

# 2024 ITRC Project Proposal Template

## Proposed Project Title

Guidance on Applying Sorption-Based Technologies for Separation and Concentration of PFAS

## State Team Leader

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## Abstract

Sorption-based technologies for separation and concentration of PFAS are commercially-available and are increasingly being used at full-scale in the field to meet extremely low treatment targets, often in the part-per-trillion range. Treatment approaches like adsorptive media and foam fractionation remove PFAS from the aqueous-phase, resulting in a purified water stream and produce a solid, slurry, or foam fractionate that is highly concentrated in PFAS. A focused technical and regulatory guidance document is needed to reduce barriers to using sorption-based technologies for PFAS. The guidance document will describe how to apply these technologies from start to finish, including constraints and limitations, costs, outcomes, and the role of treatability/piloting. The end goal is to improve consistency in application and provide a resource and network for practitioners working to clean up PFAS contaminated sites with sorption-based technologies.

## Problem Statement & Importance to the States and Broader Environmental Community

Per- and polyfluoroalkyl substances (PFAS) have contaminated groundwater, surface water, soil, and sediments across the globe. Increasing scrutiny on adverse toxicological impacts, as well as the awareness that PFAS are present in environmental media and are transported to receptors, has resulted in numerous health advisories and regulations. Engineering solutions with the goal of separating, concentrating, and, ultimately, destroying PFAS will be needed for the foreseeable future. Although PFAS destruction is still in the research and development phase, sorption-based technologies for PFAS concentration and separation are being applied at full-scale for a variety of water types, as well as for stabilization of PFAS contaminated soil. There has been significant research, development, and field pilot studies over the past few years, and this information needs to be leveraged and disseminated widely to improve efficiencies and application outcomes. Accordingly, SERDP and ESTCP listed development of a decision framework for ex situ PFAS treatment (with concentration technologies) as a *critical* tech transfer need in its 2022 Strategic Workshop of Management of PFAS in the Environment. Objective and validated technical information on

how to effectively apply sorption-based technologies to meet PFAS treatment targets would provide an essential resource to the environmental clean up community.

Sorption-based technologies are used to separate PFAS from water and concentrate them. They are an important first step, prior to disposal or destruction. Examples of sorption-based technologies are adsorptive media such as Granular Activated Carbon (GAC), ion-exchange (IX) resin, and novel adsorbents, as well as foam fractionation. This proposal is for an ITRC team that will develop a technical and regulatory guidance document on how to apply sorption-based technologies from bench to pilot to full scale, as well as best practices for treating a wide-variety of PFAS waste streams. The team will connect professionals who are involved in using sorption-based technologies and provide resources that aid in better decision-making at PFAS clean up sites.

Some of the topics to be covered in a technical and regulatory guidance document on sorption-based technologies are:

- Technology description
- Specific barriers to use and how they can be overcome
- Constraints and limitations of the technology (e.g. upper/lower limits, dissolved/suspended phase chemistry, geochemistry, competitive effects of other constituents, feasibility of treating short-chain PFAS and precursors )
- Typical costs for bench, pilot, and full-scale implementation
- Case studies with documented outcomes showing where each technology has been used effectively and/or ineffectively, including industrial, municipal, State, and Federal facilities
- Treatability testing and steps to implementation

Of particular importance is how to conduct and interpret bench-scale and pilot-scale treatability tests (including rapid, small-scale tests), so that full-scale systems can be efficiently modeled, designed, and operated. Consensus among practitioners on what level of piloting is needed for actionable results would alleviate the need to test at each site, as well as assist regulators with review and acceptance of sorption-based technologies.

This proposed team would work in parallel with the original ITRC PFAS team, but is envisioned as a separate effort with different content. Importantly, this effort would expand ITRC's network of connected professionals across sectors, states, and organizations who are effectively deploying sorption-based technologies and serve as a resource for the community at large. The topic is connected to PFAS-1 through Chapter 12, which summarizes many different technologies for PFAS treatment and provides a great foundation for the proposed effort. The proposed team will fill a critical nationwide need for guidance on *how* to implement separation and concentration technologies and associated best practices.

## **Project Deliverables**

Project deliverables are a web-based technical and regulatory guidance document and associated training course. Depending on the level of detail needed, fact sheets for each type of sorption-based technology could also be developed prior to the guidance document. Additionally, the team will provide a "practitioner network" that will serve as an essential resource for environmental professionals involved in (or seeking to be involved in) using sorption-based technologies for PFAS separation and concentration.

# 2024 ITRC Project Proposal Template

## Proposed Project Title

PFAS Team Continuation: Providing Accurate and Current Guidance in a Continuously Evolving Technical and Regulatory Landscape

## State Team Leader

Indicate at least one state team leader committed to serving as the Team Leader for this team:

1. Kristi Herzer, VT DEC
2. The PFAS Team has had significant support from state members. We will identify a second and possibly third state team leader upon confirmation of the continuing team.

## Proposal Contacts

1. Kristi Herzer, Environmental Analyst, VT DEC, [Kristi.herzer@vermont.gov](mailto:Kristi.herzer@vermont.gov)
2. Robert Burgess, Environmental Program Specialist IV AK DEC, [robert.burgess@alaska.gov](mailto:robert.burgess@alaska.gov)
3. Shalene Thomas, SVP, Global Emerging Contaminants, WSP, [shalene.thomas@wsp.com](mailto:shalene.thomas@wsp.com)
4. Mitchell Olson, PE, Ph.D., Emerging Contaminants Director, Trihydro, [MOlson@trihydro.com](mailto:MOlson@trihydro.com)

## Abstract

The ITRC PFAS Technical and Regulatory Guidance Document has become an essential resource for U.S. states and the broader national and international environmental community. According to year-to-date data collected in May 2023, the ITRC PFAS page was viewed 117,458 times, the fact sheets page was viewed 28,219 times, and the **water/soil values table has been downloaded approximately 100 times per month**. Furthermore, the team has provided training and outreach in 15 sessions just over the past year within the U.S. and internationally, **educating over 1800 participants**. Requests for training and outreach presentations continue to be made on a regular basis, reflecting the excellent reputation established by the ITRC PFAS team and the popularity and success of the training courses provided to date. These requests strongly indicate the need to continue offering a variety of PFAS trainings. Since the team's inception in 2016, the scientific understanding and regulatory landscape surrounding PFAS has continuously changed and expanded, requiring multiple rounds of Guidance Document reviews and revisions. For the next phase (2024-2025), the team is proposing to support the Guidance Document, with a focus on maintaining accuracy, updating it with new factual information, and improving readability and accessibility of information. The team is proposing to create an **Emerging Issues Section** for newer, highly focused topics that have recently attracted more attention by both regulators and the scientific community. In addition to the essential maintenance of accuracy of the Guidance Document and developing the Emerging Issues Section, the team proposes to continue to add valuable, time sensitive data to the team's external tables (i.e., tables that are accessed online separately from the main document), such as the water and soil values tables, air criteria table, regulatory programs table, treatment technology tables, and analytical methods table, as well as continuing to develop and offer up-to-date introductory and advanced training sessions. Continuation of the highly regarded ITRC PFAS team will create confidence for the nation's users, which is imperative during this important and dynamic period, as USEPA, states, international organizations, and the larger society are actively responding to the PFAS challenge. Continuation of this team will also enable more advanced training sessions to be provided, as the new information is added to the Guidance Document, something that is requested more and more by the nation's users.

## **Problem Statement & Importance to the States and Broader Environmental Community**

### *A problem statement (what is the problem and why is it important).*

Per- and polyfluoroalkyl substances (PFAS) are a family of anthropogenic chemicals that have been widely produced over multiple decades for industrial applications (affecting a wide variety of industries), consumer products (such as food packaging, clothing, and furniture), and Class B firefighting foams such as aqueous film-forming foams (AFFF). Widespread PFAS production and use have resulted in the presence of PFAS in environmental media worldwide. The persistence and other chemical and physical properties that made PFAS useful have compounded the challenges of managing PFAS contamination in the environment.

The scientific community is actively engaged in research in many areas critical to the understanding of PFAS, including toxicology, site assessment methods, analytical methods, fate-and-transport, treatment/remediation, and countless other elements. Furthermore, state and federal regulatory responses to the PFAS challenge have been unfolding since the early 2000s with many new initiatives anticipated in the next 12 to 18 months. The PFAS initiatives by state regulatory agencies have necessarily led to the rapid evolution of variable PFAS regulations and guidance values across the country, due to varying local conditions and regulatory drivers, thus requiring continuous attention to maintain current and accurate information and guidance. Regulatory changes have driven technological advancement of analytical methods and treatment technologies, and many advancements are expected over the next several years.

As PFAS continue to challenge researchers, site remediation professionals, and environmental and public health officials, ITRC's PFAS Team has provided detailed and relevant information on the aspects of PFAS that are well understood, as well as identifying areas in which there are gaps in our understanding. The ITRC PFAS Team's products have included fact sheets, a web-based Technical and Regulatory Guidance Document, supporting tables, and training for environmental professionals including online training, videos, in-person training, and roundtable events. These products and events have been valuable for many professionals and have provided essential, go-to resources that support efforts to address PFAS issues in this country and around the world. For instance, the training courses have received widespread positive feedback and the team continues to receive a steady stream of requests for additional PFAS training. It is imperative that the training be able to provide the most recent knowledge garnered by this team that is parallel with advancements in regulations and technologies.

As the USEPA continues to advance PFAS regulations in accordance with its PFAS Strategic Road Map, including proposed CERCLA hazardous substance designations and Safe Drinking Water Act (SDWA)-proposed Maximum Contaminant Levels (MCLs) for select PFAS, maintaining an accurate and up-to-date guidance document, supporting technical tables, and training on basic and advanced PFAS topics as well as the inclusion of new information on emerging PFAS issues remain high priorities for state agencies and remediation professionals.

**The problems around PFAS contamination are a challenge across the country. The ITRC PFAS Team has created content that has met that challenge and is relied upon by professionals trying to manage PFAS issues at many different levels. At this time, there is not only a great need to provide continued guidance, but to also find more user friendly, manageable methods of information dissemination, while continuing to include new, fact-based guidance.**

*Specific technical and regulatory barriers that will be addressed through the continuation of the project. How will an ITRC project provide a solution or partial solution to state environmental technical issues?*

Since 2016, the PFAS team has developed and updated a Guidance Document and Fact Sheets addressing technical and regulatory challenges under several topic areas:

- History, Use and Environmental Sources
- Nomenclature Overview and Physical and Chemical Properties
- Fate and Transport, Site Characterization, and Sampling and Analysis
- Treatment Technologies and Methods, and Waste Characterization, Treatment, and Disposal
- Regulatory Summary and Human and Ecological Health Effects
- Surface Water Quality
- Aqueous Film-forming Foam
- Stakeholder Concerns and Risk Communication

These issues are the basis of all technical and regulatory barriers that continue to exist in the management of PFAS issues. **The continuation of this team will allow the team to bring together direct, focused information and right-sized guidance for field implementation and other areas that will increase usability of the information provided. Each new discussion is intended to deliver the most recent, reliable information to optimize all realms of PFAS management for ease of use by state agencies.**

*If this proposal seeks to update or expand upon an existing ITRC document, identify what new information will be added.*

### **Emerging Issues**

Advancements in research and information across the main technical topic areas (see list above) will be incorporated in an **Emerging Issues Section**. It is anticipated that this new section would be published as part of the current PFAS-1 website so that the new information is accessible from the same well-known location. The Emerging Issues Section will include links to the existing Guidance Document sections, as applicable. As noted above, information will be integrated into the main document's text as needed to maintain accuracy.

Many emerging issues have been identified but not all are anticipated to be discussed in the Emerging Issues section. Issues will be prioritized based on user input and need. The following list includes some examples of the focused **Emerging Issues** that may be included:

- Biosolids
  - Provide a focused, enhanced discussion of migration of PFAS from land application, mixing, and leaching of biosolids to water, plants, wildlife and domestic animals, and potential human exposure.
  - Discuss the assessment of non-target PFAS and potential future issues.
- Fate and Transport, Site Characterization, and Sampling and Analysis
  - Create area of discussion regarding PFAS contamination from septic systems and other diffuse sources.
  - Provide current state-of-science on PFAS migration from shallow soils to groundwater.
- Human and Ecological Health
  - Investigate current knowledge on the inhalation of volatile PFAS.
  - Communicate studies on human exposure via consumer products and firefighting gear.
- Treatment Technologies
  - Create usable documentation for field implementation of emerging treatment methods.
  - Provide guidance for the treatment of PFAS in wastewater and for investigation derived waste (IDW).
- History and Use

- Gather state-of-knowledge on less well known PFAS (for example, polymeric PFAS, cyclic PFAS, and volatile PFAS in consumer products).
- Present information on less-publicized PFAS sources (for instance, open burning areas, erosion inhibitors, hydraulic fluids).
- Firefighting Foams
  - Provide guidance on non-AFFF Class B firefighting foams that contain PFAS.
  - Convey established knowledge on safe foam system changeout (for example, disposal and management or suppression system decontamination).
- Regulations and Risk Communications
  - Deliver awareness of the impacts of PFAS contamination on states.
    - Review the status of regulation implementation.
    - Assess the effect of PFAS contamination in vulnerable communities.

### **External Tables**

The rapidly evolving regulations that differ across states provide an ongoing challenge for PFAS practitioners. The PFAS team has key professionals that are tuned to gathering continually changing regulations. The continuing PFAS team will be able to maintain the external soil, water, and air regulatory values table in addition to other external table resources, which are a highly valued resource for the PFAS community.

### **Fact-Based, Streamlined and Manageable**

With such a rapidly moving subject as PFAS, it is essential that the information provided by this nationally respected ITRC PFAS team ensure a factually based guidance document. This team has created a guidance document that is relied upon by professionals across the country and ensuring that the document only includes the facts supported by current knowledge, in a continuously evolving environment, is essential. The PFAS team will use this continued fact collection and dissemination to tailor training materials and provide training sessions as requested, ensuring that training initially targets State practitioners, both at the introductory and more advanced knowledge levels.

### **Project Deliverables**

The new team would begin in January 2024 and run through December 2025, and it will produce the following items:

- A new section that includes focused Emerging Issues that will be easily usable and implementable by field personnel and will be published as part of the current PFAS-1 website with links to the existing sections as needed, to provide a forum for important new information, without subjecting the entire document to another revision and review process.
- Consistent attention to the current PFAS Guidance Document with a focus on streamlining, improving readability, and updates/revisions to ensure fact-based accuracy.
- Ensuring the continuity and reliability of the external tables, such as the water and soil values, air criteria, regulatory programs, analytical methods, and treatment technologies with regular data input to deliver the most current knowledge to the practitioner.
- Developing and providing top-notch training, based on verified factual evidence gathered from the team, given by the experts that have been part of the PFAS team and continue to develop the training content to address a range of audience needs.

### **Additional Information**

*Describe any additional information that might be relevant to this proposal.*

The ITRC PFAS Team is a well-established team that comprises some of the most respected professionals across the country. This team has produced multiple highly valued and widely relied upon documents and training materials and is respected and trusted to ensure that the information and guidance is continually reliable in a rapidly changing world. The team members include representatives of 44 states and the District of Columbia, the federal government, academia, public and tribal stakeholders, and multiple industry and consulting companies. The team is excited for the opportunity to continue to create useful content that will support efforts to address PFAS contamination. The ITRC PFAS Team is well-positioned to identify the key evolving issues and to continue to update the PFAS Technical and Regulatory Guidance Document which is designed specifically to support state and federal environmental staff, as well as others (including stakeholders, project managers, and decision makers), to gain a working knowledge of the current state of PFAS science and practice.

This proposal to extend the work of the ITRC PFAS Team is supported by multiple state officials as well as key industry representatives. In addition to proposal contacts identified earlier, this proposal is supported by many others on the current team, including the following individuals:

- Sandra Goodrow, Ph.D., Research Scientist, **New Jersey** Department of Environmental Protection
  - Sandra is dedicated to staying on as team leader until a new team leader can be properly selected for the continuing team. The team contains a deep bench of talented PFAS professionals, including state representatives, and this task is expected to go smoothly.
- Alex MacDonald, Emeritus, **California** Regional Water Quality Control Board
- Brie Sterling, Environmental Group Manager, **Pennsylvania** Department of Environmental Protection
- Cliff Shierk, PE, Engineer, Solid Waste Permitting **Minnesota** Pollution Control Agency
- Jeff Wenzel, Chief of the Bureau of Environmental Epidemiology, **Missouri** Department of Health and Senior Services
- Richard Spiese, State of **Vermont**, Department of Environmental Conservation, Waste Management Division
- Li Wang, Ph.D., Senior Hazardous Substances Engineer, **California** Department of Toxic Substances Control
- Chris Evans, Senior Environmental Hydrogeologist, **Maine** Department of Environmental Protection
- Michele Crimi, Ph.D., Professor, Dean of the Graduate School, Clarkson University
- Chris Higgins, Ph.D., Colorado School of Mines
- Janice Willey, Senior Chemist, NAVSEA Laboratory Quality and Accreditation Office
- Linda Hall, PhD, Principal Consulting Toxicologist, dba Linda C Hall, PhD
- Linda Logan, Ph.D., Senior Associate Consultant, Terraphase
- Ryan Thomas, Ph.D., Emerging Contaminants Principal, Parsons Corporation
- Elizabeth Denly, VP, ASQ CMQ/OE, PFAS Initiative Leader and Chemistry Director, TRC
- Ioana Petrisor, Ph.D., Senior Project Manager/Chief Chemist, EnSafe
- Usha Vedagiri, Ph.D., Vice President, Toxicology/Risk Assessment, WSP
- Bill DiGuseppi, PG, Principal Hydrogeologist, Jacobs
- Rula Deeb, Ph.D., Senior Principal, Geosyntec
- Mahsa Modiri Gharehveran, Ph.D., P.E., Senior Scientist, EA Engineering, Science, and Technology, Inc., PBC