United States Environmental Protection Agency

Session 1: US EPA's Science-Based Approach to Understanding and Managing Environmental Risk from PFAS

Andrew J. R. Gillespie, PhD
US EPA Office of Research and Development

PFAS Science Webinars for EPA Region 1 and State & Tribal Partners

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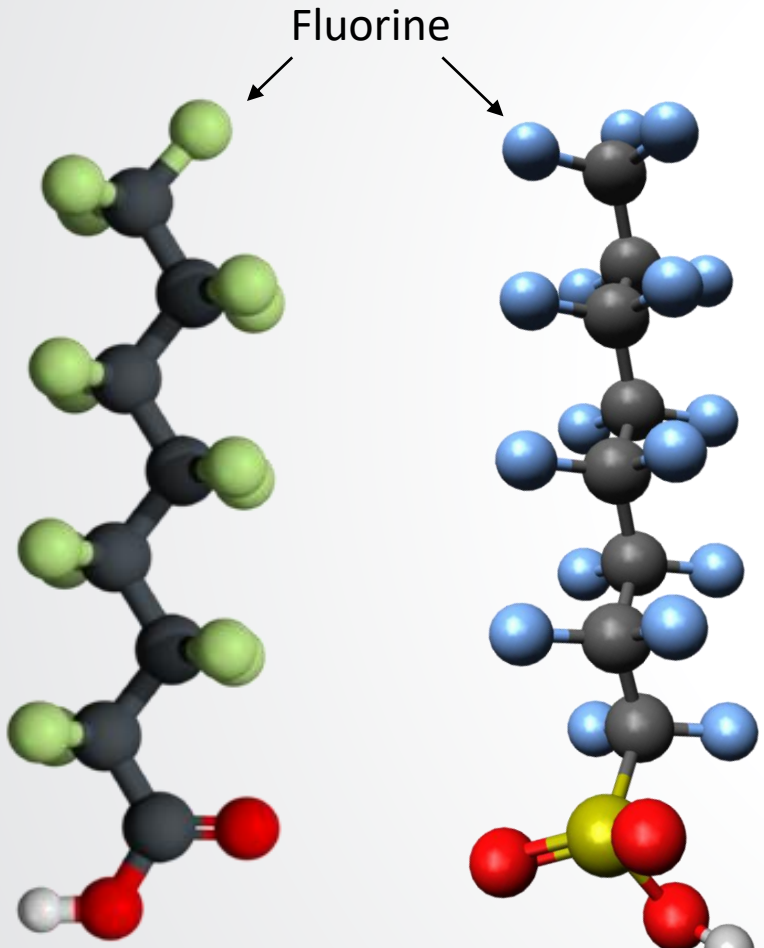
Per- & Polyfluoroalkyl Substances (PFAS)



PFOA *PFOS*

- **A very large class of synthetic chemicals**
  - **Chains** of carbon (C) atoms surrounded by fluorine (F) atoms, with different terminal ends
  - **Complicated chemistry** – thousands of different variations exist in commerce
  - **Widely used** in industrial processes and in consumer products
  - **Mobile** via multiple air, water pathways
  - **Some** PFAS are known to be **PBT:**
    - **Persistent** in the environment
    - **Bioaccumulative** in organisms
    - **Toxic** at relatively low (ppt) levels

Background

- Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals that have been in use since the 1940s in a wide array of consumer products and facilities
- Most people have been exposed to PFAS. Some PFAS chemicals can accumulate and can stay in the human body for long periods of time
- There is evidence that exposure to certain PFAS may lead to adverse human health and environmental effects
- PFAS is an issue of high and growing concern for EPA customers and the public, and so EPA is committed to taking action to address public concerns

Recent EPA Actions on PFAS

- *Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS*, which provide guidance for federal cleanup programs (e.g., CERCLA and RCRA) (December 2019)
- Published validated Method 533 for 11 PFAS in drinking water (December 2019)
- Updated list of 172 PFAS chemicals subject to Toxics Release Inventory reporting (February 2020)
- Proposal to regulate PFOA and PFOS in drinking water (February 2020)
- Significant New Use Rule (SNUR) for certain PFAS in manufactured products (June 2020)

PFAS Action Plan – Research

- EPA is rapidly expanding the scientific foundation for understanding and managing risk from PFAS.

- This research is organized around:
  - understanding **toxicity**
  - understanding **exposure**
  - assessing **risk**
  - identifying effective **treatment and remediation** actions

Recent EPA Advances in PFAS Science

- Published updated Standard Methods 537.1 and 533 for 29 PFAS in Drinking Water
- Posted draft SW-846 Method 8327 , CWA 1600 for 24 PFAS in non potable water & solids
- Published High Resolution Mass Spec methods to discover unknown PFAS
- Published research analytical methods for PFAS in serum and estuarine waters
- Established PFAS library of 430 reference samples to enable consistent analysis
- Updated HERO human toxicity literature database with citations for 32 PFAS
- Updated ECOTOX Knowledgebase with 19,457 records referencing 459 species exposed to 130 PFAS
- Updated Drinking Water Treatability Database to include data on 26 PFAS
- Tested GAC/POE water filters for PFAS removal
- Technical Assistance analytical reports provided to multiple states

Research – Analytical Methods

- **Data Gap**: Standardized/validated analytical methods for measuring PFAS
- **Action**: Develop and validate analytical methods for detecting, quantifying PFAS in water, air, solids and tissues
- **Near-Term Research Products:**
  - Method for **air emission** sampling and analysis (2020 Q4)
  - Isotope Dilution methods for 24 PFAS in **surface water, groundwater, soils, sediments** and **biosolids** (2021 Q4)
  - Method for **Total Organic Fluorine** (TOF) (2020 Q4)
  - Non-targeted analysis methods to characterize PFAS chemicals in environmental media (ongoing)
- **Impact**: *Stakeholders will have reliable standardized analytical methods to test for known and discover new PFAS in water, solids and air*

Research – Chemical Data Curation

- **Data Gap**: Lack of tools to access and integrate PFAS chemical data
- **Action**: Develop databases and tools to streamline access to PFAS chemical data
- **Near-Term Research Products:**
  - Models to predict PFAS chemical/physical properties (ongoing)
  - Public repository for high throughput toxicity/toxicokinetic data (2020 Q4)
  - Public online databases such as EPA's CompTox Chemicals Dashboard and ECOTOX knowledgebase to curate data on chemical and physical properties, sources, exposure and toxicity (ongoing)
- **Impact**: *Stakeholders will have easy access to the most comprehensive and current PFAS-relevant chemical data*

Research – Exposure

- **Data Gap**: Knowledge on nature, sources, extent, fate and transport, bioaccumulation, and human and ecological exposure
- **Action**: Develop and test methods, models and databases to characterize PFAS sources and predict human and ecological exposures
- **Near-Term Research Products:**
  - Case Study: PFAS fate and transport/air dispersion (2020 Q4)
  - Framework for comparative PFAS exposure analysis (2021 Q2)
  - Multimedia human exposure estimates for 6 PFAS (2021 Q4)
- **Impact**: *Stakeholders will be able to identify and assess potential PFAS sources and exposures, and identify key pathways for risk management*

Research – Human Health Assessment

- **Data Gap**: Lack of human toxicity information for many PFAS of interest
- **Action**: Address data gaps for PFAS with **sufficient** existing published studies
  - Conduct systematic review/evidence mapping of PFAS toxicology literature
  - Add PFAS literature to the HERO database of scientific studies
  - Develop standard toxicity assessments (e.g. IRIS) where data are available
- **Near-Term Research Products:**
  - Final toxicity assessments for PFBS (2020 Q4), HFPO-DA
  - Public review draft IRIS assessments for PFBA (2020 Q4), PFHxA (2021 Q1), PFHxS, PFDA, PFNA (2021 Q2)
- **Impact**: *Stakeholders will have PFAS toxicity reference values to inform risk analysis, management decisions and risk communication*

Research – Human Health Toxicology

- **Data Gap**: Human toxicity information for many PFAS of interest
- **Action**: Address data gaps for PFAS with **limited/no** existing published studies
  - Use *in vitro*, high throughput toxicity/toxicokinetic testing to fill in gaps to support prioritization, chemical grouping, read across, relative toxicity and mixtures assessment
  - Apply New Approach Methods (NAMs) to inform hazard characterization and prioritization for targeted *in vivo* testing
- **Near-Term Research Products:**
  - Develop risk-based testing strategy using High Throughput results (2020 Q3)
  - Report on bioactivity analysis of (~120 different PFAS) x (7 sets of assays) (2020 Q4)
  - Test categorization, read across and bioactive dose level approaches (2021 Q2)
- **Impact**: *Stakeholders will have PFAS toxicity information to inform risk analysis, management decisions, and risk communication*

Research – Ecological Toxicology

- **Data Gap**: Knowledge on bioaccumulation and ecotoxicity of PFAS of concern
- **Action**:
  - Identify sensitive taxa, quantify bioaccumulation, support establishment of effects benchmarks and thresholds
  - Develop PFAS-related adverse outcome pathways (AOPs) to provide basis for predicting ecological effects of poorly tested PFAS
- **Near-Term Research Products:**
  - Review/synthesis of PFAS bioaccumulation literature (2021 Q1)
  - Develop putative AOPs for PPAR signaling (fish), Thyroid (avian) (2021 Q2)
  - Update bioaccumulation factors for PFAS in aquatic species (2021 Q2)
- **Impact**: *Stakeholders will have PFAS ecotoxicity information to support risk management decisions (e.g., aquatic life criteria/benchmarks)*

Research – Drinking Water Treatment

- **Data Gap**: Water treatment technology performance and cost data for PFAS removal
- **Action**:
  - Review PFAS performance & cost data from different configurations and range of system sizes (in collaboration with utilities, industry, DoD, academia, international)
  - Test commercially available granular activated carbons (GACs) and ion exchange (IX) resins for effectiveness over a range of PFAS under different water quality conditions
  - Evaluate technologies for regeneration or disposal of spent GAC and IX
- **Near-Term Research Products:**
  - Updated Drinking Water treatment performance, cost models and data (2020 Q4)
  - Updates to Drinking Water Treatability Database (ongoing, next is 2020 Q4)
  - PFAS fate from reactivation/thermal treatment of spent GAC and IX (2021 Q1)
- **Impact**: *Utilities will be able to better identify cost-effective treatment strategies for removing PFAS from drinking water compatible with their situation*

Research – Site Remediation

- **Data Gap**: Knowledge to support remediation and clean up of PFAS-contaminated sites
- **Action**:
  - Characterize PFAS sources such as fire training/emergency response sites, manufacturing facilities, production facilities, disposal sites
  - Evaluate technologies for remediating PFAS-impacted soils, waters, and sediments
  - Generate performance and cost data with collaborators to develop models and provide tools to determine optimal treatment choices
- **Near-Term Research Products:**
  - Groundwater remediation performance, cost models and data (2020 Q4)
  - Thermal treatment of PFAS-contaminated soils (2021 Q1)
  - PFAS fate and transport from land application of PFAS-contaminated biosolids (2021 Q1)
  - Migration potential of PFAS via vapor intrusion (2021 Q3)
- **Impact**: *Responsible officials will have greater information to make decisions to reduce risk of PFAS exposure and effects at contaminated sites and to repurpose sites for beneficial use*

Research – PFAS Disposal

- **Data Gap**: Knowledge regarding end-of-life management and disposal of PFAS-containing materials
- **Action:**
  - Characterize end-of-life PFAS disposal streams (e.g. municipal, industrial, manufacturing, recycled waste streams)
  - Evaluate efficacy of disposal technologies (e.g. landfilling, incineration, composting, stabilization) to manage end-of-life disposal
  - Evaluate performance and cost data to manage these materials and avoid environmental PFAS re-releases following disposal
- **Near-Term Research Products:**
  - PFAS presence in different types of landfills and leachates in FL (2020 Q3)
  - PFAS behavior in incineration environments (2021 Q2)
  - Thermal treatment of PFAS-contaminated biosolids (2021 Q2)
- **Impact**: *Responsible officials will be able to manage effectively end-of-life disposal of PFAS-containing materials*

Research – PFAS Innovative Treatment Team

- **Data Gap**: Validated solutions for destroying/disposing PFAS molecules in various media
- **Action:**
  - Assess current and emerging methods being explored by EPA, universities, other research organizations and industry
  - Near-term focus: thermal destruction, mechanochemical ball milling, electrochemical treatment, and supercritical water oxidation
  - Launched Innovative Ways to Destroy PFAS Technical Challenge (August 2020)
- **Near-Term Research Products:**
  - A toolbox of practical knowledge on current and innovative solutions/methods for destruction of PFAS (2020 Q3)
- **Impact**: *Responsible officials will have data on viable approaches for destruction/disposal of PFAS, leading to confidence in permitting and monitoring of cleanup operations.*

Competitive Grants and Prizes

EPA Water Research Grants National Priorities competitive grants program

Congressional mandate to fund ~4M for water quality and availability research to not-for-profit organizations

- 2019: PFAS impacts on water quality and availability (2 awards)
- 2020: PFAS Impacts in Rural Communities and Agricultural Operations (3 awards)

EPA Science to Achieve Results (STAR) competitive extramural grants program

- 2019: PFAS waste management, including landfills and PFAS destruction technologies (8 awards)

Technical Challenge: Innovative Ways to Destroy PFAS

- $50,000 in prizes for creative solutions submitted via Challenge.gov

Collaboration

PFAS is a topic of interest to many different organizations, and EPA is committed to leveraging partnerships and collaborations to achieve results. Some examples:

- **National Toxicology Program** (NTP) – high throughput toxicology testing
- **FDA** and **USDA** – analytical methods
- **DOD** – analytical method development, treatment/remediation approaches, and participation in the Strategic Environmental Research and Development Program (SERDP)
- **States and public utilities** – testing and applying PFAS sampling, measurement, and treatment methods
- **Academic community** – EPA's Science to Achieve Results (STAR) and National Priorities competitive grant programs

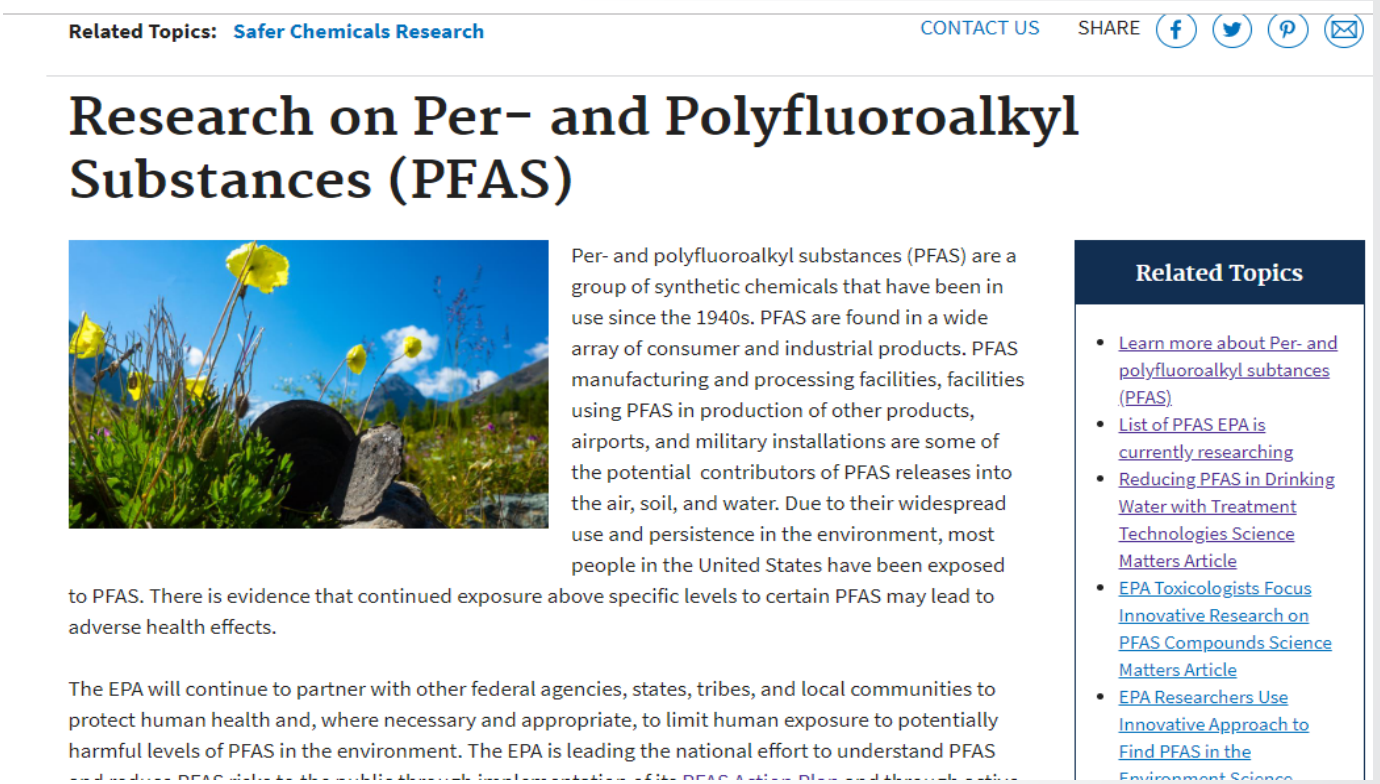
Technical Assistance

- **Data Gap**: State, tribes and communities often lack some capabilities for managing PFAS risk
- **Action:**
  - Make EPA technical staff available to consult on PFAS issues
  - Utilize applied research while also providing technical support to site managers
  - Summarize and share lessons learned from technical support activities
- **Examples of Projects and Impacts:**
  - **NC** – Discovery and identification of novel PFAS in source and finished water
  - **NH, NJ** – Assisted State in identifying novel PFAS in air and water
  - **MI/MN** – Characterizing PFAS sources in a chrome plating facility
- **Impact**: *Enable states, tribes and communities to "take scientifically sound 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:

- EPA's PFAS Homepage
- EPA Research on PFAS Homepage
- Status of EPA Research and Development on PFAS



Related Topics: Safer Chemicals Research

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Research on Per- and Polyfluoroalkyl Substances (PFAS)

Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals that have been in use since the 1940s. PFAS are found in a wide array of consumer and industrial products. PFAS manufacturing and processing facilities, facilities using PFAS in production of other products, airports, and military installations are some of the potential contributors of PFAS releases into the air, soil, and water. Due to their widespread use and persistence in the environment, most people in the United States have been exposed to PFAS. There is evidence that continued exposure above specific levels to certain PFAS may lead to adverse health effects.

The EPA will continue to partner with other federal agencies, states, tribes, and local communities to protect human health and, where necessary and appropriate, to limit human exposure to potentially harmful levels of PFAS in the environment. The EPA is leading the national effort to understand PFAS

Related Topics

- Learn more about Per- and polyfluoroalkyl subtances (PFAS)
- List of PFAS EPA is currently researching
- Reducing PFAS in Drinking Water with Treatment Technologies Science Matters Article
- EPA Toxicologists Focus Innovative Research on PFAS Compounds Science Matters Article
- EPA Researchers Use Innovative Approach to Find PFAS in the

Contact

Andrew Gillespie, PhD
Executive Lead for PFAS R&D
Associate Director, Center for Environmental Measurement and Modeling
US EPA Office of Research and Development
Gillespie.Andrew@epa.gov
919-541-3655

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