

Per- and Polyfluoroalkyl Substances

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PFAS: Integrating Science and
Solutions- North Carolina

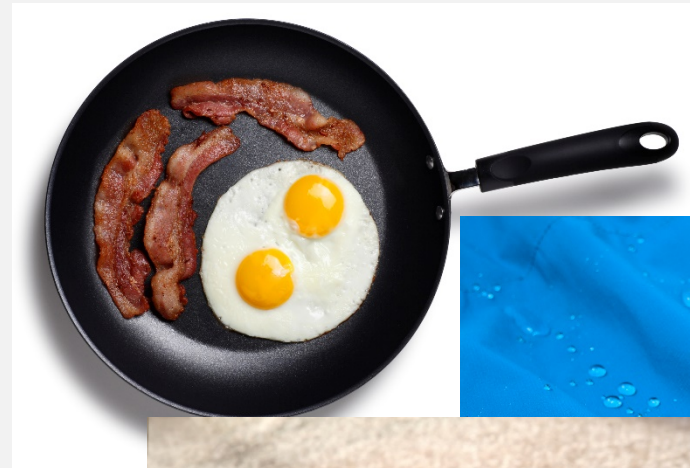
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Per- and Polyfluoroalkyl Substances (PFAS)

- Large class of over 5,000 man-made chemicals that have been used in industry and consumer products worldwide since the 1950s.

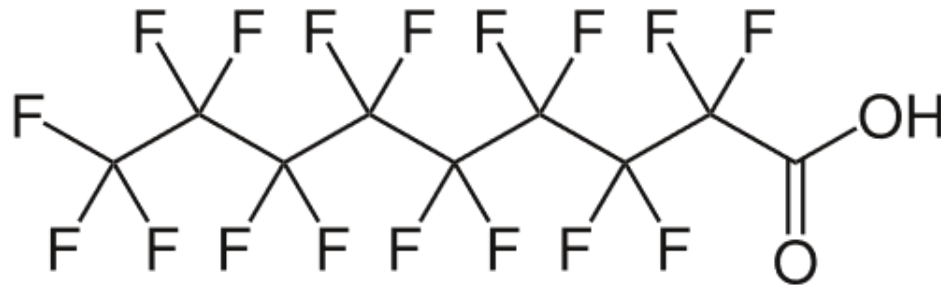
- Non-stick cookware
- Water-repellent clothing
- Stain-resistant fabrics and carpets
- Some cosmetics
- Some firefighting foams
- Products that resist grease, water and oil



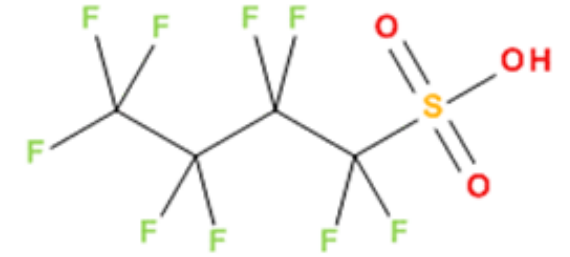
Examples of PFAS



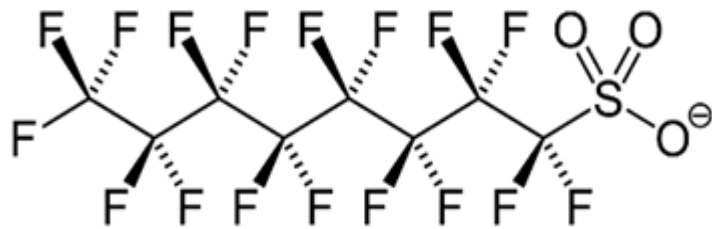
PFOA



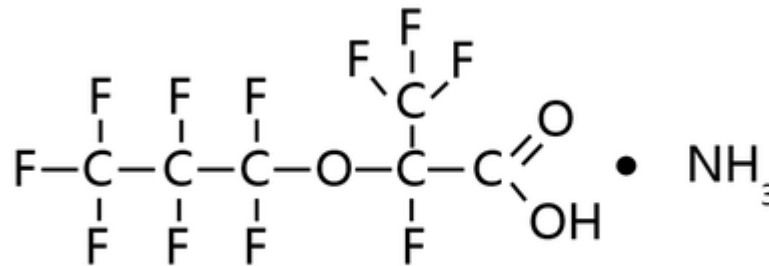
PFNA



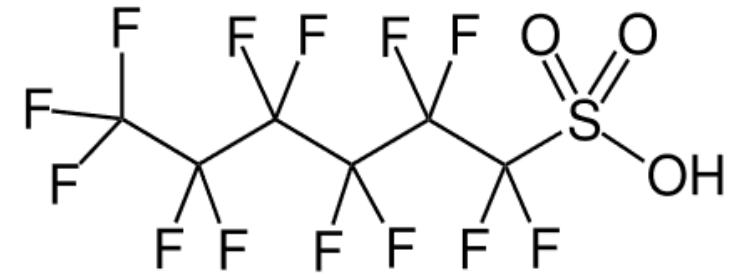
PFBS



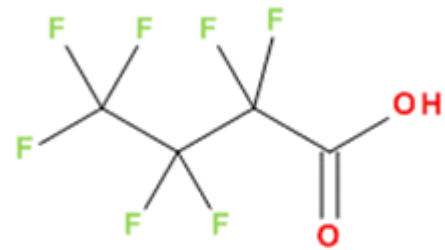
PFOS



GenX



PFHxS



PFBA

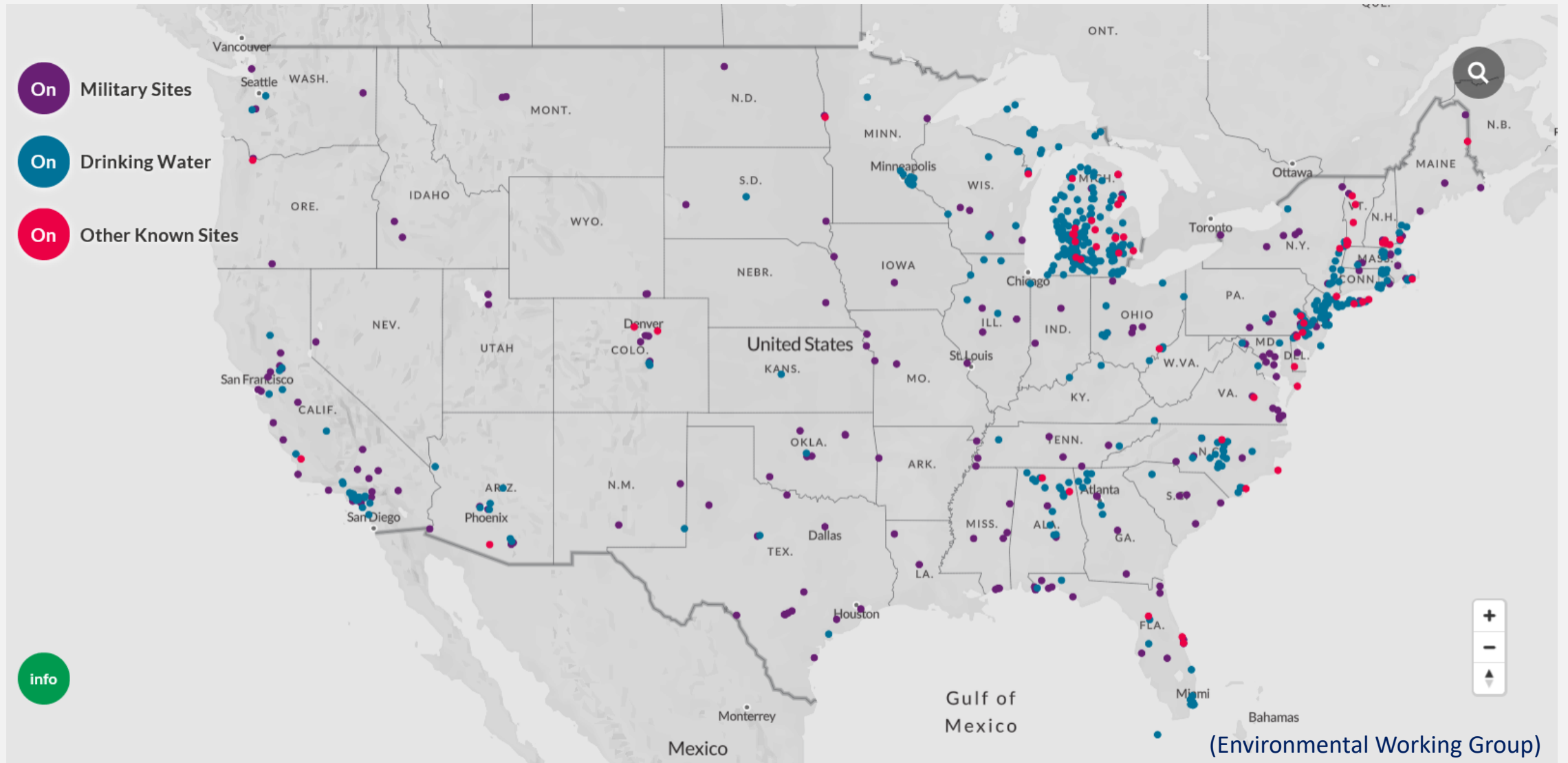


6:2 Fluorotelomer acrylate

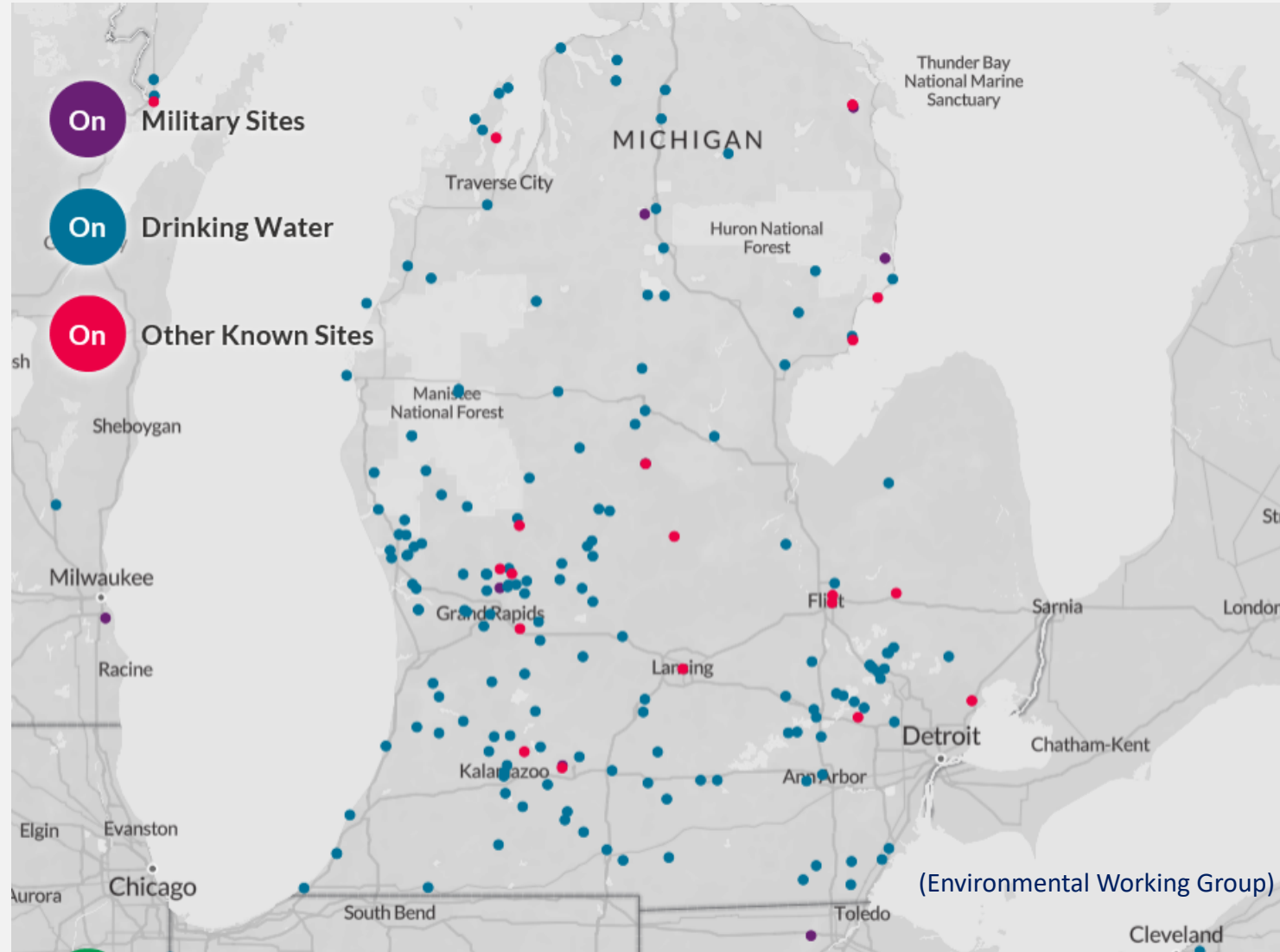
PFAS Trends from the National Health and Nutrition Examination Survey (NHANES)

- Four PFAS were **detected in > 98% of NHANES participants** in the 2003-2004 cohort
- PFOS serum levels **decreased** from 1999 to 2008 due to industrial phase-outs
- Specific PFAS that are voluntarily phased out (PFOA, PFOS) are usually **replaced with different PFAS**
- PFNA showed a **significant upward trend**, while PFHxS fluctuated

PFAS Contamination in the U.S.



PFAS Contamination in Michigan



History of PFAS Contamination from Firefighting Foam



Potential Health Effects

■ PFOA

- Increased risk of asthma diagnosis

■ PFOA, PFOS

- Increased risk of decreased fertility
- Increased risk of thyroid disease
- Small decreases in birth weight
- Pregnancy-induced hypertension/pre-eclampsia

■ PFOA, PFOS, PFHxS

- Liver damage

■ PFOA, PFOS, PFHxS, PFDeA

- Decreased antibody response to vaccines

■ PFOA, PFOS, PFNA, PFDeA

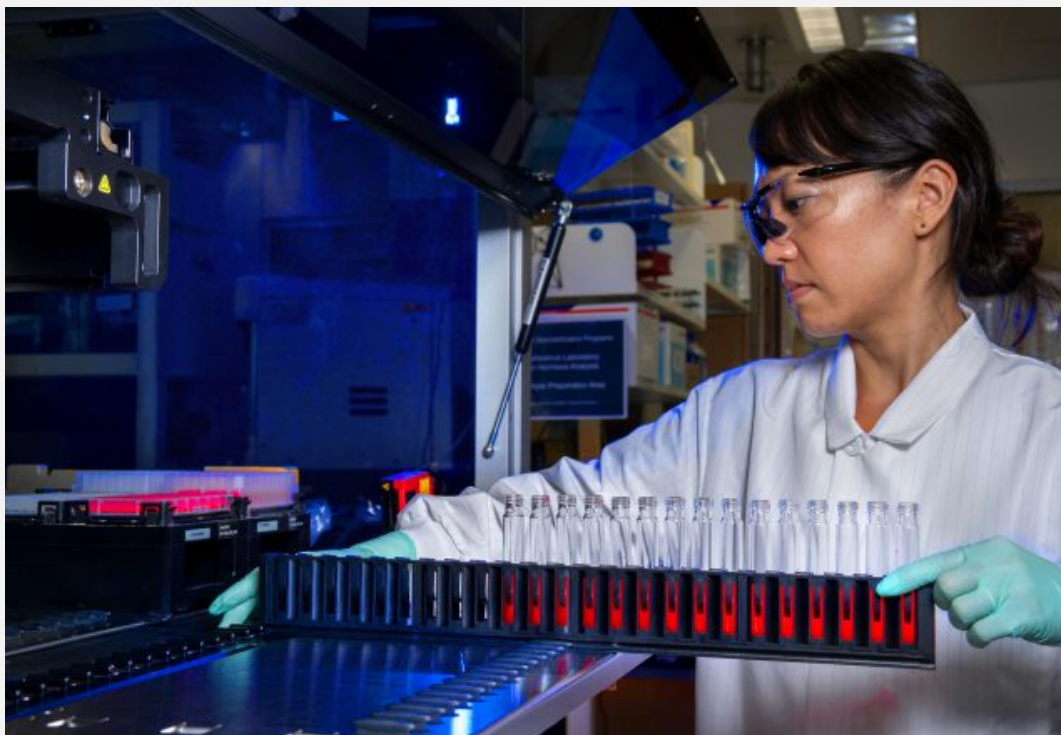
- Increased serum lipids (cholesterol and LDL)

Steps to Address PFAS Exposure

- PFAS Biomonitoring
- Health Consultations and Site Work
- Exposure Assessments
- Pease Study
- Multi-Site Health Study
- Development of Tools and Resources



Environmental Health Lab- Biomonitoring



PFAS in serum		99-00	03-04 -----11-12	13-14
Short-alkyl chain	PFBS		X	X
	PFHpA	X	X	X
Long-alkyl chain	PFHxS	X	X	X
	PFOS	X	X	X ^a
	PFOA	X	X	X ^a
	PFNA	X	X	X
	PFDA	X	X	X
	PFUnDA	X	X	X
	PFDoDA	X	X	X
	FOSA	X	X	
	EtFOSAA	X	X	
	MeFOSAA	X	X	X

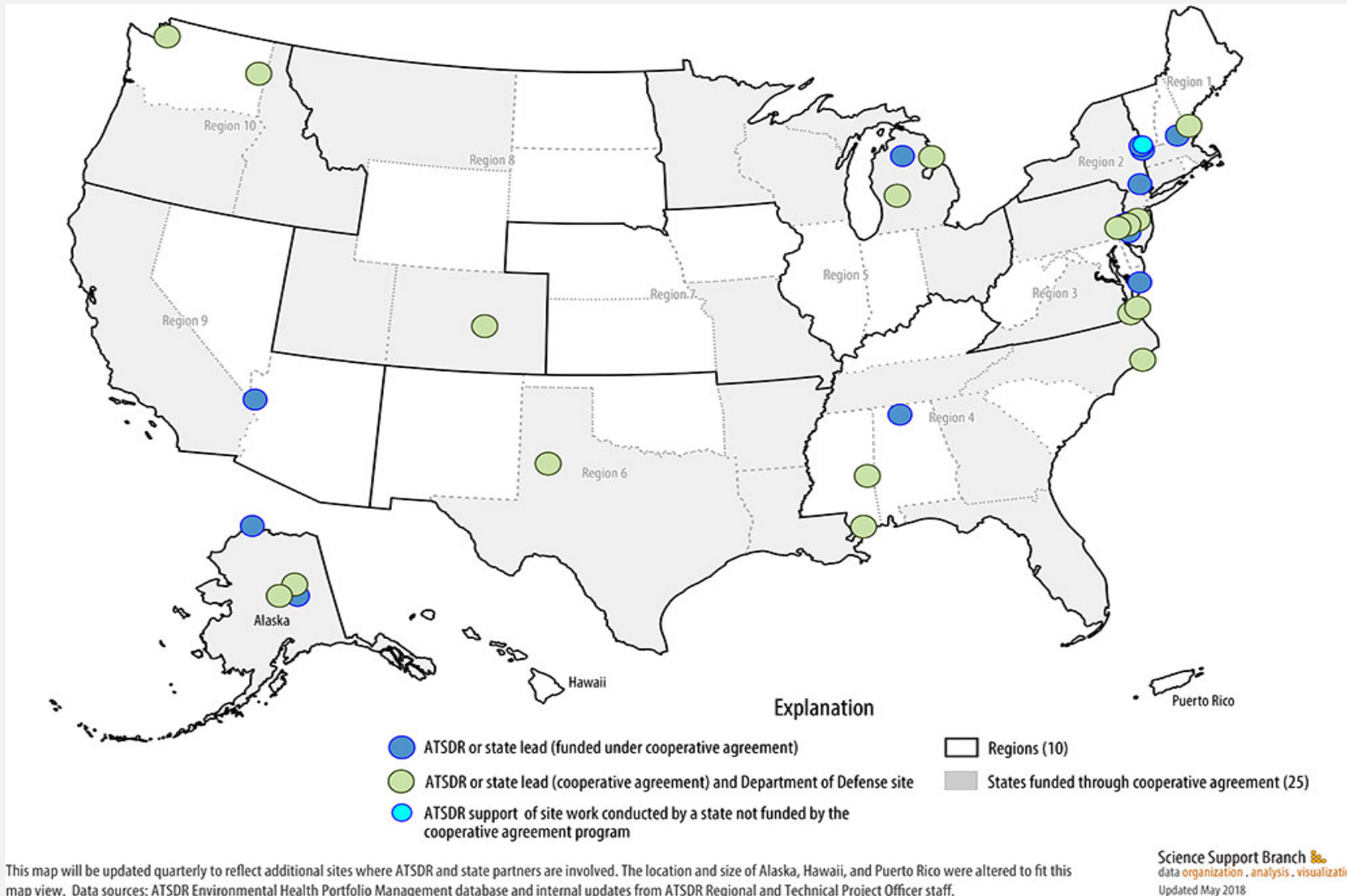
*No serum available in 2001-2

^aMeasured as isomers

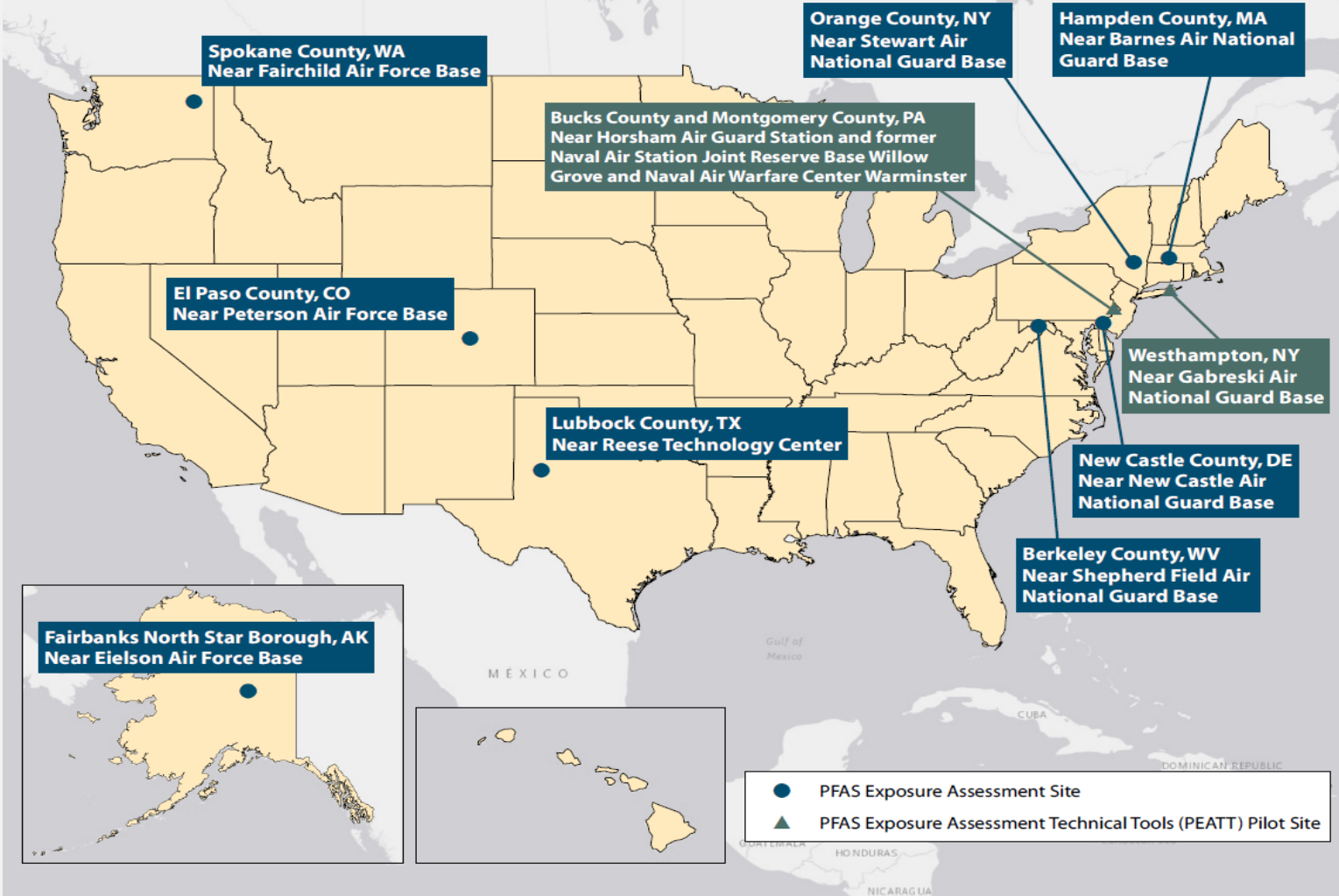
Targeted Biomonitoring for PFAS in North Carolina, 2018

- **GenX and other PFAS detected in Cape Fear River in 2017**
 - Source: PFAS chemical manufacturing facility
- **837 private wells within 5 mile radius of facility were tested**
 - 25% had GenX exceeding 140 ppt
- **CDC quantified GenX and other PFAS in serum and urine specimens from convenience sample of residents**
 - Serum for 17 PFAs and urine for 16 PFAS
 - GenX not detected in serum or urine of any participants
 - Nine PFAS detected in serum **higher** than those in NHANES participants

Health Consultations and Site Work in 40+ Communities



PFAS Exposure Assessments



Pease Health Study

- Association between **health outcomes and PFAS exposure** to expand the PFAS science base
- **Used lessons learned** from the Pease Study to make changes to the **multi-site health study protocol**
- Will serve as the **first site in the multi-site health study**



Multi-Site Health Study

- Will expand the science about the **relationships between PFAS exposure and certain health outcomes**
 - Will look at many specific health endpoints
- Seeks to enroll **6,000 adults and 2,000 children exposed to PFAS** through drinking water
- Will help people **better understand their risk for health effects**



Tools and Resources for States and Communities

- PFAS Exposure Assessment Technical Tools (PEATT)
- Draft Toxicological Profile for Perfluoroalkyls
- PFAS Factsheets
- PFAS Guidelines for Clinicians

Visit online:

<https://www.atsdr.cdc.gov/pfas/>



Perfluoroalkyls - ToxFAQs™

What are perfluoroalkyls (PFAs)?

Perfluoroalkyls (PFAs) are a group of man-made chemicals that are not found naturally in the environment. Some chemicals that are in this group PFAs include:

- perfluorooctanoic acid (PFOA)
- perfluorooctane sulfonic acid (PFOS)
- perfluorononanoic acid (PFNA)
- perfluorohexane sulfonic acid (PFHxS)
- perfluorodecanoic acid (PFDEA)

These PFAs were used to protect products like carpet and fabric, and as a coating for paper and cardboard packaging. They can also be found in some fire-fighting foams.

Where are PFAs found in the environment?

- PFAs can be found in air, soil, and water.
- They break down very slowly in air within days or weeks, but then fall to the ground where they can enter water or soil.
- PFAs do not break down in water or soil and may be carried over great distances by wind or rain.

How can I be exposed to PFAs?

- You may be exposed to PFAs in the air, in indoor dust, food, and water, and in some home products. However, the main sources of exposure to PFAs, such as PFOA and PFOS, are usually from eating food and drinking water that has these chemicals.
- Breast feeding infants may be exposed to PFAs since these chemicals have been found in breast milk. The benefits of breastfeeding are well known and almost always outweigh any potential risk, but you can talk with your doctor about concerns.

Children can be exposed to PFAs in carpet since they are closer to the ground and play on the floor.

Workers in facilities that make or use PFAs can be exposed to higher amounts of these chemicals and have higher levels in their blood.

Some communities near factories that made or used PFOA and PFOS or in areas that used certain types of firefighting foam that spread into the environment may have been exposed to high levels of these substances in their drinking water.

How can PFAs affect my health?

A large number of studies have examined possible relationships between levels of PFAs in blood and harmful health effects in people. However, most of these studies analyzed only a small number of chemicals, and not all PFAs have the same health effects. Research suggests that high levels of certain PFAs may:

- increase cholesterol levels;
- decrease how well the body responds to vaccines;
- increase the risk of thyroid disease;
- decrease fertility in women;
- increase the risk of serious conditions like high blood pressure or pre-eclampsia in pregnant women;
- lower infant birth weights; however, the decrease in birth weight is small and may not affect the infant's health.

At this time, scientists are still learning about the health effects of exposures to mixtures of PFAs.

One way to learn about whether PFAs will harm people is to conduct studies in lab animals. Most of these studies have tested doses of PFOA and PFOS that are higher than levels found in the environment.

- These animal studies have found that PFOA and PFOS can cause damage to the liver and the immune system.
- PFOA and PFOS have also caused birth defects, delayed development, and newborn deaths in lab animals.

Humans and animals react differently to PFAs, and not all effects observed in animals may occur in humans.

- Scientists have ways to estimate how the exposure and effects in animals compare to what they would be in humans.
- What they learn from this process helps them decide how to protect people from harm caused by chemical exposure.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)

Frequently Asked Questions

What are PFAS?

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a large group of man-made chemicals that have been used in industry and consumer products worldwide since the 1950s.

- PFAS do not occur naturally, but are widespread in the environment.
- PFAS are found in people, wildlife and fish all over the world.
- Some PFAS can stay in people's bodies a long time.
- Some PFAS do not break down easily in the environment.

How can I be exposed to PFAS?

PFAS contamination may be in drinking water, food, indoor dust, some consumer products, and workplaces. Most non worker exposures occur through drinking contaminated water or eating food that contains PFAS.

Although some types of PFAS are no longer used, some products may still contain PFAS:

- Food packaging materials
- Nonstick cookware
- Stain resistant carpet treatments
- Water resistant clothing
- Cleaning products
- Paints, varnishes and sealants
- Firefighting foam
- Some cosmetics

How can I reduce my exposure to PFAS?

PFAS are present at low levels in some food products and in the environment (air, water, soil etc.), so you probably cannot prevent PFAS exposure altogether. However, if you live near known sources of PFAS contamination, you can take steps to reduce your risk of exposure.

- If your drinking water contains PFAS above the EPA Lifetime Health Advisory, consider using an alternative or treated water source for any activity in which you might swallow water.
 - » drinking
 - » food preparation
 - » cooking
 - » brushing teeth, and
 - » preparing infant formula
- Check for fish advisories for water bodies where you fish.
 - » Follow fish advisories that tell people to stop or limit eating fish from waters contaminated with PFAS or other compounds.
 - » Research has shown the benefits of eating fish, so continue to eat fish from safe sources as part of your healthy diet.
- Read consumer product labels and avoid using those with PFAS.

Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations

Questions?

<https://www.atsdr.cdc.gov/pfas>

For more information, contact NCEH/ATSDR
1-800-CDC-INFO (232-4636)

TTY: 1-888-232-6348 www.atsdr.cdc.gov www.cdc.gov

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention and the Agency for Toxic Substances and Disease Registry.

