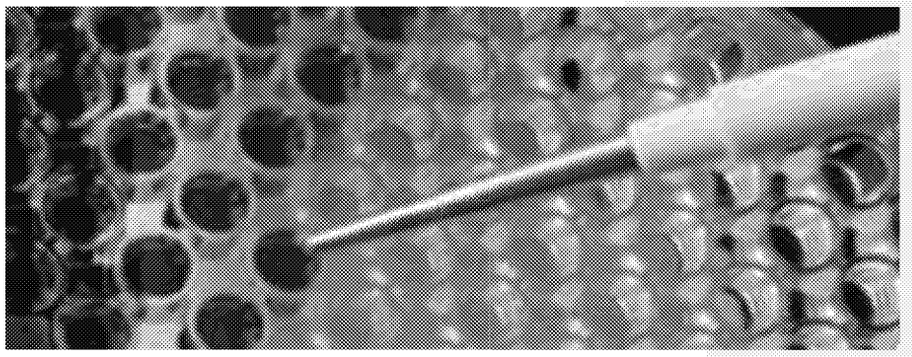
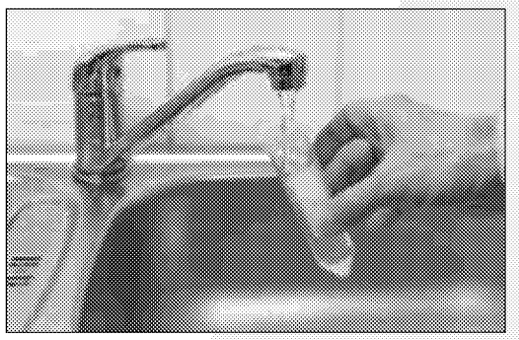
Current PFAS Research Activities

- Human Health/Toxicity
- Analytical Methods
- Exposure
- Treatment/Remediation
- Technical Assistance





Research: Human Health/Toxicity

Problem: Lack of toxicity values for many PFAS compounds

Action:

- Literature review of published toxicity data for 31 PFAS of interest
- Conduct additional assessments and work to address knowledge gaps through computational toxicology and rapid/high-throughput screening

Results:

- Literature review complete, ~21 PFAS with some in vivo data to support assessment
- Toxicity assessment underway for GenX, PFBS, + five additional PFAS
- Computational assays underway for 75 PFAS representative of PFAS chemical space

Impact: States will have PFAS toxicity values to support risk management decisions and risk communication

Tools: **EPA Chemistry Dashboard**
Health and Environmental Research Online (HERO)

Research: Analytical Methods

Problem: Lack of standardized/validated analytical methods for many PFAS analytes (especially short chain), and in media other than drinking water

Action: Perform multi-laboratory validations for analytical methods for (1) non-drinking water samples and solids (SW-846 Methods for facility or site investigation and remediation), (2) additional PFAS analytes for drinking water samples, and (3) methods for sampling air stack emissions

Results:

- Draft SW-846 Direct Injection analytical method external validation study underway
- Draft SW-846 Isotope Dilution method in review
- Method development for short-chained PFECAs (GenX, ADONA) in drinking water, for PFAS in estuarine waters, and for PFAS precursors in aqueous and solid matrices underway
- Pilot test of air emission sampling and analysis methods underway in NH and NC

Impact: Stakeholders will have standard analytical methods for PFAS analytes in different environmental media

Tools: **EPA Method 537** (drinking water)
SW-846 Compendium (non drinking water and solids)

Research: Exposure

Problem: Lack of knowledge on sources, site-specific concentrations and exposure

Action: Develop and test methods to characterize PFAS sources and exposures

Results:

- Published non-targeted analysis (NTA) methods for qualitatively/semi-quantitatively assessing novel PFAS (including PFAS precursors) in environmental samples
- Developing exposure models for identifying PFAS exposure pathways and relative source contribution
- Developing and evaluating sampling and site characterization approaches to identify sources and extent of contamination

Impact: Stakeholders will be able to assess potential PFAS sources and exposures, and identify key exposure pathways for risk management

Tools: Published methods and models

Research: Drinking Water Treatment Performance

Problem: Utilities lack drinking water treatment technology performance data for PFAS removal

Action:

- Review PFAS performance data from available sources (industry, DoD, academia, international)
- Test commercially available granular activated carbons (GACs) and ion exchange (IE) resins for effectiveness over a range of PFAS under different water quality conditions
- Evaluate a range of system sizes – large full-scale utility options to home treatment systems

Results:

- Update EPA's **Drinking Water Treatability Database**, a public database for treatment performance data for regulated and unregulated contaminants
- Use state-of-the-science models to extrapolate existing treatment studies to other conditions

Impact: Utilities will be able to identify effective treatment strategies for removing PFAS from drinking water

Tool: **EPA Drinking Water Treatability Database**

Research: Drinking Water Treatment Cost

Problem: Utilities lack treatment technology cost data for PFAS removal

Action:

- Gather performance and cost data from available sources (DOD, WRF, industry, etc.)
- Compare costs and cost models across different entities
- Update EPA's **Unit Cost Models** to address PFAS
- Connect EPA's **Drinking Water Treatability Database** to EPA's cost models for ease of operation
- Evaluate tradeoffs between cost and removal of a range of PFASs and mixtures of PFASs

Results: Tools and data to support selection of optimal treatment choice

Impact: Utilities will be able to make informed decisions about cost-effective treatment strategies for removing PFAS from drinking water

Tools: E**PA Drinking Water Treatment Technology Unit Cost Models**

Research: Contaminated Site Remediation

Problem: PFAS-contaminated sites require remediation and clean up to protect human health and the environment

Action:

- Characterize sources of PFAS such as fire training and emergency response sites, manufacturing facilities, production facilities, disposal sites
- Evaluate treatment technologies for remediating PFAS-impacted soils, waters, and sediments
- Develop treatment trains to address complex matrices with co-mingled wastes that may occur with PFAS contamination
- Generate performance and cost data with collaborators (DOD, WRF, industry, etc.) to develop models and provide tools to determine optimal treatment choices

Results: Tools, data and guidance regarding cost, efficacy, and implementation for remedy selection and performance monitoring

Impact: Responsible officials will know how to reduce risk of PFAS exposure and effects at contaminated sites, and to repurpose sites for beneficial use

Research: Wastewater Treatment

Problem: Consumer and industrial use of PFAS-containing products often results in disposal to wastewater, becoming a source of PFAS in the environment

Action:

- Characterize various waste streams (e.g. municipal, industrial, manufacturing, landfill leachate) contributing to wastewater as sources of PFAS
- Evaluate efficacy of current and innovative wastewater treatment technologies (e.g. conventional, advanced, centralized, decentralized, pretreatment, water reuse, biosolids) to manage PFAS contamination
- Evaluate performance and cost data with other entities (WRF, industry, consultants, etc.)

Results: Provide data, tools and guidance to operators on management of PFAS in wastewater, biosolids, wastewater reuse, and pretreatment

Impact: Responsible officials will be able to manage effectively PFAS in wastewater

Research: Materials Management

Problem: Lack of knowledge regarding end-of-life management (e.g. landfills, incineration) of PFAS-containing consumer and industrial products

Action:

- Characterize various end-of-life disposal streams (e.g. municipal, industrial, manufacturing, landfills, incinerators, recycled waste streams) contributing PFAS to the environment
- Evaluate efficacy of current and advanced waste management technologies (e.g. landfilling, thermal treatment, composting, stabilization) to manage PFAS at end-of-life disposal
- Evaluate performance and cost data with other entities (DOD, industry, academia, etc.) to manage these materials and manage PFAS releases to the environment

Results: Provide technologies, data and tools to manage these end of use streams

Impact: Responsible officials will be able to manage effectively end-of-life disposal of PFAS-containing products

Technical Assistance for States, Tribes and Communities

Problem: State, tribes and communities sometimes lack full capabilities for managing PFAS risk

Action:

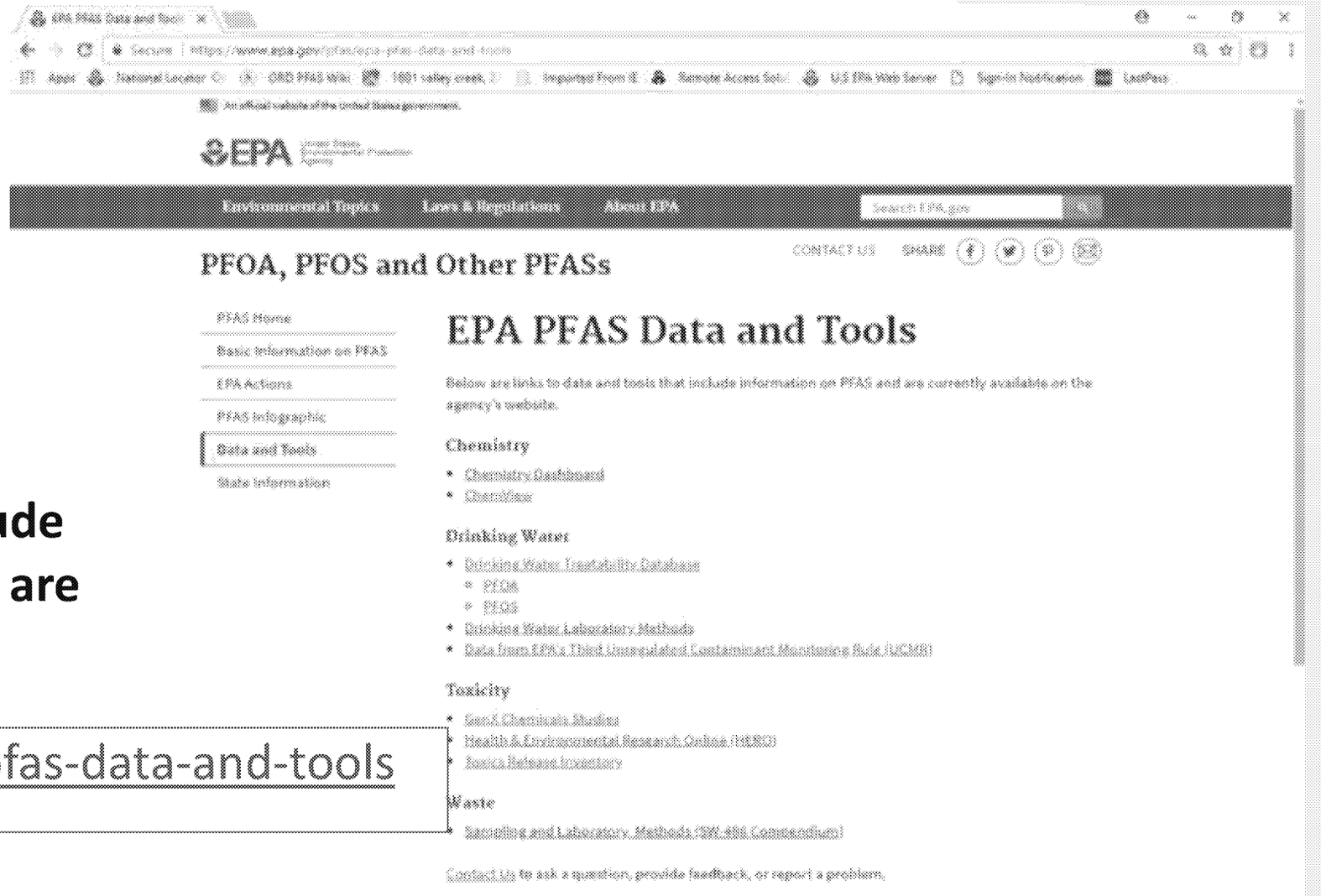
- Make ORD technical staff available to consult on PFAS issues
- Utilize applied research at impacted sites to develop new research solutions while also providing technical support to site managers
- Summarize reoccurring or common support requests to share lessons learned from technical support activities in ORD
- Collaborate with ECOS and ASTHO to develop state case studies for effective risk communication of waterborne contaminants (PFAS and HABs)

Results: Many examples of past and ongoing technical assistance

- **Cape Fear River, NC** – Significant reductions in PFAS in source and finished drinking water
- **Manchester, NH** – Collaboration on air and water sampling
- **Wyoming, OH** – Rapid analysis of PFAS cross contamination in water distribution system

Impact: Enable states, tribes and communities to 'take action on PFAS'

EPA PFAS Data and Tools



Links to data and tools that include information related to PFAS and are available on EPA's website:

https://www.epa.gov/pfas/epa-pfas-data-and-tools

For More Information

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