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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. DEPARTMENT OF COMMERCE

PURDUE UNIVERSITY

Extension - Forestry and Natural Resources

# Per- and Polyfluoroalkyl Substances (PFAS)

## THE PROBLEM, THE RESPONSE, AND WHAT HAPPENS NEXT

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Pollution Prevention Extension Specialist
Illinois-Indiana Sea Grant

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## PFAS contamination is Michigan's biggest environmental crisis in 40 years

These once-common chemicals are linked to cancer and a host of other ailments. And they may be tainting more than 11,000 sites around Michigan.

**Keith Matheny, Detroit Free Press**
Updated 4:27 p.m. EDT Apr. 26, 2019

CHEMICALS

## States take up PFAS fight: 'Is this the next asbestos?'

Ellen M. Gilmer and Ariana Figueroa, E&E News reporters • Published: Monday, June 3, 2019

PBS NEWS HOUR

## FDA food testing finds contamination by PFAS and other 'forever chemicals'

Health Jun 3, 2019 12:33 PM EDT

The New York Times

## *E.P.A. Will Study Limits on Cancer-Linked Chemicals. Critics Say the Plan Delays Action.*

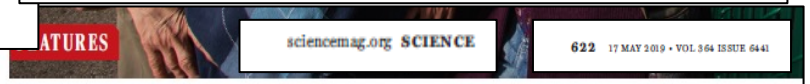
By Coral Davenport

Feb. 14, 2019

CBS NEWS NEWS SHOWS LIVE

## New study claims 43 states expose millions to dangerous chemical in drinking water

BY BRIAN PASCUS
MAY 7, 2019 / 3:48 PM /




Union of Concerned Scientists
Science for a healthy planet and safer world

[ BLOG ] UNION OF CONCERNED SCIENTISTS

## How the Chemical Industry Deployed the Disinformation Playbook on PFAS

GENNA REED, LEAD SCIENCE AND POLICY ANALYST | MARCH 27, 2019, 2:54 PM EDT

## THEY PERSISTED

In Michigan, concerned citizens have helped reveal contamination by long-lasting nonstick chemicals

*By* **Sara Talpos**, *in Rockford, Michigan*

npr NEWSCAST DONATE LIVE RADIO

Shots

YOUR HEALTH

## Scientists Dig Into Hard Questions About The Fluorinated Pollutants Known As PFAS

FOX NEWS .com

## Toxic Chemicals Contaminate Cape

By Georeen Tanner

Published January 25, 2019

## EPA plans to regulate cancer-causing chemicals found in America's drinking water

Ledyard King, USA TODAY Published 9:15 a.m. ET Feb. 14, 2019 | Updated 3:55 p.m. ET Feb. 14, 2019

## Toxic stream of 'mystery foam' near Detroit was PFAS – but from where?

Updated May 7, 2019;
Posted May 7, 2019

MLIVE Michigar

ENVIRONMENT

# Illinois AG says 3M's Cordova plant dumped, hid chemicals in surrounding water

In a lawsuit, the state says the artificial chemicals were discharged into the river, groundwater and residential wells around the Cordova facility for years.


6 KWQC

Livestream News Weather Video Celebrating 75 Sports Black History Month Hometown Hero Download Our Ap

## Illinois, Iowa's history with 3M, announces $10.3B settlement over PFAS contaminating water supplies

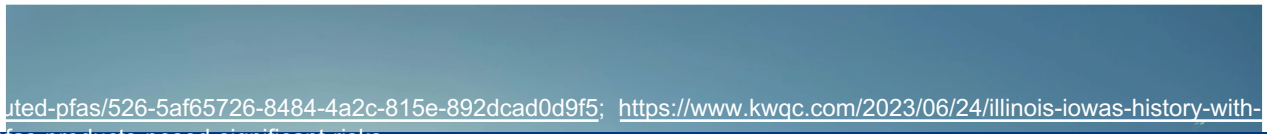
Chemical giant announces $10.3B settlement over PFAS contaminating water supplies


WNIJ News

# Illinois AG's latest lawsuit alleges manufactures knew PFAS products posed significant risks

Northern Public Radio | By Juanpablo Ramirez-Franco

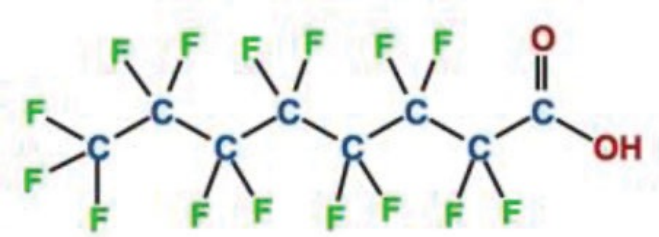
Published February 2, 2023 at 1:16 PM CST



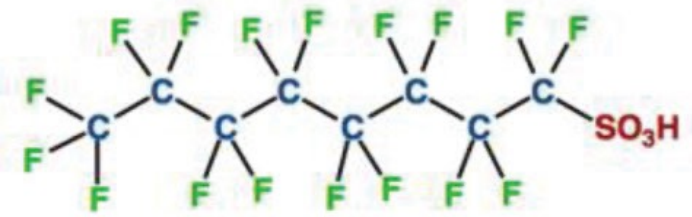
https://www.wqad.com/article/tech/science/environment/3m-cordova-illinois-lawsuit-water-chemicals-contaminated-p uted-pfas/526-5af65726-8484-4a2c-815e-892dcad0d9f5; https://www.kwqc.com/2023/06/24/illinois-iowas-history-with-3m/; https://www.northernpublicradio.org/wnij-news/2023-02-02/illinois-ags-latest-lawsuit-alleges-manufactures-knew-pfas-products-posed-significant-risks

# What are PFAS?

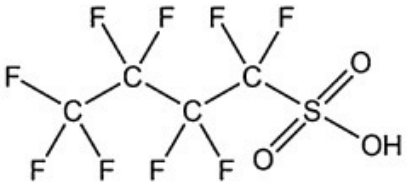
- Per- and poly-fluoroalkyl substances (PFAS)
- Represent a group of nearly 15,000 man-made organic compounds are that mainly contain carbon-fluorine bonds
  - PFOA/PFOS = ≥6 fully fluorinated carbons
    - “long chain”
  - Alternatives (GenX, PFBS) = ≤5 fully fluorinated carbons
    - “short chain”
- Highly stable, persistent, and bioaccumulative in the environment -- a.k.a. “forever” chemicals



**PFOA** - perfluorooctanoic acid



**PFOS** - perfluorooctanesulfonic acid



PFBS - perfluorobutanesulfonic acid

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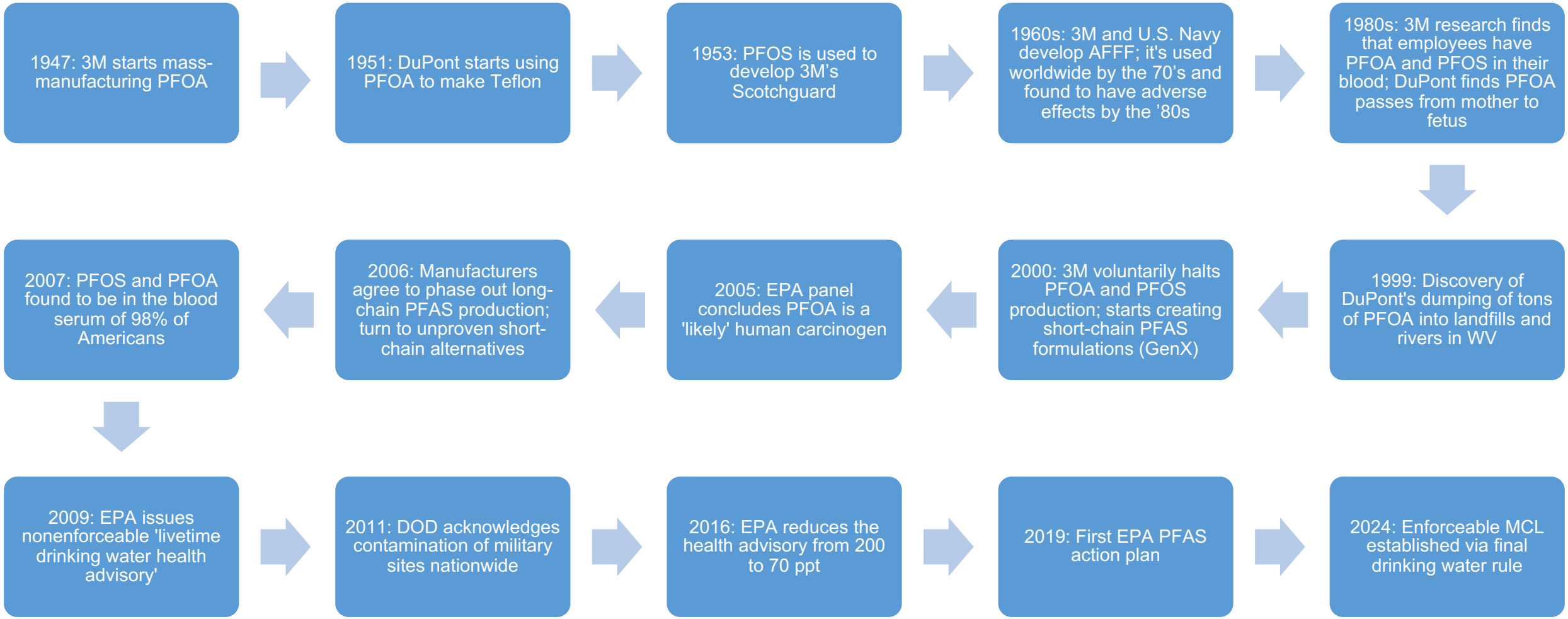
# PFAS Timeline

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# How are PFAS used?

Industrial applications and consumer products since the 1950s.

Aqueous Film Forming Foam (AFFF)

Non-stick cookware and utensils

Stain repellent carpets, upholstery, and other fabrics

Grease/oil-resistant food packaging and containers

Stain and water-repellent apparel

Dental floss

Polishes, paints, sealants, and waxes

Personal care products and cosmetics

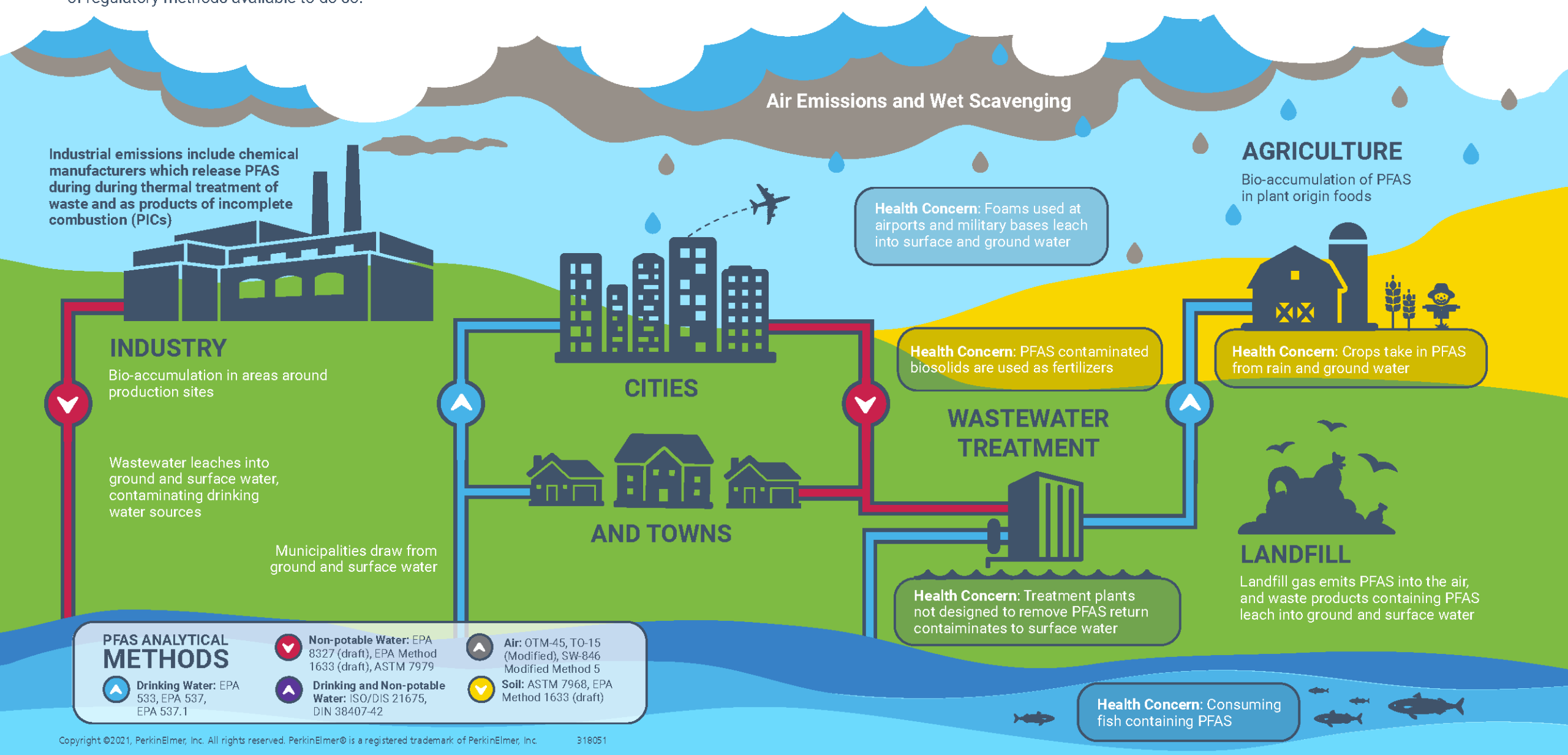
Cleaning products

Contaminated food

# PFAS HEALTH CONCERNS IN AIR AND WATER

Per- and polyfluoroalkyl substances (PFAS) are industrial chemicals that have been used in a variety of industries around the world since the 1940s. These chemicals are stable in the environment and can accumulate over time. Research shows their negative impacts on human health, including reproductive and developmental issues, depressed immune response, liver and kidney problems, and cancer. Detecting PFAS is the first step in mitigating health risks, and there are a growing number of regulatory methods available to do so.

PerkinElmer
For the Better

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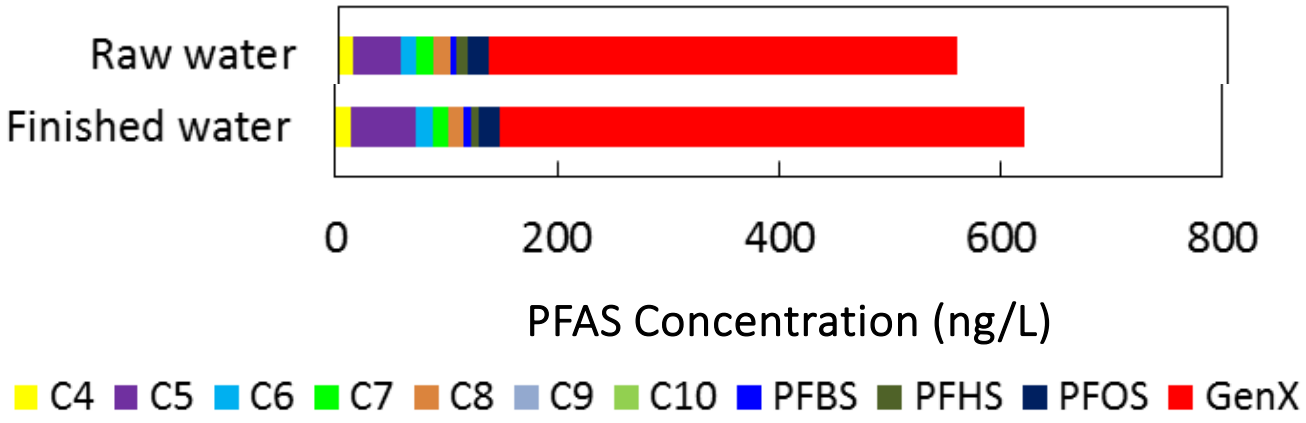
# PFAS Removal

Conventional and advanced water treatments do not effectively remove legacy PFAS and GenX from drinking water




LC-MS-MS used for measurement

Sun et al. 2016

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# PFAS as a Problem

- The presence of PFAS was not widely reported until the late 1990s to early 2000s
- Can be ingested, absorbed through skin, and inhaled
- Readily absorbed in the digestive tract and enters the bloodstream quickly
- Possible health effects include: altered liver function, kidney and cardiovascular disease, immune suppression, low birth weight, difficulty becoming pregnant, pre-term birth, and cancer

# PFAS in Humans

- Found in soil, air, water, wildlife, and humans worldwide (including the Arctic and Antarctic)
- 2015 study by U.S. National Health and Nutrition Examination Survey found PFAS in over 97% of human blood samples
- PFAS can be broken down by our bodies, but slowly
  - *Dose varies with exposure route and total dose is key
  - *Type of PFAS would affect associated risks
  - Can accumulate rapidly with continued exposure.

# PFAS in Fish

- PFAS persist in fish for long periods and can bioaccumulate to high levels
- PFAS can be passed from female salmonids to their eggs (Conard et al. 2022)
- You can be exposed to PFAS by consuming contaminated fish
- PFAS cannot be removed from the fish via cooking

Yellow perch (Photo courtesy Christian Perry)

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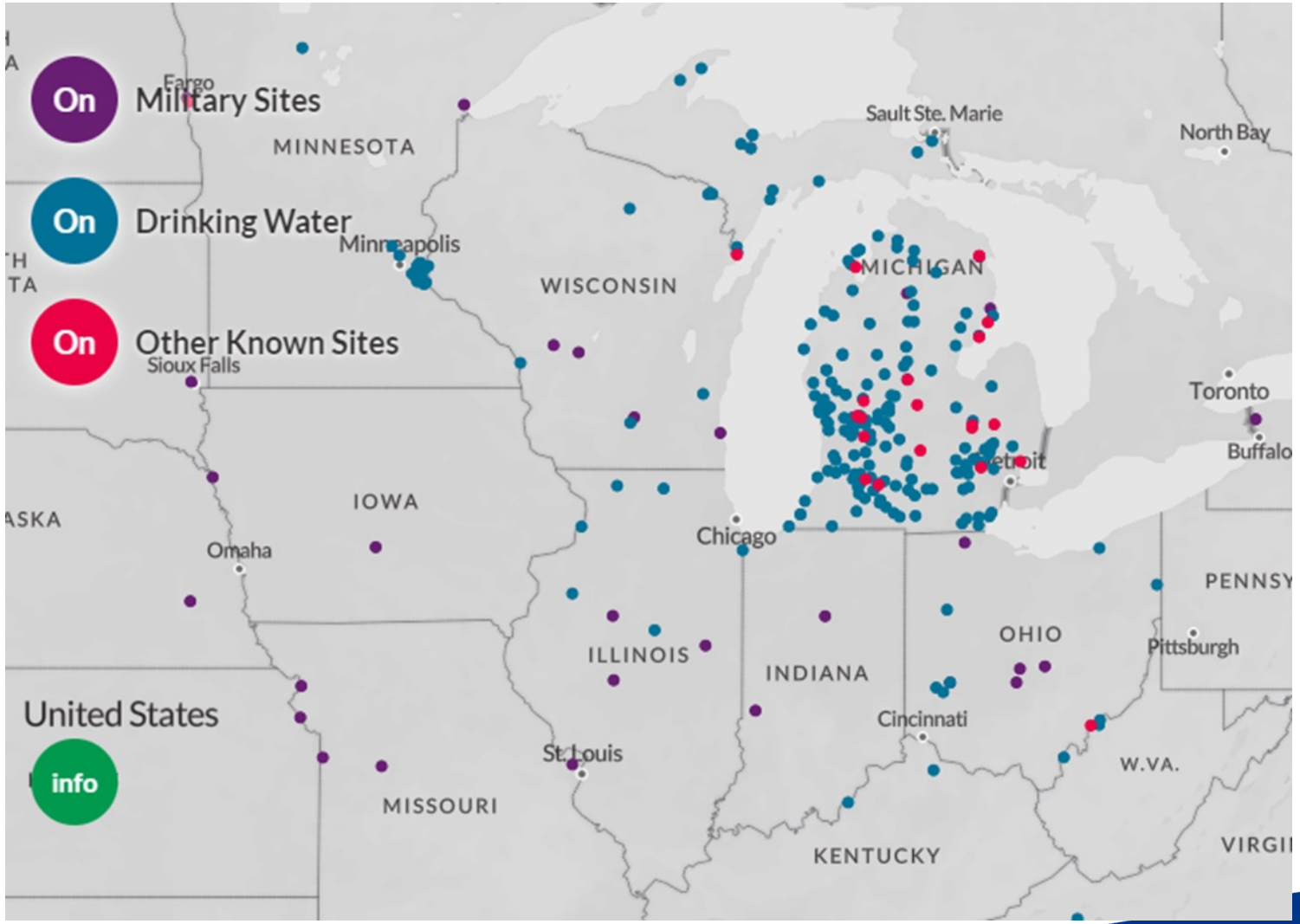


https://www.ewg.org/interactive-maps/pfas_contamination/map/;

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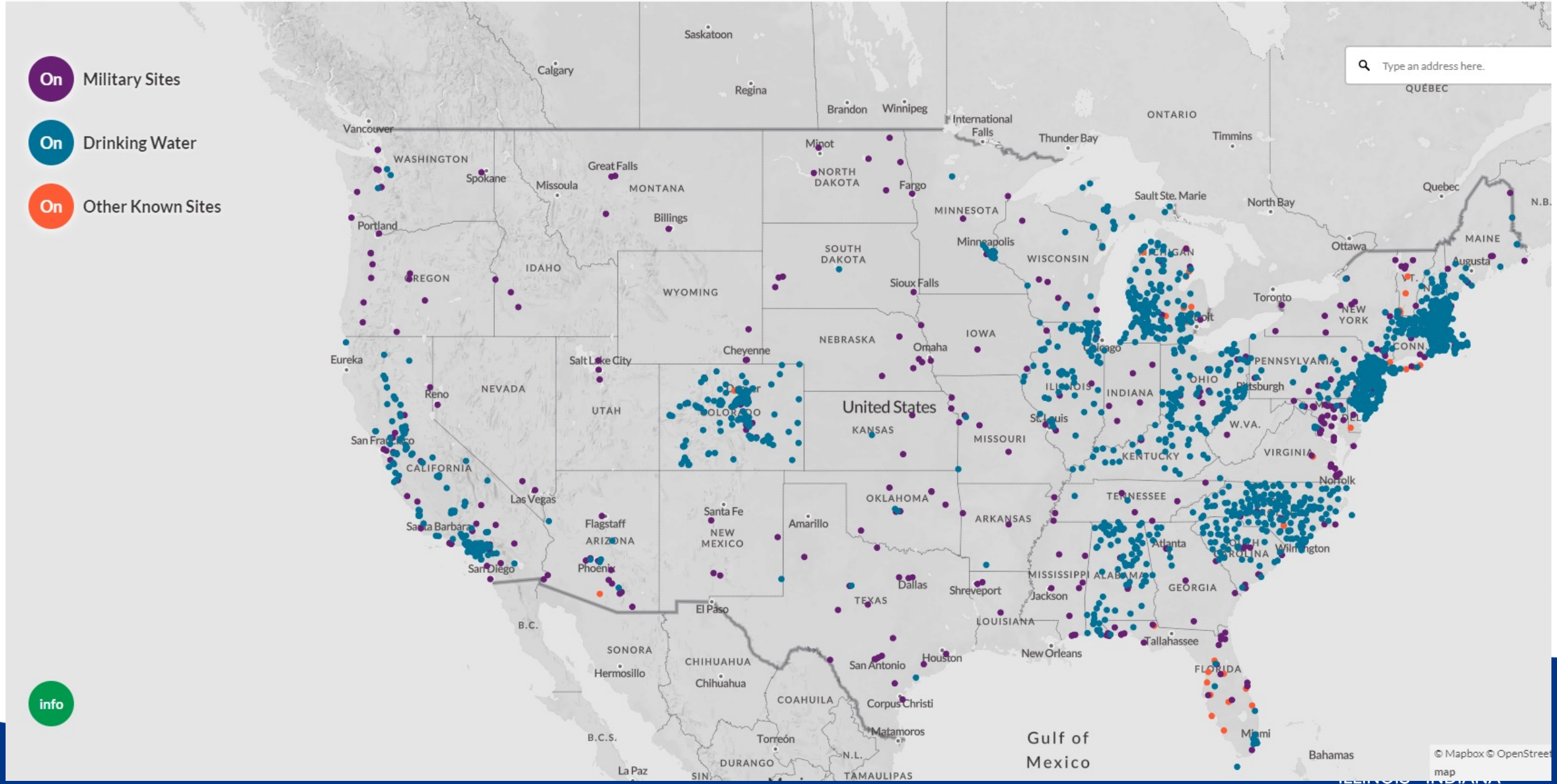
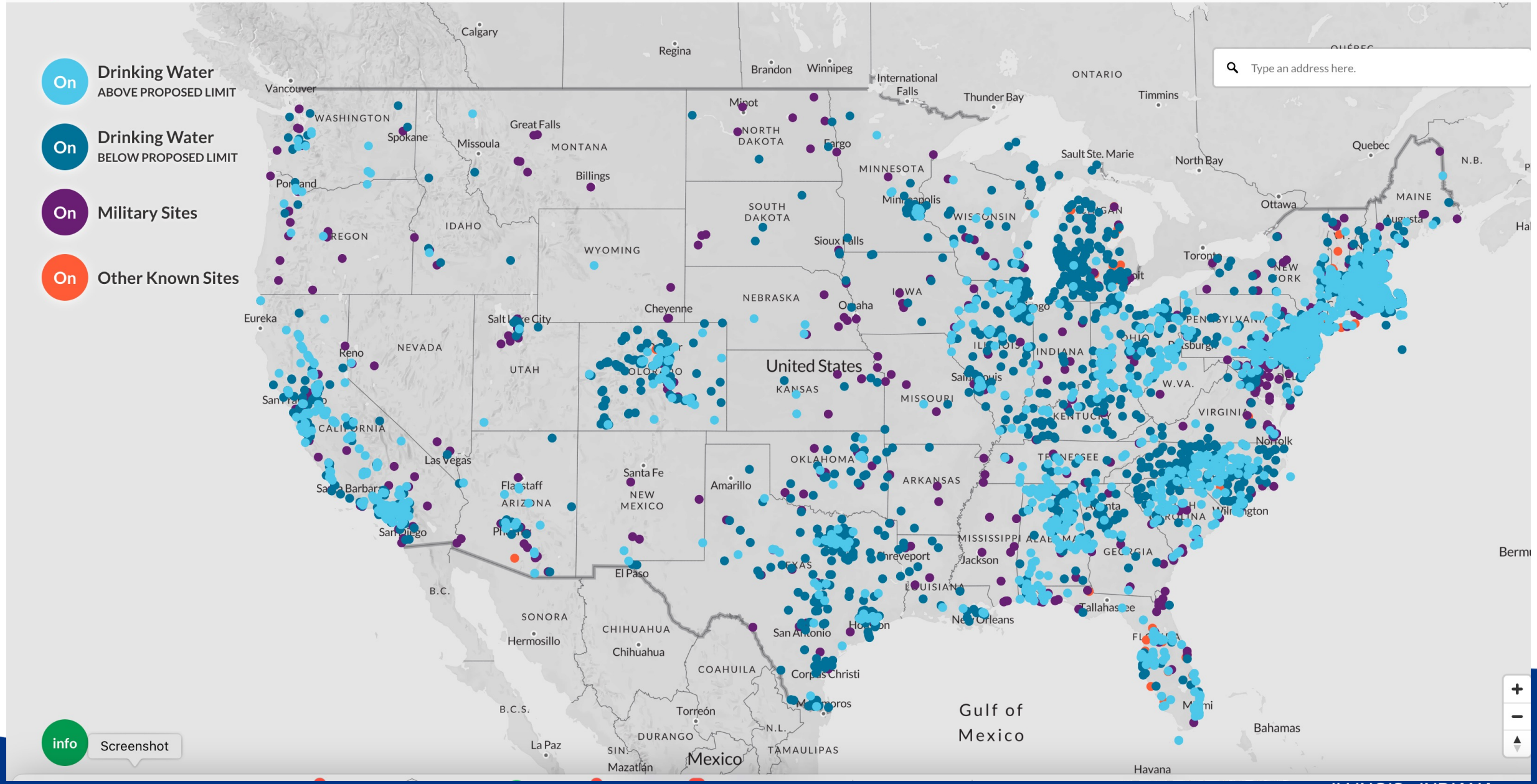
# PFAS Contamination in the U.S. (October 4, 2021)




https://www.ewg.org/interactive-maps/pfas_contamination/map/; accessed 7 December 2021

# PFAS Contamination in the U.S. (February 5, 2024)

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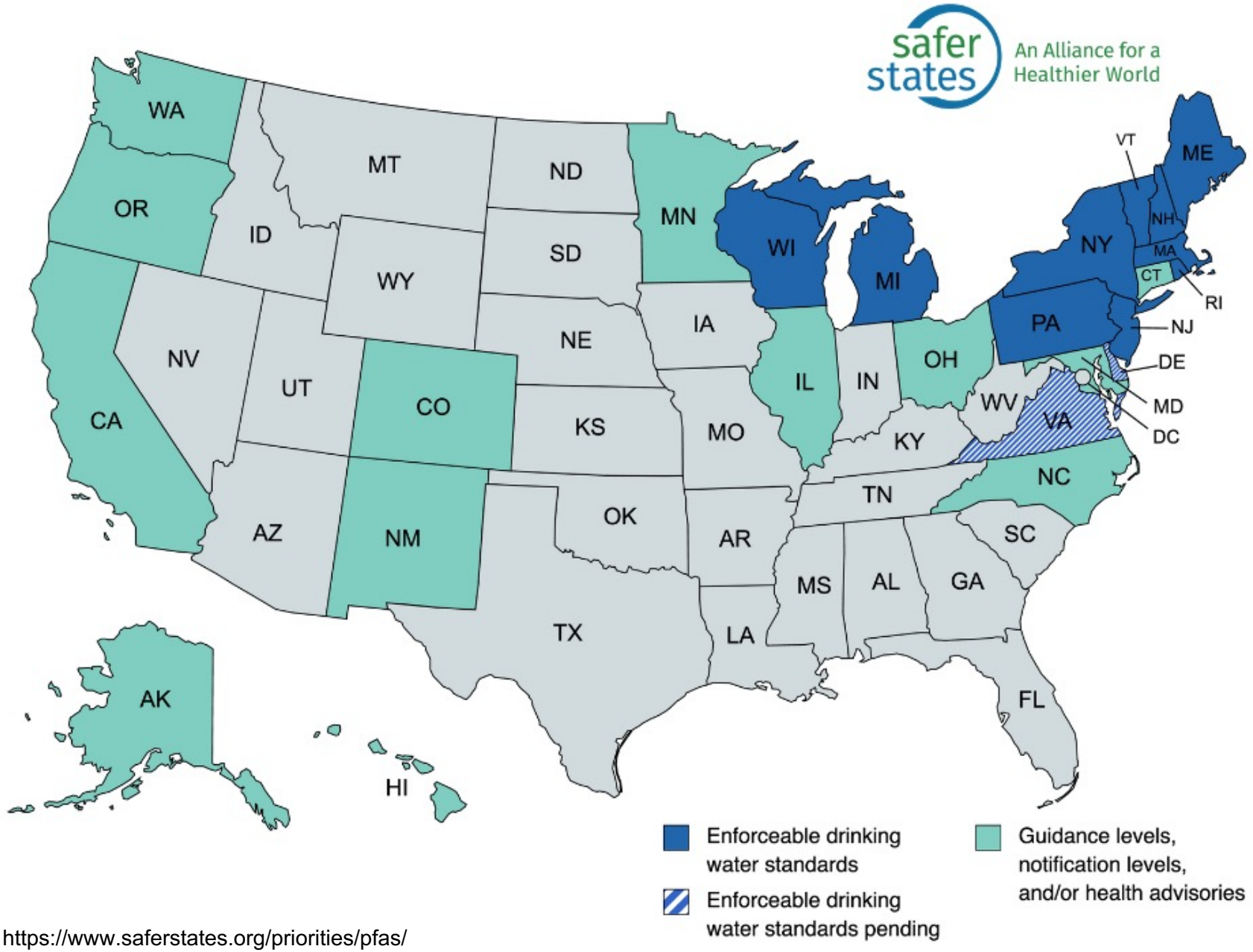
https://www.ewg.org/interactive-maps/pfas_contamination/map/; accessed 7 March 2024

# State Drinking Water Limits




https://www.saferstates.org/priorities/pfas/

Ten states (ME, MA, MI, NH, NJ, NY, PA, RI, VT, and WI) have enforceable drinking water standards for some PFAS chemicals (DE and VA are pending).

Thirteen additional states (AK, CA, CO, CT, IL, MD, MN, NC, NM, OH, OR, and WA) have adopted guidance levels, notification levels, and/or health advisories for PFAS in drinking water.

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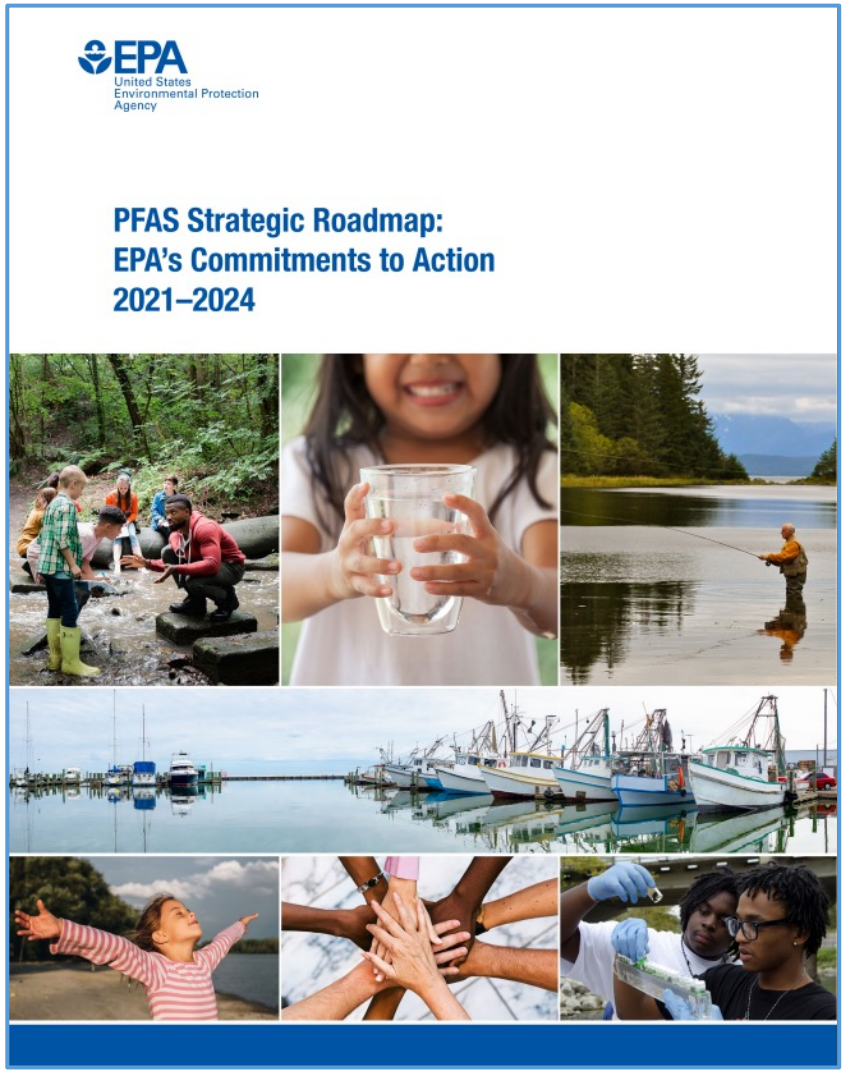
# U.S. EPA Approach to PFAS

- Consider the lifecycle of PFAS
  - Unique properties, ubiquity of uses, multiple pathways for exposure
- Get upstream of the problem
- Hold polluters accountable
- Ensure science-based decision-making
- Prioritize protection of disadvantaged communities
- Proposed MCL 4 ppt




https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024

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# U.S. EPA Drinking Water Final Rule – April 2024

| Compound | Final MCLG | Final MCL (enforceable levels) |
|---|---|---|
| PFOA | Zero | 4.0 parts per trillion (ppt) (also expressed as ng/L) |
| PFOS | Zero | 4.0 ppt |
| PFHxS | 10 ppt | 10 ppt |
| PFNA | 10 ppt | 10 ppt |
| HFPO-DA (commonly known as GenX Chemicals) | 10 ppt | 10 ppt |
| Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS | 1 (unitless)<br>Hazard Index | 1 (unitless)<br>Hazard Index |

https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas

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# U.S. EPA Drinking Water Final Rule – April 2024

- How will it function?
  - Regulated public water systems have 3 years to complete initial monitoring
    - Results must be included in their Annual Water Quality reports to customers.
  - Systems that have PFAS above the MCL have 5 years to implement solutions to reduce PFAS.
    - Public must be notified if levels exceed MCL
    - Recommended solutions: GAC, RO, and ion exchange but no required way
      - May require closing contaminated wells or finding new source

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https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas

# U.S. EPA Drinking Water Final Rule – April 2024

- What about funding?
  - 1B available for small, disadvantaged, rural communities through grant program for initial testing
    - For public water systems and private well owners
    - Part of 9B set aside to address PFAS contamination in drinking water
  - 12B available for general drinking water improvements
  - Water Infrastructure Finance and Innovation Act low-cost loan program also can be used to address PFAS

https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas

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