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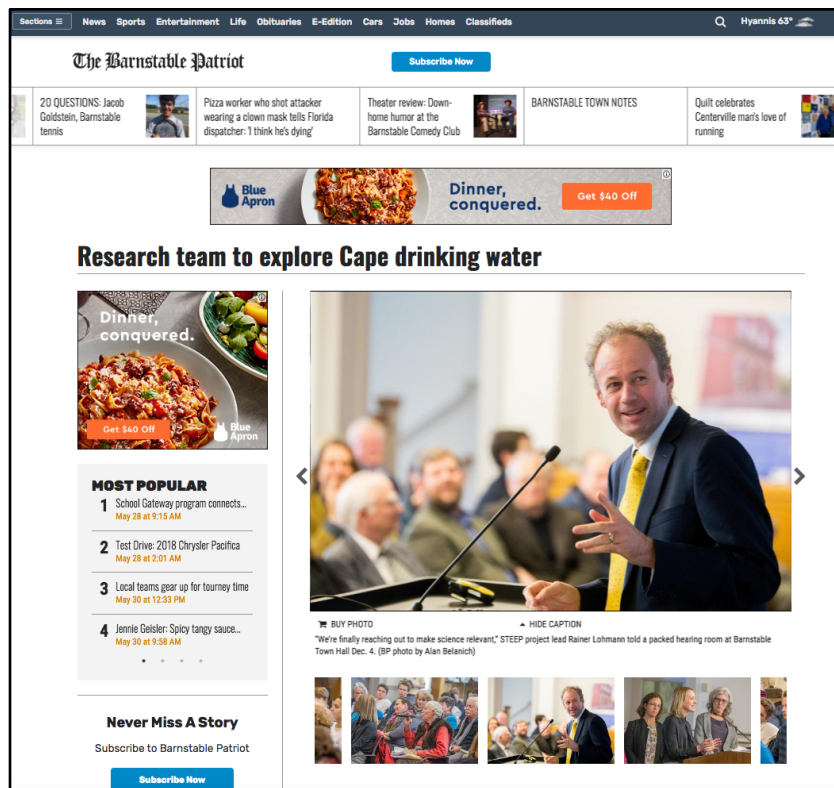
Sources, Transport, Exposure & Effects of PFASs
UNIVERSITY OF RHODE ISLAND SUPERFUND RESEARCH PROGRAM

The Geography of PFAS Information



Where to find information

- www.uri.edu/stEEP
- Traditional media



- Social media



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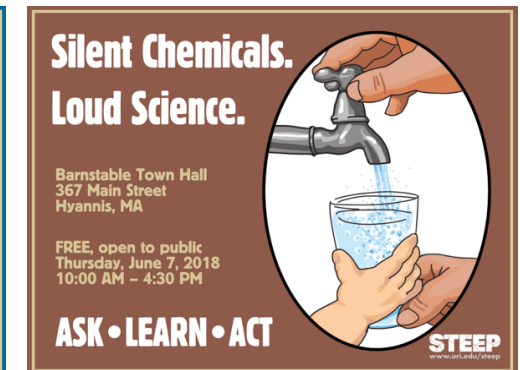
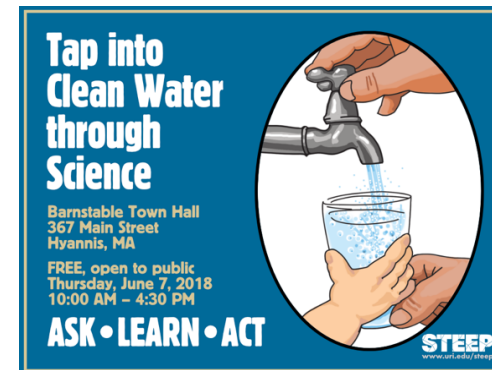


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- Promotion for community events



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News

The EPA's "Leadership Summit" on PFOA pollution will exclude victims and community groups

– STEEP's Grandjean says EPA today is at least 10 years behind the scientific evidence on PFAS.

EPA is keeping troubling new study on drinking water under wraps

– Unpublished study says communities across the country may be exposed to concerning levels of per- and polyfluoroalkyl substances with adverse health effects. It is hoped that EPA's upcoming National Leadership Summit will take action on PFAS.

STEEP launches well water testing study

– Cape Cod residents invited to sign up to have their private well water tested for contaminants through new research study.

Tweets by @steepsuperfund

 URI STEEP Superfund @steepsuperfund
 STEEP #nextgeneration trainee and @NOAA Nancy Foster Scholar @annaruthski in the field collecting passive samplers for #PFAS from across #MassachusettsBay on a series of acoustic moorings, as well as gathering water samples from across #StellwagenBank #PFASSTEEP #sanctuaries



2h

Events & Highlights

Dr. Philippe Grandjean discusses ~20 year delay before PFASs toxicity known to public

– May 27–30, 2018 The Faroe Islands STEEP researcher, Dr. Philippe Grandjean, serves as co-chair of international conference focused on the impacts of toxic chemicals – including PFAS – on prenatal health. The conference be held on the Faroe Islands, a STEEP community research site. Learn more about the conference. Dr. Philippe Grandjean of Harvard's T.H. [...]

Notes from the Field

– STEEP trainee and NOAA Nancy Foster Scholar Anna Robuck is aboard the R/V Warren Jr. collecting passive samplers for PFAS from across Massachusetts Bay on a series of acoustic moorings, as well as gathering water samples from across Stellwagen Bank as part of STEEP's Detection Tool's research. A partnership of the University of

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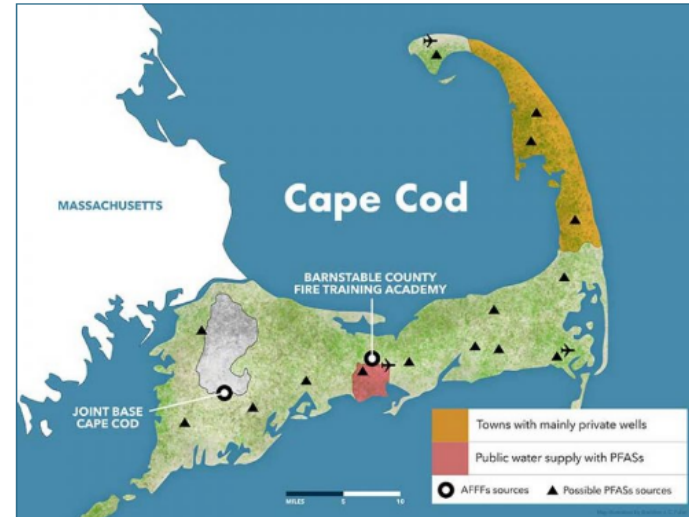
News & Events



Communities Cape Cod Faroe Islands

Cape Cod

Groundwater on Cape Cod has been contaminated by PFASs from multiple sources. To date, these sources have been identified as fire training areas, airports, military bases, landfills, municipal wastewater, and septic systems. The spread of PFASs is exacerbated by Barnstable's location in an outwash plain with permeable soil. The result is that groundwater aquifers are highly susceptible to movement of contaminants from the surface of the ground—the place where surface water both contributes to aquifers and enters the food web. Given these multiple inputs of PFASs and the unique geology of the area, there is an ongoing threat to Cape Cod's sole source aquifer that provides drinking water for 200,000 year-round and 500,000 summer residents.



Once PFASs get into groundwater, they move with the groundwater and eventually can contaminate both public and private drinking water sources. Prior research by Silent Spring Institute demonstrated the presence of PFASs in both public and private drinking water wells on Cape Cod from a wide range of sources. This research alerted the Hyannis Water System in the Town of Barnstable to PFAS contamination in some of the public wells. Additional testing by the Hyannis Water System and Silent Spring Institute found PFAS levels above EPA health guidelines. The town responded by installing activated carbon treatment to remove PFASs; however, private well owners are not required to test for PFASs, so there is little information about the extent of PFAS contamination in Cape Cod private wells.

Contamination Sources

The primary contamination source that STEEP addresses on Cape Cod is aqueous film-forming foams (AFFFs), which are a class of firefighting foams used to fight fuel fires. These AFFFs have been used in firefighting training at the Barnstable County Fire/Rescue Training Academy (BCFTA) and the Joint Base Cape Cod (JBCC). STEEP researchers will assess the movement of PFASs from AFFFs seeping into groundwater to better understand how these chemicals can end up in drinking water wells and accumulate in food webs. Once in groundwater and food sources, this can lead to human exposure through drinking contaminated tap water or eating contaminated fish.

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About PFASs

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Health Risks

There is significant and widespread exposure of the general public to various PFASs, particularly PFOS (perfluorooctanesulfonic acid) and PFOA (perfluorooctanoic acid), which are specific compounds within the overall group of PFASs. Today, more and more evidence is emerging concerning the adverse health effects at levels the typical American experiences regardless of geographic location. Throughout the U.S., various PFASs were detected in 98% of human blood samples analyzed through 2012. Exposure to the most notorious PFASs, i.e., PFOA and PFOS, is decreasing in the general population, while newer and different PFASs are either increasing or staying steady—both of which groups are likely threats to human and environmental health. High-end exposure from PFAS contaminated drinking water has been shown to contribute to kidney and testicular cancers and thyroid disease, among others.



Current animal studies have associated PFASs with a suite of adverse health effects including obesity, liver toxicity, and reproductive toxicity, and partial confirmation regarding PFASs impacts on humans has been obtained in additional studies. For example, in landmark epidemiological studies on the Faroe Islands, STEEP co-lead Dr. Philippe Grandjean and collaborators found that the immunotoxic effects observed in early life development are due to emerging PFAS contaminants.

Human exposure to PFASs is ubiquitous and adversely impacts human health, including:

- Elevated serum-cholesterol
- Ulcerative colitis
- Thyroid disease
- Kidney and testicular cancers
- Pregnancy-induced hypertension
- Immunotoxicity in children

There is evidence from laboratory studies of animals of additional effects, including:

- Liver, testicular, and pancreatic cancers
- Liver enlargement
- Mammary gland tumors
- Altered breast development
- Depressed immunotoxicity
- Changes in serum-lipids

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Where do PFASs come from?

There are three primary sources of PFAS contamination: (1) aqueous film-forming foam (AFFF) use at civilian and military airports, industrial sites, and firefighting training centers; (2) industrial PFAS production by eight major industries in the U.S.; and (3) manufacturing sites of PFAS-containing products, such as carpets or car parts.

There are more than 600 PFAS contaminated sites around the country, many of which will require remediation or treatment, and some are already identified as official Superfund sites. At least 14 Superfund sites on the U.S. EPA National Priorities List are co-contaminated by PFASs. In addition, the release of PFASs to the environment has resulted in ongoing food web contamination, which has become global in extent and caused substantial background exposure to PFASs that affect all Americans.



Photo Credit: U.S. Air Force/Senior Airman Heather Hayward

Where can you find PFASs?

Most prominently, in your own home. If you own water resistant clothing, have stain repellent carpets, or eat food from grease-proof packaging, chances are you are exposed to a range of PFAS. The good news is that you can choose not to use these products. There is widespread use of PFASs in consumer products, and the [Top 9](#) are:

1. Takeout containers such as pizza boxes and sandwich wrappers
2. Non-stick pots, pans, and utensils
3. Popcorn bags
4. Outdoor clothing
5. Camping tents
6. Stain-repellant or water-repellant clothing
7. Stain treatments for clothing and furniture



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Environmental Engineering

STEEP will characterize sources of PFASs through in situ groundwater measurements combined with geochemical modeling to assess transport and fate, including chemometric approaches to fingerprint sources of PFASs as a function of distance from the contaminated site. In other words, STEEP will be a real-world CSI, figuring out where the PFASs are coming from, where they are going, and where they end up—both in humans and the environment.



Human Health Impacts

Researchers will conduct parallel laboratory and human epidemiologic studies to assess the impact of in utero and early-life PFAS exposures on immune dysfunction and metabolic abnormalities. The relationship of PFASs will be used to derive benchmark dose levels to determine when PFAS levels move from less concerning to harmful.



Community Engagement

Sites where high levels of PFASs can be found include firefighter training facilities that use aqueous film forming foams (AFFF). The use of AFFF for fire training activities on Cape Cod has led to contamination of public and private drinking water wells in Hyannis and other parts of the Cape. STEEP is engaging Cape Cod communities that have been exposed to elevated PFAS levels, and these sites mirror the situation at hundreds of other sites around the country.



Spreading the word

STEEP will develop educational materials for communities on the human and environmental health impacts of PFASs. These will be based on the work of STEEP research projects, and designed to engage individuals and community leaders as they decide whether prevention or intervention is needed to reduce PFAS exposure. Outreach materials will range from social to traditional media, from documentaries to print materials, and serve audiences of diverse ages, backgrounds, and influence.



Passing the baton

We have moved from the age of "better living through chemistry" to the age of "better living through research," and to ensure that environmental and human health challenges like PFASs are continuously addressed, STEEP is committed to training the next generation of scientists. The skills and knowledge that are passed on to these graduate students and post-docs today will enhance their ability to identify and hopefully mitigate these stable, long-living compounds in the future.

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The EPA's "Leadership Summit" on PFOA pollution will exclude victims and community groups

STEEP's Grandjean says, "EPA today is at least 10 years behind the scientific evidence on PFAS." [News Coverage.](#)

EPA is keeping troubling new study on drinking water under wraps

[Unpublished study](#) says communities across the country may be exposed to concerning levels of per- and polyfluoroalkyl substances with adverse health effects. It is hoped that EPA's upcoming [National Leadership Summit](#) will take action on PFAS.



STEEP launches well water testing study

Cape Cod residents are invited to sign up to have their private well water tested for per- and polyfluoroalkyl substances (PFASs) through new well water testing program. [Learn More.](#)

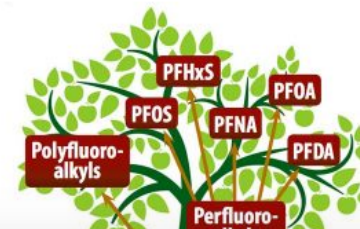
STEEP on the Move

Nine STEEP researchers and eight trainees attended the 2018 Northeast Superfund Research Program (SRP) Meeting in Woods Hole, MA on March 26-27. The URI-led STEEP center includes partners from the Harvard T.H. Chan School of Public Health, Department of Environmental Health, and Silent Spring Institute. The STEEP team joined seven other northeast SRP programs to share research updates, participate in trainee mentoring lunches, and poster session presentations. Other SRPs in attendance included Brown University, Boston University, Columbia University, Dartmouth College, Massachusetts Institute of Technology, Northeastern University, and University of Pennsylvania. [Overview of the conference.](#)



STEEP researcher served as expert witness in settled Minnesota v. 3M lawsuit

3M used PFASs since the late 1940s, continued disposing of them in Minnesota dumpsites until the 1970s, and completely phased them out in 2002, when 3M made an agreement with the EPA due to escalating concern about their effects. The chemicals leached into MI's groundwater and contaminated residential wells. In 2004, traces of the chemicals were found in the drinking water of about 67,000 people in the state. In 2007, 3M signed an agreement with the state of Minnesota to finance cleanup of landfills and provide drinking water to contaminated communities. In 2010, Minnesota Attorney General Lori Swanson sued 3M stating that 3M



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Published by Amber Neville [?] · Yesterday at 10:17am · 🌐

Hear the latest research on highly fluorinated chemicals #PFAS on June 7th at Science Day on #CapeCod: <https://web.uri.edu/steep/science-day/>

**Get in the Game:
Play Ball
with Scientists**



**Barnstable Town Hall
367 Main Street
Hyannis, MA**

**FREE, open to public
Thursday, June 7, 2018
10:00 AM – 4:30 PM**

ASK • LEARN • ACT

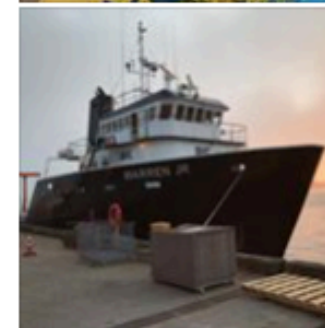
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Published by Amber Neville [?] · 4 hrs · 🌐

STEPP trainee and NOAA Nancy Foster Scholar Anna Ruth Robuck aboard the R/V Warren Jr. collecting passive samplers for #PFAS from across Massachusetts Bay on a series of acoustic moorings, as well as gathering water samples from across Stellwagen Bank as part of STEPP's Detection Tool's research: <https://web.uri.edu/steep/steep-research/detection-tools/>






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URI STEEP Superfund @steepsuperfund · May 18

EPA's "Leadership Summit" on PFOA pollution to exclude victims and community groups. Grandjean, "EPA today is at least 10 years behind the scientific evidence." intercept.pt/2k8fG4Y by @fastlerner @NIH_STEEP #PFAS @SilentSpringIns @HarvardChanSPH @universityofri @SRP_NIEHS



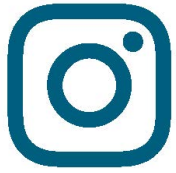
The EPA's "Leadership Summit" on PFOA Pollution Will Exclude Victi...
The EPA doesn't want to hear from people who have PFOA and other PFAS chemicals in their drinking water.
theintercept.com

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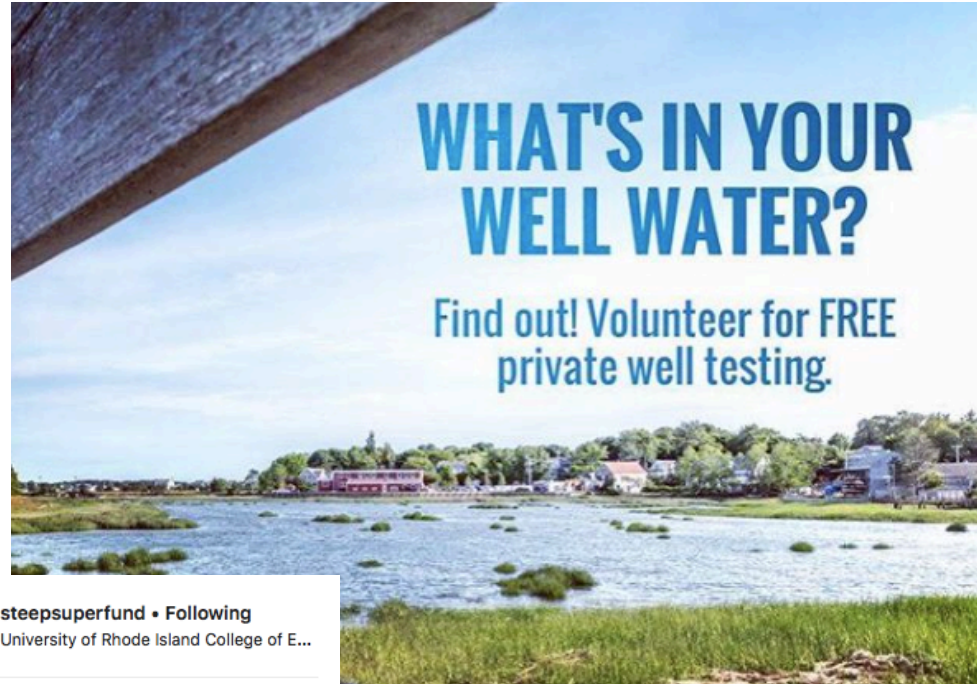
URI STEEP Superfund
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@SRP_NIEHS @steepsuperfund Dr. Philippe Grandjean @faroe_islands #PPTOX VI Conference discussing ~20 years delay before crucial info on #PFAS went public. #PFAS pass from placenta to fetus so mother's level shared. #PFAShealthimpacts #STEEPchallenges





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steepsuperfund @universityofri Big Thinkers work hard for the NIEHS Superfund Research Program – STEEP (Sources, Transport, Exposure & Effects of PFAS). These progressive scientists use their research to address the human health threat of poly- and per-fluorinated alkyl substances through rigorous science. #STEEP+NIEHS #STEEPchallenges #PFAShealthimpacts #PFASimmunehealth #PFAS #ThinkBigWeDo

michaelfedorenko, amcrisalli, ayfx, miamill and marthamconnell like this

MARCH 9

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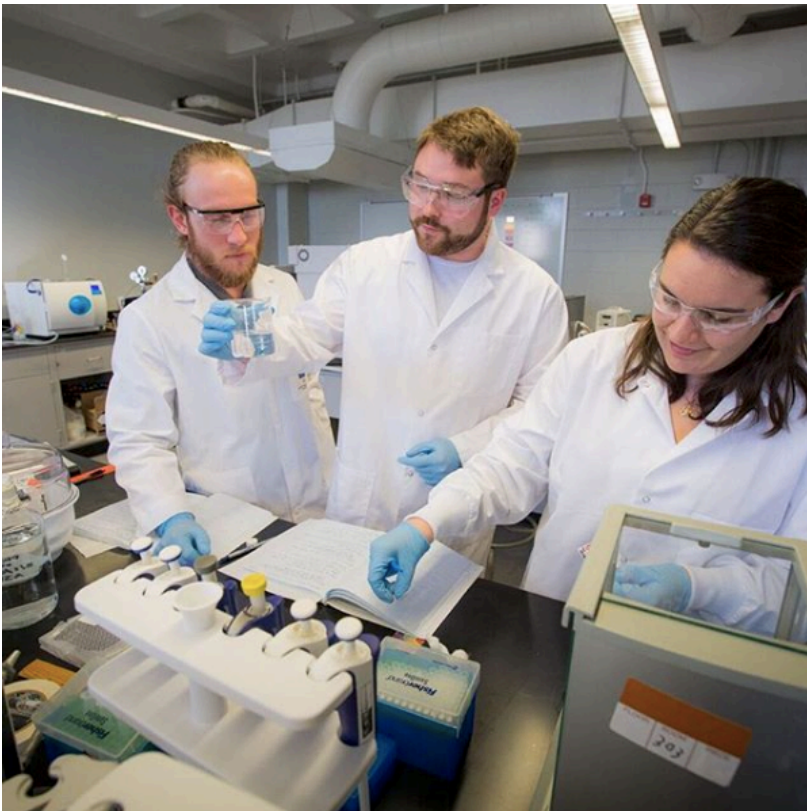
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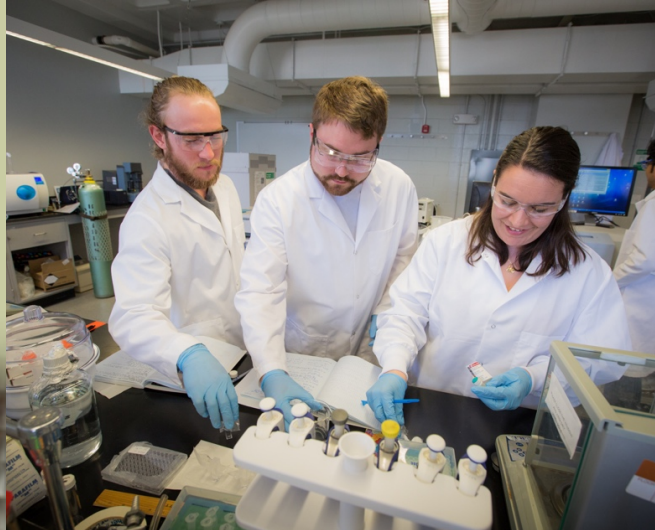
steepsuperfund @steepsuperfund invites #capecod residents to participate in well water study to test for #PFASs Learn more: https://bit.ly/2vEZWyX

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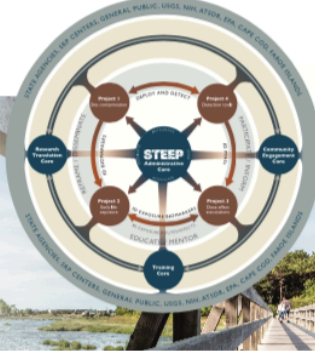




STEEP's goal is to address the human and environmental health threats of PFASs (Per- and Polyfluoroalkyl Substances) to reduce exposure and mitigate future contamination.

PFASs Overview

- PFASs have emerged as high-priority environmental contaminants at increasing numbers of sites, including drinking water sources.
- Produced and used in consumer products for more than 60 years, ubiquity in human blood and environment discovered less than 20 years ago.
- Primary sources of contamination are:**
 - Aqueous film-forming foam.
 - Manufacturing sites of PFAS-containing products.
 - PFAS production industrial sites.
- More than 600 PFAS-contaminated sites in U.S.; many likely to become official superfund sites.
- Major challenges remain for effective protection from PFAS exposure through regulation and remediation.



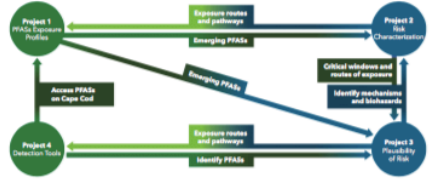
Research Projects

Environmental Engineering (1)

Trace unique PFASs chemical signature—fingerprint—to establish PFASs exposure levels at a contaminated groundwater site on Cape Cod through drinking water and fish as a function of PFAS chemistry, geochemistry and distance from source.

Epidemiological Study (2)

Link prenatal, lactational, and postnatal PFAS exposure data to clinical indicators of immune dysfunction and metabolic abnormalities as indicators of sensitive effects during early development; volunteer cohort located in Faneuil Islands.



Environmental Engineering (4)

Develop and validate novel passive sampling tools for PFASs to measure time weighted average concentrations for both ionic PFASs and their volatile precursors; deploy to aid site managers in their risk characterization.

Laboratory Model (3)

Establish pathways of PFAS effects on metabolic and inflammatory abnormalities to better assess PFASs role contributing to obesity and weakening immune system; prime human health epidemics.

WHAT'S IN YOUR WELL WATER?

Find out! Volunteer for FREE private well testing.

Why study well water?
In some areas of Cape Cod, PFASs have been found in drinking water.

What are PFASs?
PFASs are chemicals found in household products and firefighting foam. They've been around for 60 years, but their harmful health effects have only drawn concern in the last 20 years.

How can PFASs get into my well water and what are the harmful effects?
They can seep into the ground and move through groundwater to your well. They suppress certain immune system functions, particularly in kids, impact metabolic and liver functions, and are linked to some cancers and adverse effects on pregnancy, such as low birth weight.

Who can participate and how much time will it take?
Private well owners who live in Barnstable County on Cape Cod are eligible to participate, and participation will take about three hours.

What's the purpose of this study?
To test 50 private wells on Cape Cod each year over the next 5 years. Wells will be chosen from areas in Barnstable County that may be impacted by PFASs. The benefit to Cape Cod residents is a better understanding of PFAS exposure and contamination.

Who is doing the study?
The STEEP project is part of a National Institutes of Health Superfund Research Project led by the University of Rhode Island, URI and Silent Spring Institute will collect well water samples and Harvard University will analyze them.

Will I receive the test results?
We will report individual results and interpret them for each participant. We will share summaries of our findings with Cape residents in reports and public meetings. Names and addresses of participants will be kept confidential.

For more info, or to apply, contact either:

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Peer of Environmental Health (2018) 17:31
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RESEARCH Open Access

Can profiles of poly- and Perfluoroalkyl substances (PFASs) in human serum provide information on major exposure sources?

Xinli C. Hu^{1,2}, Delfan Dissanayake^{1,3}, Keiming Zhang¹, Philippe Grandjean¹, Jill Wolfe¹, Glorija M. Webster¹, Keiming Nieber¹, and Blue M. Sunderland^{1*}

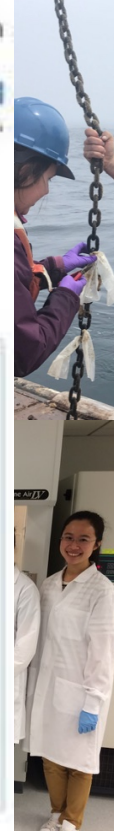
Abstract
Background: Humans are exposed to poly- and perfluoroalkyl substances (PFASs) from diverse sources and this has been associated with negative health impacts. Advances in analytical methods have enabled routine detection of more than 15 PFASs in human sera, allowing better profiling of PFAS exposures. The composition of PFASs in human sera reflects the complexity of exposure sources but source identification can be confounded by differences in toxicokinetics affecting uptake, distribution, and elimination. Common PFASs, such as perfluorooctanoic acid (PFCA), perfluorodecanoic sulfonic acid (PFDA), and their precursors are ubiquitous in multiple exposure sources. However, their composition varies among sources, which may impact associated adverse health effects.

Methods: We use available PFAS concentrations from several demographic groups in a North Atlantic seafood-consuming population (Faneuil Islands) to explore whether chemical fingerprints in human sera provide insights into predominant exposure sources. We compare serum PFAS profiles from Faneuil individuals to other North American populations to investigate commonalities in potential exposure sources. We compare individuals with similar demographic and physiological characteristics and samples from the same years to reduce confounding by toxicokinetic differences and changing environmental releases.

Results: Using principal components analysis (PCA) confirmed by hierarchical clustering, we assess variability in serum PFAS concentrations across three Faneuil groups. The first principal component (PC1) is a ratio of C12/C10 perfluoroalkyl carboxylates (PFCA) and is consistent with measured PFAS profiles in consumed seafood. The second PC1 cluster includes perfluorooctanesulfonic acid (PFOS) and the PFOS-precursor N-ethyl perfluorooctanesulfonamide (N-EFOSAA), which are directly used or metabolized from fluorochemicals in consumer products, such as vapor and food packaging. We find that the same compounds are associated with the same exposure sources in two North American populations, suggesting generalizability of results from the Faneuil population.

Conclusions: We conclude that PFAS homologue profiles in serum provide valuable information on major exposure sources. It is essential to sample samples collected at similar time periods and to correct for demographic groups that are highly affected by differences in physiological processes (e.g., pregnancy). Information on PFAS homologue profiles is crucial for attributing adverse health effects to the proper mixtures or individual PFASs.

Keywords: Serum, Fish and shellfish, Consumer products, Source attribution, Homologues, Perfluoroalkyl carboxylates (PFCA)



Going forward

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3:00 PM today





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Thanks to the Cape Cod Community!

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Department of Environmental Health



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More information about STEEP is available at: <https://web.uri.edu/steep/>

