

# Overview of SERDP & ESTCP Efforts in Sampling and Analysis of PFAS

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# Strategic Environmental Research and Development Program (SERDP)

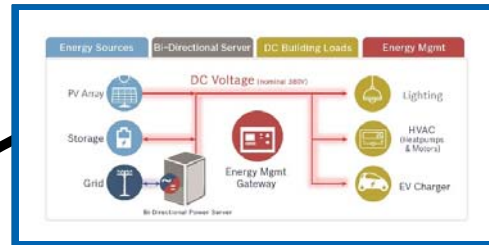
- Established by Congress in FY 1991
  - ◆ 10 U.S.C. Section 2901 - 2904
  - ◆ DoD, DOE, and EPA partnership
  - ◆ 6.3 Program Element with statutory authority to support 6.1 through 6.3
- High-priority environmental science and technology areas that address
  - ◆ DoD unique issues
  - ◆ Environmental issues with large costs to DoD

## Environmental Security Technology Certification Program (ESTCP)

- Established by DoD in FY 1995
  - ◆ 6.4 Demonstration/Validation program
- Demonstrate innovative and cost-effective environmental and energy technologies
  - ◆ Capitalize on past investments
  - ◆ Transition technology out of the lab
- Promote implementation
  - ◆ Facilitate regulatory acceptance

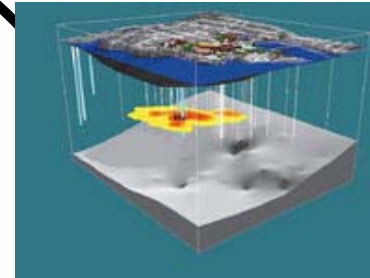
# Program Area Management Structure

**Weapons Systems & Platforms**



**Installation  
Energy & Water  
(ESTCP only)**

**Environmental  
Restoration**



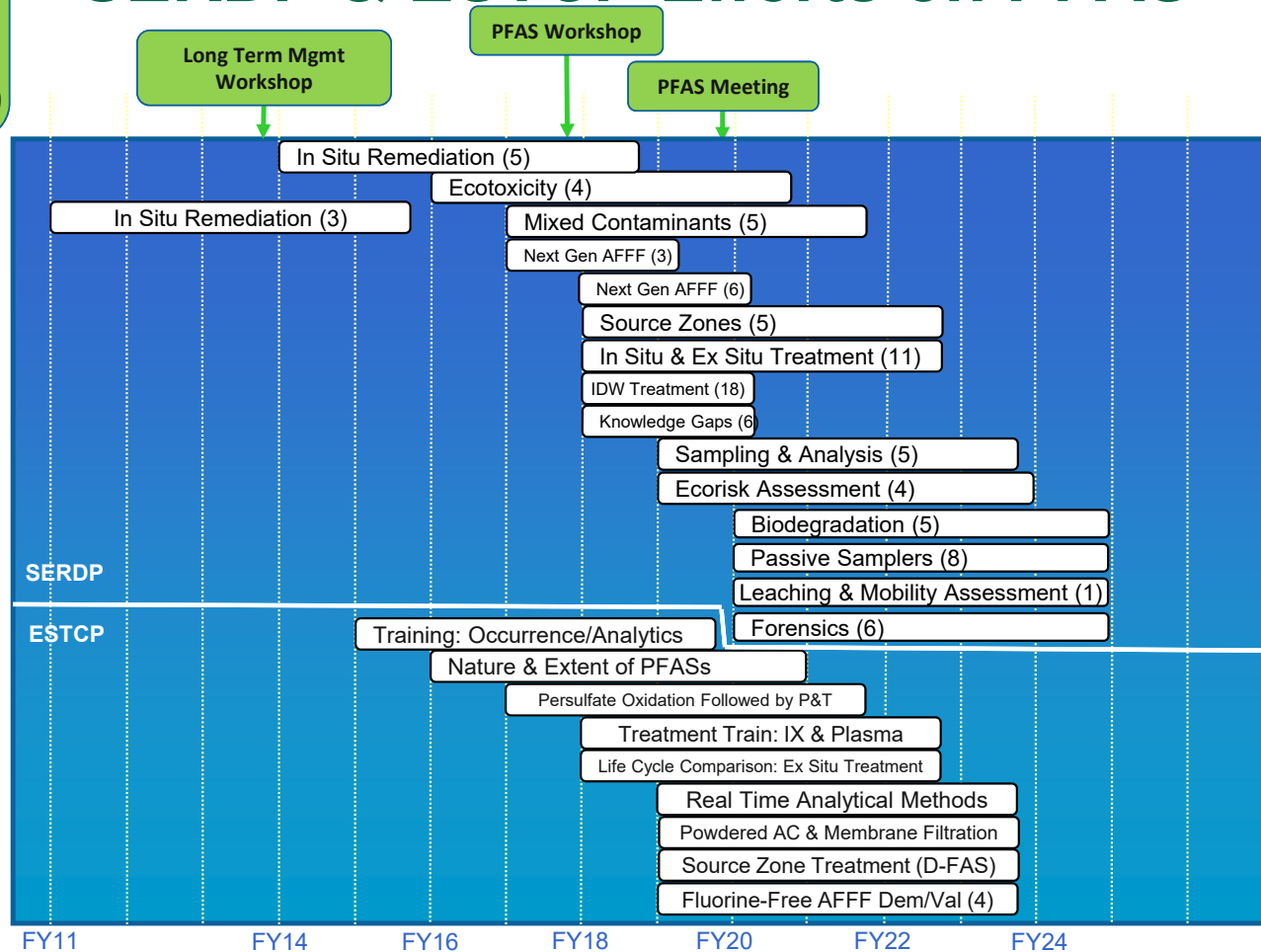
**Resource Conservation  
& Resiliency**



**Munitions  
Response**

# SERDP & ESTCP Efforts on PFAS

EPA published provisional health advisory for PFOS & PFOA in January 2009



[http://serdp-estcp-pfas.com/pfas\\_efforts/pfas\\_efforts.pdf](http://serdp-estcp-pfas.com/pfas_efforts/pfas_efforts.pdf)

## PFAS Workshop

- In May 2017, SERDP and ESTCP sponsored a two-day workshop: Research and Development Needs for Management of DoD's PFAS Contaminated Sites to:
  - ◆ Review the current state of the science regarding PFAS contamination in general, and AFFF in particular
  - ◆ Evaluate current and potential characterization and remediation technologies
  - ◆ Prioritize research and demonstration opportunities that can improve remediation performance and efficiency, and ultimately reduce the costs to manage sites.
  - ◆ Summarize findings in a workshop report.

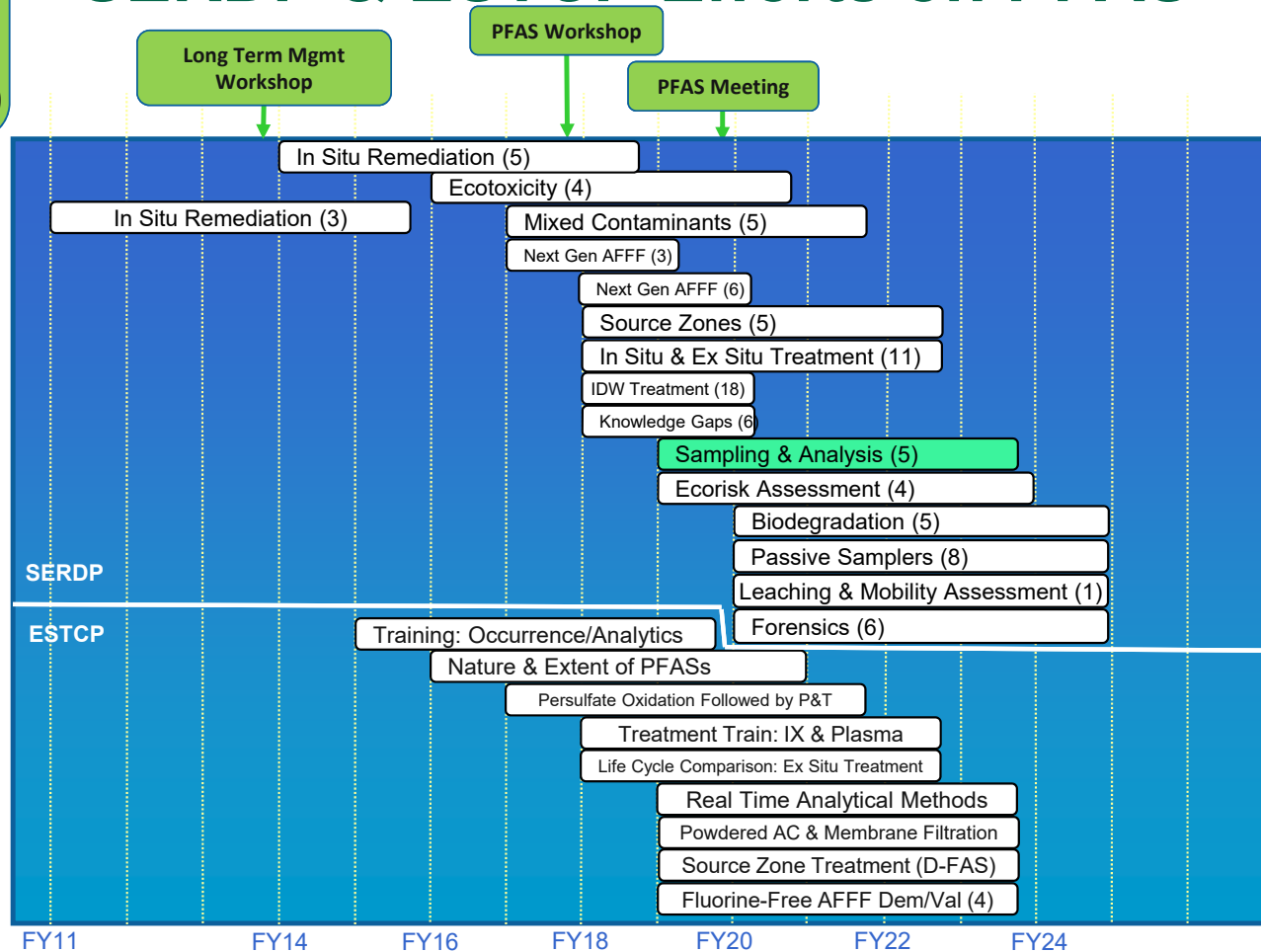
28 Research, Demonstration and  
Technology Transfer Needs Identified

## PFAS Workshop – Major Findings

- Fate and transport properties
- Bioavailability, biomagnification
- Toxicity
- Development of on-site technologies for concentrated PFAS waste streams
- PFAS forensics
- **Sampling & Analysis**
- Treatment technology demonstrations
- Technology transfer needs

# SERDP & ESTCP Efforts on PFAS

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# FY19 Statement of Need (SON): Development of Standardized Analytical and Environmental Sampling Methods for PFAS in the Subsurface

Projects were asked to address the following research needs:

- Development of:
  - ◆ sampling techniques;
  - ◆ procedures to assess the total organofluorine;
  - ◆ rapid field screening procedures; and
  - ◆ extraction techniques for accurate and precise quantitation.
- Evaluation of:
  - ◆ potential media to be used for passive samplers and their performance;
  - ◆ techniques to eliminate matrix interference;
  - ◆ techniques to achieve the lowest limit of quantitation possible for AFFF formulations and high PFAS concentration samples; and
  - ◆ techniques to ensure precision and accuracy of total PFAS analytical procedures.
- Assessment of subsampling techniques to determine the process by which the subsample provides results that are most representative of the entire sample collected.

5 Projects Funded

# FY19 SERDP Funded Sampling & Analytical Methods Projects

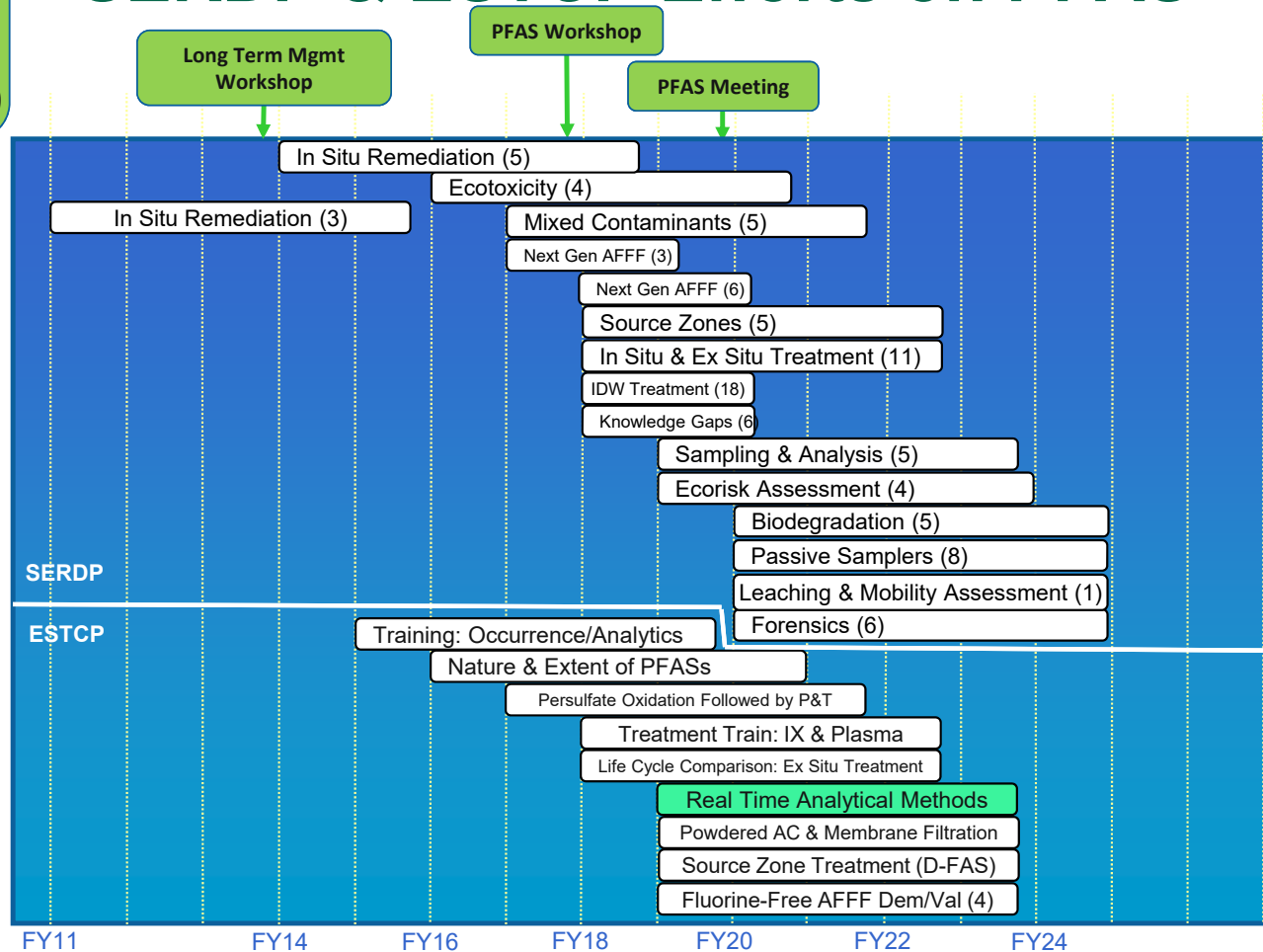
Project Number/Title	PI Name/Organization
ER19-1128: Bench-Scale Assessment of Nuclear Magnetic Resonance (NMR) and Complex Resistivity (CR) Screening Technologies for Rapid Assessment of PFASs in Soils and Sediments	Lee Slater Rutgers University Newark
ER19-1142: Developing PIGE into a Rapid Field-Screening Test for PFAS	Graham Peaslee University of Notre Dame
ER19-1157: Development and Validation of Analytical Methods for Comprehensive Profiling of Perfluoroalkyl and Polyfluoroalkyl Substances in Firefighting Foam Impacted Environmental Matrices	Jinxia Liu McGill University
ER19-1205: Assessing and Mitigating Bias in PFAS Levels during Ground and Surface Water Sampling	Jennifer Field Oregon State University
ER19-1214: Rapid Site Profiling of Organofluorine: Quantification of PFASs by Combustion Gas Analysis	David Hanigan University of Nevada, Reno

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## FY19 ESTCP Topic Area: Management of Contaminated Groundwater

- Innovative technologies and approaches for managing sites and the associated risks where contamination will persist for a significant period of time after initial remedy is selected.
  - ◆ Cost-effective management tools or technologies to specific zones in complex geological environments that cause pers
  - ◆ **Cost-effective management tools or technologies to address groundwater contaminated with emerging contaminants (e.g., PFAS), must address co-contaminants.**
  - ◆ Assessment of how to better combine existing or new technologies to address complex contaminated sites and make informed management decisions.
  - ◆ Optimization, assessment, and/or long-term monitoring tools related to remediation of contaminated groundwater.
  - ◆ Tools to collect more site data of better quality at lower cost.

3 PFAS Projects Funded

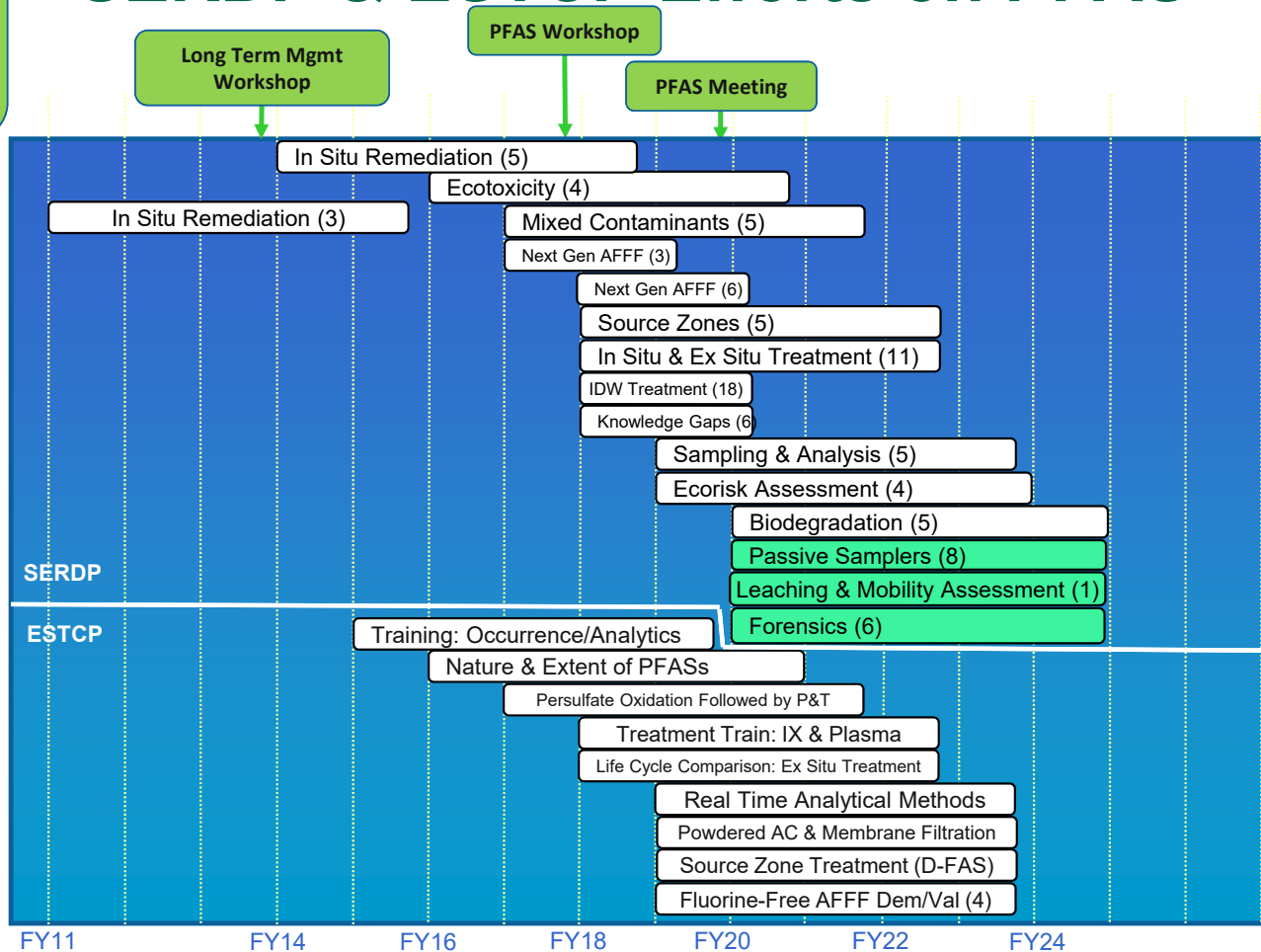
1 Sampling & Analysis-Related Project Funded

## FY19 ESTCP Funded Sampling & Analysis Project

- Validation of Streamlined Mobile Lab-Based Real Time PFAS Analytical Methods
  - ◆ Joseph Quinnan, Arcadis U.S., Inc.
- **Objective:** Demonstrate the utility of a mobile lab capable of providing near real-time analysis of PFASs consistent with DoD's Environmental Laboratory Accreditation Program (ELAP) under Quality Systems Manual (QSM) 5.1.

# SERDP & ESTCP Efforts on PFAS

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## FY20 SON:

# Development of Analytical Methods to Assess Leaching and Mobility of Per- and Polyfluoroalkyl Substances from Soils, Sediments, and Solid Wastes

- The objective was to develop standard operating protocols to assess the potential for leaching and mobility of PFAS from solids, soils, and sediments. Specifically, the goal was to address the following research needs **1 Project Selected for Funding**
  - ◆ Development of a standardized method, similar to the Synthetic Precipitation Leaching Procedure (SW-846 Method 1312), to assess the leachability and mobility of PFAS from solid matrices.
  - ◆ Development of new or improved methods to evaluate sorption/desorption affinity of PFAS for specific solid materials of concern to the DoD.



## FY20 SERDP Funded Analytical Methods Projects

Project Number/Title	PI Name/Organization
ER20-1126: Development and Validation of Novel Techniques to Assess Leaching and Mobility of Per and Polyfluoroalkyl Substances (PFAS) in Impacted Media	Jennifer Guelfo Texas Tech University

## FY20 SON: Forensic Methods for Source Tracking and Allocation of Per- and Polyfluoroalkyl Substances

- The objective was to develop improved forensic methods and tools for source tracking and allocation of per- and polyfluoroalkyl substances (PFAS).

Specifically, the goal was to address the following research **6 Projects Selected for Funding**

- ◆ Evaluation of conventional or novel analytical techniques or methodologies to differentiate PFAS from aqueous film forming foam (AFFF) versus non-AFFF sources.
- ◆ Develop spectral libraries of PFAS to include both AFFF-derived PFAS as well as PFAS derived from other sources.
- ◆ Improved analytical methods and/or validated models to predict changes to AFFF mixtures over time, including chemical pathways to the most toxic compounds.

## FY20 SERDP Funded PFAS Forensic Methods Projects

Project Number/Title	PI Name/Organization
ER20-1056: Improving Access and Utility of Analytical Data for the Confident Discovery, Identification, and Source-Attribution of PFAS in Environmental Matrices	Benjamin Place National Institute of Standards & Technology
ER20-1121: Establishing an Approach to PFAS Forensics and a PFAS Source Materials Forensic Library	Mark Benotti NewFields Government Services
ER20-1205: Machine Learning Pattern Recognition for Forensic Analysis of Detected Per- and Polyfluoroalkyl Substances in Environmental Samples (Proof-of-Concept)	Tohren Kibbey University of Oklahoma
ER20-1265: Ultrahigh-Resolution Fourier-Transform Ion Cyclotron Resonance Mass Spectrometry for Fingerprinting, Source Tracking, and Allocation of Per- and Polyfluoroalkyl Substances (PFAS) (Proof-of-Concept)	Jens Blotevogel Colorado State University

## FY20 SERDP Funded PFAS Forensics Methods Projects (Cont'd)

Project Number/Title	PI Name/Organization
ER20-1330: A Simple and Robust Forensic Technique for Differentiating PFAS Associated with AFFF from other PFAS Sources	David Sedlak University of California, Berkeley
ER20-1375: Comprehensive Forensic Approach for Source Allocation of Poly- and Perfluoroalkyl Substances	Chris Higgins Colorado School of Mines

## FY20 SON:

# Development of Passive Sampling Methodologies for Per- and Polyfluoroalkyl Substances

- The objective was to develop passive sampling methods to provide repeatable and environmentally relevant measures of per- and polyfluoroalkyl substances (PFAS). Specifically, the goal was to address the following research needs:
  - ◆ Develop passive sampling media competent to quantitatively “concentrate” the wide range of PFAS of interest from water.
  - ◆ Establish physical-chemical properties, including sorbent/water partition coefficients, molecular diffusivities of PFAS in water and sorbent media.
  - ◆ Establish the range of PFAS that can be quantifiably sampled using the sorbent(s).
  - ◆ Characterize the impacts of co-contaminants and various water quality and conditions.
  - ◆ Develop a fundamental understanding of the natural solid-water sorption coefficients of PFAS as a function of sorbate properties, natural solids, and solution properties.
  - ◆ Develop passive samplers that yield representative spatial and temporal interrogation of site contaminants when deployed.
  - ◆ Develop passive sampling methods/procedures that are capable of being efficiently deployed and retrieved in widely varying field applications.

**8 Projects Selected for Funding**

## FY20 SERDP Funded PFAS Passive Sampling Projects

Project Number/Title	PI Name/Organization
ER20-1073: Ion exchange membranes and fibers as passive samplers for chemically-diverse PFAS (Proof-of-Concept)	Lee Blaney University of Maryland Baltimore County
ER20-1098: Development of a Novel PFAS Passive Sampler with Efficient Sorbent Media and Robust Membrane Barrier (Proof-of-Concept)	Yin Wang University of Wisconsin, Milwaukee
ER20-1127: Osorb® Media Use in Per- and Polyfluoroalkyl Substances (PFAS) Passive Samplers	Craig Divine Arcadis
ER20-1156: Development of passive sampling methodologies for per- and polyfluoroalkyl substances	Sarit Kaserzon University of Queensland
ER20-1211: Passive samplers for per- and polyfluoroalkyl substances with innovative sorbents	Mei Sun University of North Carolina at Charlotte

## FY20 SERDP Funded PFAS Passive Sampling Projects (Cont'd)

Project Number/Title	PI Name/Organization
ER20-1293: Development and field-testing of advanced passive samplers for PFAS	Rainer Lohmann University of Rhode Island
ER20-1336: Development of novel functionalized polymeric thin films for equilibrium passive sampling of PFAS compounds in surface and groundwater (Proof-of-Concept)	Upal Ghosh University of Maryland Baltimore County
ER20-1363: Development of a Diffusive Gradients in Thin-Films Passive Sampling Methodology for Per- and Polyfluoroalkyl Substances in Water	Julian Fairey University of Arkansas

## SERDP and ESTCP Efforts on PFAS

Workshop Report:  
Long Term Mgmt of  
Contaminated  
Groundwater

Workshop Report:  
PFAS R&D Needs

Workshop on PFAS:  
Sampling, Analysis  
and Treatment

**SERDP** RESEARCH PROJECTS  
DOD • EPA • DOE

In Situ Groundwater Remediation	In Situ Groundwater Remediation
2011	2014

FAQs Regarding PFAS at DoD Sites
2015

Ecotoxicity
2016

Mixed Contamination in Groundwater
Fluorine-Free Aqueous Film Forming Foam
2017

Source Zones
Investigation Derived Waste
In Situ & Ex Situ Groundwater Remediation
Ecotoxicity/Assessing Remediation Effectiveness
Fluorine-Free Aqueous Film Forming Foam
2018
Ion Exchange & Low Energy Electrical Discharge Plasma Process
Life Cycle Comparison of Ex Situ Treatment Technologies

Ecological Risk Characterization
Analytical and Environmental Sampling Methods
2019
Mobile Lab-Based Real Time PFAS Analytical Methods
Sub-Micron Powdered Activated Carbon & Ceramic Membrane Filter System
Source Zone Treatment Technology (D-FAS)
Demonstration/Validation of Fluorine-Free AFFF

Biodegradation
Passive Sampling Methodologies
Analytical Methods to Assess Leaching and Mobility
Forensic Methods for Source Tracking and Allocation
2020

**ESTCP** Demonstration Projects

■ Remediation    
 ■ Ecotoxicity    
 ■ Fate, Transport and Characterization    
 ■ Analytical and Sampling Methods    
 ■ Fluorine-Free AFFF





December 3-5, 2019 at the Marriott Wardman Park

Plenary session the first morning then two days of technical sessions and one day of short courses

A two-part PFAS-related technical session that will include several talks on analytical and sampling methods as well as posters for all currently funded PFAS-related project.

Expected Attendance: 1000