PFAS exposure and health effects: Scientists and activists working together to protect public health

Laurel Schaider, PhD
Senior Scientist, Silent Spring Institute
MBCC Webinar, November 16, 2021

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

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

PFAS-REACH
PFAS Research, Education, and Action for Community Health

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

We are an independent, non-profit research organization dedicated to identifying the links between everyday chemicals and health, with a focus on women's health and breast cancer.

History

Founded by Massachusetts Breast Cancer Coalition in 1994.

Now a leading scientific research organization on environmental causes of breast cancer.

"A lab of our own"

Activists are central to action on PFAS

- Some activist groups previously focused on other types of toxics and are now addressing PFAS too
- Some are new grassroots groups founded in response to discovery of local PFAS contamination
- All types of activists have played key roles in shaping and supporting research, legislation, and policies on PFAS

STEEP: Sources, Transport, Exposure & Effects of PFAS Superfund Research Program

- 5-year study on health effects, exposures, environmental transport, and chemical properties
- Community Engagement Core on Cape Cod, including private well testing, community events, and community advisory committee
- Translation of research findings

Study partners

- Univ. of Rhode Island (lead)
- Harvard University
- Silent Spring Institute

Local partners

- Mass. Breast Cancer Coalition
- Sierra Club Cape Cod Group
- Mashpee Wampanoag Tribe

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PFAS-REACH: Research, Education, and Action for Community Health

Study components

- Study of PFAS effects on children's immune systems

- PFAS Exchange: Online resource center

- Analysis of experiences of affected communities

Study partners

- Silent Spring Institute (lead)
- Northeastern University
- Michigan State University
- Mass. Breast Cancer Coalition
- Testing for Pease
- Community Action Works

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MA PFAS and Your Health Study

- Part of Multi-Site Study led by CDC and Agency for Toxic Substances and Disease Registry (ATSDR)
- Hyannis and Ayer, MA
- Investigating PFAS exposure and health effects in adults and children
- Reconstructing past exposures
- Enrollment now underway in Hyannis

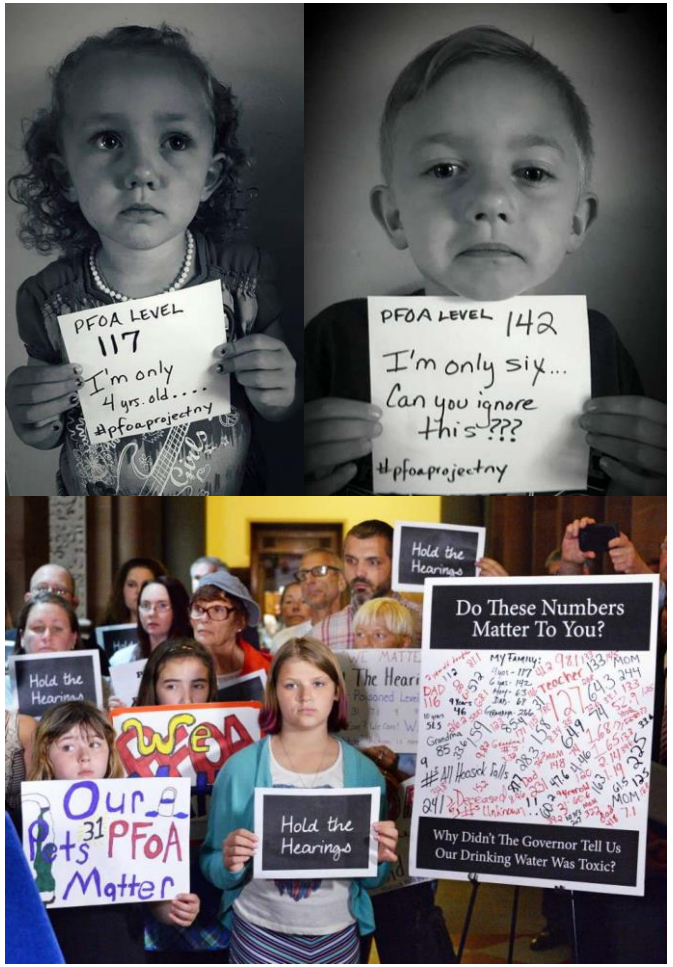
Study partners

- Silent Spring Institute (lead)
- Harvard School of Public Health
- Eastern Research Group
- Mass. Breast Cancer Coalition
- People of Ayer Concerned about the Environment (PACE)

Multi-site Health Study

What are communities seeking?

- Water monitoring and treatment
- Drinking water standards and other regulations
- Environmental measurements
- PFAS biomonitoring
- Medical monitoring guidance and education for health professionals
- Health studies



PFOA Project NY
Hoosick Falls, NY, 2016

Challenges faced by communities

- Blood testing often unavailable and expensive
- Medical professionals unfamiliar with PFAS health concerns
- Some states not testing drinking water or only testing for limited number of compounds
- US EPA and many states have not set drinking water standards
- Fish and other local foods often not tested
- Few opportunities for health studies

"Despite the significant impacts this contamination has on many areas of our life, impacted communities struggle to be seen as critical stakeholders."

- Andrea Amico, co-founder, Testing for Pease

Discussion topics

- Discovery of contamination
- Biomonitoring for PFAS levels in blood
- Exposure and health studies
- Medical monitoring and outreach to clinicians
- Public outreach and education
- Legislative action
- Conclusions

Discovery of contamination

More communities are finding toxic chemicals in their drinking water

By David Abel Globe Staff, Updated May 23, 2021, 6:12 p.m.

193

The Boston Globe

Results are now available from half of those public water sources required to start testing — those that supply more than 10,000 people. Of them, 20 percent have reported concentrations above what state regulations allow.

Because of the elevated levels of PFAS found in its public water sources, Wayland had been distributing bottled water to the public. PAT GREENHOUSE/GLOBE STAFF

Source:
https://www.bostonglobe.com/2021/05/23/science/more-communities-are-finding-toxic-chemicals-their-drinking-water/

PFAS testing in MA public water supplies

MassDEP addressing PFAS contamination

Projects by Public Water Systems PWS in Massachusetts to address PFAS contamination that describe the efforts by MassDEP and the PWSs to address PFAS contamination.

PFAS information

1 Introduction

2 Testing

3 Public Water Systems Free Testing

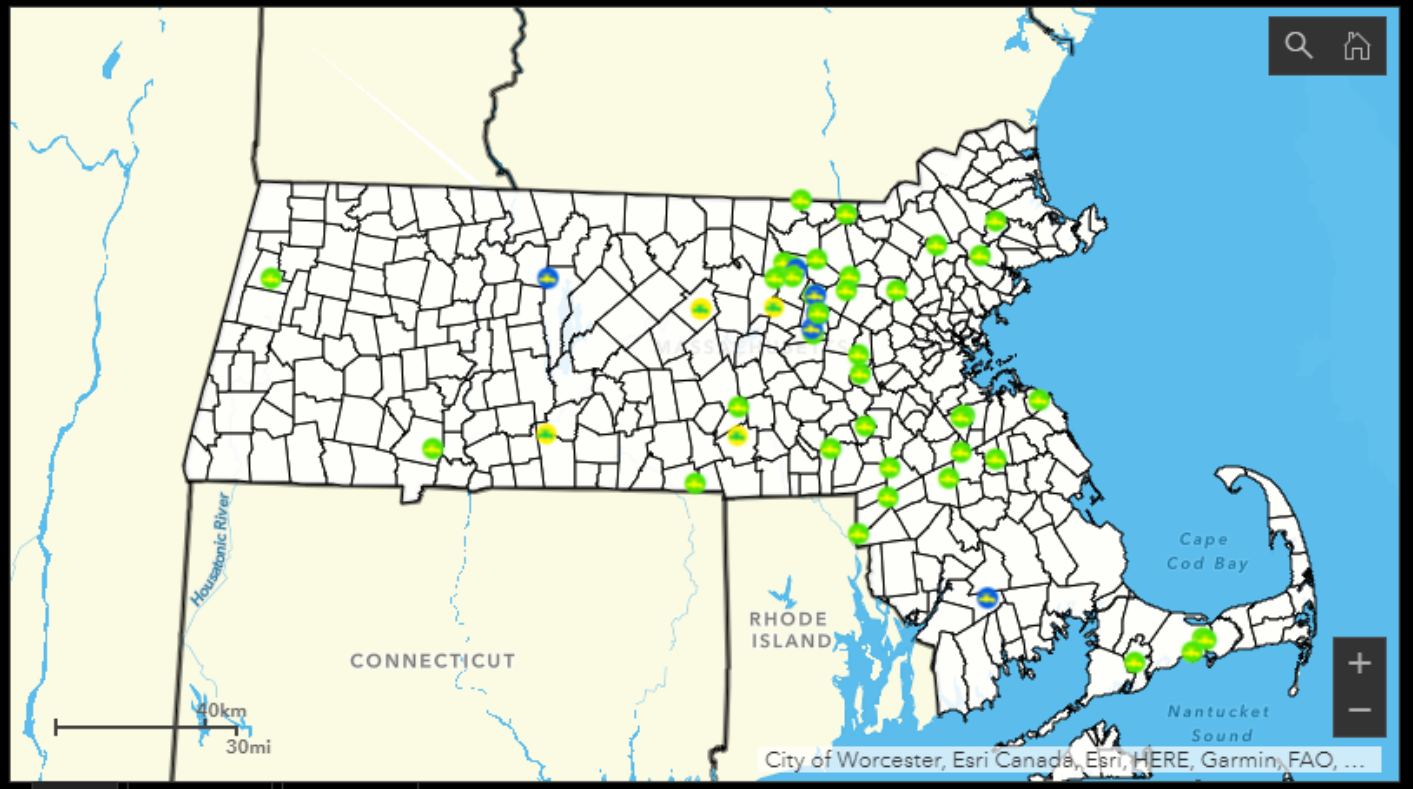
4 PFAS detections and responses by public water systems

MassDEP recently adopted a drinking water standard limiting the sum of six specific PFAS to no more than 20 parts per trillion. Together, these six PFAS are referred to as "PFAS6." The following interactive map displays locations where public water systems have detected the sum of these six state-regulated PFAS at levels over 20 parts per trillion in "finished" water, or in water that is made available for public use.

5 Removing PFAS from drinking water

Public Water System PFAS Detection and Response Actions

Public Water Systems (PWS) who detected PFAS6 over the Maximum Contaminant Level (MCL) in their finished water and their response actions



Map | PWS types | More info

PWS detected PFAS6 above 20 ppt

- Abington/Rockland Joint Water Works
- Acton Water District
- Aquarion Water Company, Millbury
- Ayer DPW Water Division
- Ayer Road Properties, LLC
- Barnstable Fire District Water Department
- Bedford Water Dept
- Bellingham Water Dept
- Bolton Orchards
- Braintree Water Dept
- Brockton Water Department
- Carriage House Condominium
- Centerville Osterville Marston Mills Water Department

Last update: a few seconds ago

LEGEND

Public Water Systems type

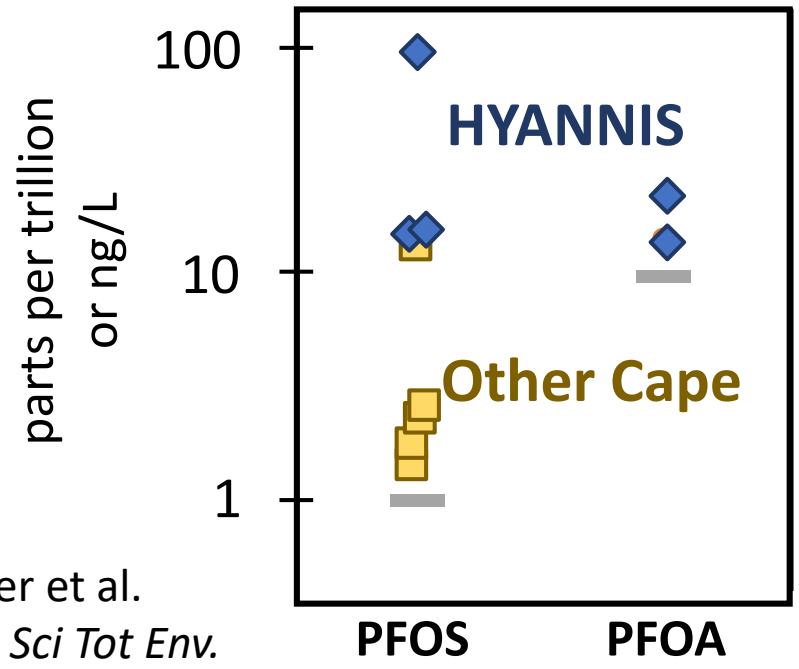
- Community water system
- Non-transient Non-community Water

WEBSITE
www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas#pfas-detected-in-drinking-water-supplies-in-massachusetts-

Silent Spring first to find PFAS in Cape Cod, MA, drinking water

Public wells (2010)

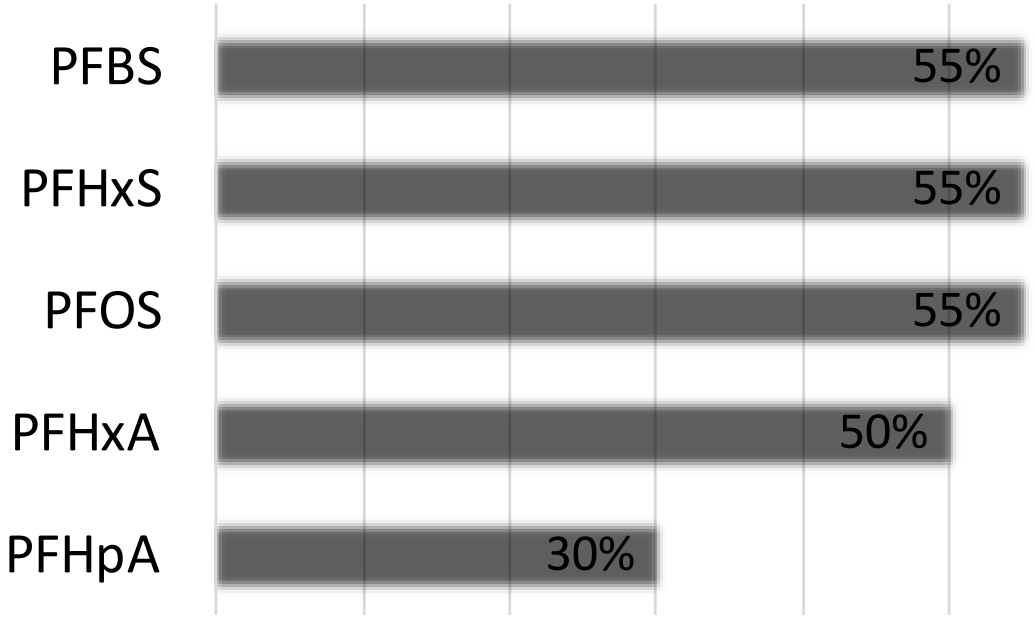
PFOS & PFOA in Cape public wells, highest levels in Hyannis



Schaider et al. 2014. *Sci Tot Env.*

Private wells (2011)

Long-chain (older) and short-chain (newer) PFASs commonly detected



Schaider et al. 2016. *Sci Tot Env.*

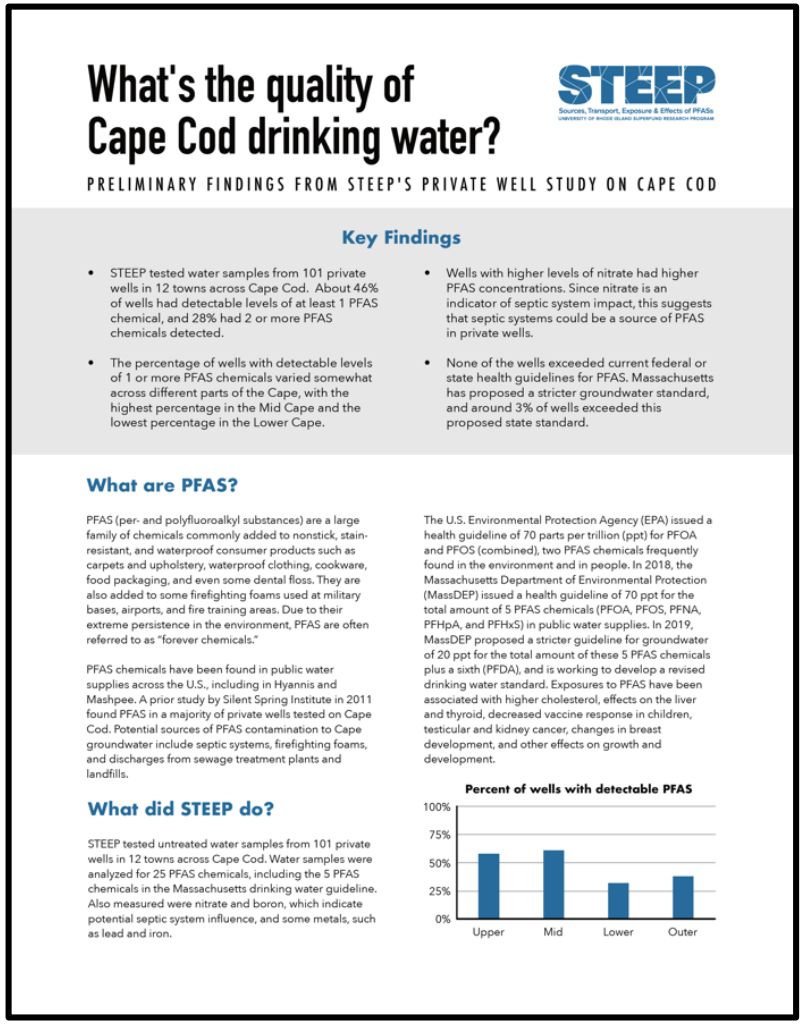
PFAS within the Cape Cod context

- Water quality is a major concern on Cape Cod
- Proposed upgrades to wastewater infrastructure to address nutrient pollution
- Our research has supported advocacy to extend focus to emerging contaminants
  - Links between wastewater and drinking water
  - Stopping pollution at the source

Common questions in communities after PFAS detected in water

- Where do PFAS come from?
- How will it affect my health?
- Should I buy a water filter?
- Is it safe to shower?
- What about backyard gardens?
- What can I do?

Community engagement



What's the quality of Cape Cod drinking water?

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PRELIMINARY FINDINGS FROM STEEP'S PRIVATE WELL STUDY ON CAPE COD

Key Findings

- STEEP tested water samples from 101 private wells in 12 towns across Cape Cod. About 46% of wells had detectable levels of at least 1 PFAS chemical, and 28% had 2 or more PFAS chemicals detected.
- The percentage of wells with detectable levels of 1 or more PFAS chemicals varied somewhat across different parts of the Cape, with the highest percentage in the Mid Cape and the lowest percentage in the Lower Cape.
- Wells with higher levels of nitrate had higher PFAS concentrations. Since nitrate is an indicator of septic system impact, this suggests that septic systems could be a source of PFAS in private wells.
- None of the wells exceeded current federal or state health guidelines for PFAS. Massachusetts has proposed a stricter groundwater standard, and around 3% of wells exceeded this proposed state standard.

What are PFAS?

PFAS (per- and polyfluoroalkyl substances) are a large family of chemicals commonly added to nonstick, stain-resistant, and waterproof consumer products such as carpets and upholstery, waterproof clothing, cookware, food packaging, and even some dental floss. They are also added to some firefighting foams used at military bases, airports, and fire training areas. Due to their extreme persistence in the environment, PFAS are often referred to as "forever chemicals."

PFAS chemicals have been found in public water supplies across the U.S., including in Hyannis and Mashpee. A prior study by Silent Spring Institute in 2011 found PFAS in a majority of private wells tested on Cape Cod. Potential sources of PFAS contamination to Cape groundwater include septic systems, firefighting foams, and discharges from sewage treatment plants and landfills.

What did STEEP do?

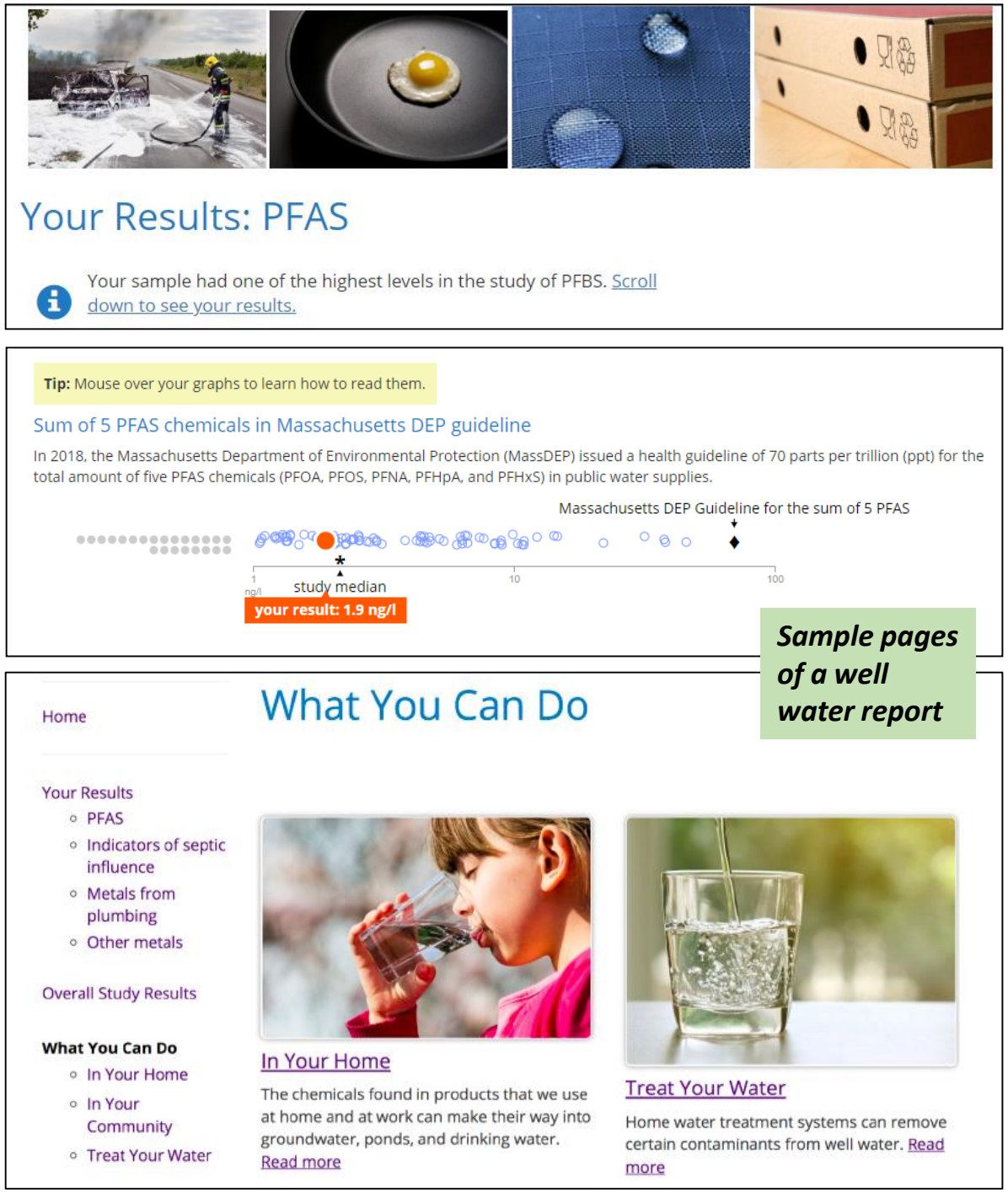
STEEP tested untreated water samples from 101 private wells in 12 towns across Cape Cod. Water samples were analyzed for 25 PFAS chemicals, including the 5 PFAS chemicals in the Massachusetts drinking water guideline. Also measured were nitrate and boron, which indicate potential septic system influence, and some metals, such as lead and iron.

The U.S. Environmental Protection Agency (EPA) issued a health guideline of 70 parts per trillion (ppt) for PFOA and PFOS (combined), two PFAS chemicals frequently found in the environment and in people. In 2018, the Massachusetts Department of Environmental Protection (MassDEP) issued a health guideline of 70 ppt for the total amount of 5 PFAS chemicals (PFOA, PFOS, PFNA, PFHpA, and PFHxS) in public water supplies. In 2019, MassDEP proposed a stricter guideline for groundwater of 20 ppt for the total amount of these 5 PFAS chemicals plus a sixth (PFDA), and is working to develop a revised drinking water standard. Exposures to PFAS have been associated with higher cholesterol, effects on the liver and thyroid, decreased vaccine response in children, testicular and kidney cancer, changes in breast development, and other effects on growth and development.

Fact sheet with key findings

Individual report-back

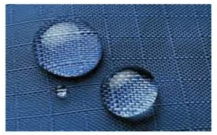
- **D**igital **E**xposure **R**eport-**B**ack **I**nterface developed by Silent Spring
- Interactive online reports, with option for print reports, with graphs and text to contextualize results
- Additional resources on sources, health effects, tips for exposure reduction, and other ideas for what you can do
- View examples at: silentspring.org/project/digital-exposure-report-back-interface-derbi



PFAS Exchange fact sheets

PFAS-REACH
PFAS Research, Education, and Action for Community Health

How to Reduce Your Exposure to PFAS


PFAS (per- and polyfluoroalkyl substances) are a class of chemicals that companies add to consumer products to make them nonstick, waterproof, and stain-resistant. They are found in carpets and upholstery, waterproof apparel, non-stick cookware, grease-proof food packaging, and even dental floss. They are also used in firefighting foams for putting out fuel fires.

Unfortunately, studies have linked these chemicals with a range of health problems including thyroid disease, cancer, high cholesterol, obesity, and effects on the immune system. Luckily, there are simple steps you can take to reduce your everyday exposure to PFAS and create a healthier environment for you and your loved ones.

In your personal life:

- ✓ Avoid stain-resistant carpets and upholstery, as well as stain-resistant treatments and waterproofing sprays.
- ✓ Avoid products with the ingredient PTFE or other "fluoro" ingredients listed on the label.
- ✓ Choose cookware made of cast iron, stainless steel, glass, or enamel instead of Teflon.
- ✓ Filter your drinking water with an activated carbon or reverse osmosis filtration system.
- ✓ Eat more fresh foods to avoid take-out containers and other food packaging.
- ✓ Avoid microwave popcorn and greasy foods wrapped in paper.
- ✓ Look for nylon or silk dental floss that is uncoated or coated in natural wax.

In your community:

- ✓ Tell retailers and manufacturers you want products made without PFAS.
- ✓ Urge your local water utility to test for PFAS.
- ✓ Ask your state legislators to set up a statewide water and blood testing program.
- ✓ Encourage your state to follow the lead of other states in creating more health protective drinking water limits.
- ✓ Ask your elected officials to support restrictions on PFAS in consumer products and remediation of contaminated sites.
- ✓ Find out about local groups working to protect water quality by visiting:

www.pfas-exchange.org

NIH NIEHS PFAS-REACH is a five-year project funded by the National Institute of Environmental Health Sciences (NIEHS) under grant R01ES028311.

PFAS-REACH is led by Silent Spring Institute in collaboration with Northeastern University and Michigan State University. Community partners include Testing for Pease, Massachusetts Breast Cancer Coalition, and Toxics Action Center.

How Can PFAS Affect Your Health?

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PFAS (per- and polyfluoroalkyl substances) are among the most ubiquitous synthetic chemicals in the world. Approximately 98 percent of Americans have PFAS in their bodies. People can be exposed to these chemicals in many different ways—through the water they drink, the products they use, the air they breathe, and the food they eat. During pregnancy, PFAS can pass from the mother to the fetus through the umbilical cord, and babies can be exposed through breast milk or formula made with contaminated water.

Their strong chemical bonds and unique structures make them very effective at repelling water and oil even at high temperatures. These same characteristics also make PFAS extremely persistent, meaning they don't break down in the environment. Even more concerning, some PFAS can remain in the body for years, and people continue to be exposed to the chemicals.

Because of their persistence and because exposures are so widespread, scientists are concerned about the potential health impacts. Most health studies have looked at PFOA and PFOS, the two most commonly found PFAS. However, new research suggests other types of PFAS have similar health effects.

Learn more: www.pfas-exchange.org

Although the science on health effects is still evolving, scientists are increasingly concerned about low-dose exposures, as they continue to find health effects at lower and lower levels. More research is needed on other PFAS chemicals, in particular ones that companies have developed to replace PFOA and PFOS. Because people are exposed to multiple PFAS from multiple sources, researchers are beginning to investigate the effects of mixtures of PFAS on human health.

Scientific studies have linked exposure to PFAS with:

Human studies

- High cholesterol
- Ulcerative colitis
- Cancer (testicular, kidney)
- Preeclampsia
- Liver damage
- Thyroid disease
- Decreased vaccine response
- Asthma
- Decreased fertility
- Lower birth weight

Animal studies

- Cancer (testicular, liver, pancreatic)
- Liver damage
- Delayed mammary gland development
- Developmental problems
- Effects on brain development
- Immune system effects
- Changes in cholesterol levels
- Changes in thyroid hormones
- Low birth weight

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PFAS: A Word About Drinking Water Guidelines

PFAS-REACH
PFAS Research, Education, and Action for Community Health

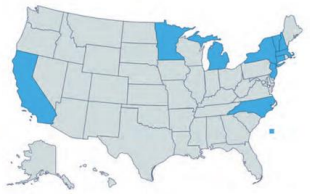
Are PFAS regulated in drinking water?

PFAS (per- and polyfluoroalkyl substances) are currently not regulated under the Safe Drinking Water Act. This means there are no federal drinking water standards and public water supplies do not have to test or treat their water for PFAS under federal law.

The U.S. Environmental Protection Agency (EPA) has set a non-enforceable health-based guideline level of 70 parts per trillion (ppt) for PFOA and PFOS, individually or combined.

However, many scientists and regulators believe this guideline is not protective enough of human health. As a result, some states have developed their own guideline levels for PFAS that are stricter than EPA's, and some have set, or are in the process of setting, enforceable standards.

Although guideline levels are not enforceable, meaning water utilities are not required to test or treat the water, they do offer some protection.



10 states with drinking water guidelines that are more restrictive than EPA's.

Why do guidelines vary?

Guideline levels are created when regulators, after reviewing the science, calculate a level of exposure below which health effects are not expected to occur. Regulators consider different types of evidence and factors when developing guideline levels:

- Studies linking exposure to PFAS with various health effects (for instance, effects on the immune system, liver, or mammary gland development).
- The impact on vulnerable populations such as infants or pregnant women.
- How much water people drink in a day.
- How much exposure likely comes from drinking water versus diet and consumer products.
- Molecular studies that show what happens to PFAS after the chemicals enter the body.

Although some variation is expected among the different state guideline levels, more recent guidelines are being set at similarly lower levels.

Learn more: www.pfas-exchange.org

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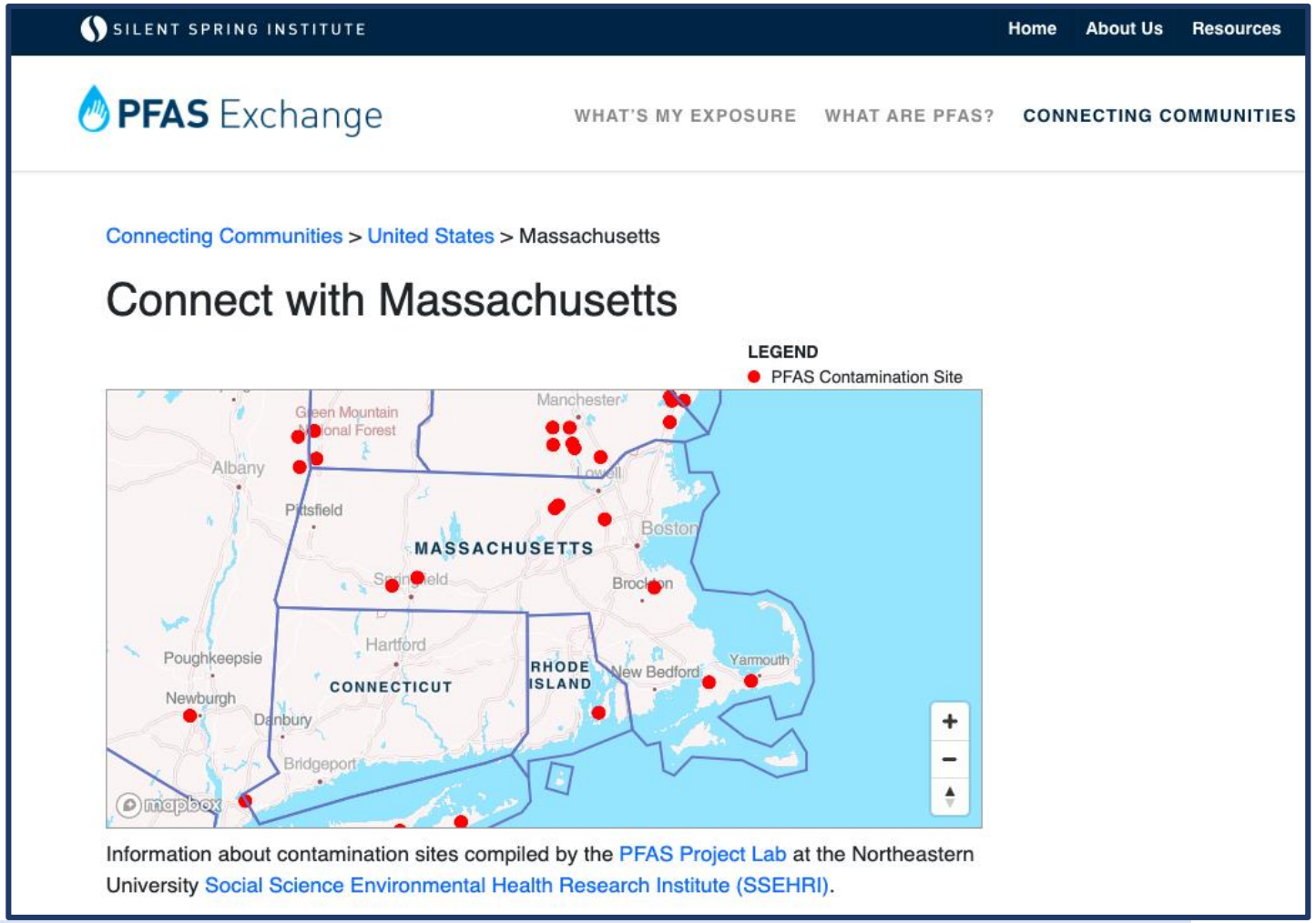
www.pfas-exchange.org/resources

Connecting communities

PFAS-REACH
PFAS Research, Education, and Action for Community Health

- CONTAMINATION AREAS
- COMMUNITY GROUPS
- PFAS EXPOSURE AND HEALTH STUDIES
- STATE AGENCY WEBSITES
- OTHER RESOURCES



https://www.pfas-exchange.org/connecting-communities/

New map coming soon

PFAS-REACH
PFAS Research, Education, and Action for Community Health

PFAS Contamination in the United States
An interactive mapping project from the PFAS-REACH team

Known Contamination | Suspected Contamination | Community Resources | State Action

How to use this map:

- Click on a community group or PFAS study symbol to learn more about it.
- Use the layers button in the top right to make the known contamination layer visible.
- Choose one of the buttons below to learn more about the layers that make up this map.

Details: The purpose of the "Community Resources" map is to connect community members with research and activism about PFAS contamination in their community. Click on a water drop symbol to learn more about community groups on the map. Please visit the PFAS Exchange for more information about community resources and how you can get informed and involved.

Community Groups

Health and Exposure Assessment Studies

Legend

Community Groups

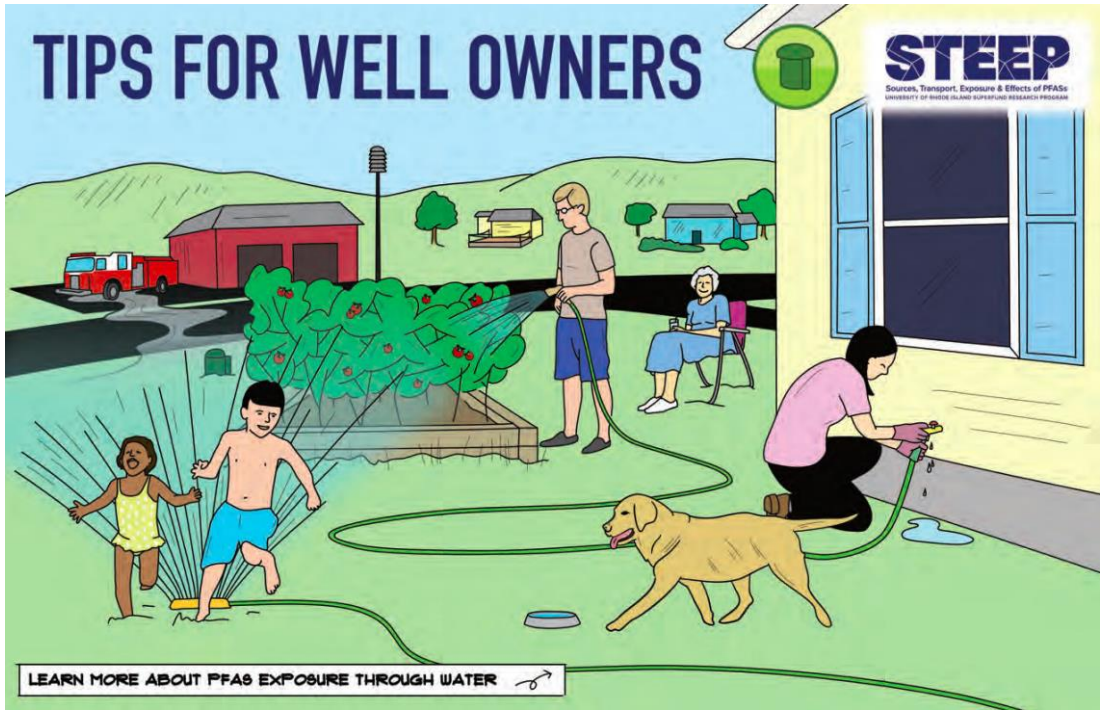
Health and Exposure Assessment Studies

Type of study

- Biomonitoring
- Exposure Assessment
- Health Survey

Our Partners:

About | Contact Us | PFAS Project | PFAS Exchange



URI STEEP's website has resources for a variety of audiences on PFAS, their health effects, and tips to minimize exposures

web.uri.edu/steep/resources

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Biomonitoring for PFAS levels in blood

Advocacy for blood testing

Advocacy by **Testing for Pease**, **Merrimack Citizens for Clean Water**, and others supported state biomonitoring programs in New Hampshire

State of New Hampshire

Department of Health and Human Services
Division of Public Health Services

Pease PFC Blood Testing Program:
April 2015 – October 2015

Pease Tradeport
Portsmouth, NH

Merrimack Village District
Community Exposure Assessment Summary Report

Purpose of the MVD Community Exposure Assessment.

The New Hampshire Department of Health and Human Services (DHHS) launched the Merrimack Village District (MVD) Community Exposure Assessment in 2016 to evaluate exposure to perfluorochemicals (PFCs) among residents served by the MVD public water system. In March 2016, perfluorooctanoic acid (PFOA) was discovered in several southern NH communities initially around the Saint-Gobain Performance Plastics facility in Merrimack, including in groundwater wells that feed into the MVD system. The MVD public water system serves residents of Merrimack and Bedford and is supplied by multiple individual wells that are combined prior to delivery of residential drinking water. Two MVD supply wells (wells 4 & 5) were taken offline in June 2016 when they tested above 70 nanograms per liter (ng/L), which is the Lifetime Health Advisory Level set by the U.S. Environmental Protection Agency. MVD water supply wells are currently providing drinking water below the Health Advisory Level.

DHHS initiated the MVD Community Exposure Assessment in response to concerns by MVD customers and Merrimack and Bedford town officials. The Community Exposure Assessment tested the blood (serum) of 217 randomly selected MVD customers. Results from this assessment provide residents with information about levels of PFOA exposure in the community. DHHS thanks MVD residents, and local and state officials for their engagement on this environmental health project. This project provides residents, town officials, and DHHS with valuable information about the approximate levels of PFC exposure among MVD customers.

Summary of the MVD Community Exposure Assessment.

The MVD Community Exposure Assessment sought to include 200 customers, a sufficiently large enough sample size to be representative of the entire drinking water system and comparable to other populations. A total of 217 individuals participated in the MVD Community Exposure Assessment, representing 132 households. A random sampling of 900 households within the MVD system were invited to participate until 200 individuals were included. All participants were required to register online, complete an exposure assessment survey, and have a blood sample drawn at a participating blood draw center.

Blood testing challenges

- Cost (for individuals, state health departments)
- Availability of laboratories with sensitive testing
- Current testing may miss new PFAS now in use
- Perception that results will alarm residents
- Results can be difficult to interpret
- Linking results to an individual's health conditions

National Academies science panel

- **"Guidance on PFAS Testing and Health Outcomes"**

The National Academies of | SCIENCES ENGINEERING MEDICINE

- Committee tasks:
  - Assess evidence on human health effects of the most studied PFAS
  - Develop general principles for clinical evaluation or biological testing
  - Review current knowledge about contributions of PFAS exposure sources
  - Advise on changes to current CDC/ATSDR clinical guidance/recommendations
- Series of town hall sessions with PFAS impacted communities

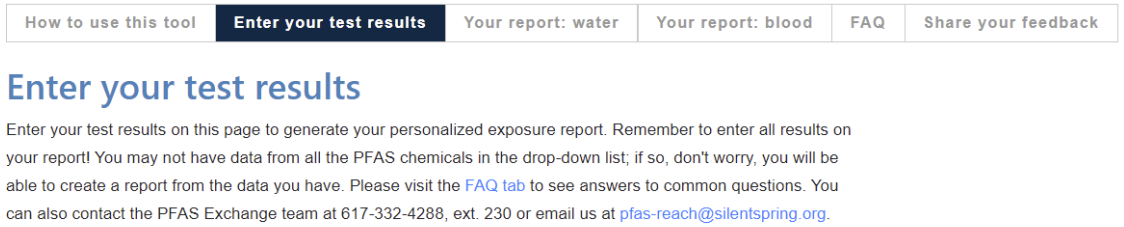
Watch recorded presentations:
www.nationalacademies.org/our-work/guidance-on-pfas-testing-and-health-outcomes

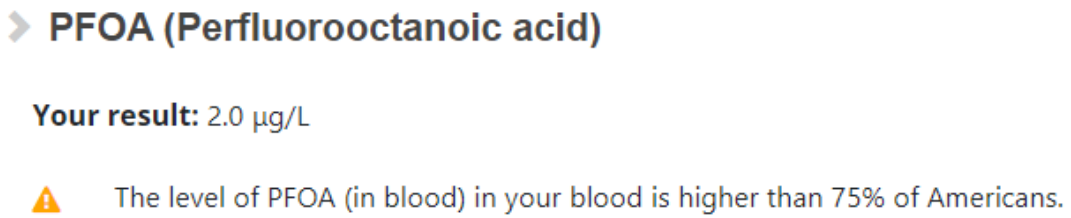
“Ignorance is not bliss”

- Communities want PFAS blood testing
- Understand that results won't give definitive answers on illness
- Results provide baseline for future tests and can be part of medical history

Tracy Carluccio
Delaware Riverkeeper Network

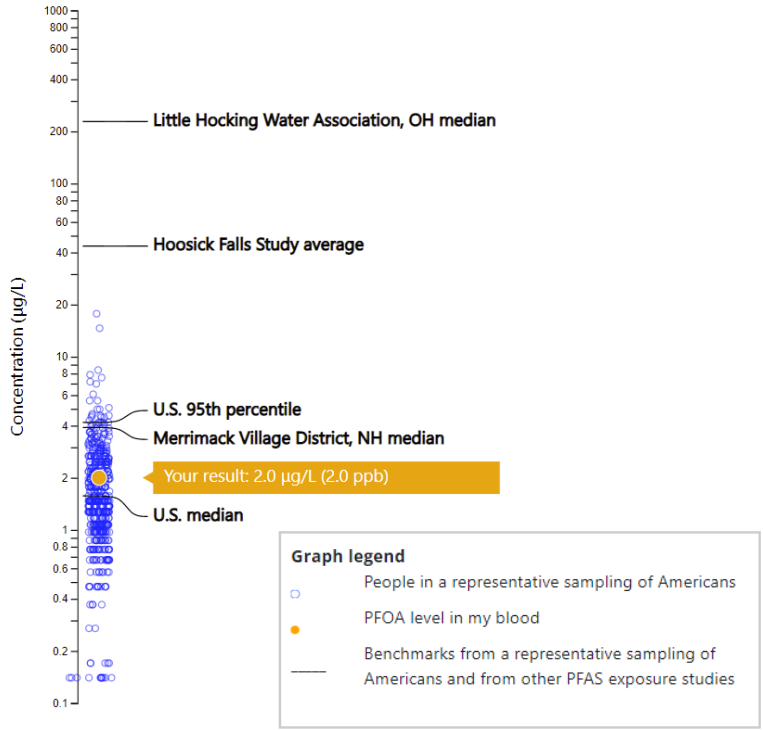
PFAS Exchange – What's My Exposure data interpretation tool





Features:

- Interface for entering drinking water and/or blood test results
- Results compared to benchmarks, standards, and comparison datasets in real-time
- Graphs and short text headlines
- Additional information on sources, health effects, and exposure reduction



PFAS Exchange resources coming soon

- New materials under development:
  - Questions to ask when seeking blood testing
  - Information about blood testing laboratories

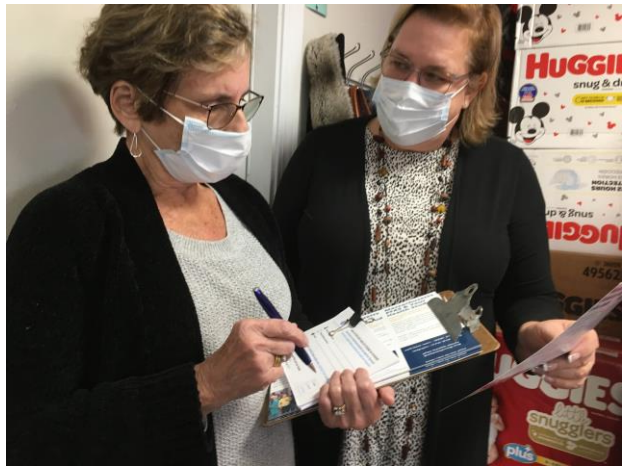
Exposure and health studies

Community partners central to health studies

- Support recruitment
- Connect with diverse communities
- Provide connections and credibility with local stakeholders
- Share information about site history

- "Nothing about us without us"

MBCC Executive Director **Cheryl Osimo** at Maranatha Church and A Baby Center in Hyannis



Community-led health study

Panikkar *et al. Environmental Health* (2019) 18:79
https://doi.org/10.1186/s12940-019-0513-3

Environmental Health

RESEARCH Open Access

Making the invisible visible: results of a community-led health survey following PFAS contamination of drinking water in Merrimack, New Hampshire

Bindu Panikkar[1*], Benjamin Lemmond[1], Laurene Allen[2], Carol DiPirro[2] and Shaina Kasper[3]

Medical screening and outreach to clinicians

Medical monitoring and screening

- Testing for health conditions or markers of health conditions associated with PFAS exposure
- Lawsuit from C8 study in W. Virginia provided medical monitoring for impacted residents
- Communities seeking medical monitoring guidance to help protect their health in long-run

Medical screening guidance documents

- PFAS-REACH scientists and community leaders collaborated with physicians
- Based on concerns of affected community members
- 2 documents:
  - Overview / introduction to PFAS
  - Guidance for clinicians and patients on medical tests for health effects linked to PFAS exposures

PFAS Exchange


PFAS-REACH
PFAS Exposure: Information for patients and guidance for clinicians to inform patient and clinician decision making
For people in PFAS-impacted communities

Purpose
This guidance document is intended for people living in communities with contaminated water or who have had some other source of substantial exposure to PFAS. This guidance document is not targeted to those at average risk from PFAS.

What are PFAS?
Per- and polyfluoroalkyl substances (PFAS) are a large group of over
which has been associated with several serious health effects. They a
mobile in the environment, and have contaminated hundreds of drin
in the blood of over 99% of Americans and some PFAS can remain in

How can I be exposed to PFAS?
At home
- Drinking contaminated water
- Eating food contaminated from environmental sources or from processing and packaging
- Using stain- and water-resistant products, grease-proof food packaging, nonstick cookware, and many other consumer products

How are PFAS regulated in drinking water?
- PFAS are not regulated under the U.S. Environmental Protectio
means there are no federally enforceable standards and public
routinely test or treat for PFAS under federal law.
- In 2016, the U.S. Environmental Protection Agency established
Advisory of 70 parts per trillion (ppt) for PFOA and PFOS (two c
individually or combined, for municipal drinking water. Some s
is not sufficiently protective of human health.
- As of April 2021, 12 states have adopted more stringent, and in
guidelines. The PFAS Exchange provides more information abo
guidelines. Some states have established guidelines for additio
- The Northeastern University Contamination Site Tracker has do
sites in the U.S., with more sites being added as testing continu

This fact sheet is a product of the PFAS-REACH (Research, Education, and Actio
PFAS-REACH is funded by the National Institute of Environmental Health Scie

PFAS-REACH
PFAS Exposure: Information for patients and guidance for clinicians to inform patient and clinician decision making
For clinicians

About this guidance document
The guidance summarized here is to help inform discussion and decision making for physicians and their patients. Many of the tests and screenings noted are part of basic primary care annual appointments. In 2019, the American Medical Association (AMA) resolved to support research and policy to address the effects of PFAS exposure.

We based the following suggestions for medical screening tests on those previously developed and implemented for a PFAS-impacted community as well as peer-reviewed research and scientific assessments using weight of evidence approaches from:
- Agency for Toxic Substances and Disease Registry (2021)
- Centers for Disease Control and Prevention (2019)
- C8 Science and Medical Panels (2005-2013)
- European Environment Agency (2019)
- International Agency for Research on Cancer (2017)
- National Toxicology Program (2016)

These recommendations are for those living in communities with contaminated water or who are exposed to other sources of PFAS that substantially increases their internal burden of PFAS. These recommendations are not targeted to those with average levels of PFAS exposure.

Guidance for adult patients

Laboratory tests
- **Lipid panel (cholesterol, LDL, HDL, triglycerides).** PFAS exposure has been associated with higher total and LDL cholesterol and fatty liver.
- **Liver function tests**, such as ALT, AST, and GGT. PFAS exposure has been associated with higher-than-normal liver function tests, as well as hepatoxicity, including hepatocyte and liver architecture damage.
- **Serum creatinine and urine protein and urine albumin.** PFAS exposure is associated with chronic kidney disease and kidney cancer. An important note for researchers is that there is enhanced excretion of PFAS in moderate-to severe kidney disease, especially if there is albuminuria. Reduced serum PFAS concentrations for those individuals introduces a bias towards the null if not controlled for in epidemiologic studies.
- **Thyroid tests**, such as TSH with or without FT4. PFAS exposure has been associated with thyroid disease.

Clinical examinations
- **Regular testicular examinations**. Exposure to high levels of PFAS has been associated with increased risk of testicular cancer.

Counseling topics
- **Vaccine response**. PFAS exposure has been associated with decreased antibody response to vaccines. There is currently no consensus on revaccinating patients with low vaccine titer when tested a month following vaccination (i.e., Tdap, MMR); more research is needed.
- **Home blood pressure monitoring during pregnancy**. PFAS are associated with elevated blood pressure during pregnancy and with preeclampsia.
- **Breastfeeding**. Babies can be exposed to PFAS during pregnancy since PFAS can cross the placenta. PFAS chemicals also accumulate in breast milk. However, the benefits of breastfeeding are clear, and include benefits to maternal as well as child health. There is insufficient evidence to recommend against breastfeeding based on maternal PFAS exposure.

https://www.pfas-exchange.org/resources/

Challenges for medical community

- Medical professionals receive little environmental health training
- Often unfamiliar with PFAS
- PFAS health effects often not unique

- Some doctors are starting to ask about exposure history, often when they see clusters of rare diseases
- State health departments may be able to help
- And some community members are also very knowledgeable!

Outreach to medical professionals

- Dissemination of medical screening guidance documents
- Webinar for clinicians with Nantucket Hospital and Nantucket PFAS Action Group
- Additional fact sheets on PFAS and vaccine effectiveness

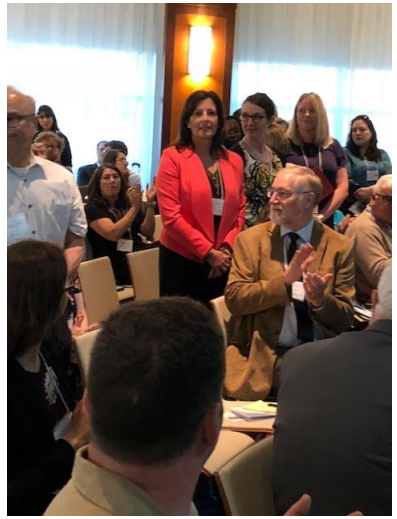
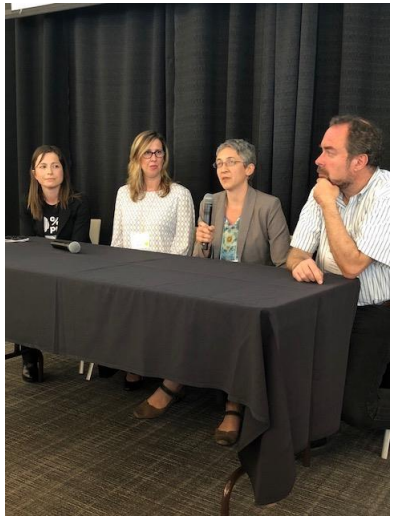
Public outreach and education

National PFAS Conferences Northeastern University (2017, 2019)

- A different kind of conference – Centered on community concerns, with community members contributing to each panel
- Innovative, multidisciplinary and multisector approach
- Sessions on science, policy, activism, litigation, media, remediation, regulation
- Co-organized by scientists and community members (funded by NIEHS)

Attendees

- Members of impacted communities
- Scientists
- Government officials
- NGOs
- Water utilities
- Journalists and filmmakers
- Industry representatives
- Lawyers

National PFAS Contamination Coalition

https://pfasproject.net/

- Network of grassroots groups
- Fighting PFAS contamination in communities across the US
- Formed following the June 2017 National PFAS Conference
- Represents 18 groups in 16 U.S. states

Save the date: June 2022 in NC

June, 2022

Wilmington, North Carolina

In 2017 and 2019, we came together in Boston as scientists, community advocates, government officials, journalists, attorneys, and more to discuss cutting-edge PFAS topics. Due to COVID-19, we will not meet in 2021…

In June of 2022, we plan to gather in Wilmington, NC to discuss PFAS developments from the previous three years. This gathering will bring together research, community, and legislation perspectives to discuss how best to address PFAS contamination.

https://pfasproject.com/conference-presentations/2022-pfas-conference/

2019 attendees

STEEP Let's Talk About PFAS webinars

- Series of 4 webinars in 2021
- Organized by STEEP in partnership with MBCC
- Topics of local and national concern
  - PFAS in drinking water
  - PFAS health effects
  - PFAS in consumer products
  - PFAS in Cape Cod surface waters

ASK • LEARN • ACT

To watch past webinars:
http://web.uri.edu/STEEP/

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

MBCC webinars

Massachusetts Breast Cancer Coalition

2021 WEBINAR SERIES

January 26 12:30pm	Personal Care Use Among Women of Diverse Communities: The Taking Stock Study Dr. Robin Dodson, Silent Spring Institute
March 3 12:00pm	Does Cancinogenesis Start in the Womb? Endocrine Disruptors and Breast Cancer Dr. Ana Soto, Tufts University School of Medicine
April 7 12:30pm	The BCERP Legacy: Windows of Susceptibility to Environmental Risks of Breast Cancer Dr. Gwen Collman, Ph.D., National Institute of Environmental Health Sciences
April 22 12:30pm	Breast Cancer Care in Communities of Color Hope White, Codman Square Health Center
May 11 12:00pm	Working with Diverse Communities to Explore Environmental Health Dr. Courtney Carignan, PhD., Michigan State University
June 10 12:00pm	An Update on STEEP (Sources, Transport, Exposures & Effects of PFASs) Superfund Dr. Rainer Lohmann, University of Rhode Island
July 14 12:30pm	The Health Impacts of Cell Phone Radiation Theodora Scarato, Environmental Health Trust
August 10 12:30pm	Sixty Years of Failure on Food Chemical Safety and the Increased Risk of Chronic Diseases Dr. Maricel Maffini, Environmental Health Scientist and Independent Consultant
September 1 12:30pm	Environmental Chemicals in Breast Developmental Timing Dr. Suzanne Fenton, National Institute of Environmental Health Sciences
October 6 12:30pm	Breast Cancer Trends: The Importance of Prevention Dr. Jill S. Oxley, MD, Cape Cod Hospital
November 16 12:00pm	PFAS and Health Effects: Scientists and Activists Working Together Dr. Laurel Schaider, Silent Spring Institute
December 9 12:30pm	An Update on Breast Cancer Pathology Dr. Michael Misialek, Newton-Wellesley Hospital

www.mbcc.org

Massachusetts Breast Cancer Coalition

2022 WEBINAR SERIES

January 20 12 noon	The Margo Simon Golden Memorial Webinar: Advocating for Health Towards a Cancer-Free Future An Update on PFAS in Food Packaging Dr. Arlene Blum, Green Science Policy Institute, Dr. Maricel Maffini, Environmental Health Scientist and Independent Consultant, and Dr. Laurel Schaider, Silent Spring Institute
February 10 12 noon	How Does Climate Change Impact Women and Their Health? Dr. Gwen Collman, National Institute of Environmental Health Sciences
March 15 12 noon	Impacts of Community-Engaged Research and Advocacy on Action around PFAS in Diverse Populations June Jiao, Silent Spring Institute and Dr. Jennifer Liss Ohayon, Silent Spring Institute
April 20 12 noon	Breast Cancer-Related Chemicals in Products Used by Black Women Dr. Elissia Franklin, Silent Spring Institute
May 11 12 noon	An Update on Breast Pathology Dr. Michael Misialek, Newton-Wellsley Hospital
September 13 12 noon	Cell Phones and Cancer Risk Dr. Devra L. Davis, Environmental Health Trust
October 26 12 noon	Breast Cancer in Younger Women from Diverse Cultural Backgrounds Dr. Jill S. Oxley, Cape Cod Hospital
November 8 12 noon	What's New with PFAS in Massachusetts and Across the US Dr. Laurel Schaider, Silent Spring Institute
December 8 12 noon	Looking Back to Look Forward: Environmental Chemical Exposure and Breast Cancer Dr. Maricel Maffini, Environmental Health Scientist and Independent Consultant

www.mbcc.org

Informing the legislative process

State level action

- Little action on PFAS at federal level
- Advances in policies and regulations at the state level
  - Drinking water
  - Food packaging
  - Firefighting foam
  - Consumer products
- Scientists and activists have both played active role

Drinking water standards in MA

Environmental Groups Petition for a Strict PFAS Drinking Water Standard in Massachusetts

Friday, January 25, 2019

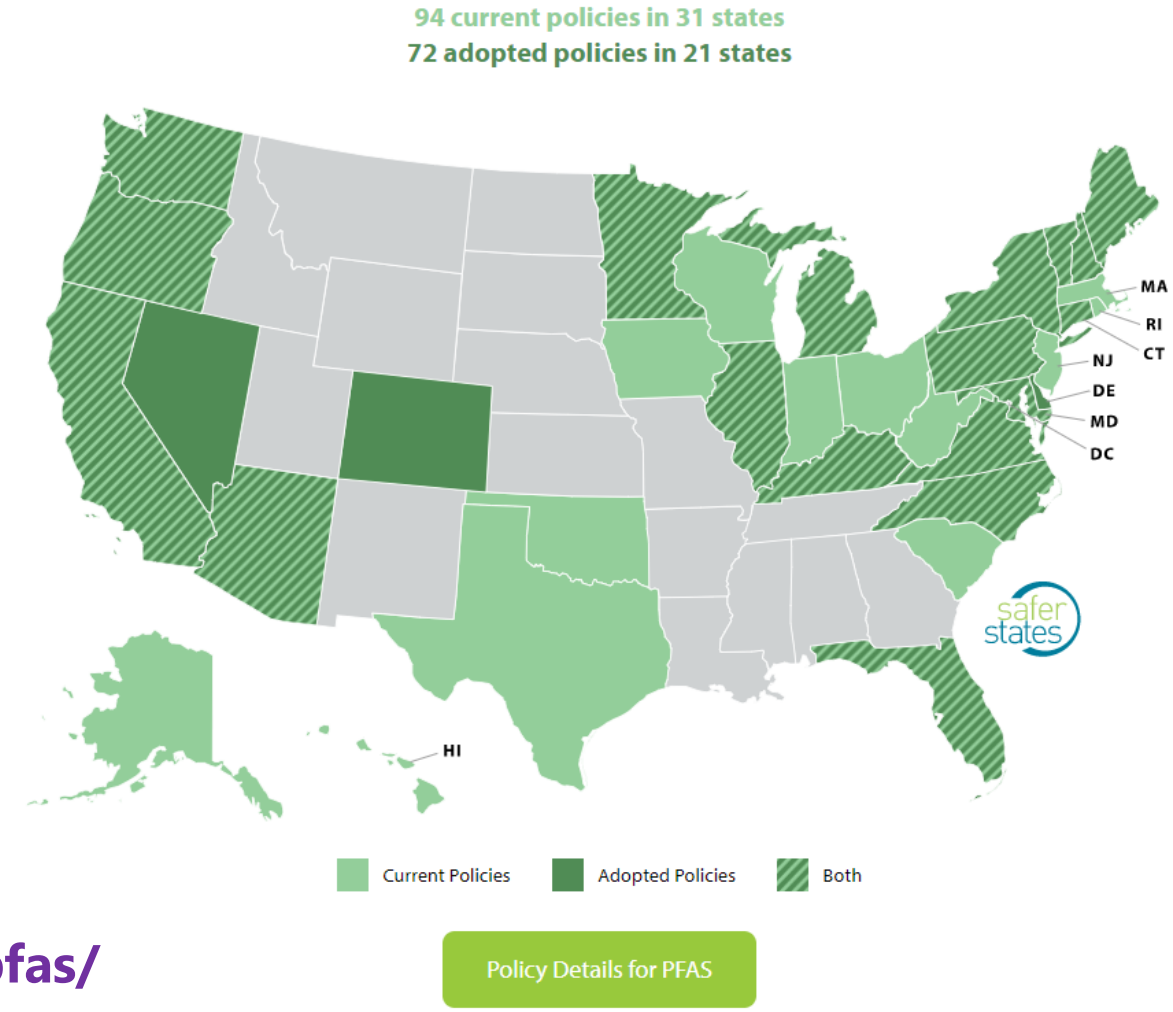
MassDEP will decide on January 28 whether to establish a strict drinking water standard for per- and polyfluoroalkyl substances, known as PFAS, and promulgate further regulations for the identification and remediation of PFAS in drinking water in response to a petition from Conservation Law Foundation and Toxics Action Center. The October 25, 2018, Massachusetts petition was concurrent with similar petitions to the other New England states. The New Hampshire Department of Environmental Services recently rejected the petition, and the remaining states have not issued a determination.

www.natlawreview.com

Testifying at a MassDEP public hearing on Massachusetts drinking water standards

Safer States

- Diverse coalition of advocates, policymakers, scientists, and representatives from impacted communities
- Track state policies that have been adopted and are under consideration

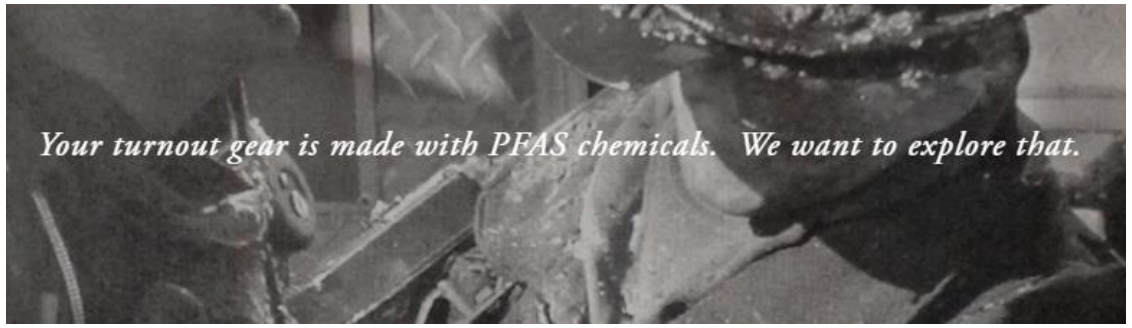


https://www.saferstates.com/toxic-chemicals/pfas/

Final thoughts

Not all communities are geographic

- Vulnerable groups can be based on occupation, especially firefighters
  - PFAS in firefighter turnout gear
  - SF Women Firefighters Biomonitoring Collaborative



https://www.yourturnoutgearandpfoa.com/#

https://www.biomonitoringcollaborative.org/wfbc

EJ concerns and exposure disparities

- Cumulative exposures
- Disparities in exposures:
  - Limited ability to afford household and community-level water treatment
  - Limited ability among renters to change out carpets
  - Fast food workers can't avoid handling food wrappers
  - People in food deserts can't access fresh foods.

La'Meshia Whittington
North Carolina Black Alliance

How can scientists be good allies for communities?

- Show up
- Be available to community members
- Be a resource to local media
- Share what you know and don't know
- Involve communities throughout entire study
- Pay community partners who support your studies

CAPE COD TIMES

Opinion

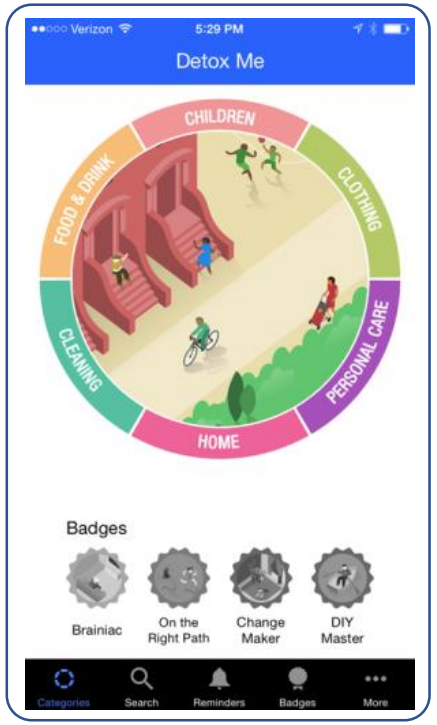
PFAS: A local and global challenge

By Laurel Schaider / and Cheryl Osimo
Posted Dec 11, 2019 at 3:00 AM
Updated Dec 11, 2019 at 9:09 AM

Thanks to the film "Dark Waters," released in theaters in November, people around the country now know about a group of chemicals threatening our environment and our health. The Hollywood film tells the true story of a community in Parkersburg, West Virginia, whose drinking water was contaminated with toxic chemicals from a DuPont facility, and the heroic figures who exposed the company's efforts to hide the truth.

What can you do?

- Avoid microwave popcorn, eat more fresh foods
- Skip stain-resistant coatings for furnishings
- Let retailers know you want safer products
- Support stricter chemical safety testing
- Learn and share information about avoiding toxics
- Stay up-to-date about state and local legislation



Try out the Detox Me Smartphone app!

Resources

- PFAS Exchange: www.pfas-exchange.org
- Silent Spring Institute: www.silentspring.org
- Northeastern University SSEHRI: www.pfasproject.com
- STEEP Superfund Research Program: web.uri.edu/steep
- Green Science Policy Institute: www.pfascentral.org
- National PFAS Contamination Coalition: www.pfasproject.net

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