Overview of EPA's PFAS Research and Development Portfolio

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Office of Research and Development

OUR MISSION

Provide the best available environmental science and technology
to inform and support human health and environmental decision making

Intramural Research and Technical Assistance

ORD Scientific and Technical Expertise

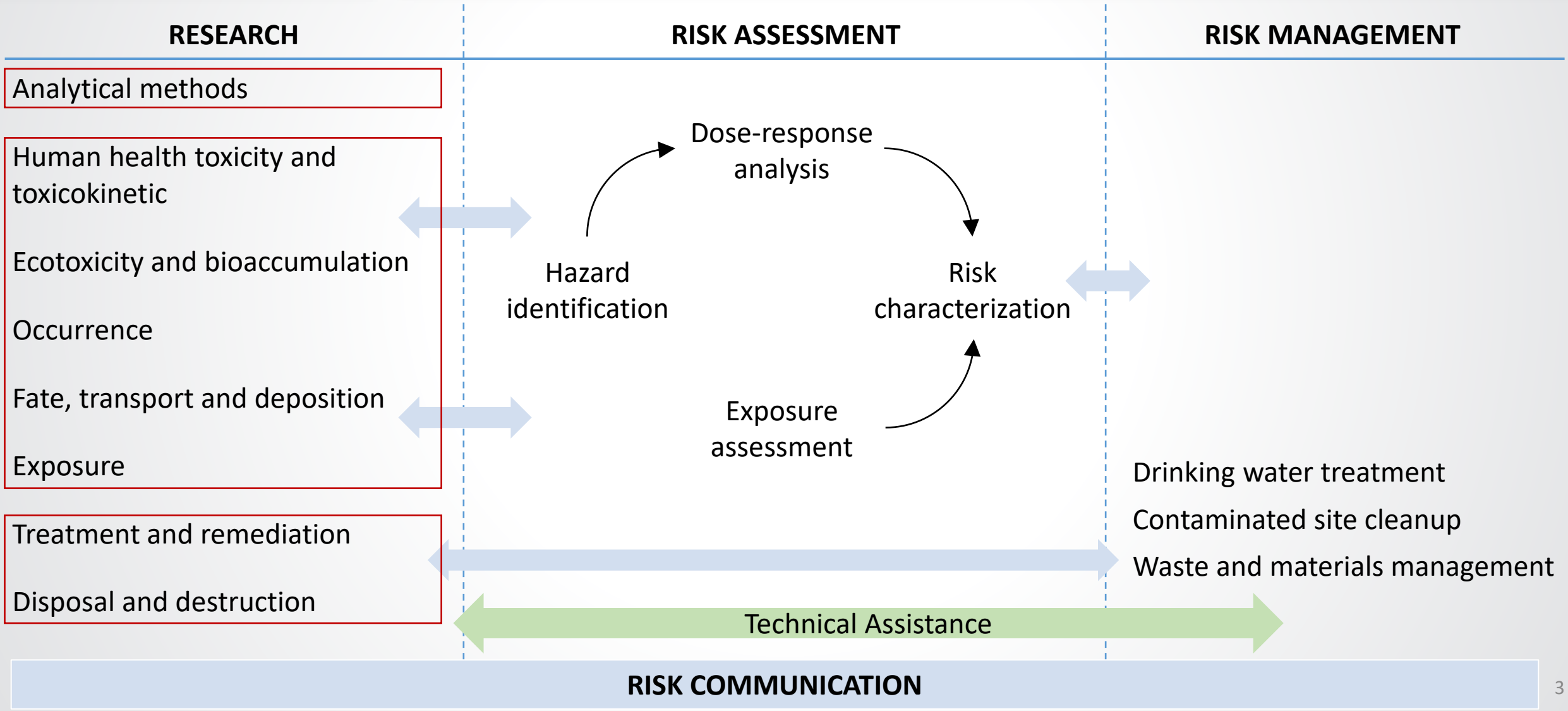
ORD Laboratory Capabilities

Extramural Research

Outside expertise
and laboratory capabilities

- Science to Achieve Results (STAR)
- National Priorities
- People, Prosperity and the Planet (P3)
- Small Business Innovation Research (SBIR)
- Challenges/Prizes

Research to Inform Decision Making



Environmental Measurement

Reliable analytical methods are needed to identify and measure PFAS in air, water, and land

Recent Accomplishments

Air

- OTM-45 (air emissions; 2021)

Water

- EPA Method 533 (drinking water; 2019)
- EPA Method 537.1 (drinking water; 2018/2020)
- SW-846: Method 8327 (wastewater, groundwater, surface water; 2021)
- Draft Method 1633 (water, solids, tissue; 2021)

Current & Ongoing Efforts

Air

- Develop methods for additional PFAS in air emissions and PFAS in ambient air

Land / Water

- Support multi-laboratory validation of Draft Method 1633

Other Methods

- Develop “total PFAS” methods
- Refine non-targeted analysis methods

Research to Inform Risk Assessment

How harmful are PFAS to people and the environment?
How are people and ecosystems exposed to PFAS?

Human Health Effects

Identification and assessment of human health effects are needed to inform risk analysis, risk management, and risk communication

Recent Accomplishments

Toxicity Assessments

- Human health toxicity assessment for PFBS (2021)
- Draft IRIS toxicological review of PFBA (2021)

Tiered Toxicity Testing

- A chemical category-based prioritization approach for selecting 75 PFAS for tiered toxicity and toxicokinetic testing (2019)
- Bioactivity profiling of PFAS identifies potential toxicity pathways related to molecular structure (2021)

Current & Ongoing Efforts

Toxicity Assessments

- Develop IRIS assessments for PFBA, PFHxA, PFHxS, PFNA and PFDA
- Develop systematic evidence maps for 9,000 PFAS

Tiered Toxicity Testing

- Complete high-throughput toxicity and toxicokinetic testing
- Refine PFAS categories and prioritize PFAS for further toxicity testing and assessment
- Conduct targeted *in vivo* testing

Ecological Effects

Bioaccumulation and ecotoxicity data are needed to inform ecological hazard assessments and benchmark development

Recent Accomplishments

Bioaccumulation

- Evaluation of published bioconcentration and bioaccumulation factors (2021)
- Integrative computational approaches to inform relative bioaccumulation potential of PFAS across species (2021)

Ecotoxicity

- Assessing the ecological risks of PFAS: Current state-of-the-science and a proposed path forward (2020)
- Tissue-specific distribution of legacy and novel PFAS in juvenile seabirds (2021)

Current & Ongoing Efforts

Bioaccumulation

- Evaluate and develop approaches and data (e.g., partitioning, metabolism) to predict bioaccumulation

Ecotoxicity

- Update the ECOTOX Knowledgebase
- Use new approach methods (NAMs) to prioritize and categorize data-poor PFAS for further toxicity testing
- Develop approaches to support predicting effects of untested PFAS in different species (e.g., adverse outcome pathways)

Human Health Exposure

Data on sources, occurrence, environmental fate and transport, and human exposure are needed to identify key exposure pathways

Recent Accomplishments

Fate and Transport

- Case Study: Emissions, transport and deposition from a fluoropolymer manufacturing facility (2021)
- PFOA/PFOS source and transportation pathways through the air (2021)

Human Exposure

- Human exposure pathways to PFAS from indoor media: A systematic review protocol (2021)

Current & Ongoing Efforts

Fate and Transport

- Conduct multimedia sampling and analysis
- Identify and generate data on physical and chemical properties

Human Exposure

- Collection of concordant multimedia measurements to evaluate PFAS human exposure pathways
- Estimates for human exposure pathways from indoor media (meta-analysis)

Research to Inform Risk Management

How do we remove PFAS from drinking water and wastewater?
How do we address PFAS at contaminated sites?
How do we effectively manage and dispose of PFAS and PFAS-containing materials?

Treatment and Remediation

Treatment and remediation approaches should be cost-effective and tailored to specific situations

Recent Accomplishments

Drinking Water Treatment

- Avoiding pitfalls when modeling removal of PFAS by anion exchange (2021)
- Cross-flow treatment of PFAS in water: Materials challenges and potential solutions (2021)

Contaminated Sites

- Reconstructing the composition of PFAS in contemporary AFFFs (2020)
- Remediation of PFAS-contaminated soils: To mobilize or to immobilize or to degrade? (2021)

Current & Ongoing Efforts

Drinking Water Treatment

- Update the Treatability Database
- Evaluate treatment efficacy and approaches for managing residuals and spent materials

Wastewater Treatment

- Determine fate and transformation in conventional wastewater treatment
- Evaluate approaches for managing residuals

Contaminated Sites

- Identify approaches for site characterization and remediation

Destruction and Disposal

Data on end-of-life management approaches are needed to inform risk management decisions

Recent Accomplishments

Thermal Destruction

- Low temperature thermal treatment of gas-phase fluorotelomer alcohols by calcium oxide (2021)

Innovative Destruction Approaches

- PFAS Innovative Treatment Team (PITT)
- Research Briefs on electrochemical oxidation, mechanochemical degradation, pyrolysis and gasification, supercritical water oxidation (2021)
- Innovative Ways to Destroy PFAS Challenge (2020/2021)

Current & Ongoing Efforts

Thermal Destruction

- Evaluate destruction efficacy
- Identify products of incomplete combustion

Innovative Destruction Approaches

- Evaluate destruction efficacy of innovative approaches
- Identify products of incomplete destruction

Landfills

- Evaluate PFAS in landfill leachate

Summary

- ORD is expanding the scientific foundation for understanding and addressing risk from PFAS
- ORD is conducting scientific research to:
  - **Develop methods** and approaches for measuring PFAS
  - Better **understand risks** to human health and the environment from PFAS
  - Identify and evaluate **approaches for addressing PFAS** in the environment