General Meeting of the
Federal Remediation Technologies Roundtable

Per- and Polyfluoroalkyl Substances (PFAS) Emerging Characterization and Remedial Technologies

U.S. Geological Survey (USGS) National Center (Headquarters)
12201 Sunrise Valley Drive | Reston, Virginia 20192
Wednesday, November 7, 2018

- National Site Assessment Symposium (NSAS) training program in Denver, CO: December 3-7, 2018. https://trainex.org/NSAS2018
- Guidance for Evaluation of Federal Agency Demonstrations that Remedial Actions are Operating Properly and Successfully
- Federal Agency Hazardous Waste Compliance Docket Update #34 published October 29, 2018
- Multiple webinars focused on geophysical tools and techniques hosted on Clu-In.org

"FRTR Presents…" webinars are hosted on CLUIN

- *Evolution of Subsurface Remediation: Lessons Learned from Technical Challenges to Achieving Cleanup Goals*
- >300 live webinar participants
- Archived and upcoming sessions can be found at Clu-In.org

Air Force Civil Engineer Center

Environmental Technology Demonstration-Validation Projects (BAA initiative)

- New Project Awards
  - Guidance and demonstration for high resolution site characterization at Air Force sites
  - In-situ sorption-treatment technology: Field-scale evaluation of treatment processes and performance for TCE degradation
- Recent Reports and Outreach
  - Hydrogeophysical tomography mapping of subsurface migration pathways (final report; workshop presentations)
- FY2019 BAA Announcement: Dec-Jan (FedBizOps)

Web: https://www.afcec.af.mil/

Email: afcec.czte.baa@us.af.mil

US ARMY ENVIRONMENTAL COMMAND (AEC)

- **Location:** Joint Base San Antonio, Fort Sam Houston, San Antonio, Texas

- **Mission:** Cleanup and compliance for active and reserve Army installations, U.S. and overseas

- **PFAS Actions:** Following DoD/Army policies, guidances, and Operational Orders (OPORDs); providing toxicology, risk assessment, engineering support; & Contracting: 85 Preliminary Investigations (PAs) awarded to date; 5 Site Investigations (SIs) ongoing where PFAS known / suspected

NASA Update

- PFAS Response
  - NASA is currently working on a granular activated carbon system to treat water for PFAS for the Town of Chincoteague in Virginia. Contamination was from the use of AFFF in response to crashes and Fire Training at the Wallops Flight Facility.
  - Work is ongoing to inventory uses and releases of PFCs across all NASA facilities. Site-wide sampling is planned at Wallops and Kennedy Space Center

- Biennial Restoration Meeting for all Restoration Project Managers is the planning stages for early 2019.

Ecosystems ★ Climate ★ Energy & Minerals ★ Natural Hazards ★ Environment & Human Health ★ Water

USGS Technical Announcements

https://www.usgs.gov/news/technical-announcements

Water Resources
Energy Resources
Environmental Health
Mineral Resources
Ecosystems
Core Science Systems
Natural Hazards

https://www.usgs.gov/science/mission-areas

U. S. Geological Survey

National Institute of Environmental Health Sciences
Your Environment. Your Health.

NIEHS Superfund Research Program

- New NIEHS Strategic Plan 2018-2023
- Open Solicitations:
  - Superfund Research Center (P42) – Multi-Project Grants
  - Small Business Innovative Research (R41-R44) – environmental technologies
- PFAS Conferences
  - Upcoming: Boston, June 10-12, 2019 @ Northeastern University
  - Archive: Duke Fall 2018 Symposium: "Perspectives to Guide North Carolina's PFAS Monitoring Network" https://www.youtube.com/watch?v=7rdEJFaZ0DI&feature=youtu.be
- Archive:
  - Highlights of New Superfund Research Centers Available on Clu-In.org or via SRP Website - Of Note: New PFAS Center (U Rhode Island): https://clu-in.org/conf/tio/SRPPIR7_091018/
  - "PFAS Research at NIEHS," NAEHS Council Presentation by Chris Weis, Sept 12 (available through NIEHS Website)
- Annual Meeting: Nov 28-30, Sacramento, CA https://srp2018.org/
- Monthly Research Brief: ask to join srpinfo@niehs.nih.gov

Visit the SRP Website: https://www.niehs.nih.gov/srp

Questions: heather.henry@nih.gov

Biomedical, Health Risks, Stakeholder Engagement, Transport, Detection and Remediation

U.S. Department of the Interior

Updates:

- Continue to work on cleanup prioritization
- Refining our contaminated sites inventory
- Updating our compliance guidance

U.S. Nuclear Regulatory Commission

U.S. NRC staff is evaluating risk significant events involving abnormal leaks/spills of radioactive contaminants into the environment. We also assess residual radioactivity in the subsurface at nuclear facilities, particularly during dismantling and decommissioning of those facilities. Recent NRC regulations require licensees to minimize contamination to the subsurface. Both monitoring and modeling technologies are involved in those assessments and determination of risk significance to the public health and environment. Decision-making on risk significance and the possible need of remediation relies on the coupled monitoring and modeling of the environment. A key issue is the formulation and testing of Conceptual Site Models to understand the contaminant sources and their migration; hydrogeologic flow and transport features, events and processes; bio-geochemical processes affecting contaminant migration behavior; and effectiveness of remediation methods when implemented.

Navy Update to FRTR

- **Websites**
  - **DON PFAS Website**
    - www.secnav.navy.mil/eie/pages/pfc-pfas
  - **NAVFAC Environmental Restoration & BRAC Website**
    - www.navfac.navy.mil/go/erb

- **Recent NAVFAC Guidance on Emerging Contaminants**
  - **Guidance/FAQs on 1,4-Dioxane, September 2018**
  - **Interim PFAS Site Guidance for NAVFAC RPMs, September 2017**

Navy Update to FRTR

- **New NAVFAC Technical Documents**
  - –Passive Sampling for Contaminated Sediment Sites, September 2018
  - –Tools for Estimating Contaminant Mass-In-Place, Mass Discharge, and Remediation Timeframes, August 2018
  - –Geophysical Methods for Characterization and Monitoring at Groundwater Remediation Sites, August 2018
  - –Advances in the State of the Practice for Enhanced In Situ Bioremediation, February 2018
- **Recent OER2 Webinars**
  - –Five Year Review Refresher, October 2018
  - –Munitions Response Program Update and Lessons Learned, April 2018

SERDP & ESTCP Efforts on PFAS: Occurrence, Fate, Transport, Remediation and Ecotoxicity

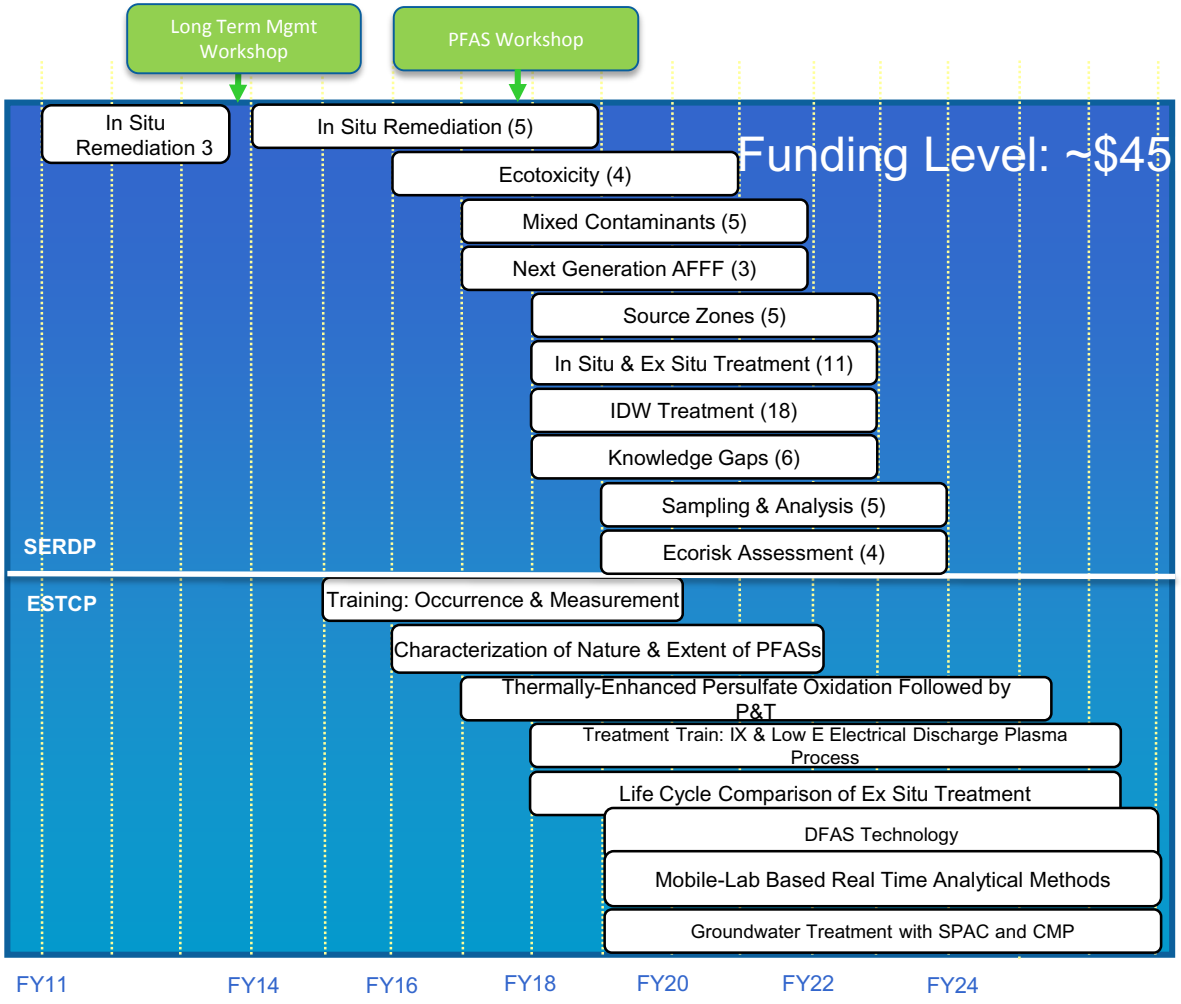
Andrea Leeson, Ph.D.
Deputy Director & Environmental Restoration Program Manager

SERDP
DOD ▪ EPA ▪ DOE

Funding to Date

- ~70 projects
- Total: $48M (FY11 – FY22)

PFAS Efforts



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
- Treatment technology demonstrations
- Technology transfer needs

FY20 SERDP Statement of Needs

- Biodegradation of Per- and Polyfluoroalkyl Substances Found in Aqueous Film Forming Foams
- Development of Passive Sampling Methodologies for Per- and Polyfluoroalkyl Substances
- Development of Analytical Methods to Assess Leaching and Mobility of Per- and Polyfluoroalkyl Substances from Soils, Sediments, and Solid Wastes
- Forensic Methods for Source Tracking and Allocation of Per- and Polyfluoroalkyl Substances

- ***Preproposals due 8 January 2019 @ 2 PM ET***

Treatment Projects Overview

Projects				
Electrocatalytic (ER2424; CDMSmith)	In situ coagulents (ER2425; Minnesota)	In situ chemical reductive defluorination (ER2426; Purdue)	Coupled reactive nanoscale materials & bioremediation; mixed contaminants (ER2714; Brown)	
In situ chemical oxidation & bioremediation; mixed contaminants (ER2715; UC Berkeley)	Electrolytic degradation with electrobiostimulation; mixed contaminants (ER2718; Colorado State)	Key F&T properties impacting attenuation & treatment; mixed contaminants (ER2720; Colorado School of Mines)	Thermally enhanced persulfate oxidation followed by P&T (ER201729; Navy)	
In situ & ex situ treatment train: ISCO or amendment, plasma destruction, IX (1306; Clarkson)	Ex situ treatment train: pre & post oxidation, adsorption, adsorption material regeneration (1289; UC Riverside)	Polymer adsorbents In or ex situ (1026; Cornell)	Commercially available regenerable resins Ex situ (1063; CSM)	IX resins, electrochemical &/or ultrasonic treatment for regenerant Ex situ (1027; Aptim)
Proof of Concept (Ex situ/drinking water or pump-and-treat)				
Protein based adsorbents (1417; U.S. Army)	Electrically enhanced adsorption onto AC, electrically discharge to regenerate (1395; NCSU)	Electrochemical oxidation (1320; Univ of GA)	Mesoporous organosilica sorbents Ex situ (1300; Wooster)	Cationic polyaniline (PANI) & polypyrrole (PPy) polymers (1052; Univ of AZ)	Electrocoagulation (1278; AECOM)
Proof of Concept (Investigation Derived Waste)				
Advanced oxidation-reduction & membrane concentration (1497; UC Riverside)	Modified SiiC based catalysts (1513; Research Triangle Institute)	Reductive defluorination by hydrated electrons (1526; Miami)	Thermal treatment (1556; Aptim)	Nonthermal plasma technology (1570; Drexel)
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Destruction

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Sequestration

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Treatment Trains

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Mixed Contamination: PFASs & Chlorinated Solvents

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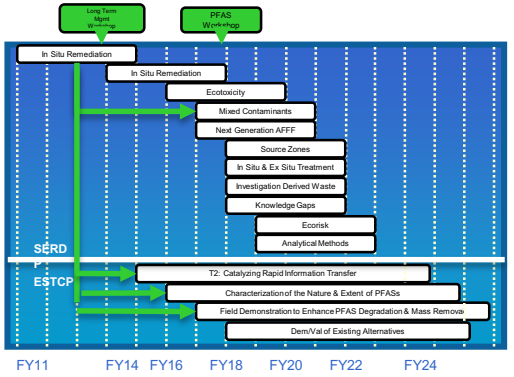
Investigation Derived Waste

Summary

- Additional research and demonstrations needed in all remediation areas: ex situ (drinking water), in situ groundwater and soil treatments
- Good progress on several fronts
- Toxicology information needed to inform remediation; which PFASs are of most concern

Resources

http://map.serdp-estcp.org/Featured-Initiatives/Per-and-Polyfluoroalkyl-Substances-PFASs/



- Workshop report
  - https://serdp-estcp.org/content/download/45585/425201/file/PFAS%20Workshop%20Report%20Final%20September%202017.pdf
- FAQ and Reference Document
  - https://www.serdp-estcp.org/content/download/46353/431598/file/FAQ%20ER-201574%20September%202017.pdf
  - In what environmental media have PFASs been found?
  - What is the fate and transport of PFASs in the environment?
  - What characterization & remedial tools are available/effective for PFASs?
  - What are human & ecological exposure pathways & health effects?