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Ongoing PFAS Research – NIEHS Superfund Research Program

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

Heather Henry, Ph.D.

Superfund Research Program (SRP)

Division of Extramural Research and Training (DERT)

National Institute of Environmental Health Sciences (NIEHS)

National Institutes of Health (NIH)

https://www.niehs.nih.gov/srp

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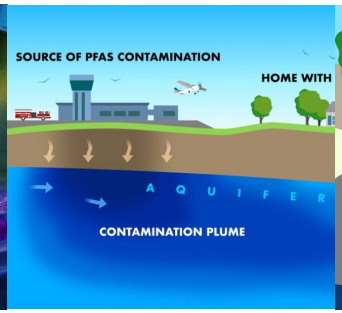
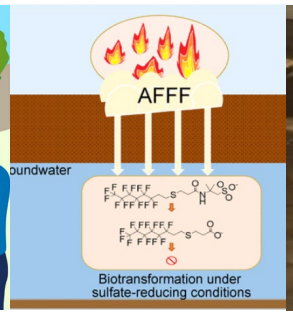



Biomedical, Health Risks, Stakeholder Engagement, Transport, Detection and Remediation

Tools and Technologies for Site Assessment and Remediation

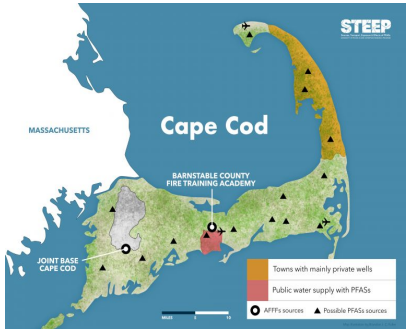
Tools for Site Assessment

Rainer Lohman, University of Rhode Island

- Developing and validating various **novel passive sampling tools** to detect and quantify dissolved PFAS in water.
  - Porewater Fiber: developing the PFAS porewater fiber to deduce partitioning and bioavailability of ionic PFAS. Comparing results to controlled bioaccumulation tests for PFAS (mussels/oysters), in collab w/ EPA.
  - Sampling Tube: field validating a PFAS sampling tube for reporting time weighted average (TWA) of ionic PFAS concentrations in water
  - Polyethylene: Testing/validating a passive polyethylene sampler for PFAS volatile precursors
- Validating at Joint Base Cape Cod and a site in Guam. Aim to deploy the PSDs to aid site managers in risk characterization.

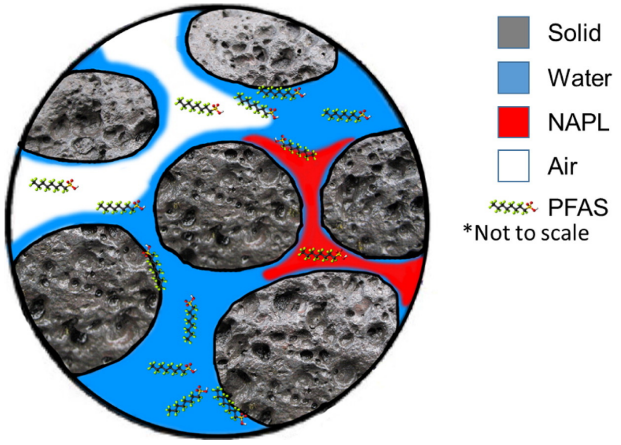
PFAS Fate and Transport

Elsie Sunderland, University of Rhode Island



- Tracing unique PFAS signature fingerprints to establish exposure levels at a contaminated groundwater site on Cape Cod through drinking water and fish.
- Understanding geochemical factors affecting PFAS mobility.

Mark Brusseau, University of Arizona



- Proposed multi-process model of PFAS transport and reported that air-water interface was primary source for retention. (Brusseau, Sci Total Environ, 2018)
- Described adsorption of PFOA at air-water interface during transport in unsaturated porous media. (Brusseau et al., Environ Sci Technol, 2018)

Biotransformation and Remediation

David Sedlak and Lisa Alvarez-Cohen
University of California, Berkeley

- Characterized the biotransformation and fate of PFAS in aqueous film-forming foams (AFFF).
  (Yi et al., Environ Sci and Technol Letters, 2018)

- Combining biological and chemical treatment options to degrade and destroy AFFF and PFAS: heat-activated persulfate.
  (Bruton and Sedlak, Environ Sci Technol, 2017; Bruton and Sedlak, Chemosphere, 2018; Harding et al., Environ Sci Technol, 2016; Sun and Sedlak, Environ Sci Technol, 2016)

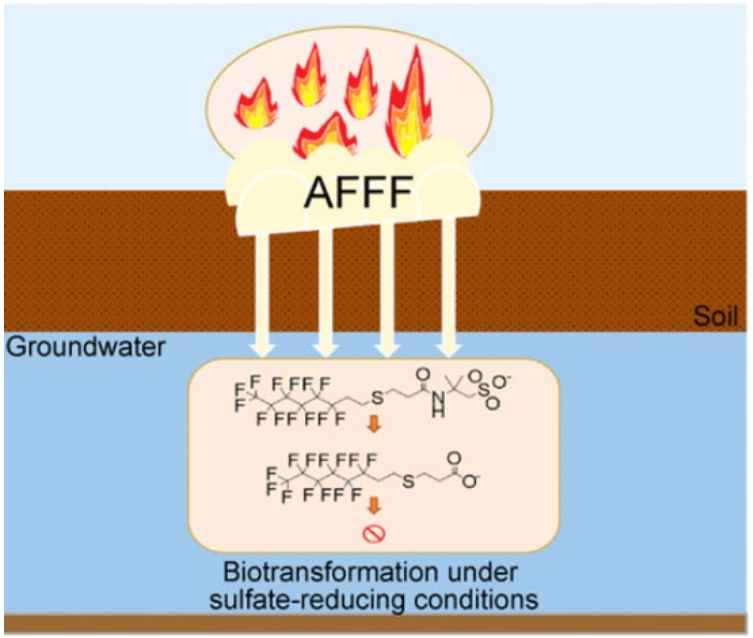
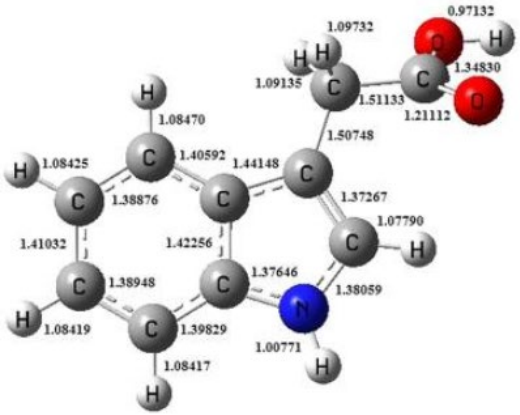


Figure from Yi et al., Environ Sci and Technol Letters, 2018)

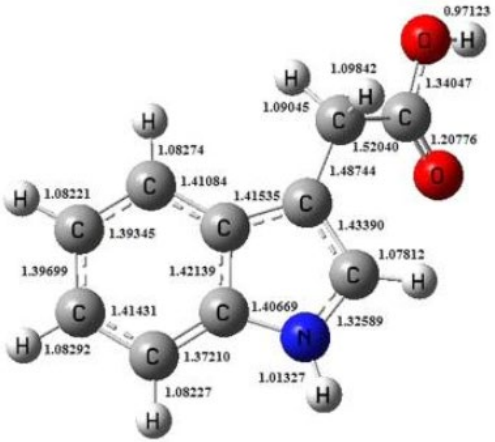
Remediation

Stephen Boyd, Michigan State University

- Developing energy efficient nanoreactors - indole with smectite interlayers - capable of breaking C-F bond at low energy irradiation.
- Reported complete defluorination of perfluorinated compounds using hydrated electrons. (Haoting et al., Sci Rep, 2016)



IAA



IAA radical cation

The optimized molecular structures of indole acetic acid (IAA) and IAA radical cation as obtained from density functional theory calculations. (From Haoting et al., Sci Rep, 2016)

Remediation – SBIR Awards

Raymond Ball, EnChem Engineering, Inc.

EnChem Engineering, Inc.

- Developing an innovative combined in-situ / ex-situ technology to cost-effectively expedite removal of PFAS from soil and groundwater.
- Results: highly contaminated FTA soils (700 ug/kg Total PFAS) remediated with Total PFAS at 97% removal with extracted water down to 70 ppt for 5 of the 6 UCMR PFAS; Destruction of broad range of PFAS in water including PFOS.

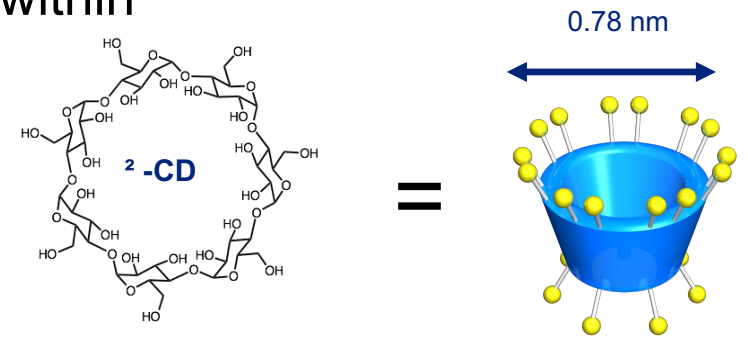
- **XCT® -patented technology (other patents pending) used for enhanced In-Situ flushing of PFAS from aquifer soil, groundwater recirculation, with Ex-Situ PFAS destruction**
- **OxyZone® -patented persulfate-based oxidant mixture for Ex-Situ and In-Situ Treatment of conventional organic contaminants**
- **OxyZone® - effective for Ex-Situ and potentially In-Situ treatment of PFAS**

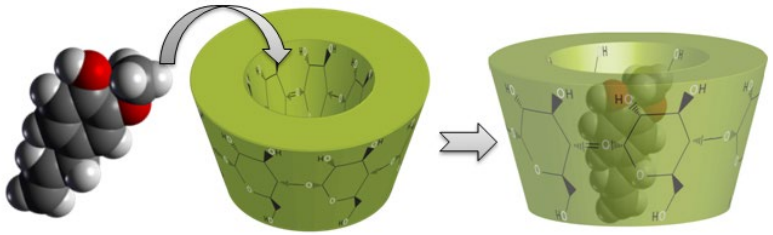
Remediation – SBIR Awards

Gokhan Barin, CycloPure, Inc.

CycloPure
MAKING WATER SAFE

- Developing adsorbent technology to capture thousands of contaminants, including PFAS.
- Novel high-affinity cyclodextrin polymers for cost-effective remediation.
  - Derived from corn, safe material
  - Bind thousands of organic molecules within their cup-shaped structures
  - Removal interactions take place within the .78 nanometer cyclodextrin cups, which form optimally-sized inclusion complexes to host the attraction and capture of micropollutants.

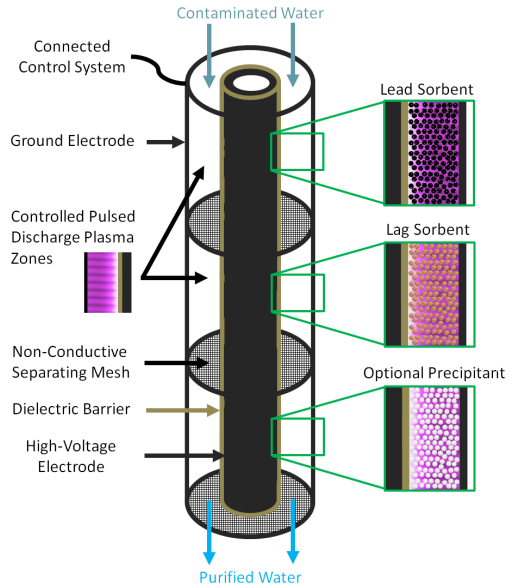


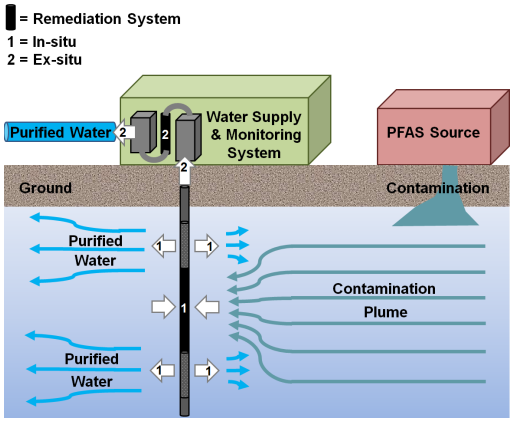


Remediation – SBIR Awards

Joseph Miller, Lynntech, Inc.

- Continuous Removal/Disposal System for the Concurrent Sorption and Breakdown of Contaminants Into Harmless Precipitates
- Developing a tunable and continuous remediation system:
  - scalable, efficient, and plasma-induced contaminate decomposition
  - sorbent regeneration system
  - integrated monitoring system
- Concept: in-situ and ex-situ groundwater purification of contaminants without need for frequent sorbent replenishment and disposal
- Goal: less than 70 ppt of PFOA/PFOS in the purified effluent





Lynntech

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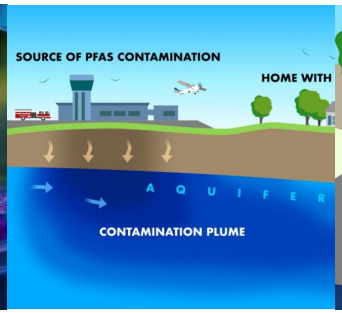


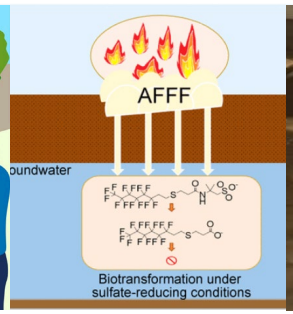


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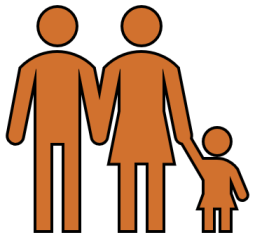
Health and Human Exposure Research



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Health and Human Exposure

Phillipe Grandjean, University of Rhode Island

- Birth cohort studies in the Faroe Islands (NIEHS)
- Characterized exposure sources
- Postnatal development, neurobehavioral functions, metabolic outcomes, and immune system responses
- The role of PFAS in obesity and weakening immune system

(Barouki et al., Environ Int, 2018; Dassuncao et al., Environ Sci Technol, 2018; Grandjean, Environ Health, 2018; Hu et al., Environ Health, 2018)

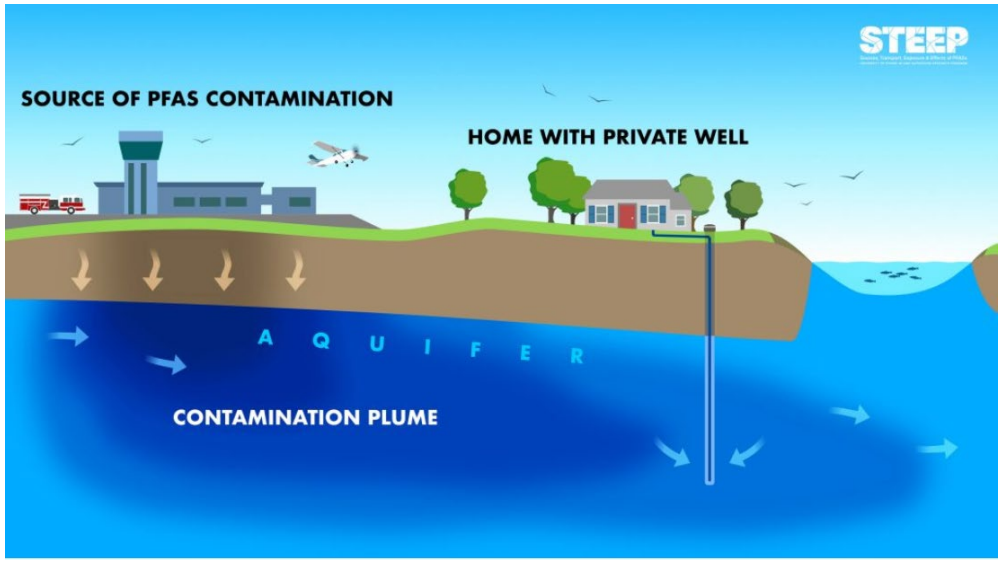
Angela Slitt, University of Rhode Island

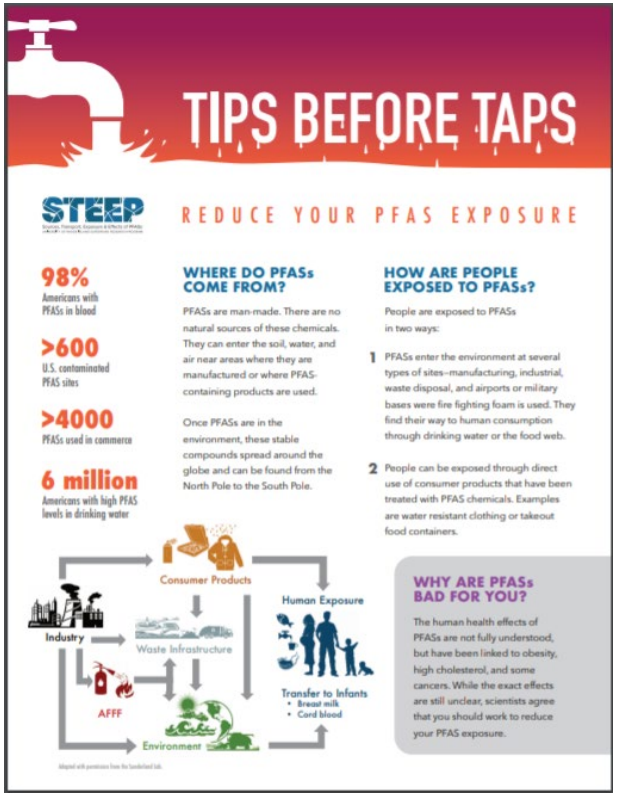
- Using rodent models to understand role of PFAS in obesity-induced fatty liver disease and metabolic disorders

Health and Human Exposure

Alyson McCann, University of Rhode Island

- Educating communities and advising stakeholders to reduce human exposure to PFAS.
- Private well testing for PFAS (Cape Cod).



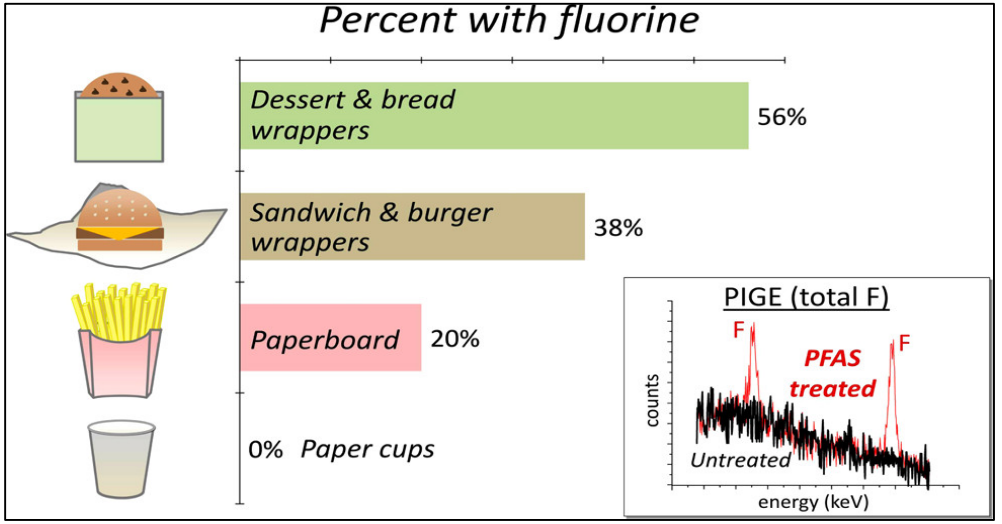


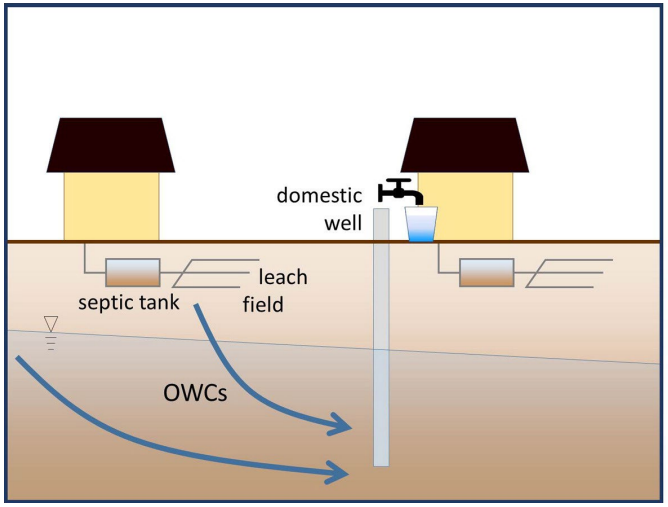
Source: URI STEEP. https://web.uri.edu/steep/communities/

Health and Human Exposure

Laurel Schaider, URI

- Measured PFAS in food packaging
  - Reported 46% of food contact papers and 20% of paperboard samples contained fluorine
  - Potentially significant contribution to dietary PFAS exposure
- Evaluated exposure through Septic Systems
  - Tested 20 wells in Cape Cod, MA
  - Detected 5 different PFAS compounds
  - Identified septic systems as likely source of contaminants



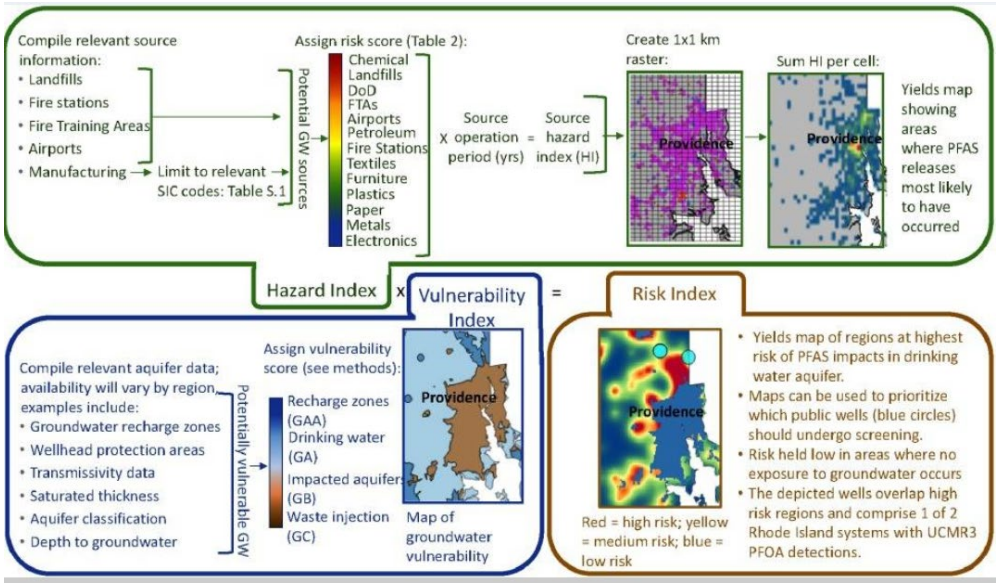


(Schaider, Environ Sci Technol Lett, 2017; Schaider et al., Scit Total Environ, 2016)

Health and Human Exposure

Jennifer Guelfo and Eric Suuberg, Brown University

- Developing GIS-based database for identifying municipalities at risk for PFAS exposure based on past land use data; Evaluated a national dataset of PFAS in the U.S. (Guelfo et al., EHP, 2018; Guelfo et al., Enviro Poll, 2018)
- Conducting training workshops throughout Northeast for federal and state officials about basics of PFAS and best lab practices for analysis.



Overview of Rhode Island case study utilizing systematic approach to conduct a geospatial risk assessment of PFAS impacts in drinking water aquifers.
(From Guelfo et al., EHP, 2018)

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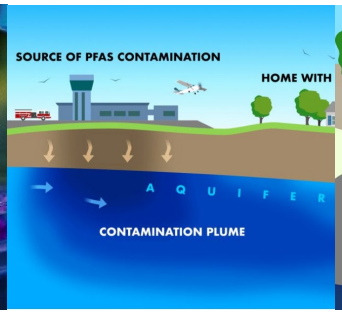


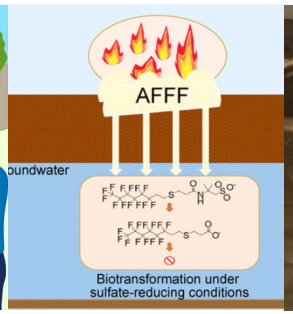


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Thank you!

Questions??

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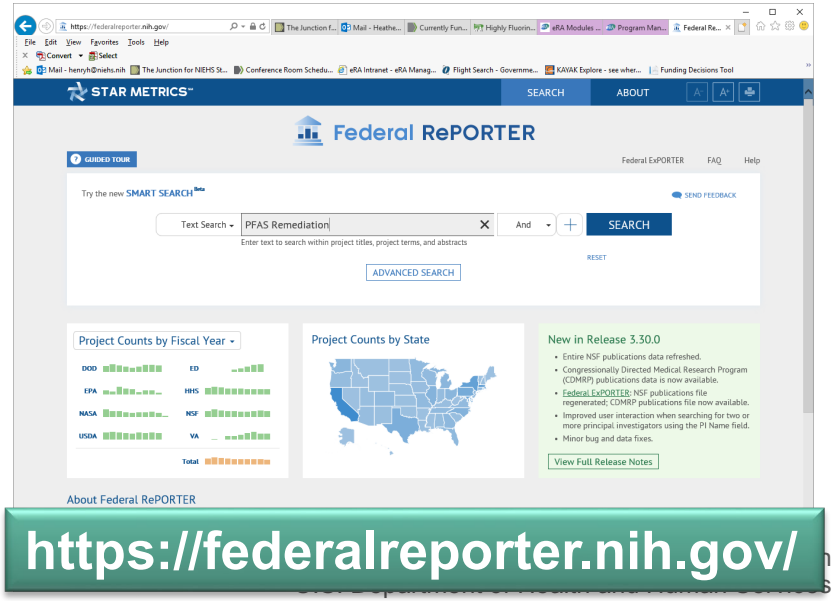
Public Searchable Database

NIH RePORT

- **NIH Reporter** is a searchable repository of NIH-funded research projects
- You can view details of other NIH-funded projects and their publications

Federal Reporter

- Includes several funding agencies: HHS (includes NIEHS Superfund), EPA, DOD, NSF, etc…
- Data 2008 to 2017



Other SRP Resources

- Visit the SRP Website: https://www.niehs.nih.gov/srp
- SRP Progress in Research Webinars: https://go.usa.gov/xPUuT
- SRP Risk E-Learning Webinars: https://go.usa.gov/xPUuD
- Subscribe to the SRP Monthly Research Brief: https://go.usa.gov/xPUk6
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