A Science-Based Approach to Understanding and Managing Environmental Risk from PFAS

February 10–11, 2021
#AWWAvirtualsummit
awwa.org/feb-summit

Thomas F. Speth

Associate Director
Center for Environmental Solutions and Emergency Response
US EPA, Office of Research and Development

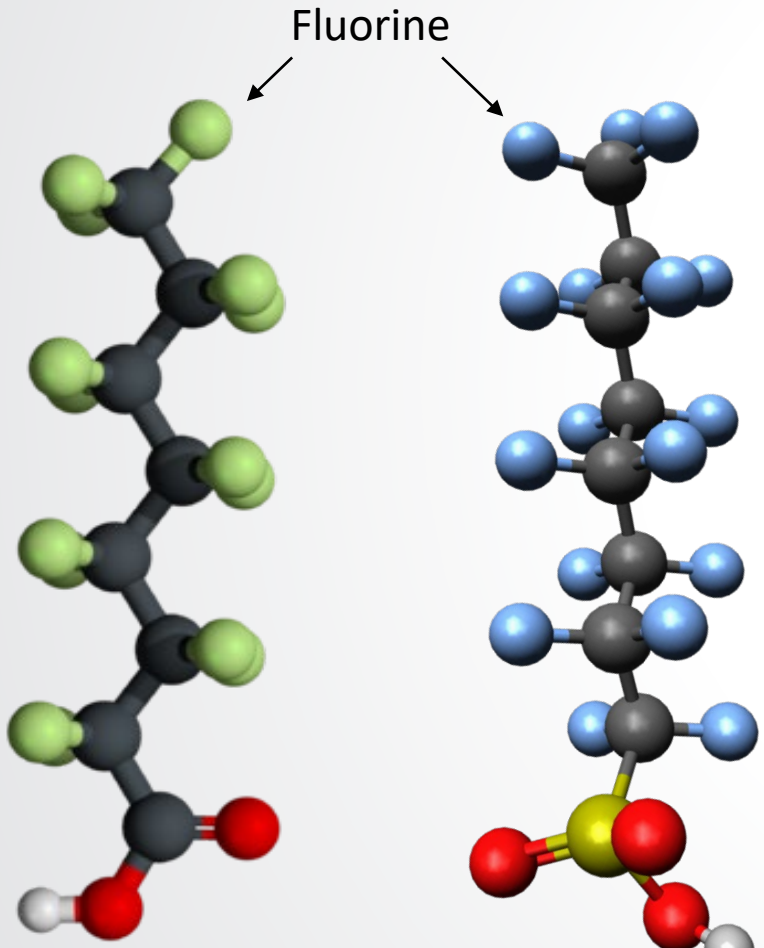
virtual summit
AWWA
Sustainable Water | PFAS | Waterborne Pathogens

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Thomas Speth
Associate Director
Center for Environmental Solutions and Emergency Response
US EPA, Office of Research and Development

Dr. Thomas Speth is the Associate Director for Science for the USEPA's Center for Environmental Solutions and Emergency Response where he is leading efforts on PFAS, lead, and small water systems. He is a Professional Engineer who has worked in the field of water-treatment research at the USEPA since 1986. Over his career, Dr. Speth has been active in numerous organizations such as the American Water Works Association and the Water Research Foundation where he has served as Trustee, Chair, and EPA Liaison on numerous divisions, committees, and advisory boards.

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

- 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
  - EPA is committed to taking action to address public concerns

PFAS Research

- The EPA is rapidly expanding the scientific foundation for understanding and managing risk from PFAS
- This research is organized around:
  - Understanding **exposure**
  - Understanding **toxicity**
  - Assessing **hazard and dose response**
  - Identifying effective **treatment and remediation** actions

Recent EPA Actions on PFAS

- Announced a final determination to regulate PFOA and PFOS in drinking water (January 2021)
- Announced a proposal for the Fifth Unregulated Contaminant Monitoring Rule, which would require public water systems to monitor for 29 PFAS in 2023-2025 (January 2021)
- Announced an ANPRM to solicit public comment and data to inform whether EPA should develop future regulations pertaining to PFOA and PFOS under CERCLA and RCRA (January 2021)
- Released OTM-45, a sampling and analysis method for measuring 50 PFAS in air emissions from stationary sources (January 2021)
- Released *Interim Guidance on the Destruction and Disposal of PFAS and Materials Containing PFAS* for public comment (December 2020)
- Published a final Significant New Use Rule (SNUR) for certain PFAS in manufactured products (July 2020)
  - Released *Compliance Guide* (January 2021)

Research – Analytical Methods

- **Data Gap:** Standardized/validated analytical methods for measuring PFAS
- **Action:** Develop and validate analytical methods for detecting and quantifying PFAS in water, air, solids and tissues
- **Near Term Research Products:**
  - Method for air emission sampling and analysis (OTM-45 released January 2021)
  - Validated isotope dilution method for measuring up to 40 PFAS in surface water, groundwater, soils, sediments and biosolids
  - Total organic fluorine (TOF) method
  - Non-targeted analysis methods to characterize PFAS in environmental media
- **Impact:** Stakeholders will have reliable standardized analytical methods to test for known and discover new PFAS in water, solids and air

Research – Exposure

- **Data Gap:** Knowledge on nature, sources, extent, fate and transport, bioaccumulation, and human and ecological exposure
- **Action:** Develop databases and models to characterize and prioritize PFAS sources and pathways and to predict human and ecological exposures
- **Near Term Research Products:**
  - Case Study: PFAS fate and transport/air dispersion – Published Jan. 4, ES&T
  - Development of human exposure datasets
  - Multimedia household human exposure estimates for 8 PFAS
- **Impact:** Stakeholders will be able to identify and assess potential PFAS sources and exposures, and identify key pathways for risk management

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
  - Public repository for high throughput toxicity/toxicokinetic data
  - Public online databases, such as the CompTox Chemicals Dashboard and ECOTOX Knowledgebase, to curate data on chemical and physical properties, sources, exposure and toxicity
- **Impact:** Stakeholders will have easy access to the most comprehensive and current PFAS chemical data

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 by:
  - Conducting systematic review/evidence mapping of PFAS toxicology literature
  - Add PFAS literature to the HERO database of scientific references
  - Develop standard toxicity assessments where data are available
- **Near Term Research Products:**
  - Final toxicity assessments for PFBS and GenX chemicals (HFPO-DA)
  - External review draft IRIS assessments for PFBA, PFHxA, PFHxS, PFNA, PFDA
- **Impact:** Stakeholders will have PFAS toxicity reference values to inform risk analysis, risk management decisions and risk communication

Research – Human Health Toxicology

- **Data Gap:** Lack of human toxicity information for many PFAS of interest
- **Action:** Address data gaps for PFAS with limited/no existing published studies by:
  - Using *in vitro*, high throughput toxicity/toxicokinetic testing to fill in data gaps and support prioritization, chemical grouping, relative toxicity and mixtures assessment
  - Applying New Approach Methods (NAMs) to inform hazard characterization and prioritization for targeted *in vivo* testing
- **Near Term Research Products:**
  - Risk-based testing strategy using high throughput results
  - Report on bioactivity analysis of ~120 different PFAS (7 sets of assays)
  - Categorization of PFAS
- **Impact:** Stakeholders will have PFAS toxicity data to inform risk analysis, risk management decisions and risk communication

Research – Ecological Toxicity

- **Data Gap:** Knowledge on bioaccumulation and ecotoxicity of PFAS of concern
- **Actions:**
  - 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
  - Update bioaccumulation factors for PFAS in aquatic species
  - Develop putative AOPs for PPAR signaling (fish), thyroid (avian)
- **Impact:** Stakeholders will have PFAS ecotoxicity information to support risk management decisions (e.g., aquatic life criteria/benchmarks)

Research – Drinking Water Treatment

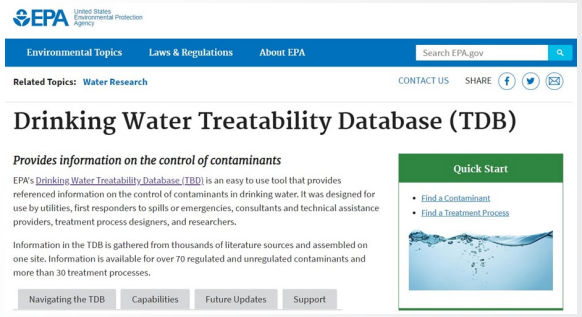
- **Data Gap:** Treatment technology performance and cost data for PFAS removal
- **Actions:**
  - Gather PFAS performance and cost data from different configurations and range of system sizes (collaborative with utilities, industry, DoD, academia, international)
  - Conduct EPA research on performance of treatment technologies including residual streams
  - Develop and update treatment models, databases, and cost models
  - Evaluate technologies for regeneration, destruction, or disposal of spent GAC and IX resins
- **Near Term Research Products:**
  - New and updated drinking water treatment performance models, databases, and cost models Performance Models, Drinking Water Treatability Database, Unit Cost Models,
  - Address treatment impact on corrosion
  - PFAS fate from reactivation/thermal treatment of spent GAC and IX resins
- **Impact:** Utilities will be able to better identify cost-effective PFAS treatment strategies

Ultimate Goal for Tools and Databases

Provide tools and approaches to accurately predict the performance and cost of treating PFAS in waters

Model Scenarios

- Variable source waters
- Variable PFAS concentrations in source waters
- Alternate treatment goals
- Changing production rates
- Document secondary benefits
- Different reactivation/disposal options



Environmental Technologies Design Option Tool Models or search EPA ETDOT
Drinking Water Treatability Database or search EPA TDB
Drinking Water Treatment Cost Models or search EPA WBS

Research – Site Remediation

- **Data Gap:** Knowledge to support remediation/clean up of PFAS-contaminated sites
- **Actions:**
  - Characterize PFAS-contaminated sites, such as fire training/emergency response sites, manufacturing facilities, production facilities, and disposal sites
  - Evaluate technologies for remediating PFAS-impacted soils, waters, and sediments
  - Generate performance and cost data to develop models and provide tools to determine optimal treatment choices
- **Near Term Research Products:**
  - Groundwater remediation performance, cost models, site characterizations
  - PFAS fate and transport from land application of PFAS-contaminated biosolids
  - Migration potential of PFAS via vapor intrusion
- **Impact:** Responsible officials will more information to make decisions to reduce risk of PFAS exposure and effects at contaminated sites

Research – Destruction & Disposal

- **Data Gap:** Knowledge regarding end-of-life management and ultimate disposal of PFAS-containing materials
- **Actions:**
  - Characterize end-of-life PFAS disposal streams (e.g., municipal, industrial, manufacturing, recycled waste streams)
  - Evaluate efficacy of disposal/destruction technologies (e.g., landfilling, incineration, *in situ* stabilization) to manage end-of-life disposal
  - Evaluate possibility of products of incomplete combustion/destruction
- **Near Term Research Products:**
  - PFAS presence in different types of landfills and leachates
  - PFAS behavior in incineration environments
  - Thermal treatment of PFAS-contaminated biosolids
- **Impact:** Responsible officials will be able to manage effectively end-of-life disposal of PFAS-containing materials

Research – Innovative Treatment

- **Data Gap:** Validated solutions for destroying/disposing PFAS molecules in various media
- **Action:** Establish the PFAS Innovative Treatment Team to identify, develop and verify a suite of effective approaches and technologies for destroying or disposing of PFAS-contaminated media
  - Intensive, 6-month effort in 2020
  - Continued research on supercritical water oxidation, pyrolysis/gasification, mechanochemical treatment, and electrochemical oxidation
- **Near Term Research Products:**
  - Research Briefs describing research efforts
  - Research paper on innovative PFAS destruction technologies
- **Impact:** Provides officials with data on approaches for destruction/disposal of PFAS, leading to confidence in permitting and monitoring of clean-up operations

Competitive Grants & Prizes

- **National Priorities** – Congressional mandate to fund water quality and water availability research by not-for-profit organizations
  - 2019: PFAS impacts on water quality and availability (2 awards)
  - 2020: PFAS impacts on agriculture and rural communities (3 awards)
- **Science to Achieve Results (STAR)** – EPA's competitive extramural grant program
  - 2019: PFAS waste management, including landfills and PFAS destruction technologies (8 awards)
- **Competitive Challenge** – "Innovative Ways to Destroy PFAS"
  - $50,000 in prizes for creative solutions submitted via Challenge.gov
  - Received >60 potential solutions from 18 countries

Collaboration

- PFAS is a topic of interest to many different organizations, and EPA is committed to leveraging partnerships and collaborations to achieve results
  - **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 STAR and National Priorities competitive grant programs

Technical Assistance

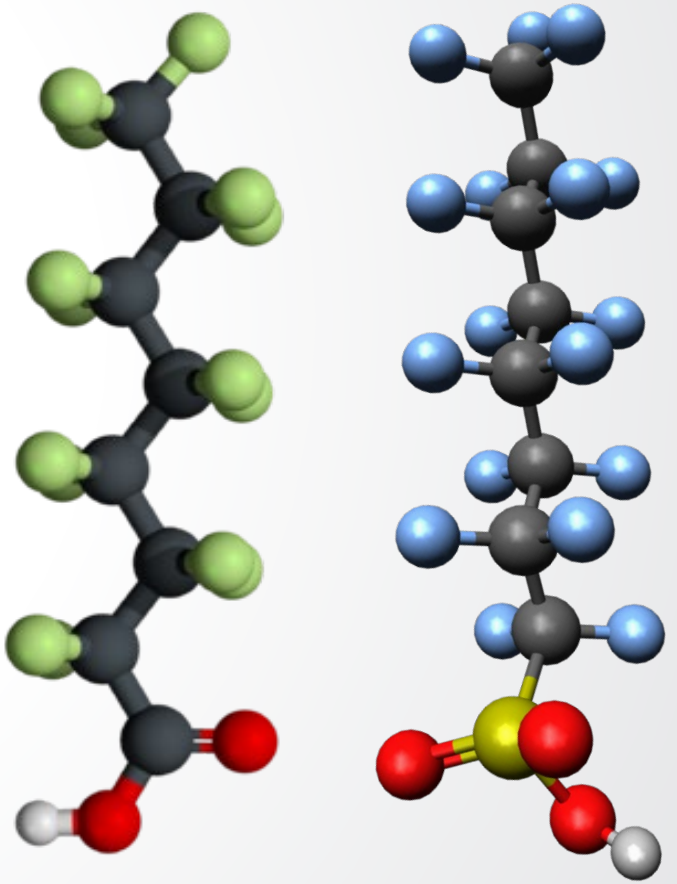
- **Data Gap:** State, tribes and communities often lack some capabilities for managing PFAS risk
- **Actions:**
  - Make EPA technical staff available to consult on PFAS issues
  - Utilize applied research while also providing technical support to site managers
  - Summarize and share lessons learned from technical support activities
- **Examples:**
  - NC, NH, NJ – Identify novel PFAS in air, water, soil and vegetation, treatment
  - MI/MN – Characterize PFAS sources in chrome plating facilities, treatment, analytics
  - AK/North Slope Borough – PFAS contamination in water, sediment and fish tissue
- **Impact:** Enable states, tribes and communities to take scientifically sound action on PFAS

For More Information

Thomas F. Speth, Ph.D., P.E.
Associate Director CESER
speth.thomas@epa.gov

Susan Burden, Ph.D.
Executive Lead for PFAS Research and Development
burden.susan@epa.gov

Office of Research and Development
U.S. Environmental Protection Agency



- **EPA PFAS Activities** – www.epa.gov/pfas
- **PFAS Research and Development** – www.epa.gov/chemical-research/research-and-polyfluoroalkyl-substances-pfas

Thank you!