

Introduction to PFAS

A Deeper Look into your Drinking Water and Fish




Extension
UNIVERSITY OF WISCONSIN-MADISON





Per- and polyfluoroalkyl substances (PFAS) are a family of man-made chemicals.

 Iowa Capital Dispatch

DNR: Ames drinking water has 'forever chemicals'

One well that is contaminated with PFAS is located in a firefighter training area. Firefighting foam is a known source of PFAS.

19 hours ago



 Ann Arbor News

Michigan's first PFAS site cleanup trial is scheduled to begin this year

HOWELL, MI — The first civil trial to arise out of Michigan's multi-year pursuit of cleanup at toxic PFAS contamination sites is scheduled...

2 hours ago




 Chemistry World

Significant levels of PFAS found in antifogging sprays and cloths for glasses

High levels of PFAS chemicals, including two largely unknown ones, detected in products to demist glasses that have become widely used...

1 day ago



 Reuters

EPA to order chemical makers to test PFAS substances for toxicity


The Environmental Protection Agency on Tuesday said it plans to require makers of a family of chemicals to fund and conduct toxicity studies...

2 weeks ago



is'
fter training area.



 Bangor Daily News

Maine's 'forever chemicals' problem has now spread to chicken eggs


It comes after state issued a "do not eat" advisory for deer meat harvested in and around Fairfield due to unsafe levels of PFAs found in...

1 month ago



led to begin
ulti-year pursuit



 The Guardian

PFAS 'forever chemicals' constantly cycle through ground, air and water, study finds

The Stockholm University study highlights the chemicals' mobility, which has been found in penguin eggs and polar bears.

3 weeks ago



prays and
ones, detected



Firefighting Foams

Non-Stick Coatings

Protective Coatings

Architectural Resins

Industrial Surfactants, Resins, Molds, Plastics

Stain & Water-Resistant Products

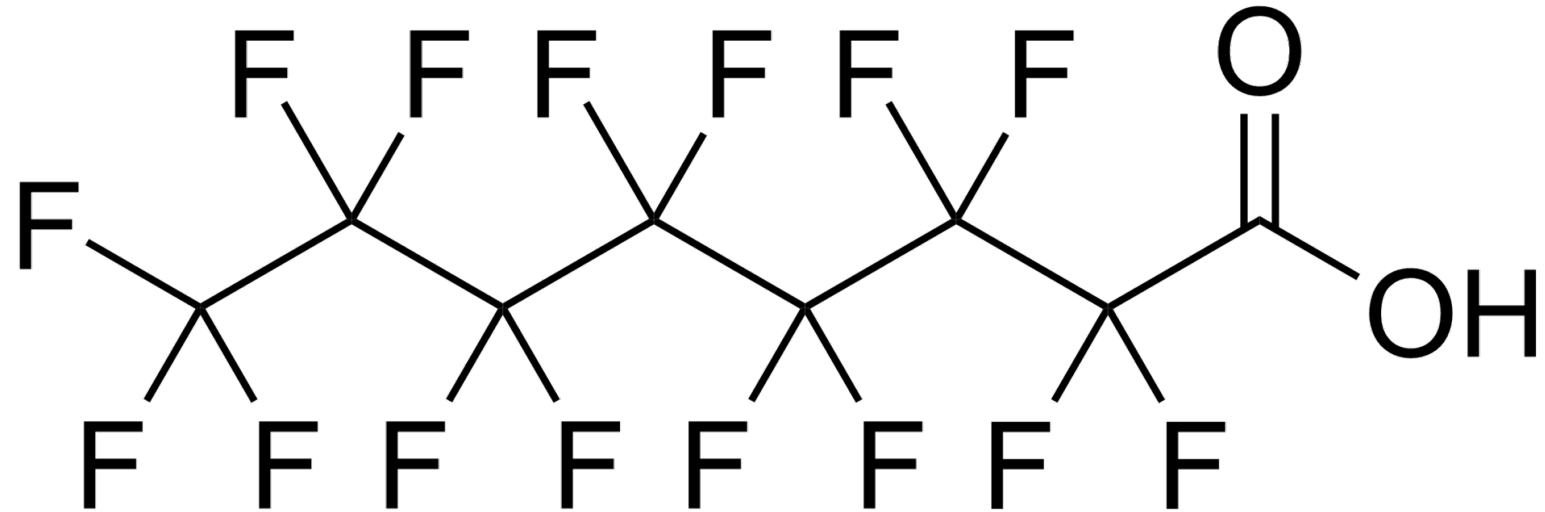
Paper products



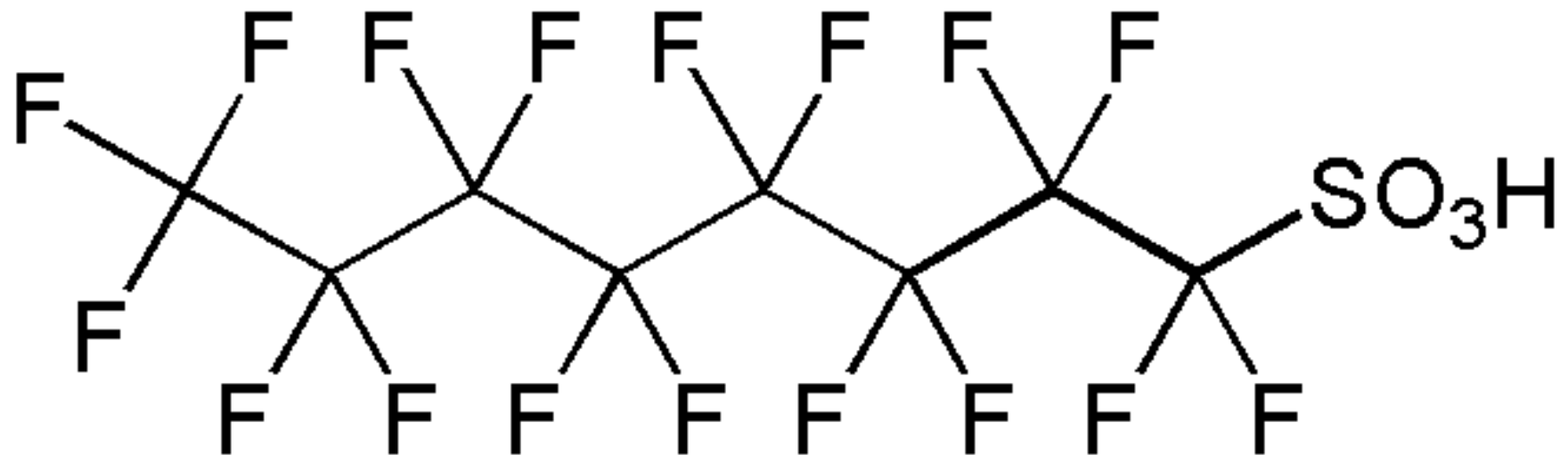


There are more than 14,000 PFAS.

PFOA = Perfluorooctanoic acid



PFOS = Perfluorooctane sulfonate





PFAS are persistent in the environment and human body.



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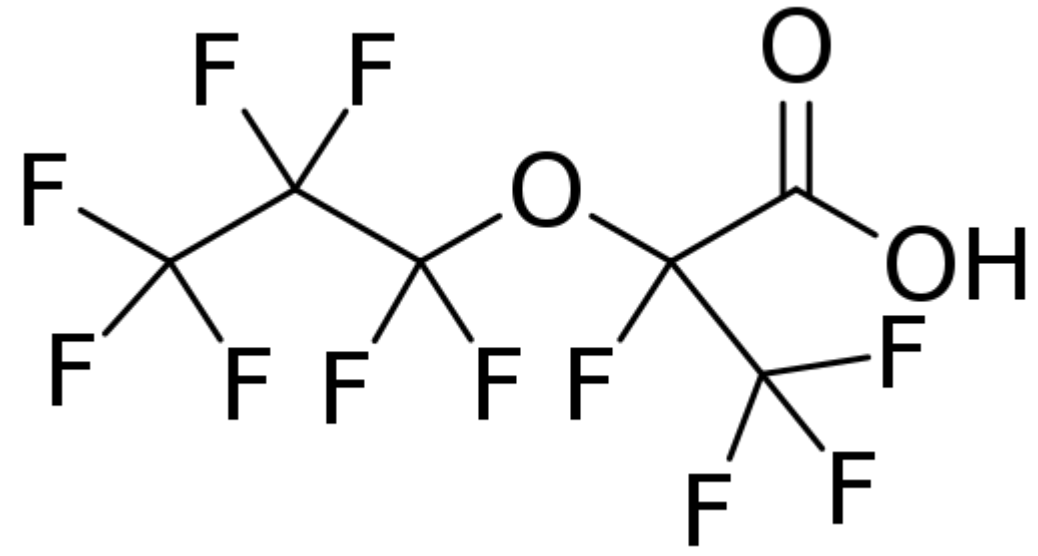


PFAS are persistent in the environment and human body.

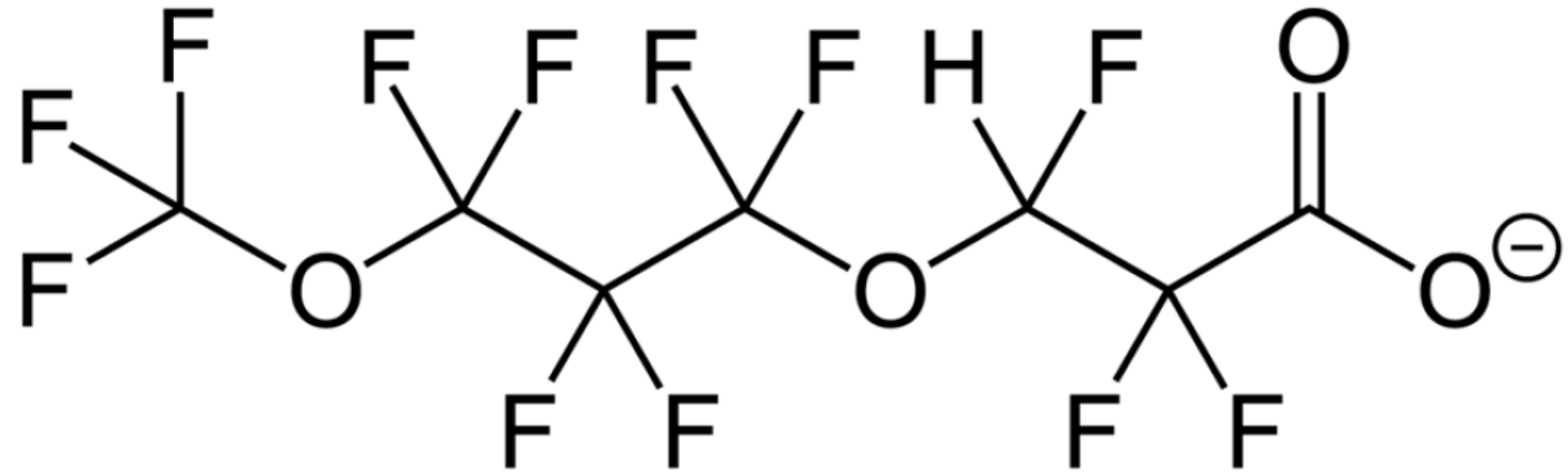


PFAS are persistent in the environment and human body.

GENX



ADONA





Groundwater, drinking water, soil and air can be contaminated with PFAS.

PFAS can cause negative health effects in people.

High levels of PFAS may



Increase
cholesterol

High levels of PFAS may



Increase
cholesterol



Reduce
antibody
response

High levels of PFAS may



Increase
cholesterol



Reduce
antibody
response



Decrease
fertility in
women

PFAS may also increase the risk of

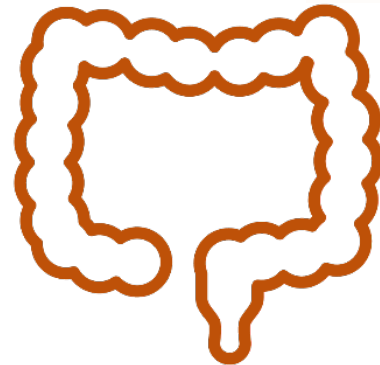
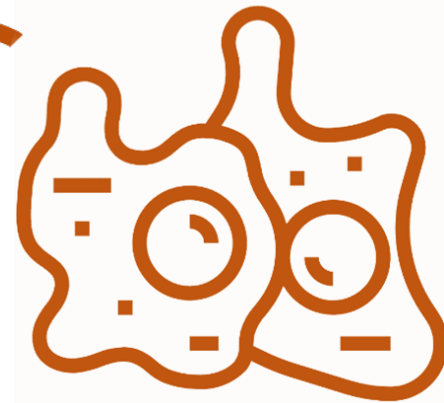
Thyroid disease

Osteoarthritis

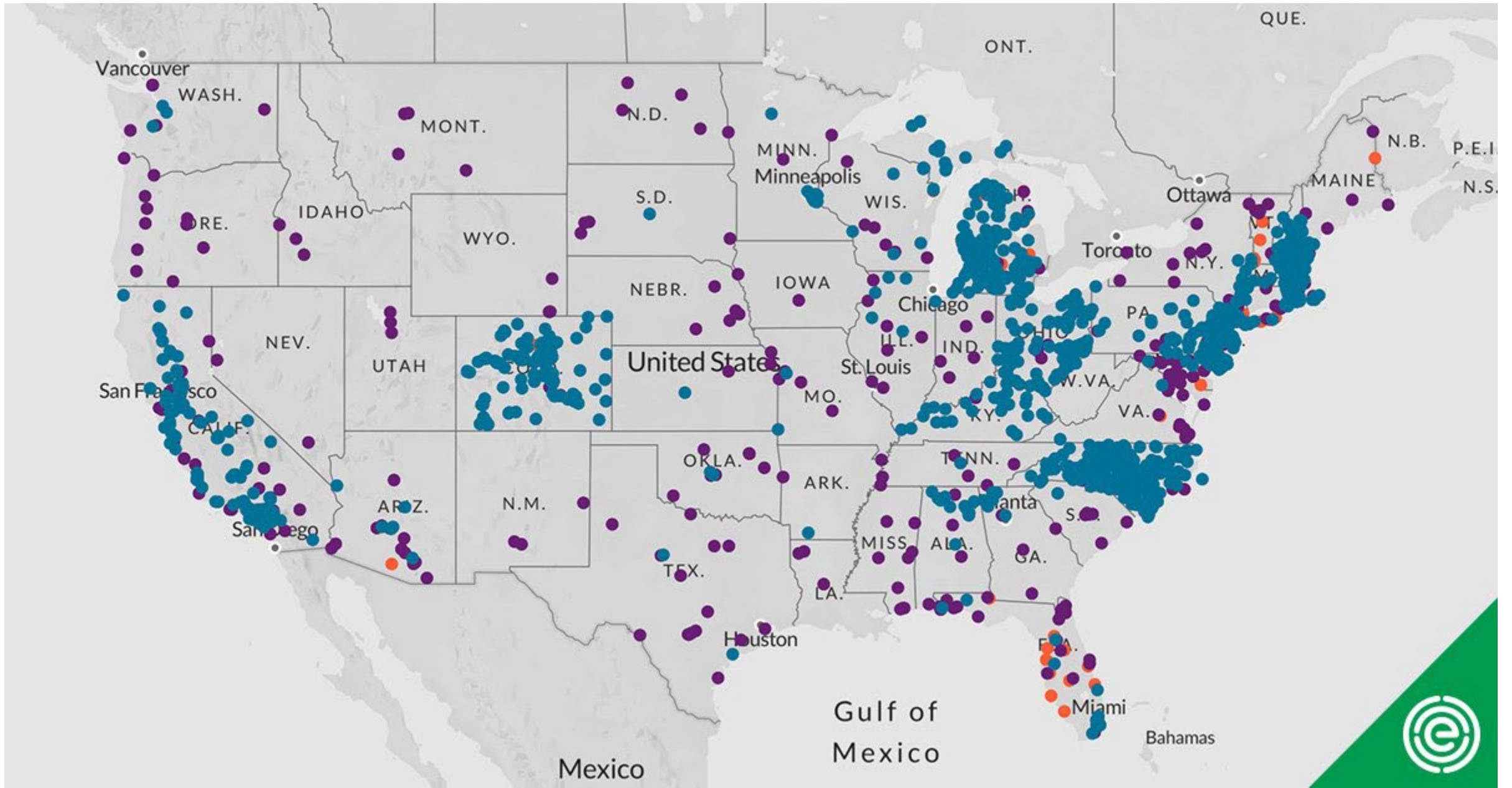
Ulcerative colitis

Testicular cancer

Kidney cancer



PFAS is found at many sites around Wisconsin and the nation.



Known contamination sites

Evidence has been mounting since the 1990s about serious health hazards from synthetic “nonstick” chemicals used in many consumer products and firefighting foam. Referred to by the acronym PFAS, they spread easily through water above and below ground. They are linked to illnesses including testicular cancer, high cholesterol and disease of the liver, kidneys, glands and immune system.

Maximum levels* of PFAS compounds found during testing:

Volk Field Air National Guard Base

Camp Douglas
Groundwater: **23,000 ppt**

Fort McCoy Army installation

Sparta
Groundwater around three burn pits used for firefighting training: **121,000 ppt**

Badger Army Ammunition Plant

Near Baraboo
Groundwater: **Test results pending**

Tyco Fire Products

Marinette
Drinking water: **1,900 ppt**
Groundwater and surface water: **202,000 ppt**

Former Mirro plant

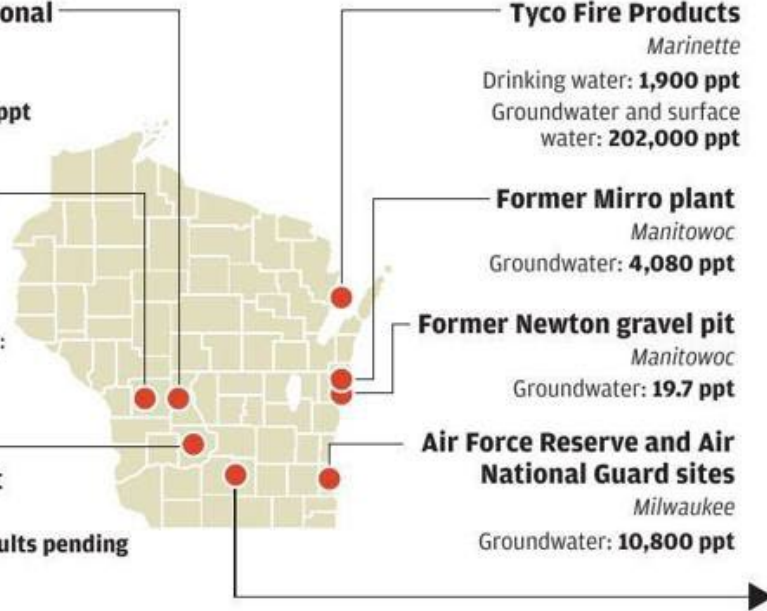
Manitowoc
Groundwater: **4,080 ppt**

Former Newton gravel pit

Manitowoc
Groundwater: **19.7 ppt**

Air Force Reserve and Air National Guard sites

Milwaukee
Groundwater: **10,800 ppt**



*In parts per trillion

Drinking water: Advised maximum PFAS level varies

There are thousands of PFAS compounds. Government agencies have issued health advisories with maximum safe-drinking levels for a few of the most common ones. Many states, including Wisconsin, follow a U.S. Environmental Protection Agency advisory.

EPA: 70 parts per trillion

Vermont: 20 parts per trillion

Agency for Toxic Substances and Disease Registry: 14-21 parts per trillion

New Jersey: 13-14 parts per trillion

Wisconsin hasn't placed specific legal limits on PFAS contamination, but the state can order polluters to investigate and clean up contamination.

Truax Air National Guard Base

Madison

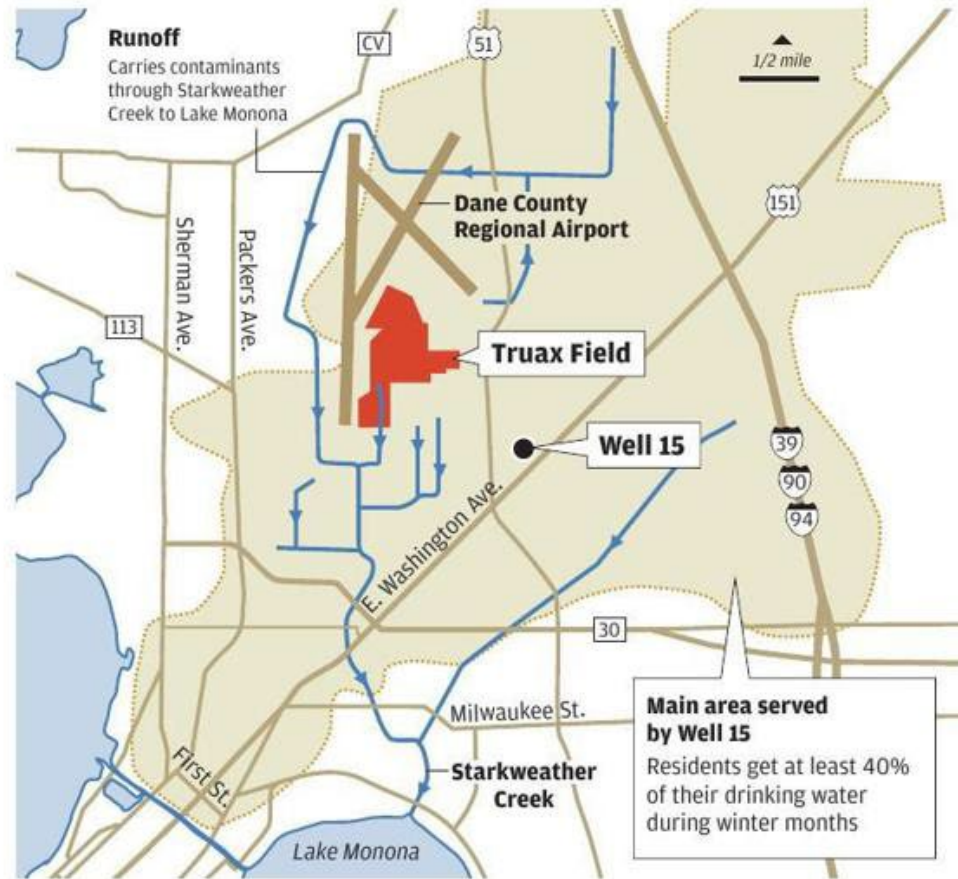
Drinking water for Well 15: **37 ppt** (for five PFAS compounds combined) and **10 ppt** (for two combined)

Groundwater: **39,841 ppt**

Pollutant used at air base showing up in drinking water

Heavy concentrations of hazardous PFAS compounds have been found in shallow groundwater under Truax Air National Guard base. The chemicals were used in firefighting foam.

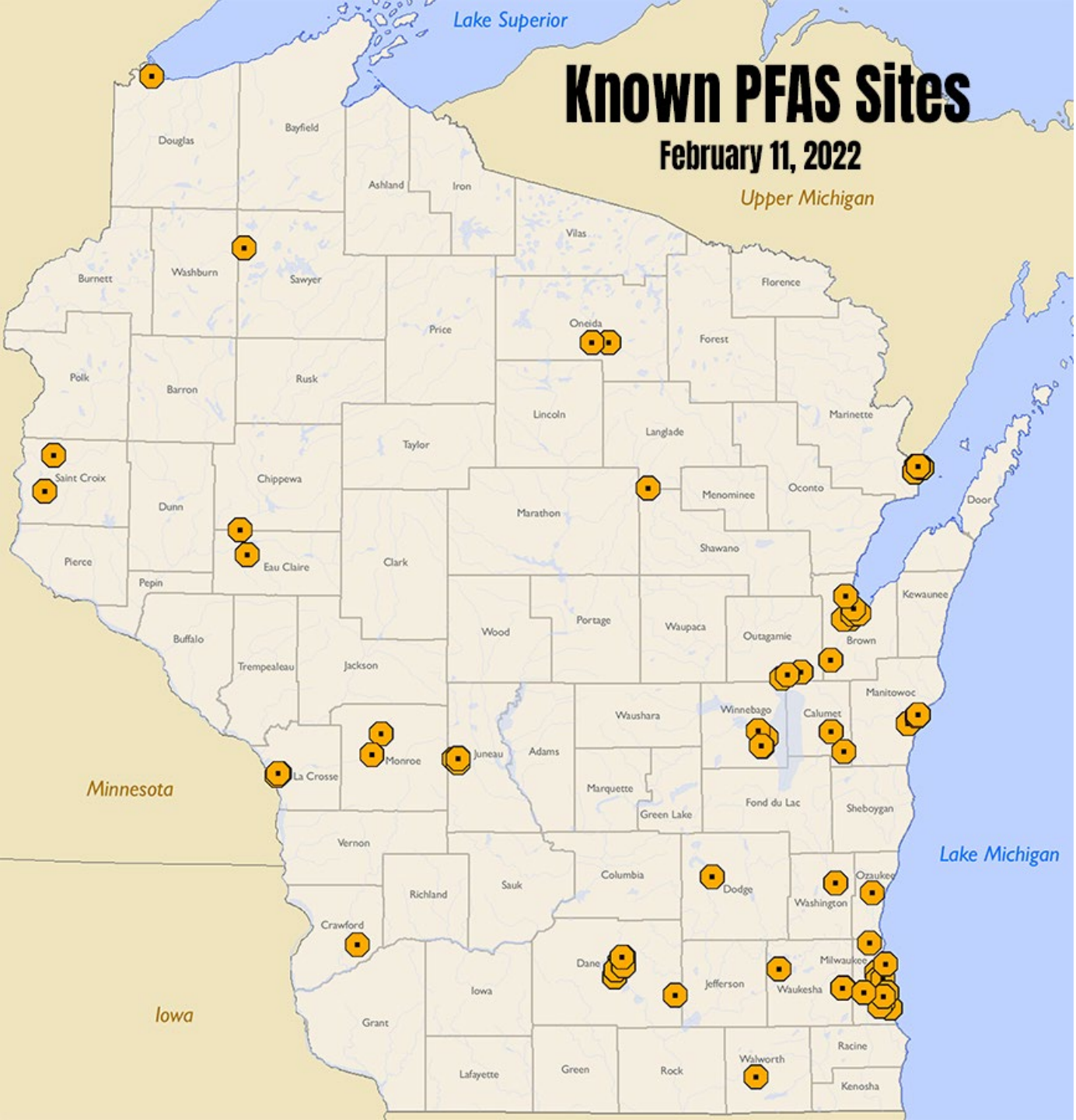
Local officials say concentrations reaching Well 15 are low enough not to require treatment, but they want the military to do more about measuring and slowing the underground flow to the well, and into Starkweather Creek and Lake Monona where they may add to health risks of eating fish.



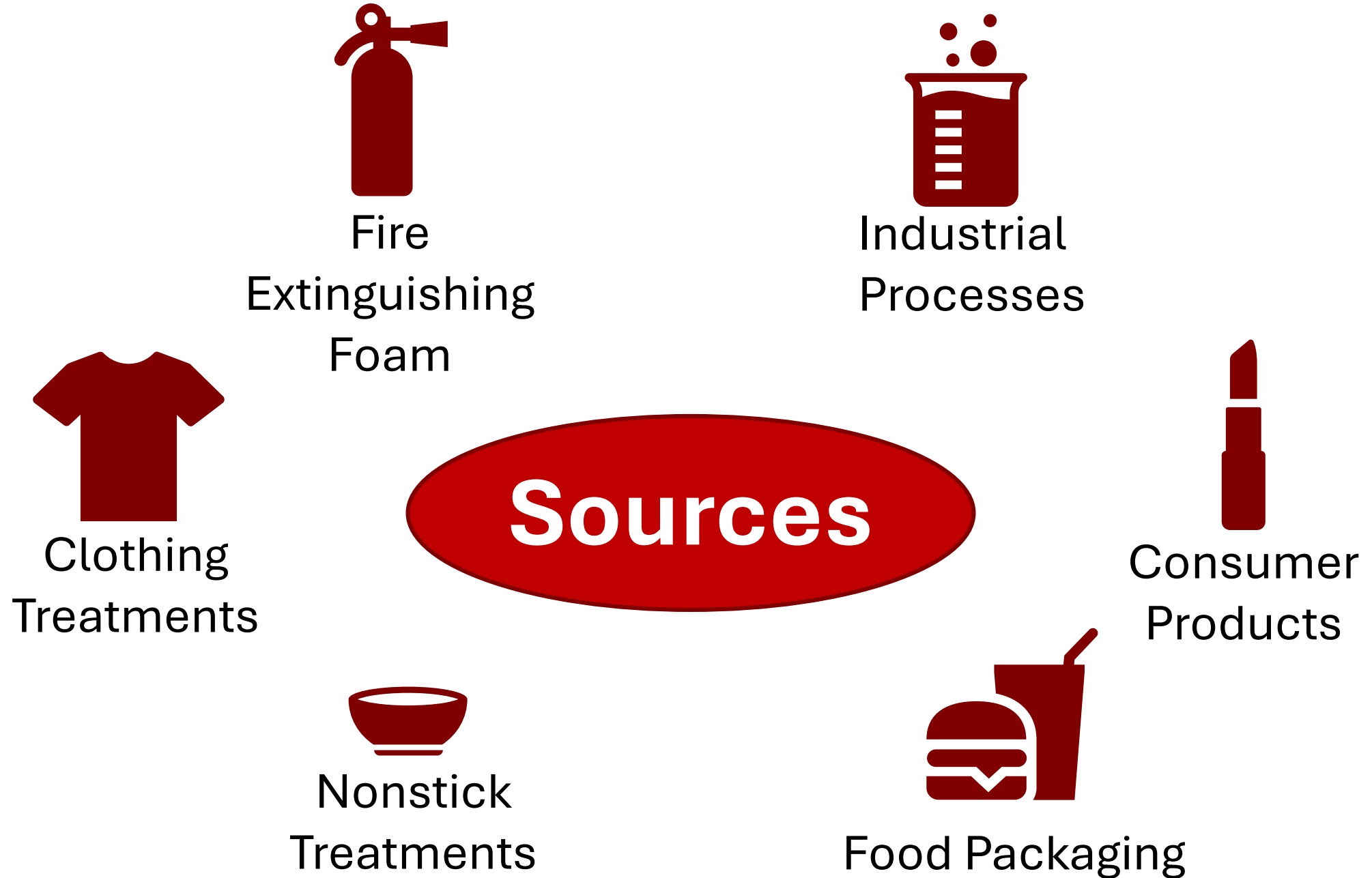
Known PFAS Sites

February 11, 2022

Upper Michigan



How does PFAS enter our water?





Drinking Water



Biosolids

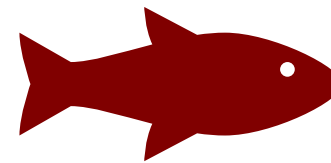
Routes of Exposure



Dust



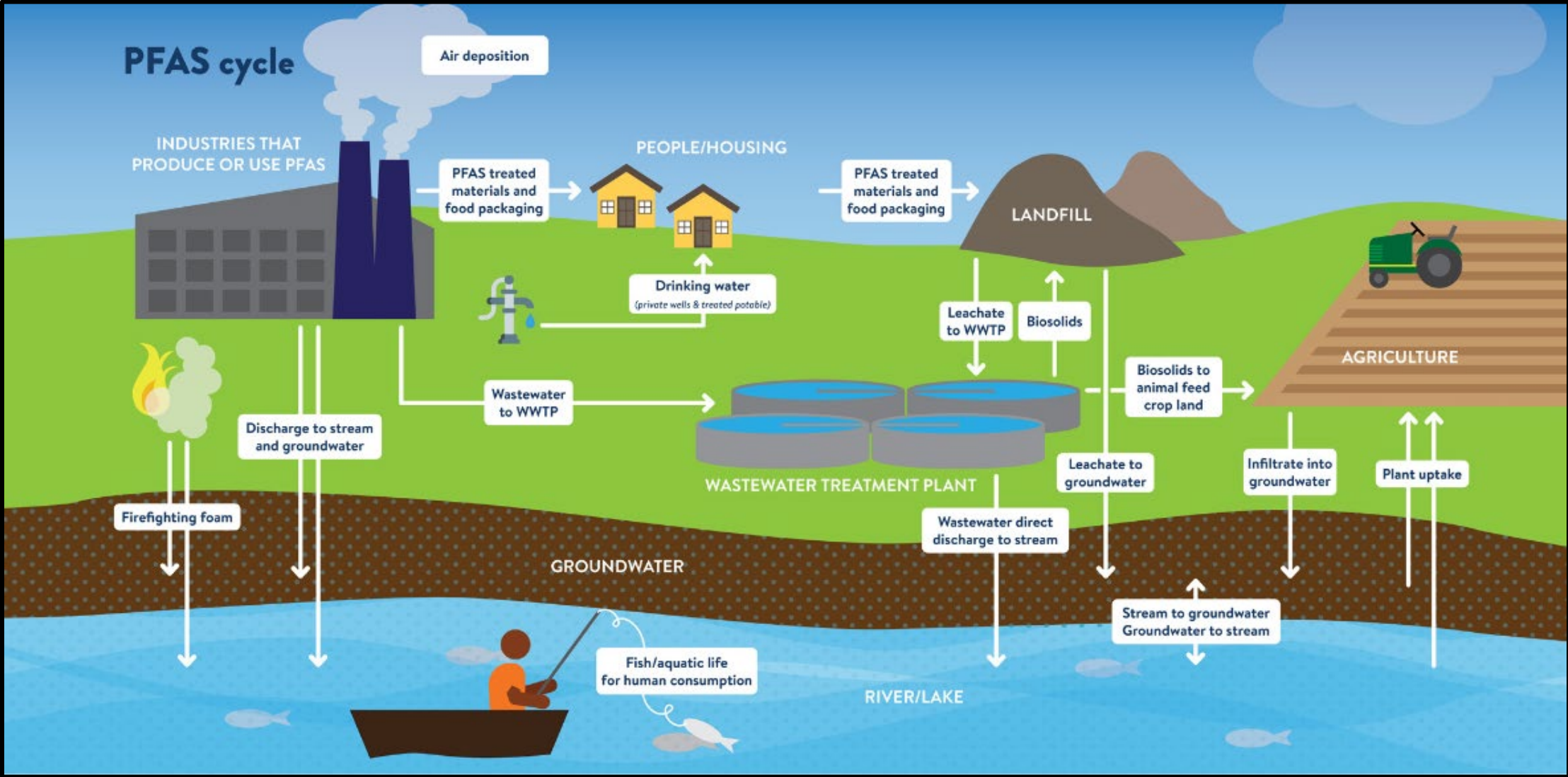
Waste Sites



Food

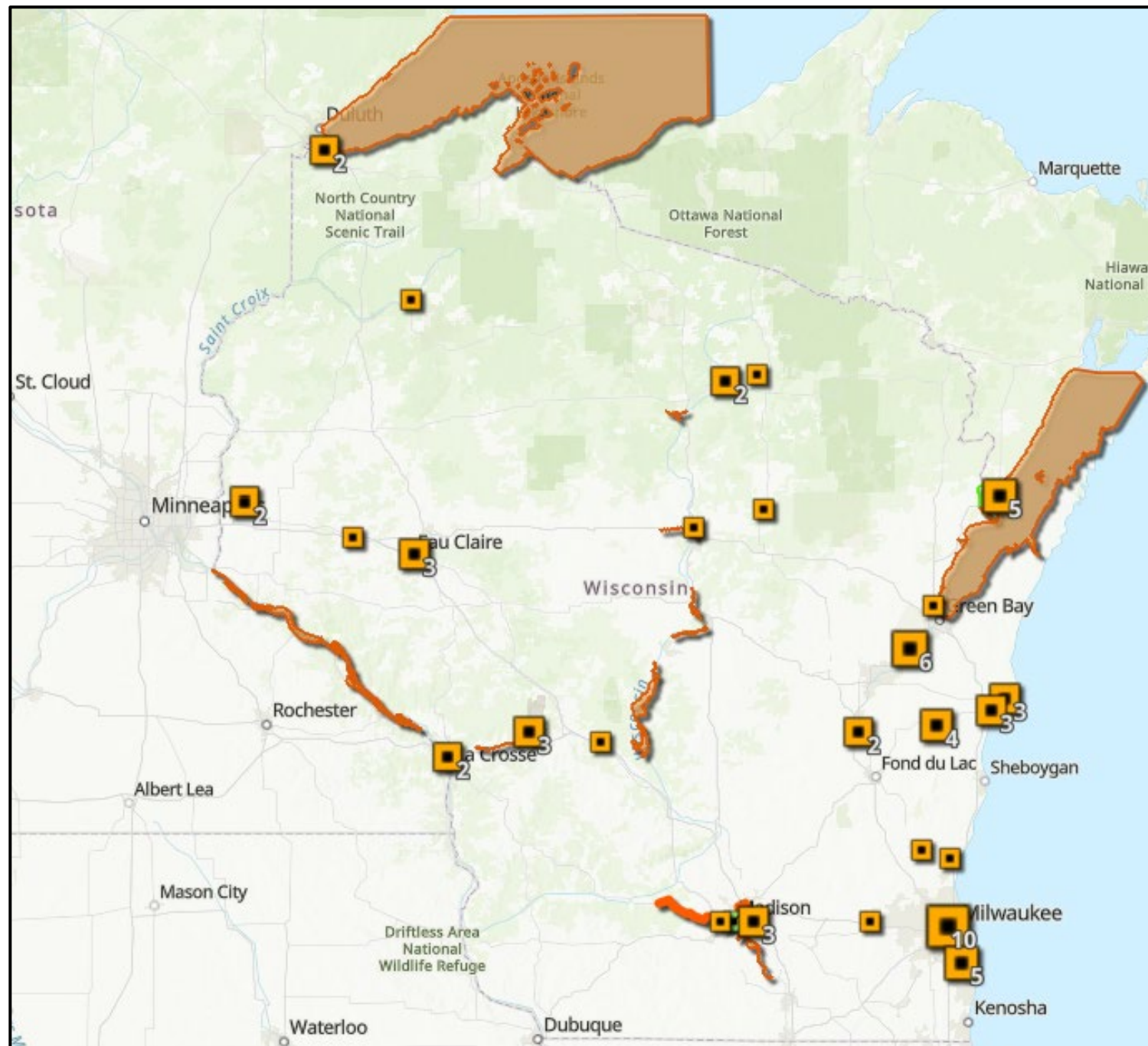
PFAS Cycle

Minnesota Pollution Control Agency 2020



Where do we find PFAS in WI

- PFAS have been found throughout the state
 - To check your area head to the [DNR's PFAS interactive Data Viewer](#)
- The only way to know where PFAS is with confidence is to test



What are our current
guidelines?

Recommended Groundwater Standards:

DONA: 3 µg/L	PFHxA: 150 µg/L	PFOA	} 20 ng/L
HPFO-DA: 300 ng/L	PFHxS: 40 ng/L	PFOS	
PFBA: 10 µg/L	PFNA: 30 ng/L	FOSA	
PFBS: 450 µg/L	PFODA: 400 µg/L	NEtFOSA	
PFDA: 300 ng/L	PFTeA: 10 µg/L	NEtFOSE	
PFDoA: 500 ng/L	PFUnA: 3 µg/L	NEtFOSAA	

µg/L = micrograms per liter = equivalent to parts per billion
 ng/L = nanograms per liter = equivalent to parts per trillion

New EPA Max Contaminant Levels



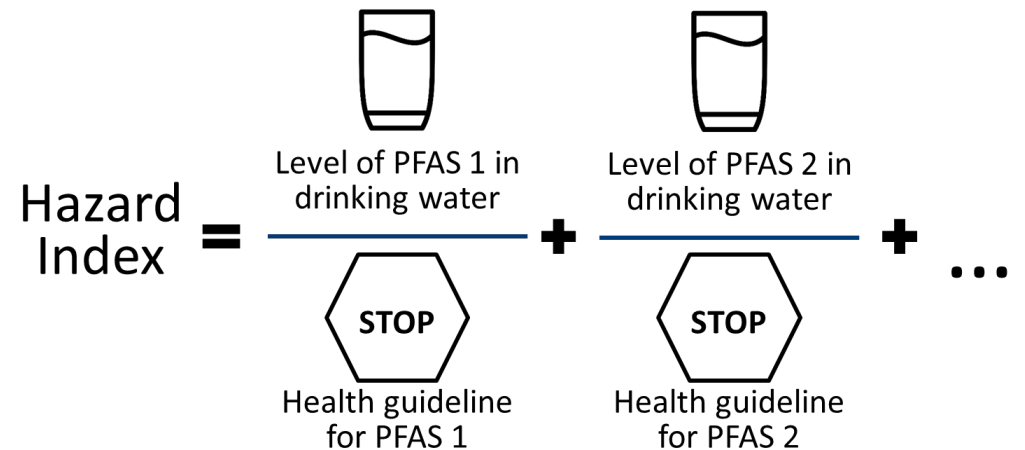
Compound	Final MCLG	Final MCL (enforceable levels)
PFOA	Zero	4.0 parts per trillion (ppt) (also expressed as ng/L)
PFOS	Zero	4.0 ppt
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
HFPO-DA (commonly known as GenX Chemicals)	10 ppt	10 ppt
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless)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

Hazard Index Approach

The hazard index approach provides a measure to evaluate the risk of specific PFAS mixtures in drinking water.

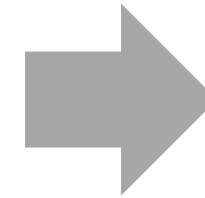
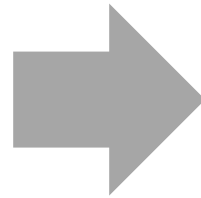
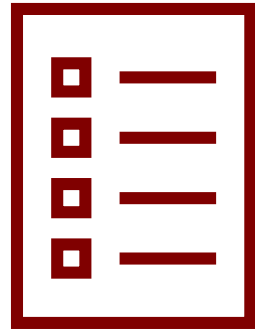
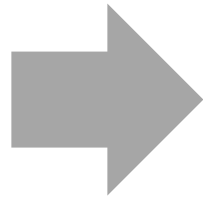
DHS explanation:

<https://www.youtube.com/watch?v=vWyQgP7F0mM>

$$\text{Hazard Index} = \frac{\text{Level of PFAS 1 in drinking water}}{\text{Health guideline for PFAS 1}} + \frac{\text{Level of PFAS 2 in drinking water}}{\text{Health guideline for PFAS 2}} + \dots$$


How can you remove PFAS from
your water?

The process for developing groundwater standards is specified in Wisconsin Statute.



State agencies identify substances that are or may be in groundwater.

DNR requests DHS review.

DHS develops recommended standards.

DNR proposes rules.

The process for developing groundwater standards is specified in Wisconsin Statute.

DNR estimates this process will take about 3 years



State
identif
that are
groundwater.

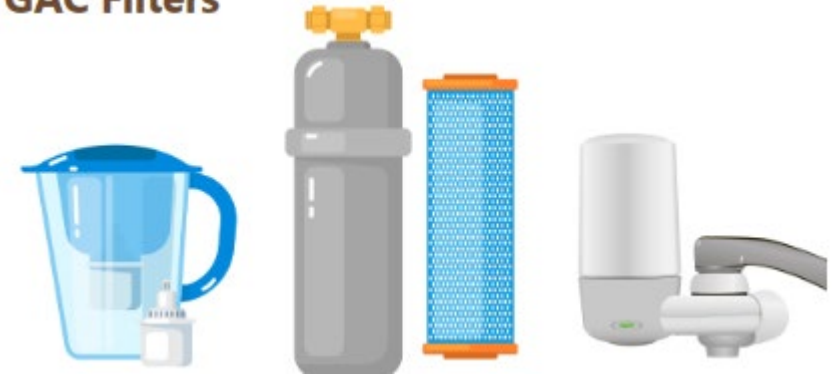
DNR
poses
ules.

How to reduce exposure?

Certified Technologies

Granulated Activated Carbon
(GAC) Filters

GAC Filters



Reverse Osmosis (RO)
Systems

RO Systems



Certified Technologies

Where to find Certified Technology:
American National Standards
Institute (ANSI)



National Sanitation Foundation
(NSF)



Other ANSI-Accredited Third-Party
Certifier

Certified Technologies



National Sanitation
Foundation



International Association
of Plumbing and
Mechanical Officials



Water Quality
Association

Certified Technologies

NSF and Other Third Party Certifiers maintain a database of certified technologies

NSF/ANSI Standards 53 and 58

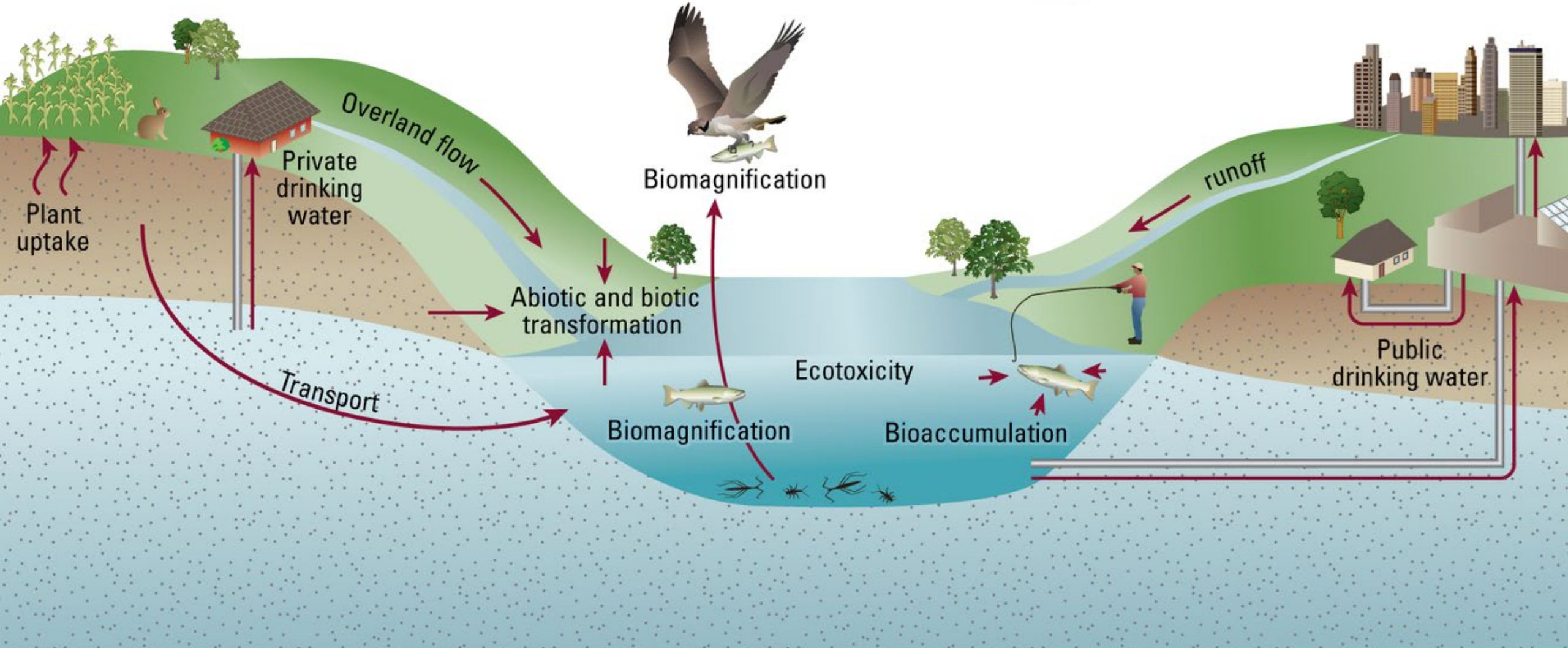
PFOS Reduction, PFOA Reduction, Total PFAS Reduction

NSF/ANSI 53: Standard for drinking water units- Health Effects. Reduce health related contaminants in drinking water

NSF/ANSI 58: Standard for reverse osmosis units

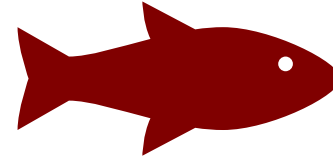
PFAS be found in plants
and animals.

Atmospheric transport
(including wet and dry deposition)

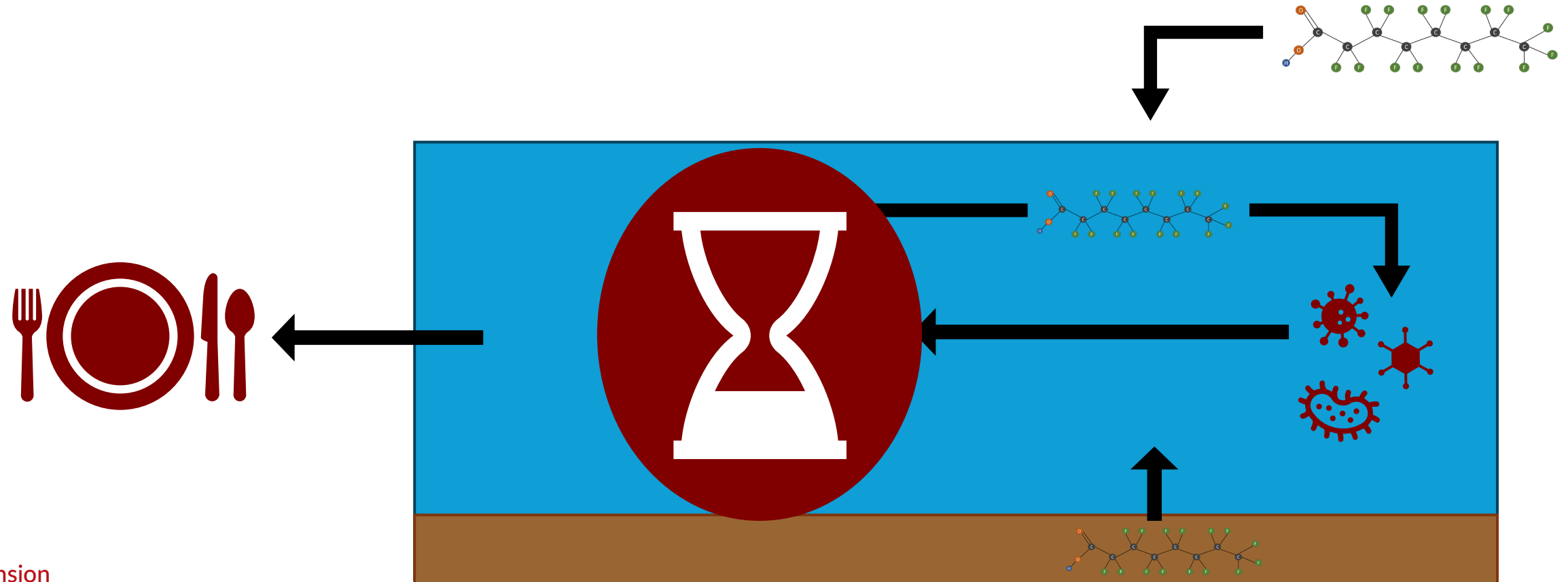




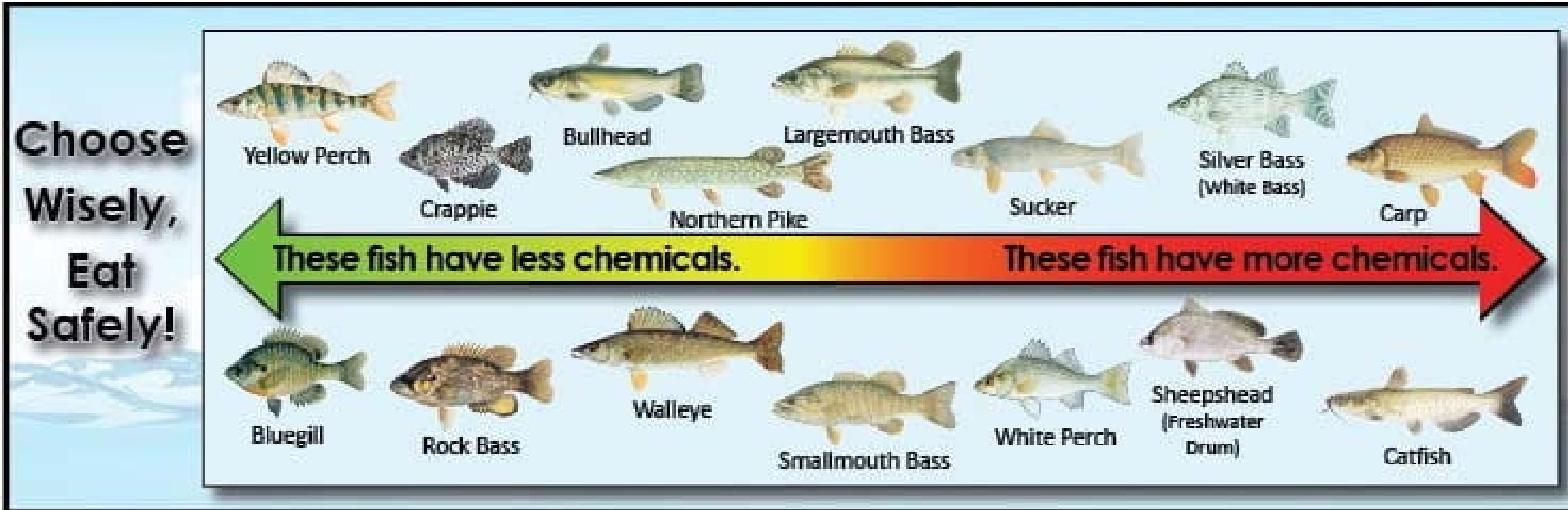
Bioaccumulation

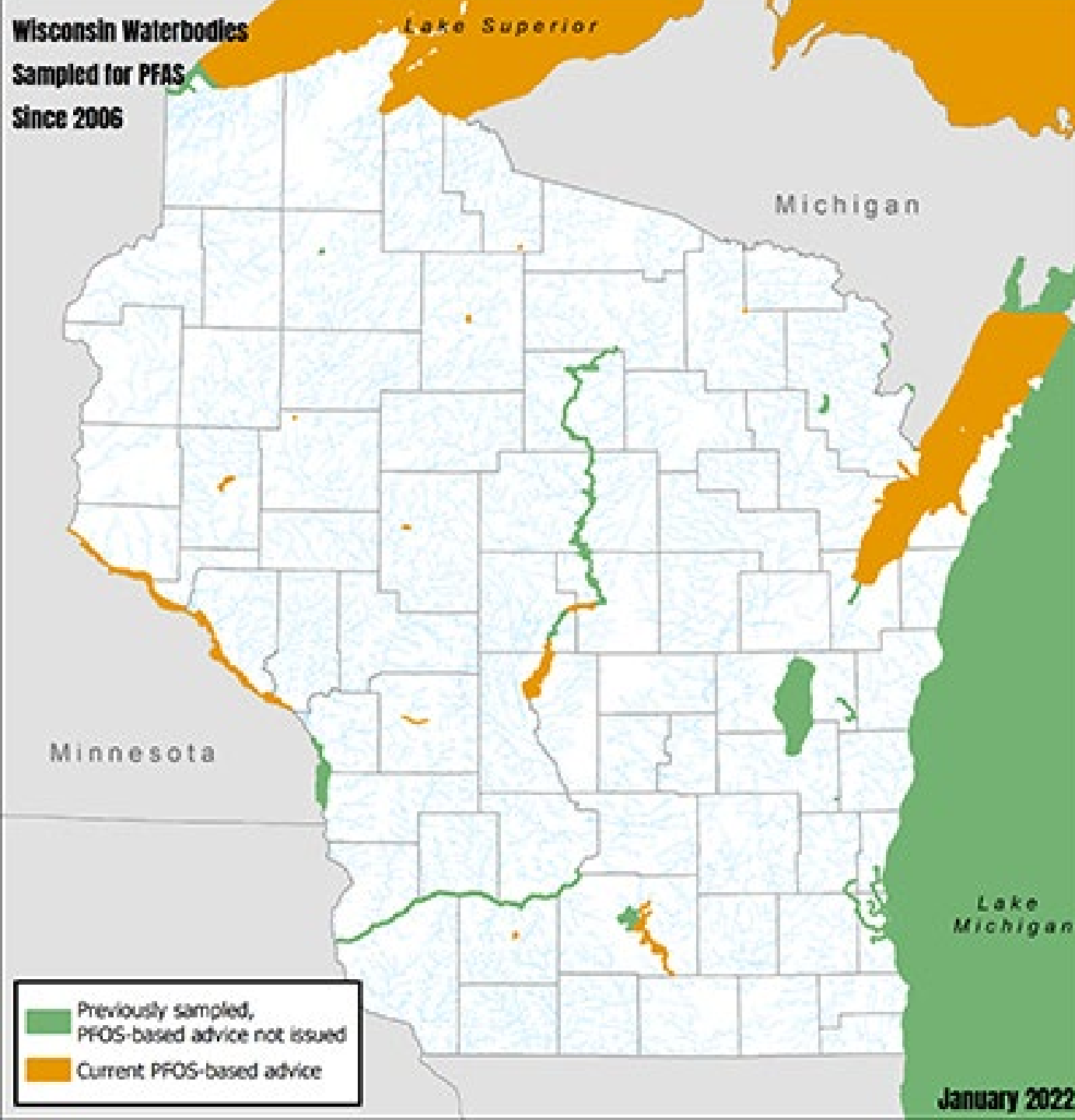


Build up of contaminants or chemicals in organisms over time.



Perfluorooctane Sulfonic Acid (PFOS) in Fish

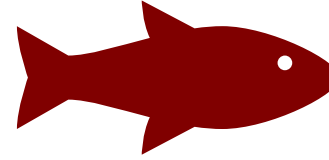




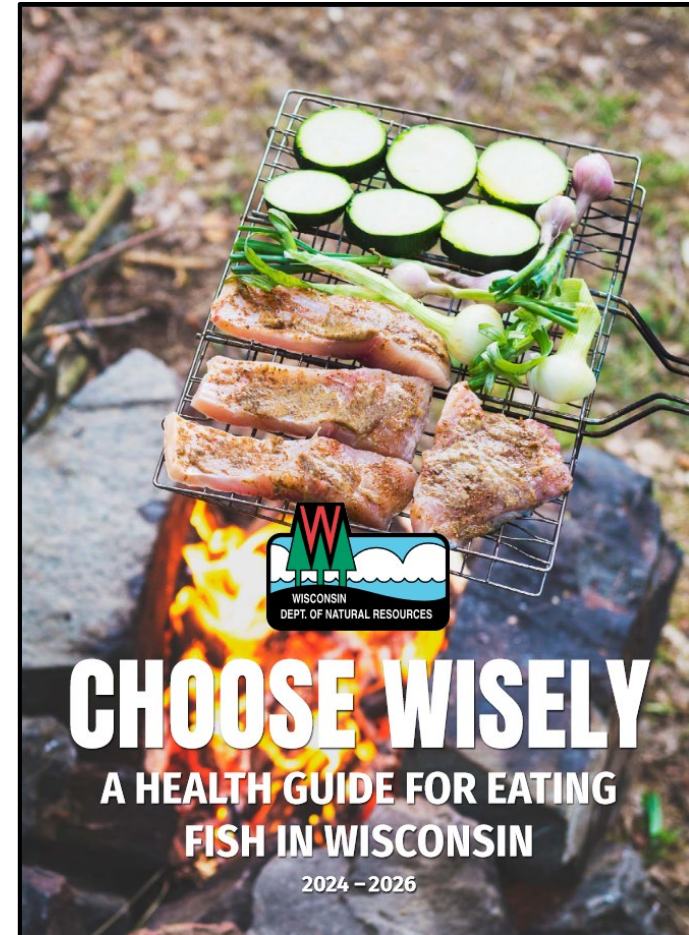
PFAS fish consumption advisories

<https://dnr.wisconsin.gov/topic/PFAS/Advisories.html>

Consumption Advisories



- Sustenance Fishing
 - DNR develops fish consumption advisories:
[https://widnr.widen.net/s/s6mkcq6t_mr/pub fh 824 choosewisely](https://widnr.widen.net/s/s6mkcq6t_mr/pub_fh_824_choosewisely)
 - Check PFAS Interactive Data Viewer
 - Check DNR Fish Consumption Advisory Query Tool:
<https://apps.dnr.wi.gov/fishconsumptionadvisoryquery/>



PFAS deer liver advisories

WPR



A hunter walks through the woods on the first day of regular firearms deer hunting season in most of Pennsylvania, Monday, Nov. 26, 2018, in Zelenople, Pennsylvania. *Keith Srakocic/AP Photo*

'Do Not Eat' Advisory Issued For Deer Liver Due To PFAS Contamination

Manmade Chemicals Linked To Some Cancers Found Near Marinette Firefighting Foam Manufacturer

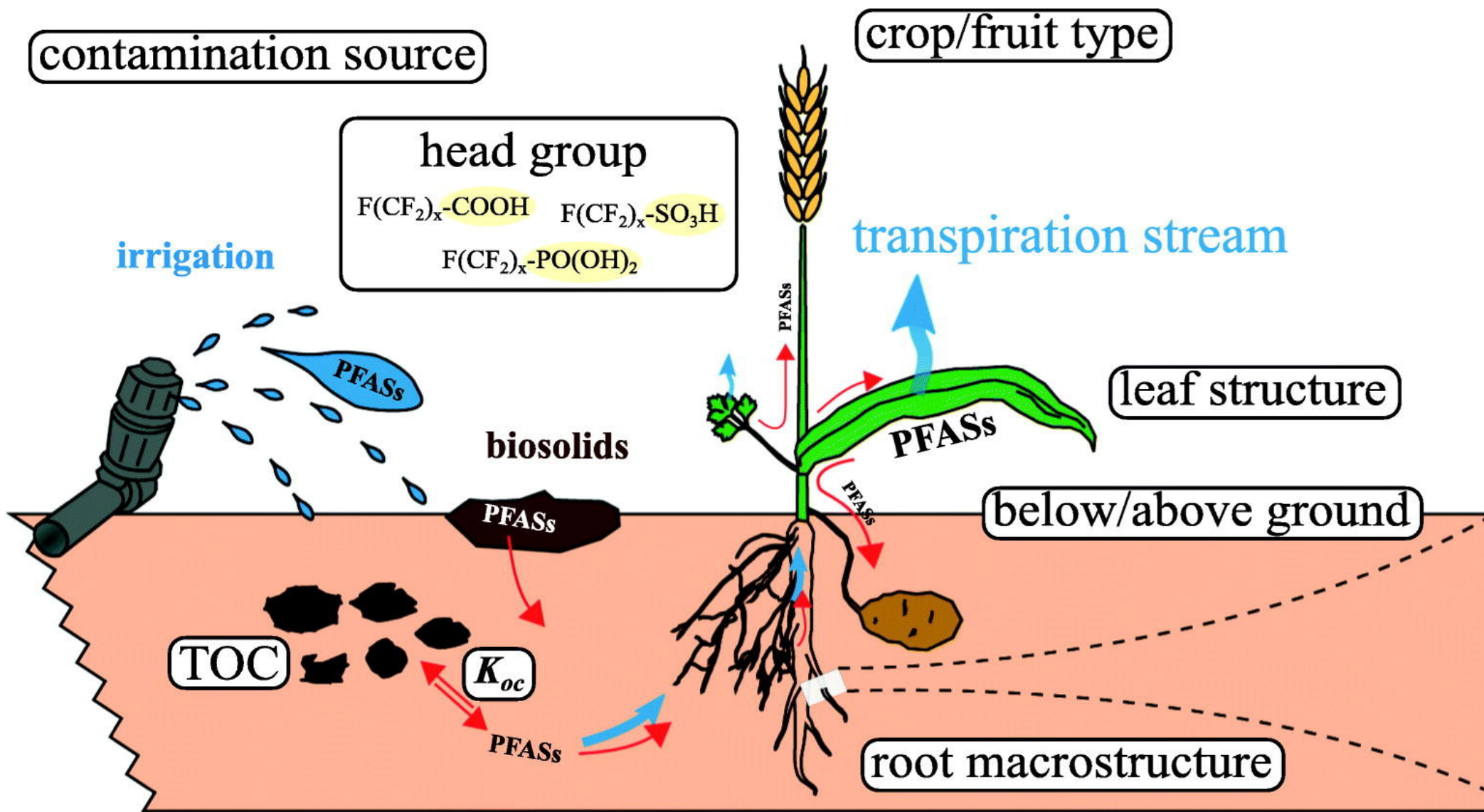
By Shamane Mills

Published: Tuesday, September 15, 2020, 12:55pm

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So-called forever chemicals found in nonstick cookware and firefighting foam have been detected in deer near the Tyco Fire Technology Center in Marinette.

Monday the Wisconsin Department of Natural Resources and state Department of Health



Your exposure to PFAS
can be reduced.

Test your drinking water

In home water treatments

- Reverse Osmosis
- Granulated Activated Carbon



**Reduce your
use of products
that contain
PFAS**

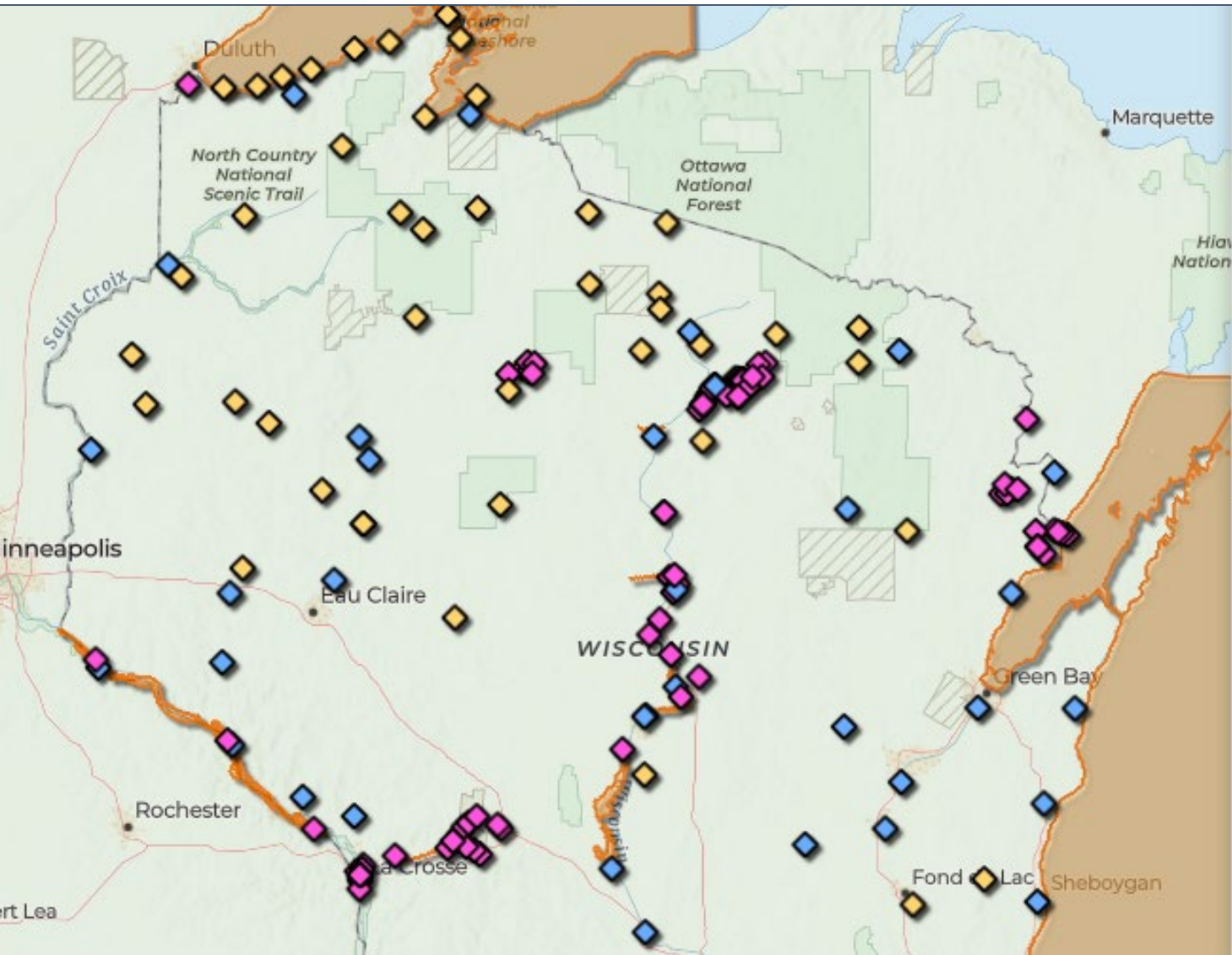


Follow consumption guidelines

E.g., Fish consumption Guidelines



Wisconsin PFAS Interactive Data Viewer



PFAS Sampling Info

Surface Water and Fish Tissue Sampling

- Yellow diamond: Background Monitoring - Lakes
- Blue diamond: Background Monitoring - Major Rivers
- Pink diamond: Targeted Monitoring



PFAS-Based Consumption Advice

Fish Advisory - River/Waterbody Area



Fish Advisory - Stream/River Line



Actions People can take

- Vacuuming carpets and limiting dust 
- Safe swimming practices: 
<https://www.dhs.wisconsin.gov/water/healthy-swimming.htm>
- Safe gardening practices: 
<https://www.dhs.wisconsin.gov/publications/p03111.pdf>
- Checking DNR consumption advisories: 
<https://apps.dnr.wi.gov/fishconsumptionadvisoryquery/>

Resources



- **EPA:** Drinking Water Infrastructure Grants- Tribal Set-Aside Program:
<https://www.epa.gov/tribaldrinkingwater/drinking-water-infrastructure-grants-tribal-set-aside-program>
- **EPA:** Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) Tribal Grant Program: <https://www.epa.gov/tribaldrinkingwater/emerging-contaminants-small-or-disadvantaged-communities-ec-sdc-tribal-grant>
- **EPA:** Tribal Public Water System Supervision Program:
<https://www.epa.gov/tribaldrinkingwater/tribal-public-water-system-supervision-program>
- **National Tribal Water Council:** Tribal PFAS Working Group:
<http://www7.nau.edu/itep/main/ntwc/Issues/PFAS> or Facebook Page:
<https://www.facebook.com/TribalPFASWorkGroup>

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