



Minnesota State Agency Panel Discussion

MPCA ISW PFAS Monitoring Plan

04.05.2022

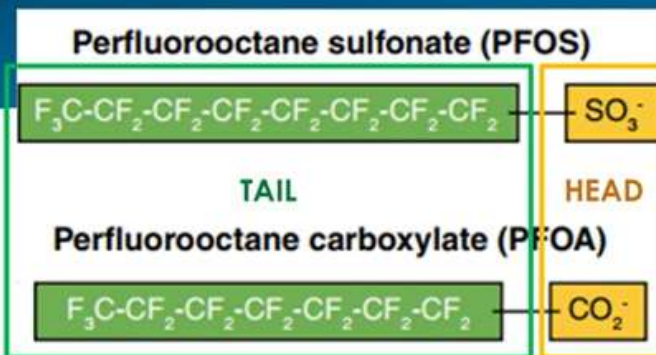
Presentation Overview

- PFAS 101
- PFAS Uses
- Why Should we Do Something
- Where did this PFAS Plan originate from
- What's in the Plan
- What should I do now
- Can we Make a Difference
- Questions/Comments



Some PFAS Basics

- ▶ Per = fully fluorinated
- ▶ Poly = partially fluorinated
- ▶ Carbon – fluorine bond extremely strong
- ▶ Length of carbon chain & functional group in large part regulates the behavior of PFAS in the environment
 - ▶ Longer chain and sulfonates – relatively less soluble, relatively better sorbed, more likely to accumulate in animals
 - ▶ Shorter chain and carboxylates – relatively more soluble, relatively less well sorbed, more likely to accumulate in plants



PFAS TRAINING SERIES



Virginia Yingling
MN Dept. of Health

- Fishing Line
- Ski wax
- Body lotion
- Body oil
- Foundation
- Concealer
- Blush
- Eye cream
- Conditioners
- Anti-aging cream
- Mascara
- Bars of Soap
- Shampoo
- Lip balm
- Lipstick
- Shaving Cream
- Sunscreen
- On and on and on...

What Is a Floating Fly Line?

There are no guessing games with floating fly line. It does exactly what the name implies. The line floats on top of the water and is regarded as the **best dry fly** fishing line.



Some of the better floating lines will also have a coating on them to help them slide through the guides more easily, which makes for better casting. It also keeps debris and other materials off your line, letting them float better in tough water.

Why should we Do Something?

- Protect human health & the environment

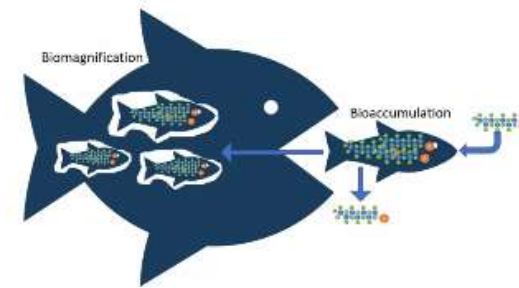
- 19 waterbodies have PFOS fish consumption restrictions:

- **“Do Not Eat”** fish consumption guideline for all species & sizes due to PFOS:

- Lakes: Lake Elmo, Horseshoe, Eagle Point, Rest Area Pond, Tartan Pond, West Lakeland Ponds (East Metro)
 - Rivers: Mississippi River (Pool 2)

- Reduced consumption (e.g. 1 meal/month):

- Lakes: Lake Bde Maka Ska (fka Calhoun), Cedar, Crystal, Gervais, Harriet, Johanna, Keller, Rebecca, Tanners (Metro Lakes), Fish Lake Flowage & Wild Rice (St. Louis County)
 - Rivers: Mississippi River (Pool 2), Raleigh Creek



Drinking water



Fishing



Eating game



Consuming other foods

Why should we Do Something?

- The largest U.S. general population biomonitoring studies are from the National Health and Nutrition Examination Survey (NHANES). A nationally representative survey conducted by the Centers for Disease Control and Prevention (CDC), began monitoring for PFAS in 1999–2000.

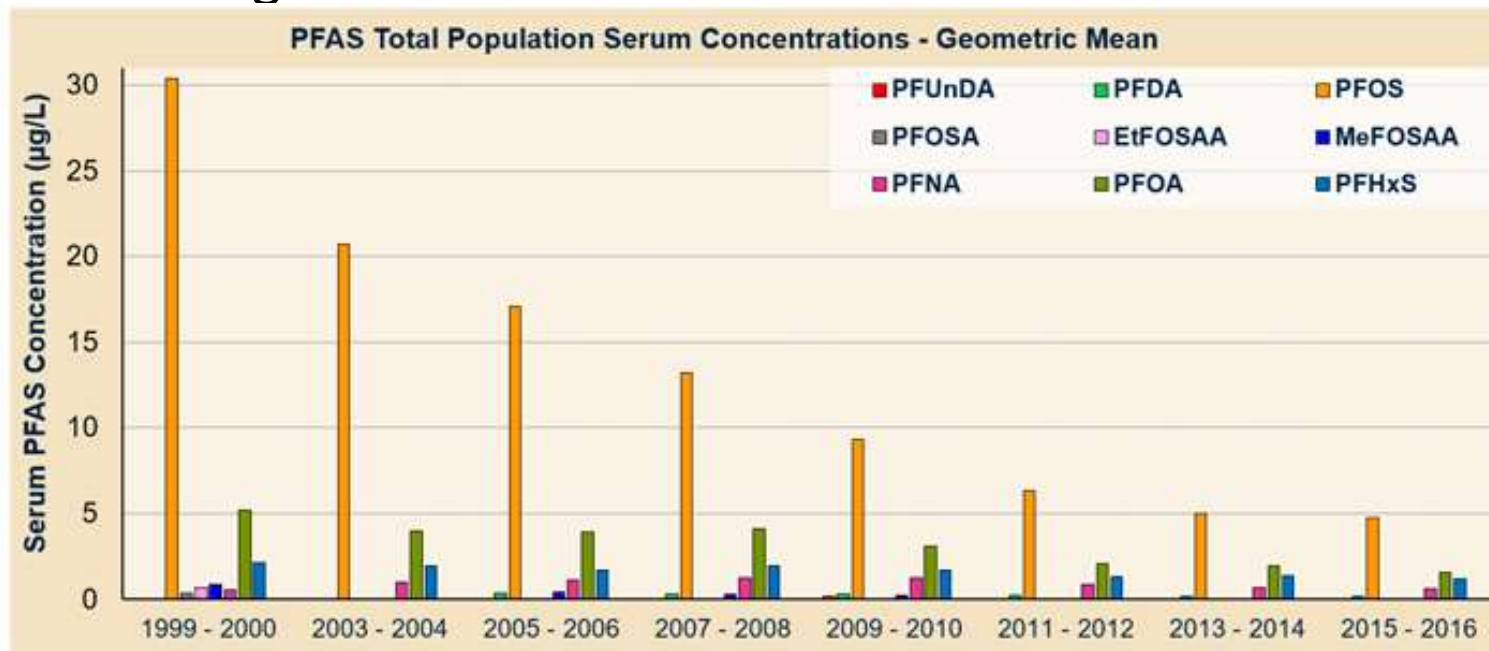


Figure 7-2. Geometric mean serum concentrations (ng/ml) of selected PFAAs (NHANES, 1999-2016).

Why should we Do Something?

PFAS Health Concerns

- Lowering a woman's chance of becoming pregnant
- Increasing the chance of high blood pressure in pregnant women
- Increasing chance of thyroid disease
- Increasing cholesterol levels
- Changing immune response
- Increasing chance of cancer (kidney, testicular)



Why should we Do Something? Drinking Water

MPRnews Sections ▾ Members ▾ More ▾



ON AIR 0:00
On Point with Meghna Chakrabarti

'Forever' chemicals leave costly water problem in Bemidji, cities across the country

Kirsti Marohn February 14, 2019 10:00 a.m.



The city discovered elevated levels of PFAS in its wells in 2016. It's believed that the source of the contamination was firefighting foam used during training at the regional airport, which is located near the wells.

The city started the first phase of the \$16 million project last year, and it's expected to be online within the next couple of weeks, Mathews said. It will use granular activated carbon to capture and remove PFAS from the water supply.

Construction on the second phase, which will allow the city to treat more water, will start this summer or fall and take about two years to construct.

Bemidji also received about \$10.1 million state bonding money last year for the project.

Why should we Do Something? Eating Fish

- Protect human health & the environment

Table 4. PFOS fish consumption advisory levels.

Level of PFOS in fish fillet (ppb)	Meal frequency
<= 10	Unrestricted
>10-20	2 meals/week
>20-50	1 meal/week
>50-200	1 meal/month
>200	DO NOT EAT

RABBIT (EAST PORTION), Crow Wing County, DOWID: 18-0093-01

Species	1 meal / month	Do Not Eat	Contaminants
Northern Pike	-	30" or longer	Mercury

BDE MAKA SKA, Hennepin County, DOWID: 27-0031-00

Species	1 meal / month	Do Not Eat	Contaminants
Crappie	All sizes	-	PFOS
Sunfish	All sizes	-	PFOS

ELMO, Washington County, DOWID: 82-0106-00

Species	1 meal / month	Do Not Eat	Contaminants
all species	-	All sizes	Mercury PFOS

Why should we Do Something? Eating Fish

- Protect human health & the environment



Why should we Do Something? Eating Fish

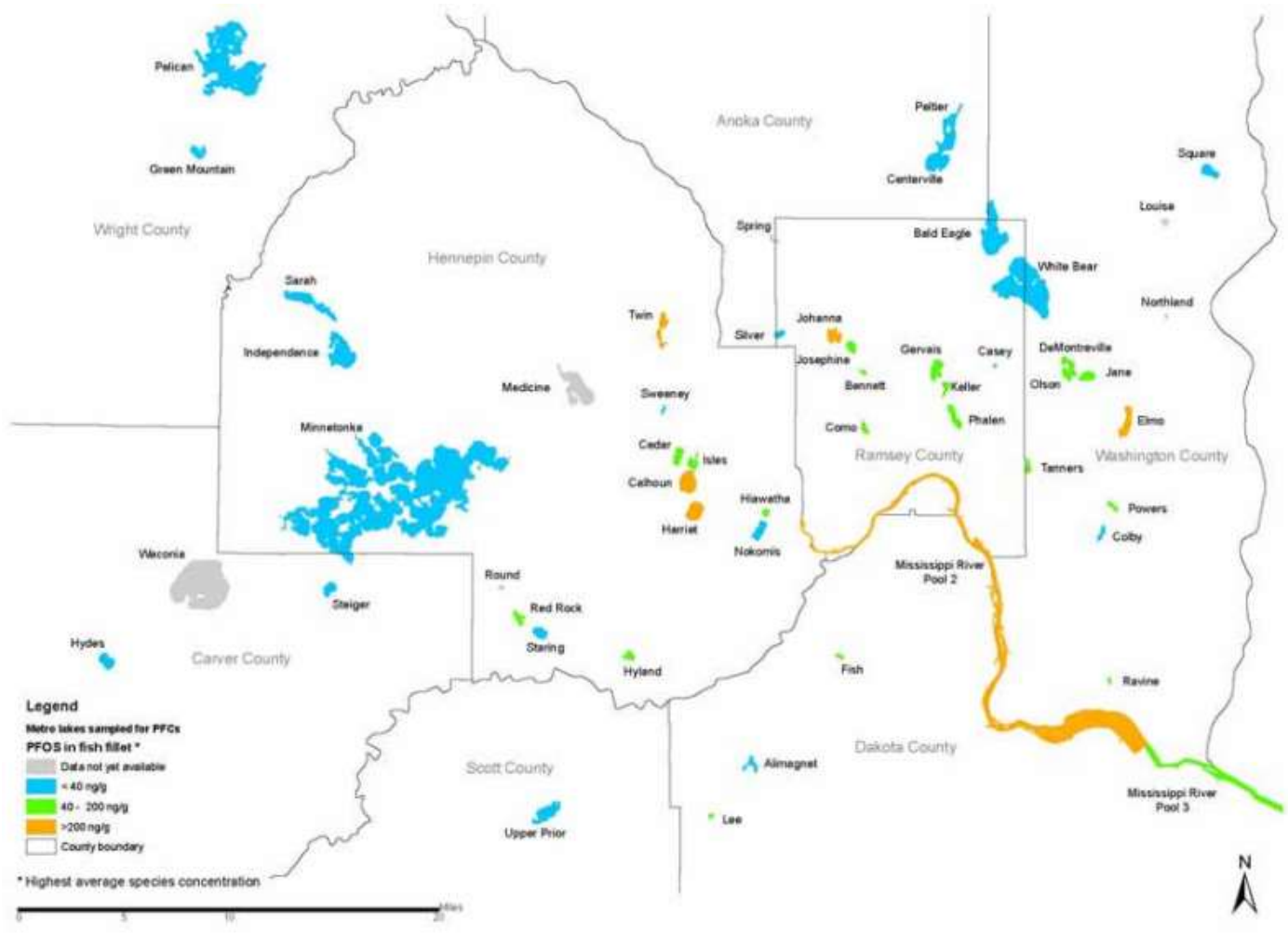




Figure 2. Fish Tissue Sampling Results for Twin Cities' Area Lakes (2006 - 2008).

Why should we Do Something? Eating Fish

[RECREATION](#) [DESTINATIONS](#) [NATURE](#) [EDUCATION & SAFETY](#) [LICENSES, PERMITS & REGULATIONS](#) [EVENTS & SEASONS](#) [ABOUT DNR](#)

[Home](#) > [Area offices](#) > [Fisheries](#) > [East Metro](#) > [Fishing lakes](#) >

East Metro area fisheries

- [Stocking](#)
- [Surveys](#)
- [Lake & stream info / Where to fish](#)
- Fishing**
 - [Main page](#)
 - [Seasons](#)
 - [Regulations](#)
 - [Tournaments](#)
 - [Licenses](#)
 - [Fish consumption advisory](#)
 - [Fish diseases](#)
 - [Fishing Education](#)
 - [Fishing in the Neighborhood \(FiN\)](#)
 - [LakeFinder](#)
 - [Turn in poachers \(TIP\)](#)
 - [Accessible outdoors](#)

Lake Elmo

Location:
Lake Elmo is located in the city of Lake Elmo.

Fish Consumption Advisory:
Minnesota Department of Health has issued a Do Not Eat fish consumption advisory for Lake Elmo due to PFOS concentrations. The following link has more information: [PFOS Information](#)

Species Present:
Northern Pike: higher than average abundance, average size but some larger individuals present.
Tiger Muskie: low abundance, average or above average size. The state record Tiger Muskie was caught in Lake Elmo (34 pounds 12 ounces).
Largemouth Bass: average abundance, average size but some larger bass present.
Bluegill: average abundance, small size.
Crappie: low abundance, larger than average size.
Trout: average abundance, large size.
Tullibee: average abundance, average size.

Boat Access:
The boat access is located within Lake Elmo Regional Park Reserve (entrance fee required). Travel east on I-94 and exit on Woodbury Drive (County Road 19). Turn left (north) to the park entrance. Follow park signs to the boat access.

Shore Fishing:
There is a fishing pier located within the regional park. Follow signs in the park. Additional shore angling is available adjacent to the boat launch area. Ambitious anglers may fish from shore anywhere in the regional park, but some areas will require lengthy hikes to access. Shore angling may be limited by overhanging trees and very clear water. Lake Elmo drops off to deep water very close to shore along most of the park shoreline.

Why should we Do Something? Eating Fish

- October, 2021 Alexandria Fish Removal:



A crew of fishermen extracted more than 26,000 pounds of invasive carp from Lake Winona on Oct. 19 which are slated for food markets on the East Coast. Separately, on Nov. 8, Minnesota announced it had found a cancer-causing chemical in fish from Lake Winona. (Echo Press file photo)

Beyond Lake Superior: High PFAS found in rainbow smelt across Michigan

Updated: Mar. 28, 2022, 8:06 a.m. | Published: Mar. 28, 2022, 8:05 a.m.



Rainbow smelt caught through the ice on Higgins Lake near Roscommon, Mich. The silvery fish are targeted by hook-and-line anglers using green lights below the ice. (Courtesy | Brandon Armstrong, Michigan EGLE).

Why should we Do Something? Eating Deer

- Protect human health & the environment

DNR AND DHS ISSUE DO NOT EAT ADVISORY FOR DEER LIVER IN FIVE-MILE AREA SURROUNDING JCI/TYCO SITE IN MARINETTE



THE DEPARTMENT OF NATURAL RESOURCES

THINGS TO DO

PLACES TO GO

BUY & APPLY

EDUCATION & SAFETY

MANAGING YOUR RESOURCES

ABOUT US

DNR

'Do Not Eat' Advisory Issued for Deer Taken within five miles of Clark's Marsh, Oscoda Township

MDHHS Contact: Angela Minicuci, 517-241-2112
DNR Contact: Tammy Newcomb, 517-284-5832

The Michigan departments of Health and Human Services (MDHHS) and Natural Resources (DNR) today issued a 'Do Not Eat' advisory for deer taken within approximately five miles of Clark's Marsh in Oscoda Township. The advisory is due to high levels of PFOS (perfluorooctane sulfonic acid) found in a single deer taken about two miles from Clark's Marsh, which borders the former Wurtsmith Air Force Base. PFOS is one type of PFAS (per- and polyfluoroalkyl substances) chemical.

One deer out of twenty tested around the former Wurtsmith Air Force Base was found to have high levels of PFOS. The level of PFOS in the muscle of the deer was 547 parts per billion, exceeding the level of 300 ppb at which action is recommended. PFAS was either not found or was at low levels in muscle samples from the other 19 deer. Although only one deer of this group tested at such high levels, the advisory was issued to protect the health of anyone eating venison taken within approximately five miles of Clark's Marsh. The state has plans to test more deer from this area.

Following DNR findings of PFAS in deer liver in Marinette, Peshigo and surrounding communities, DHS has issued an advisory against the consumption of deer liver from animals harvested within five-mile radius of JCI/Tyco Fire Technology Center.

Photo credit: Wisconsin DNR

Why should we Do Something? Eating Deer

- Protect human health & the environment



What is the "Do Not Eat" advisory?

On November 23, 2021, the Maine Department of Inland Fisheries and Wildlife (MDIFW) and the Maine Center for Disease Control and Prevention (MECDC) issued a "Do Not Eat" advisory for deer taken in the greater Fairfield area. A "Do Not Eat" advisory is a recommendation to not eat game harvested within a specified area issued in response to a possible health concern.

[Back to top](#)

Why was the advisory issued?

The "Do Not Eat" advisory was issued due to high levels of the chemical PFOS (perfluorooctane sulfonic acid) found in five of eight deer collected near Ohio Hill Road close to fields known to have high PFOS soil levels and high PFOS surface water levels. In deer from the Ohio Hill area, PFOS levels in meat were approximately 40 parts per billion. PFOS levels were similar in a fawn, yearling, and adult animal. These levels of PFOS in meat are high enough to warrant a recommendation to eat less than 2 to 3 meals per year.

PFOS levels were much lower in three other adult deer collected in different areas of Fairfield close to fields known to have PFOS in soil. Levels in these three deer were still high enough to recommend limits on eating meat. Out of an abundance of caution and because we currently only have test results on eight deer, the decision was made to extend a "Do Not Eat" advisory to all of the Fairfield area until additional sampling of deer for PFOS contamination is possible.

Navigation menu with dropdowns: Hunting & Boating, Fishing & Boating, ATV & Snowmobile, Fish & Wildlife, Game Wardens, Maine Wildlife Park, Programs & Resources, News & Events.

Breadcrumbs: [Home](#) → [Hunting Resources](#) → Deer Consumption Advisory

- ules
- Rules
- s
- doors on
- s
- on
- in
- ead
- ent Areas

Deer Consumption Advisory

Maine Department of Inland Fisheries and Wildlife, in conjunction with the Maine Center for Disease Control and Prevention (Maine CDC), has detected high levels of PFAS in some deer harvested in the greater Fairfield area and is issuing a do not eat advisory for deer harvested in the area.

On this page:

- [What is the "Do Not Eat" advisory?](#)
- [Why was the advisory issued?](#)
- [What are PFOS and PFAS?](#)
- [Where is the area from which we should avoid eating deer?](#)
- [Why such a large advisory area?](#)
- [What parts of the deer are safe for me to eat?](#)
- [Can't I just cook it to get rid of the PFAS or trim away the fat?](#)



Why should we Do Something? EPA



Search EPA.gov

Environmental Topics ▾

Laws & Regulations ▾

Report a Violation ▾

About EPA ▾

News Releases: [Headquarters](#) | [Headquarters](#) | [Water \(OW\)](#)

New Interim Strategy Will Address PFAS Through Certain EPA-Issued Wastewater Permits

November 30, 2020

- Strategy advises EPA permit writers to consider including PFAS monitoring at facilities where these chemicals are expected to be present in wastewater discharges, including from municipal separate storm sewer systems and industrial stormwater permits.

PFAS Monitoring Plan Origins

- February, 2021:

Minnesota Pollution Control Agency - PFAS Meeting



Minnesota's PFAS Blueprint supports a holistic and systematic approach to address PFAS that focuses on preventing and managing PFAS contamination and cleaning up contaminated sites.

Goal of Effort/Plan:

- Protect human health & the environment
 - Pollutants in industrial storm water may contaminate waters of the state and impair the use of groundwater and/or of surface water as a source of drinking water, irrigation water and/or as a fishery.



February 2021

Minnesota's PFAS Blueprint

A plan to protect our communities and our environment from per- and polyfluorinated alkyl substances



m1 MINNESOTA



DRAFT Monitoring Plan – November, 2021

1. Facilities of Concern

- North American Industry Classification System (NAICS) codes – Appendix F.
- Avoid duplication of multiple programs with one industry sector/facility type.

Appendix F – List of NAICS codes associated with potential PFAS use or release

NAICS	NAICS title
221310	Water Treatment Plants (wastewater)
313110	Textile goods, Not Elsewhere Classified
313210	Broadwoven Fabric Mills, Manmade Fiber and Silk
313230	Non-woven Fabrics
313310	Finishers of Broadwoven Fabrics of Manmade Fiber and Silk
313320	Coated Fabrics, Not Rubberized
314110	Carpets and Rugs
314999	Waterproof Outerwear
314999	House furnishings, Except Curtains and Draperies
316110	Leather & Hide Tanning & Finishing
316998	All Other Leather Good & Allied Product Mfg
322121	Paper Mills



DRAFT Monitoring Plan – Public Comment Form

[Air](#) ▾

[Water](#) ▾

[Waste](#) ▾

[Regulations](#) ▾

[Living Green](#) ▾

[Data](#) ▾

[About the MPCA](#) ▾

[Waste](#) / [Cleanup](#) / [PFAS pollution](#) / [What is Minnesota doing about PFAS?](#)

MPCA PFAS monitoring plan

The MPCA began working with stakeholders in June 2021 to build a draft PFAS monitoring plan. This plan encompasses a number of projects identified as near-term priorities in [Minnesota's PFAS Blueprint](#).

The draft PFAS monitoring plan lays out a path forward for PFAS monitoring at solid waste, wastewater, and stormwater facilities, hazardous waste landfills, facilities with air emissions, and sites in the Brownfield or Superfund programs. The draft plan does not establish facility-specific requirements, but outlines how the MPCA plans to prioritize locations for PFAS monitoring and what the monitoring will entail.

MPCA is accepting input on the draft plan from all interested parties from November 16 to December 20, 2021.

- [Draft PFAS monitoring plan \(p-gen1-22b\)](#)
- [PFAS monitoring plan comment form](#)

PFAS Monitoring Plan Origins



PFAS Blueprint: 1 Year Later + Monitoring Plan



PFAS Monitoring Plan

PFAS planning

March 2022

PFAS Monitoring Plan

A path forward for PFAS monitoring at solid waste, wastewater, and stormwater facilities, hazardous waste landfills, facilities with air emissions, and sites in the Brownfield or Superfund programs.

3 Main Goals:

Gather Minnesota-specific information



Drinking water

Identify urgent PFAS contamination areas

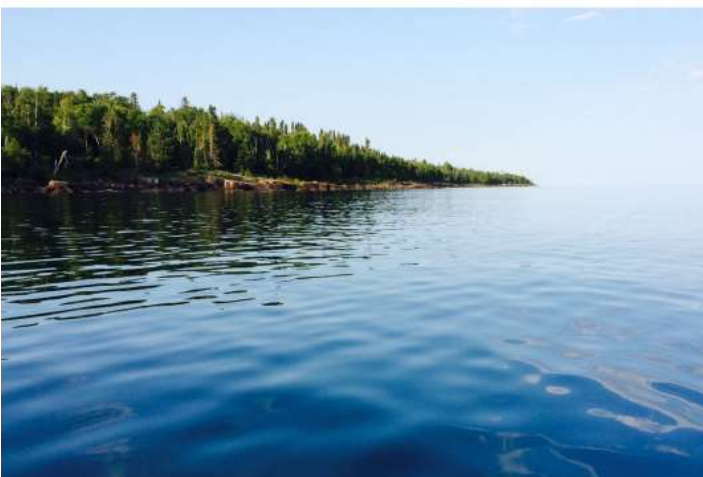


Fishing

Collect data that galvanizes support for PFAS source reduction and pollution prevention



Eating game



PFAS Monitoring Plan



MPCA PFAS Monitoring Plan



Search...

Air ▾ Water ▾ Waste ▾ Regulations ▾ Living Green ▾ Data ▾ About the MPCA ▾

Waste / Cleanup / PFAS pollution / What is Minnesota doing about PFAS?

MPCA PFAS Monitoring Plan

The PFAS Monitoring Plan lays out a path forward for PFAS monitoring at solid waste, wastewater, and stormwater facilities, hazardous waste landfills, facilities with air emissions, and sites in the Brownfield or Superfund programs. The plan does not establish facility-specific requirements, but outlines how the MPCA plans to prioritize locations for PFAS monitoring and what the monitoring will entail.

- [PFAS Monitoring Plan \(p-gen1-22b\)](#)
- [Facilities included in the PFAS Monitoring Plan \(p-gen1-22c\)](#)
- [Frequently asked questions on the PFAS Monitoring Plan \(p-gen1-22f\)](#)
- [Summary of changes in the PFAS Monitoring Plan \(p-gen1-22d\)](#)
- [Public feedback on the draft PFAS Monitoring Plan \(p-gen1-22e\)](#)

The MPCA began working with stakeholders in June 2021 to build a PFAS monitoring plan. This plan encompasses a number of projects identified as near-term priorities in [Minnesota's PFAS Blueprint](#).

PFAS planning

March 2022

PFAS Monitoring Plan

A path forward for PFAS monitoring at solid waste, wastewater, and stormwater facilities, hazardous waste landfills, facilities with air emissions, and sites in the Brownfield or Superfund programs.



Who's Monitoring - PFAS Monitoring Plan

- 379 facilities



143

Landfills and
solid waste
facilities



137

Manufacturing
and industrial
facilities



91

Municipal
wastewater
treatment plants



8

Regional airports
in Greater
Minnesota

Who's Monitoring - PFAS Monitoring Plan

- Manufacturing & Industrial Facilities
 - Metal Finishers
 - Fume Suppressants
 - PFOS replaced with 6:2 FTS.



Who's Monitoring - PFAS Monitoring Plan

- Municipal Wastewater Treatment Plants
 - MPCA sampled for PFCs in wastewater effluent at 28 municipal and industrial WWTPs in 2007.
- Additional facilities sampled in 2008.



PFCs in Minnesota's Ambient Environment:

2008 Progress Report

Who's Monitoring - PFAS Monitoring Plan

- Regional Airports/Part 139
 - Required by Federal Aviation Agency (FAA) to keep PFAS-containing foam on site
 - Past and ongoing firefighting, training, and maintenance activities.
 - Testing firefighting systems (e.g., deluge system, roof turrets).
 - PFAS-containing hydraulic brake fluid historically used for aircrafts



§ 139.317 Aircraft rescue and firefighting: Equipment and agents.

Unless otherwise authorized by the Administrator, the following rescue and firefighting equipment and agents are the minimum required for the Indexes referred to in § 139.315:

Why should we Do Something - Airports?

NEWS

PFAS contamination at Lansing airport under investigation

Craig Lyons Lansing State Journal

Published 10:00 p.m. ET Oct. 18, 2021

[View Comments](#) [f](#) [t](#) [e](#) [r](#)

DEWITT TWP. – An investigation is ongoing to assess potential PFAS contamination at the Capital Region International Airport.

WISCONSIN

'Forever chemicals' from a military installation at Mitchell Airport are a risk to nearby drinking wells, Lake Michigan, a report says

Laura Schulte Milwaukee Journal Sentinel

Published 6:04 a.m. CT Sept. 1, 2021

[View Comments](#) [f](#) [t](#) [e](#) [r](#)

MADISON - Despite testing that found "forever chemicals" at Milwaukee Mitchell International Airport two years ago, the Department of Defense has yet to move forward with a plan to address the contamination, putting nearby residents with private drinking wells at risk.



Melissa Ingells/WPR

Homeowners Offered Bottled Water After Elevated PFAS Levels Found Near La Crosse Airport

9 Wells Had Levels 50 Times The State's Proposed Groundwater Standard

By Danielle Kaeding

Published: Wednesday, January 13, 2021, 5:00am

Why should we Do Something - Airports?

Facilities of Concern

- North American Industry Classification System (NAICS) codes – Appendix F.
- “We aren’t near an airport, a military base, or a fire-training facility. Yet we had PFAS in our drinking water wells.”

Appendix F – List of NAICS codes associated with potential PFAS use or release

NAICS	NAICS title
488119	Airports
313110	Textile goods, Not Elsewhere Classified
313210	Broadwoven Fabric Mills, Manmade Fiber and Silk
313230	Non-woven Fabrics
313310	Finishers of Broadwoven Fabrics of Manmade Fiber and Silk
313320	Coated Fabrics, Not Rubberized
314110	Carpets and Rugs
314999	Waterproof Outerwear
314999	House furnishings, Except Curtains and Draperies
316110	Leather & Hide Tanning & Finishing
316998	All Other Leather Good & Allied Product Mfg
322121	Paper Mills

DRAFT Monitoring Plan – Who: Airports

1. Aqueous film-forming foam (AFFF)

- 524 airports (Part 139) across the nation were required to use AFFF.
 - 9 Part 139 airports in MN currently.
- Past and ongoing firefighting, training, and maintenance activities.
 - Currently, most training exercises are closed-loop.
 - Foam is/was expensive – therefore, incentive to not be wasteful with it.
- Testing firefighting systems (e.g., deluge system, roof turrets).

2. PFAS-containing hydraulic brake fluid historically used for aircrafts.

3. Firefighting equipment, including protective clothing for firefighters.

- These can be surface treated with side-chain fluorinated polymers or made from fluoropolymers such as woven, porous polytetrafluoroethylene (PTFE) and its copolymers.



Airports – AFFF/Foam

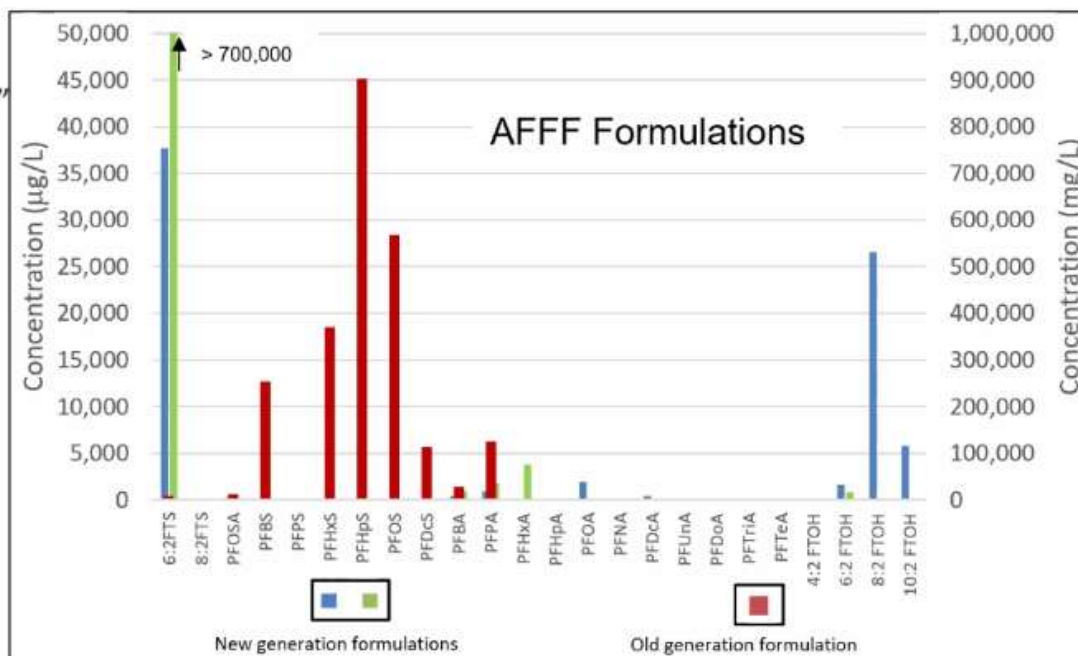
PFAS Forensic Methods: Compound Ratio Analysis

Link Certain PFAS to Production Processes and/or Sources

Geosyntec[®]
consultants

Source Fingerprints

- Different sources of PFAS can have characteristic “fingerprints” of the relative abundances of individual PFAS constituents
- Fingerprints for a single source type can change over time
- Fingerprints for a given product can differ among manufactures



Data from: Herzke *et al.* 2012. *Chemosphere* 88, 980-987

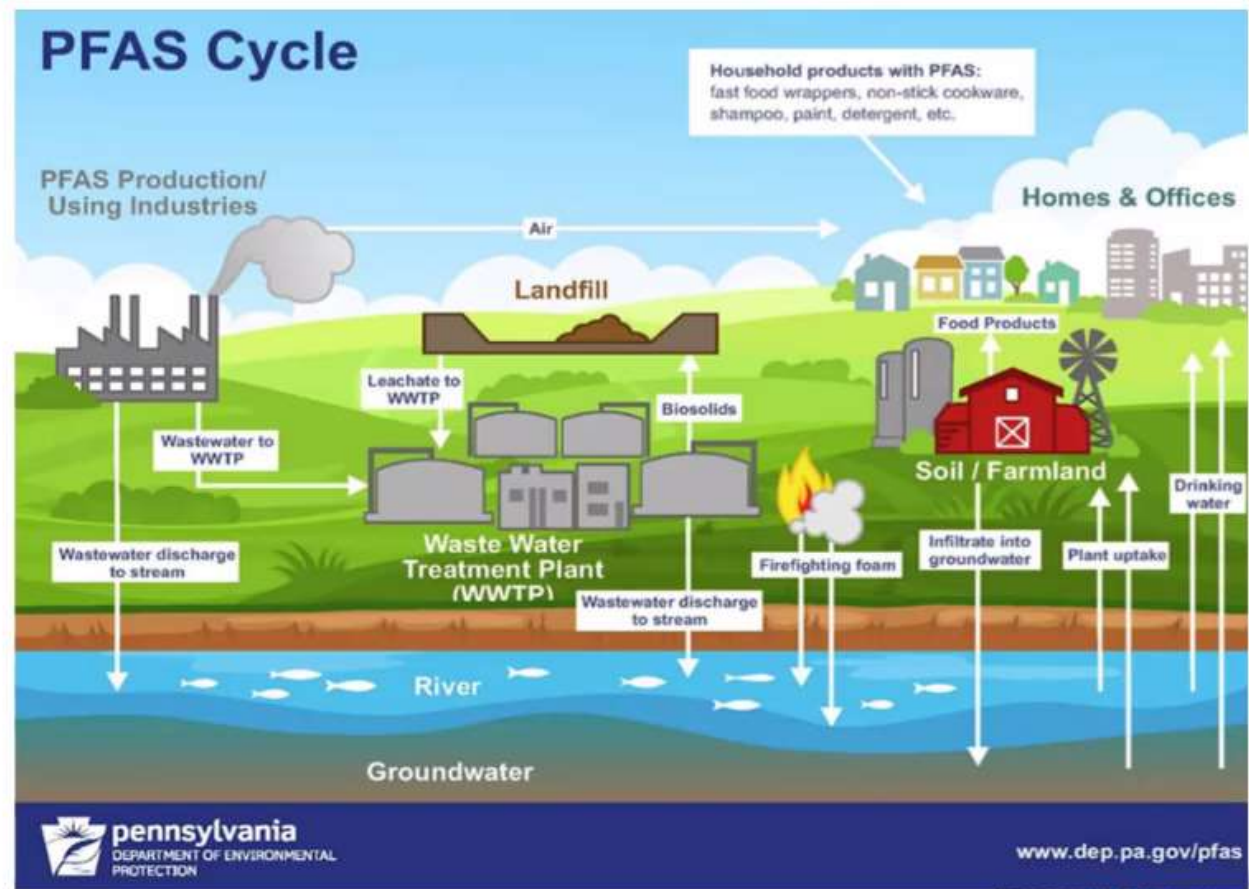


Targeted PFAS Analysis – Industrial Sector Characteristics

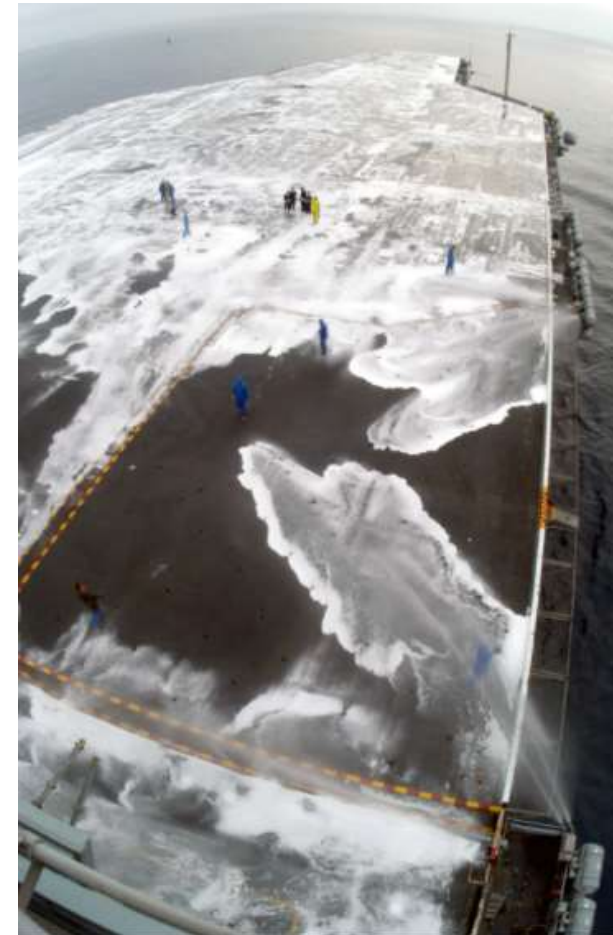
PFAS Forensics: Overview

Geosyntec[®]
consultants

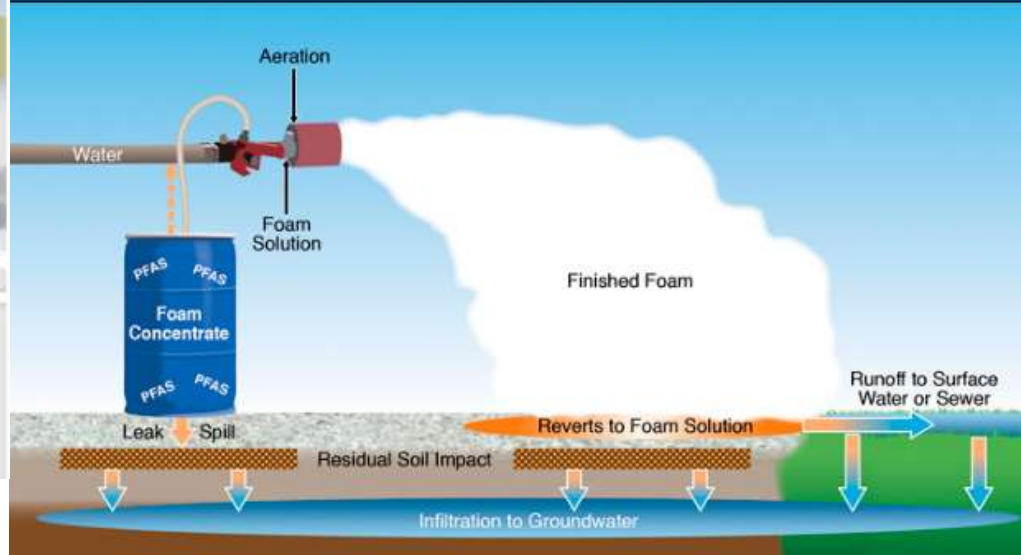
- Fluorochemical Manufacturing and Coatings Facilities
 - PFOA & PFNA
 - HFPO-DA
- Aqueous Film Forming Foam (AFFF)
 - ECF: PFOS, PFHxS
 - FT: 6:2 FTS, PFPeA, & PFHxA
- Metal Plating Industry
 - PFOS
 - 6:2 FTS
- Landfills / WWTPs
 - 5:3 FTCA, FOSE, FASAAs, & FTOHs



Airports - Foam



Airports - Foam



MPRnews Sections ▾ Members ▾ More ▾

ON AIR 0:00
On Point with Meghna Chakrabarti

'Forever' chemicals leave costly water problem in Bemidji, cities across the country

Kirsti Marohn February 14, 2019 10:00 a.m.

A photograph showing a person's hands washing a red plate in a kitchen sink. A yellow bottle of dish soap with "DAD" written on it is visible on the counter.

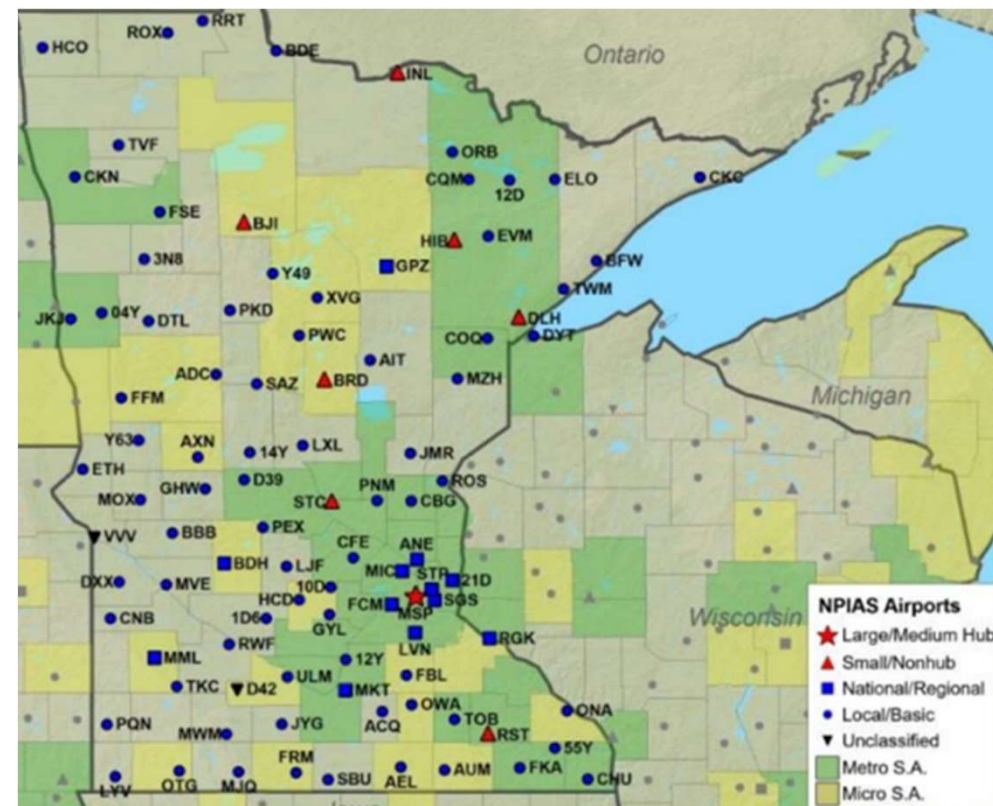
Airports

1. Only Part 139 airports:

- Recent formulations of AFFF (after approximately 2015) contain short-chain (C6) fluorotelomer-based PFAS and are referred to as modern "PFOS-free" AFFF.

2. Stakeholders:

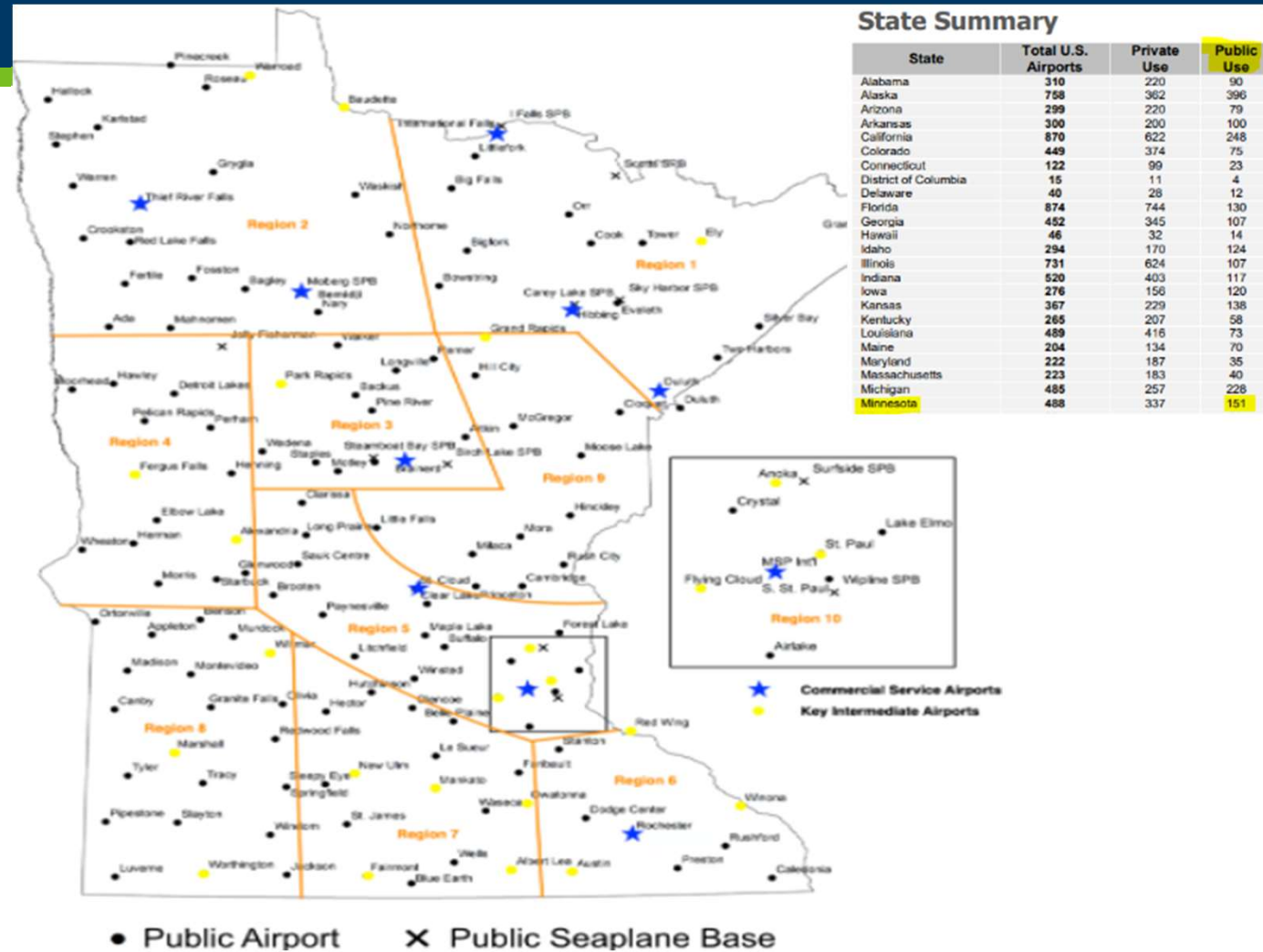
- MN Council of Airports (MNCOA)
- Metropolitan Airport Commission (MAC)
- DOT (Aeronautics)



Every Phase 1 Sector Facility?: Airports

1. Blue stars ★ represent current Part 139 airports in MN

2. 133 public airports in MN



Airports – Other Countries Care?

Table 3-7. Representative international AFFF regulatory and guidance activity

Country	Initial Effective Date	What is Regulated?	Specific Requirement	Reference
Canada	January 2018	PFOS, PFOA, long-chain PFCAs	Canada prohibits the manufacture, use, sale, or import of a number of PFAS-containing chemicals and products, such as AFFF, that have these chemicals. Canada allows certain exemptions, including the use of AFFF that contains residual levels of PFOS at a maximum concentration of 10 ppm; the use and import of AFFF contaminated with PFOS in military equipment returning from a foreign military operation; and the import, use, sale, and offer for sale of AFFF that contains PFOA and/or LC-PFCAs used in firefighting.	(ECCC 2017 [1385] _↳)
Germany	May 2013	AFFF	The German Federal Environment Agency released a Guide for the Environmentally Responsible Use of Fluorinated Fire-fighting Foams. The guidance discusses what AFFFs are, when it is necessary for use, why it endangers humans and the environment, and the consequences of use.	(German Federal Environment Agency 2013 [1451] _↳)
Australia	July 2016	Firefighting foam	The Queensland Department of Environment and Heritage Protection issued an Operational Policy on the Environmental Management of Firefighting Foam. The objective of the policy was to define the requirements and expectations for the handling, transport, storage, use, release, waste treatment, disposal, and environmental protection measures of AFFF.	(Australia Government DOD 2007 [227] _↳)

If not AFFF, then what do we Use?

3.13 Foam Research and Development

Current modern AFFF fluorosurfactant alternatives are largely short-chain C6 telomer-based fluorosurfactants. The fluorosurfactants do persist in the environment, and they have the potential to create breakdown products that are also persistent. Although numerous fluorine-free alternatives are already on the market, there is still a need to develop novel firefighting foams that provide the desired firefighting performance while not being harmful to human health and the environment. Research is currently being conducted to further evaluate modern fluorotelomer and fluorine-free alternatives. Research is discussed below.

Table 3-8. Summary of the AFFF alternatives studies supported by SERDP-ESTCP

Lead Investigator	Objectives	Expedited Completion	Project Link
Dr. Joseph Tsang, Naval Air Warfare Center Weapons Division	Proof-of-concept for the development of the next generation of fluorine-free firefighting foam formulations as a replacement for existing aqueous film-forming foam (AFFF). The novel foam systems produced in this research are derived from polysaccharide copolymers and nanoparticles that are sustainable, nontoxic, and water-soluble (or water-dispersible), and will be applied using existing military firefighting equipment.	Aug-18	https://serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2737/WP-2737
Dr. John Payne, National Foam	Improve understanding of the physical and chemical processes that underlie firefighting foams, and how the components of a foam formulation can deliver the properties required for good fire-extinguishing performance while minimizing environmental burdens. Statistical method will be employed to develop a fluorine-free surfactant formulation that meets the performance requirements defined in MIL-F-24385. A life cycle assessment will compare the environmental impact of each foam type and identify routes to improving environmental performance.	Sept-19	https://serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2738/WP-2738
Dr. Ramagopal Ananth, U.S. Naval Research Laboratory	Develop a fluorine-free firefighting surfactant formulation that meets the performance requirements of MIL-F-24385F and is an environmentally friendly drop-in replacement for the current environmentally hazardous AFFF.	Dec-20	https://serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2739/WP-2739

What's the Risk if My Airport is in the Toolies?

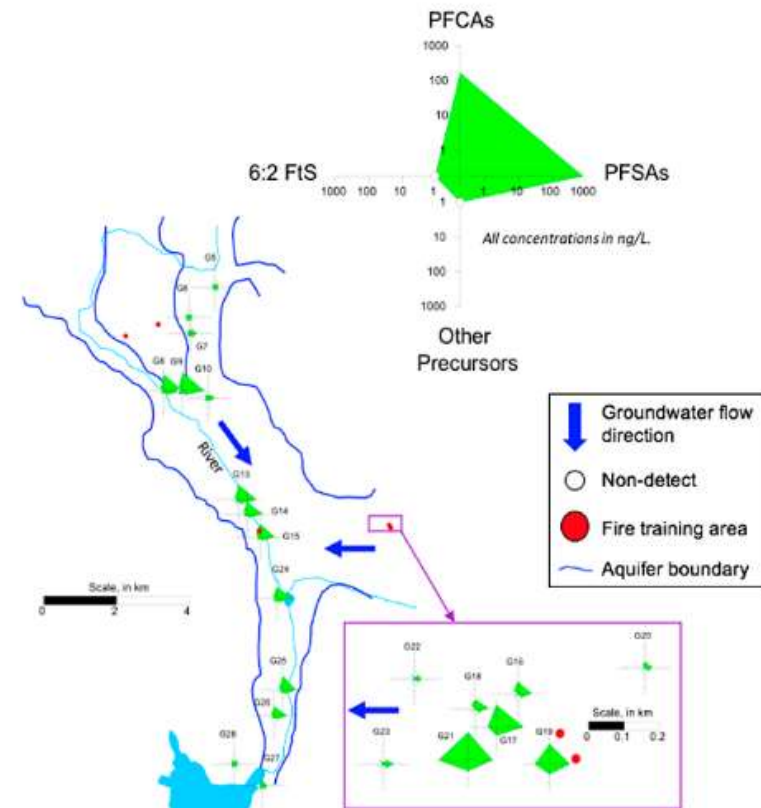


Figure 15-3. PFAS composition in groundwater.
 Source: G. Carey, Porewater Solutions. Used with permission.

ISW-Specific Portion of PLAN – Where:

- Where to Sample (Min of 2 total*) –Benchmark Monitoring Locations (min of 1)
 - *All BMLs unless a BML reduction form is submitted which utilizes the following information to justify fewer locations:
 - Wind Rose
 - Identification/Consideration of Sector-specific PFAS area(s) of concern
 - Historical Use information
 - Sector-specific PFAS area of concern (AOC) (min of 1 – location identified on SWPPP drainage map & submitted to MPCA)
 - ISW immediately adjacent to AOC:
 - Shredder fluff pile
 - Chrome plating bath vented portion of facility
 - AFFF areas @ airports

ISW-Specific Portion of PLAN – Results

- Results – response thresholds:
 - PFOS is the main PFAS compound of concern currently:
 - >1,000 ppt: Submit a PFAS source and exposure reduction plan within 90 days of last sampling quarter.
 - >10 ppt: Submit a PFAS source and exposure reduction plan within 180 days of last sampling quarter.
 - <10 ppt: No source reduction plan needed at this time. Maintain PFAS inventory and reduction activities at the site along with PFAS BMPs.

ISW-Specific Portion of PLAN – Results

1. What PFAS Compounds will be Monitored?

- All PFAS compounds included within available method the laboratory uses.

2. When does Sampling Begin:

- Q3-Q4, 2022

3. How Frequently will Monitoring be required?

- 2-3 Quarterly samples within first ½ hr. of discharge:
 - Results could factor into ISW general permit including PFAS monitoring.

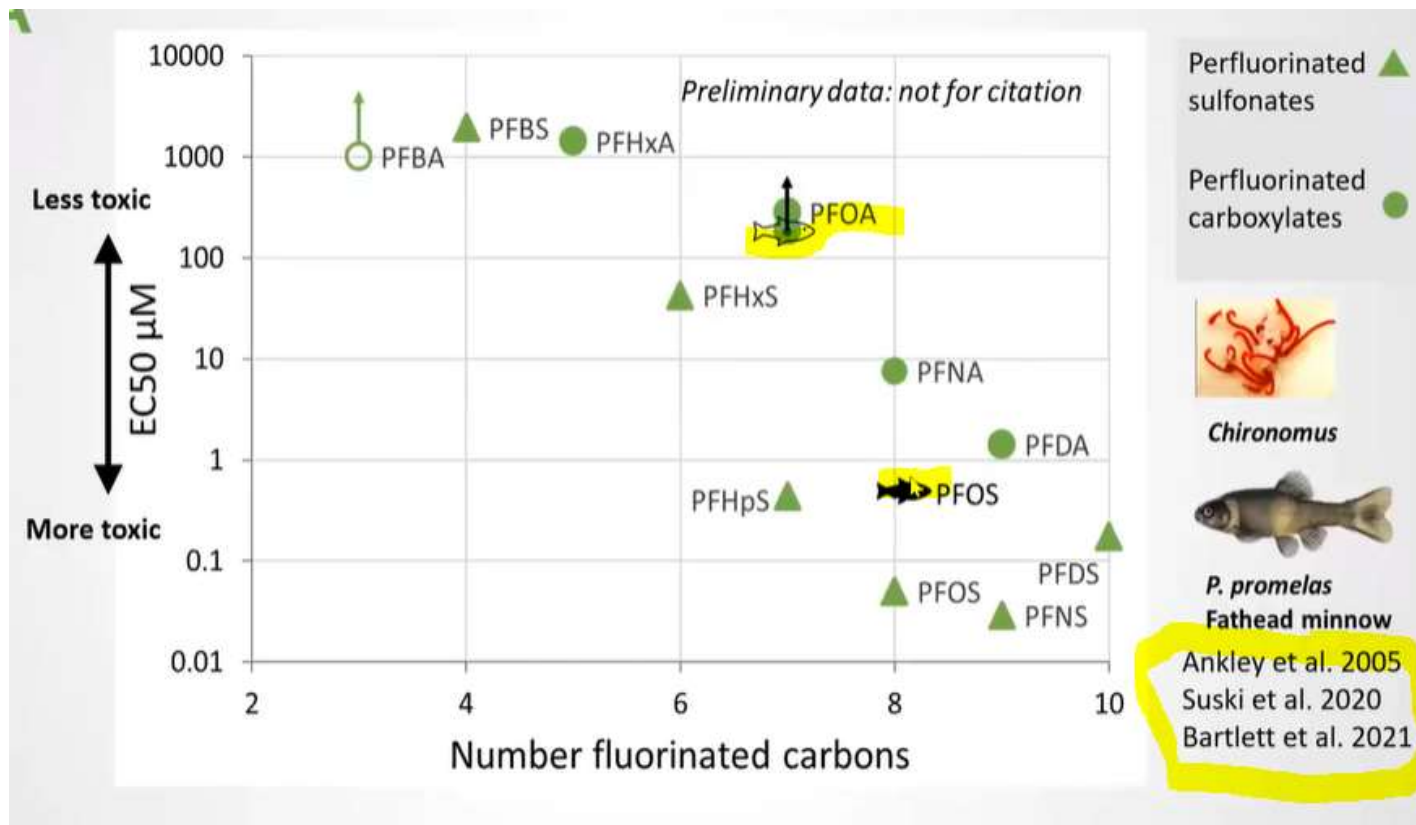
4. Cost:

- Typical costs for laboratory analysis of PFAS in water or solid media range from \$300 to \$500 per sample



ISW-Specific Portion of PLAN – Results

1. Why PFOS?



ISW-Specific Portion of PLAN – Results

Why PFOS?

- MPCA and MDH set goals for PFAS that protect human health and the environment.
- New PFOS protective values for fish consumption (called “site-specific water quality criteria”) – one is for fish tissue, the second is a surface water value that supports meeting the fish tissue value:
 - Fish tissue is a maximum 0.37 nanograms PFOS per gram (ng/g)
 - Water is a maximum 0.05 ng/L PFOS



Search...

[Air](#) ▾ [Water](#) ▾ [Waste](#) ▾ [Regulations](#) ▾ [Living Green](#) ▾ [Data](#) ▾ [About the MPCA](#) ▾

[Waste](#) / [Cleanup](#) / [PFAS pollution](#) / [What is Minnesota doing about PFAS?](#)

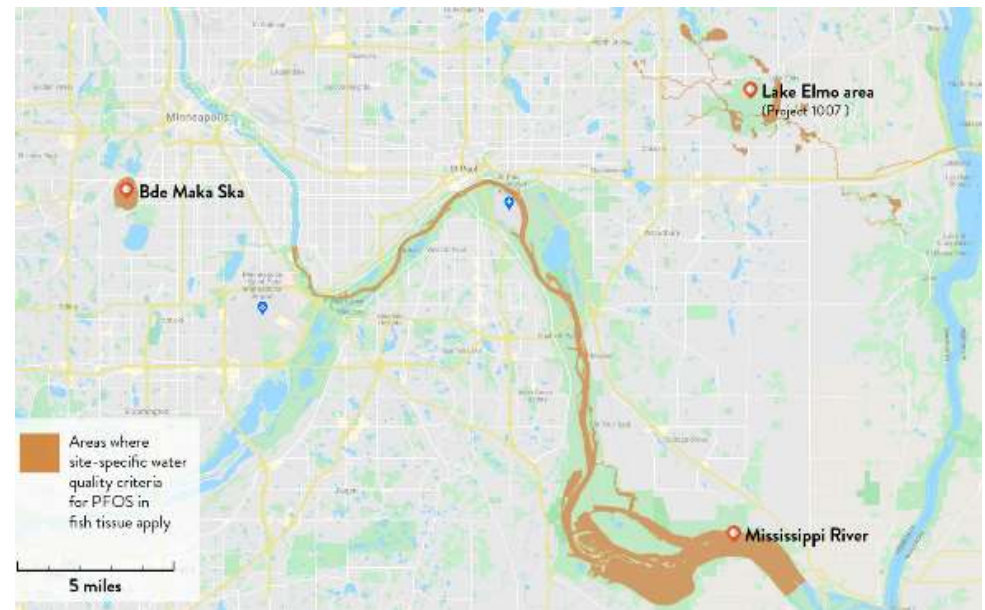
Water-quality criteria development for PFAS

The Minnesota Pollution Control Agency (MPCA), Minnesota Department of Health (MDH), and Minnesota Department of Natural Resources (MDNR) have been working to understand the presence and levels of per- and polyfluoroalkyl substances (PFAS) in Minnesota's environment, especially surface and groundwater. Studies suggest human health effects from PFAS exposure could include immune suppression, liver effects, developmental and reproductive effects, and possibly cancer. To protect the environment and human health, we need goals for safe levels of PFAS in our waters – levels that allow waters to be used as a source of drinking water and edible fish, for swimming and boating, and that support a healthy population of aquatic life.

ISW-Specific Portion of PLAN – Results

Why PFOS?

- **Not a statewide standard.**
- Site-specific water quality criteria for:
- Prior standard(s) needed to be updated to the new criteria values to reflect the recent changes in the science of PFAS impacts.



Monitoring Plan – Methods & Cost

Lab Availability:

- Search MDH's Accredited Labs (<https://eldo.web.health.state.mn.us/public/accreditedlabs/labsearch.seam>)
 - Currently there are 13 labs certified with MNELAP for some sort of PFAS work.



Search for Accredited Laboratories - Environmental Laboratory Accreditation Program

Common Searches Customized Searches

Identification:

Laboratory Name:

Location:

State/Province: County:

All Other Programs and Test Parameters:

Program:

Analyte:

Monitoring Plan – Methods

1. Targeted Analysis:

- Draft EPA 1633 - finalized in fall 2022
- Many laboratories run a “modified” version of EPA’s Method 537.1 that includes isotope dilution, which is analogous to the draft EPA Method 1633
- Chemicals are specifically targeted in tests using an authentic chemical standard obtained from commercial sources.
 - However, the majority of methods used for stormwater consist of 30 to 40 analytes.

2. Nontargeted Analysis:

- Nontargeted analysis can detect a broad range of PFAS without having a preconceived list of chemicals that are present.
- Chemicals are identified by a combination of high-resolution accurate mass, molecular fragmentation, and comparison to reference compound databases.
- Identifications of chemical compounds are tentative and there is greater uncertainty associated with concentration estimates due to the lack of authentic chemical standards for comparison.
- PFAS compounds that are shown as abundant are more certain.

Approaches to Chemical Measurements			
	<u>Targeted</u>	<u>Screening</u>	<u>Discovery</u>
Chemical Targets	Few, selected chemicals	100s – 100,000s per library	Any chemical
Method of Analysis	Focused method	Non-Targeted Method	Non-Targeted Method
Chemical Structure	Known	Known in library	Unknown
Reference Data	Available	Some, maybe simulated	Some, maybe simulated
Standards	Available	For common compounds	Unlikely

Complex, More Time-Consuming Analysis

Monitoring Plan – Methods: Targeted Analysis

EPA Region 5/MI EGLE Report #1

Attachment 2

February 19, 2020

Table 2. PFAS Analyzed in Fume Suppressants and Facility Effluent by UPLC-MS.

Short Name	Chemical Name	Formula	Monoisotopic Mass (g/mol)	CAS Registry Number
4:2 FTS	Fluorotelomer sulphonic acid 4:2	$C_4F_9CH_2 CH_2SO_3$	327.9816	757124-72-4
6:2 FTS	Fluorotelomer sulphonic acid 6:2	$C_6F_{13}CH_2 CH_2SO_3$	427.9752	27619-97-2
8:2 FTS	Fluorotelomer sulphonic acid 8:2	$C_8F_{17}CH_2 CH_2SO_3$	527.9698	39108-34-4
HFPO-DA (GenX)	Perfluoro[2-methyl-3-oxahexanoic] acid	$C_6HF_{11}O_3$	329.9750	13252-13-6
N-EtFOSAA	2-(N-Ethylperfluorooctanesulfonamido) acetic acid	$C_8F_{17}SO_2N(C_2H_5)CH_2COOH$	584.9903	2991-50-6
N-MeFOSAA	2-(N-Methylperfluorooctanesulfonamido) acetic acid	$C_8F_{17}SO_2N(CH_3)CH_2COOH$	570.9746	2355-31-9
PFBA	Perfluorobutanoic Acid	$C_4HF_7O_2$	213.9865	375-22-4
PFPeA	Perfluoropentanoic Acid	$C_5HF_9O_2$	263.9833	2706-90-3
PFHxA	Perfluorohexanoic Acid	$C_6HF_{11}O_2$	313.9801	307-24-4
PFHpA	Perfluoroheptanoic Acid	$C_7HF_{13}O_2$	363.9769	375-85-9
PFOA	Perfluorooctanoic Acid	$C_8HF_{15}O_2$	413.9737	335-67-1
PFNA	Perfluorononanoic Acid	$C_9HF_{17}O_2$	463.9705	375-95-1
PFDA	Perfluorodecanoic Acid	$C_{10}HF_{19}O_2$	513.9673	335-76-2
PFUnDA	Perfluoroundecanoic acid	$C_{11}HF_{21}O_2$	563.9641	2058-94-8
PFDoDA	Perfluorododecanoic	$C_{12}HF_{23}O_2$	613.9609	307-55-1
PFTTrDA	Perfluorotridecanoic acid	$C_{13}HF_{25}O_2$	663.9577	72629-94-8
PFTeDA	Perfluorotetradecanoic acid	$C_{14}HF_{27}O_2$	713.9545	376-06-7
PFBS	Perfluorobutane Sulfonate	$C_4HF_9SO_3$	299.9503	375-73-5
PFPeS	Perfluoropentanesulfonic acid	$C_5HF_{11}SO_3$	349.9471	2706-91-4
PFHxS	Perfluorohexane Sulfonate	$C_6HF_{13}SO_3$	399.9439	355-46-4
PFHpS	Perfluoroheptanesulfonic acid	$C_7HF_{15}SO_3$	449.9407	375-92-8
PFOS	Perfluorooctane Sulfonate	$C_8HF_{17}SO_3$	499.9375	1763-23-1
PFNS	Perfluorononanesulfonic acid	$C_9HF_{19}SO_3$	549.9343	68259-12-1
PFDS	Perfluorodecanesulfonic acid	$C_{10}HF_{21}SO_3$	599.9311	335-77-3
PFOSA	Perfluorooctanesulfonamide	$C_8F_{17}SO_2NH_2$	498.9535	754-91-6



Monitoring Plan – Methods: Non-Targeted Analysis

- Thousands of compounds:
 - Per- and polyfluoroalkyl substances (PFAS) are a large group of nearly 5,000 different synthetic chemicals that are resistant to heat, water, and oil.
- Of the more than 9,000 known PFAS compounds, 600 are currently used in the U.S. in countless [products](#), including firefighting foam, cookware, cosmetics, carpet treatments and even dental floss.

Oral-B Glide floss tied to potentially toxic PFAS chemicals, study suggests

[Ryan W. Miller](#) USA TODAY

Published 8:25 p.m. ET Jan. 9, 2019 | Updated 7:15 p.m. ET Jan. 10, 2019



Monitoring Plan – Who in the Future

1. Phase 2+:

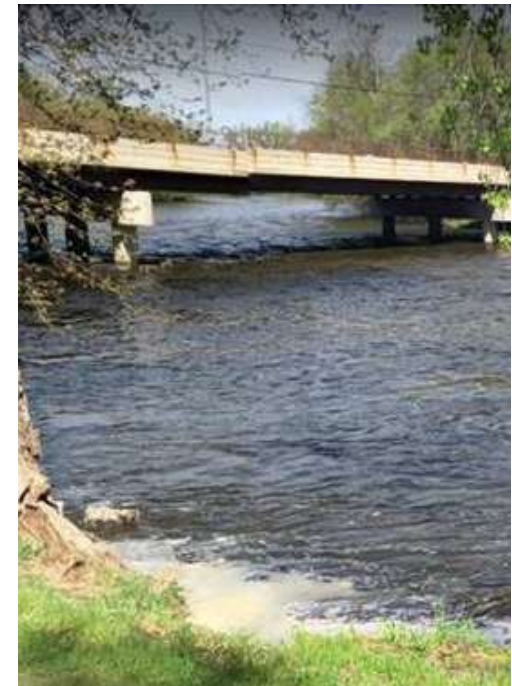
- NAICS code list

2. Phase Anytime:

- Elevated PFAS results from other program monitoring

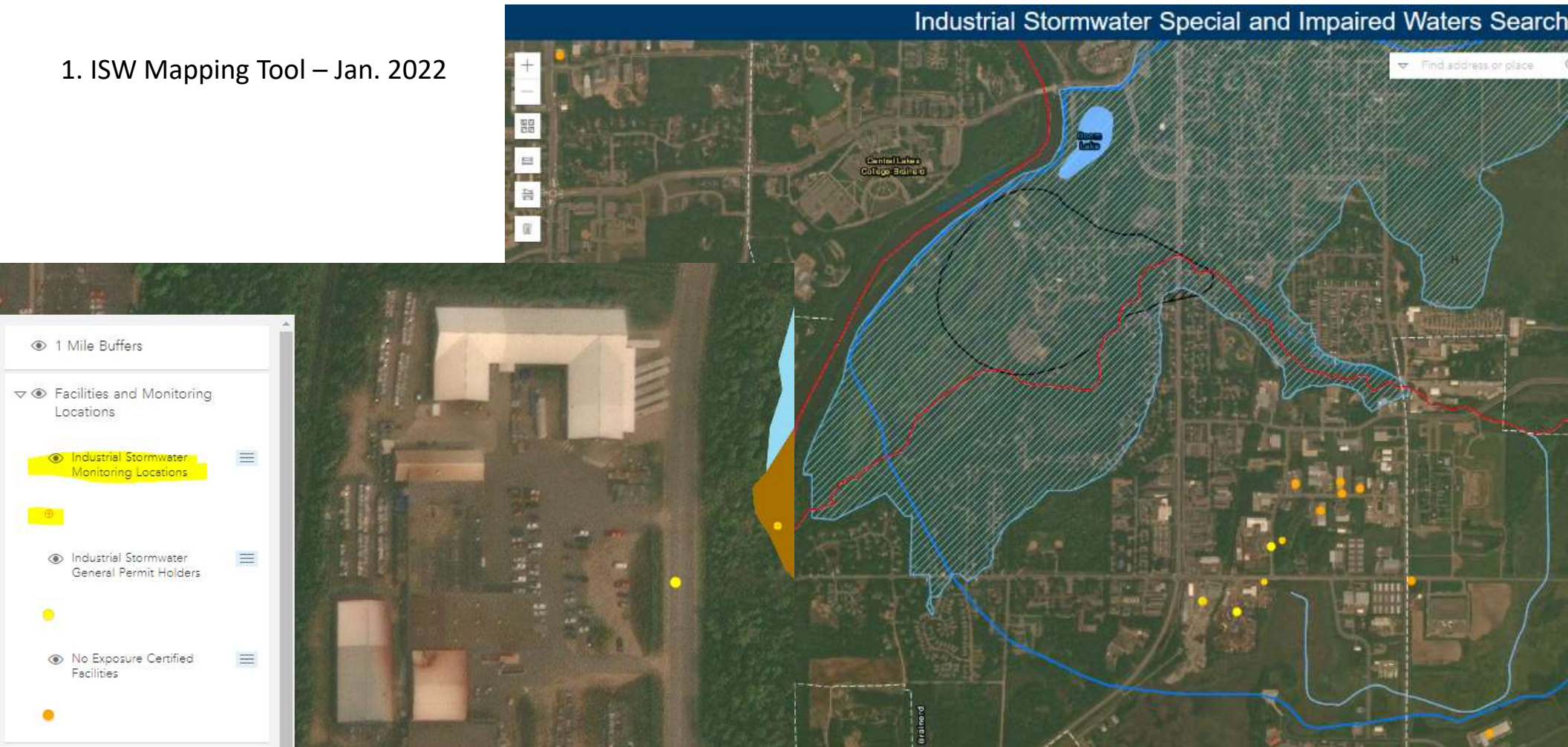
3. Prioritization Factors:

- Proximity to drinking water sources, surface waters
- Other factors



Monitoring Plan – Prioritization Factors

1. ISW Mapping Tool – Jan. 2022



Where - Sample All Existing BMLs?: Refinement

1. Benchmark Monitoring Locations?
 1. Sample all of them for all four (4) quarters
 2. Sample a subset based on PFAS potential

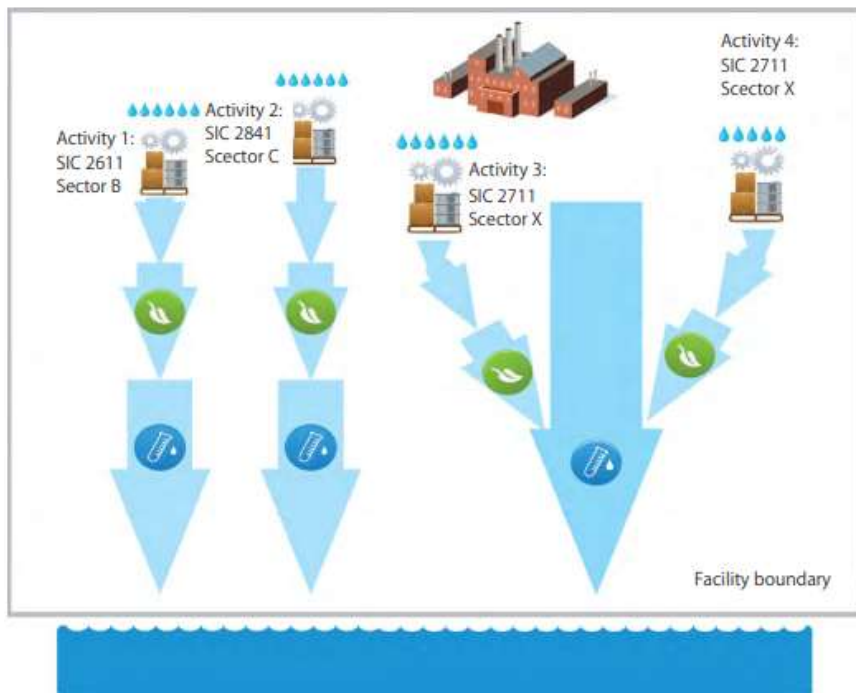


Diagram 3.

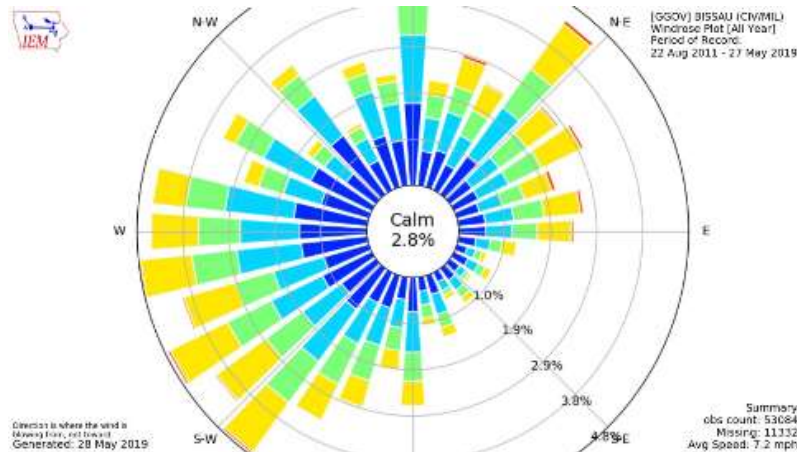
The materials / activities for Activities 1 and 2 are different so each discharge needs its own BML. For Activities 3 and 4, a facility could choose to have only one BML and sample for all of the benchmark parameters down gradient of both BMPs. Alternatively, the facility could have BMPs further "upstream" and choose BMLs immediately downgradient from each individual BMP.



Where - Sample All Existing BMLs?: Refinement

Benchmark Monitoring Locations – All of them?

- Not necessarily
- Up to 28 BMLs (some airports)...
- Area of Concern (AOC)



Background Concentrations

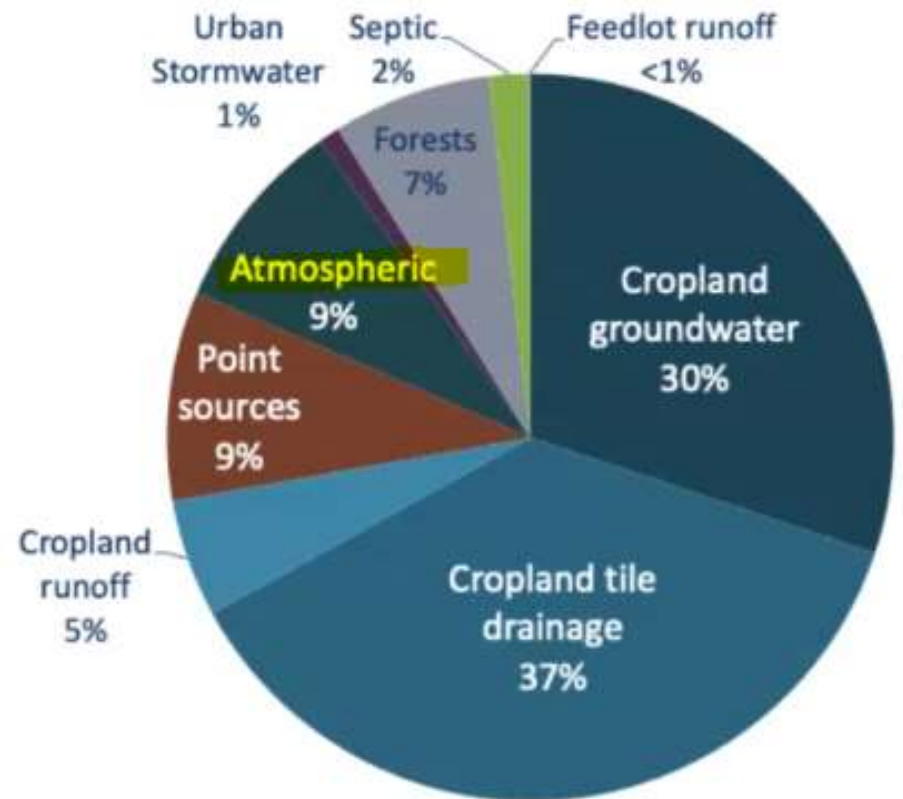
Background can be a touchy term... “Baseline”

- Rainfall: 1-5ppt PFOS ([07.29.21 Webinar Notes](#))
 - A. Mercury example (MINNESOTA STATEWIDE MERCURY TOTAL MAXIMUM DAILY LOAD – 2007):
 - Significant precipitation gradient from northeast to southwest Minnesota, but this does not apparently determine the mercury deposition pattern. The uniformity in deposition indicates that sources causing locally elevated atmospheric deposition have been removed.
 - Between 1994 and 1999, with a different monitoring program, Watras et al. (2000) reported a 40% decrease in mercury deposition in northern Wisconsin

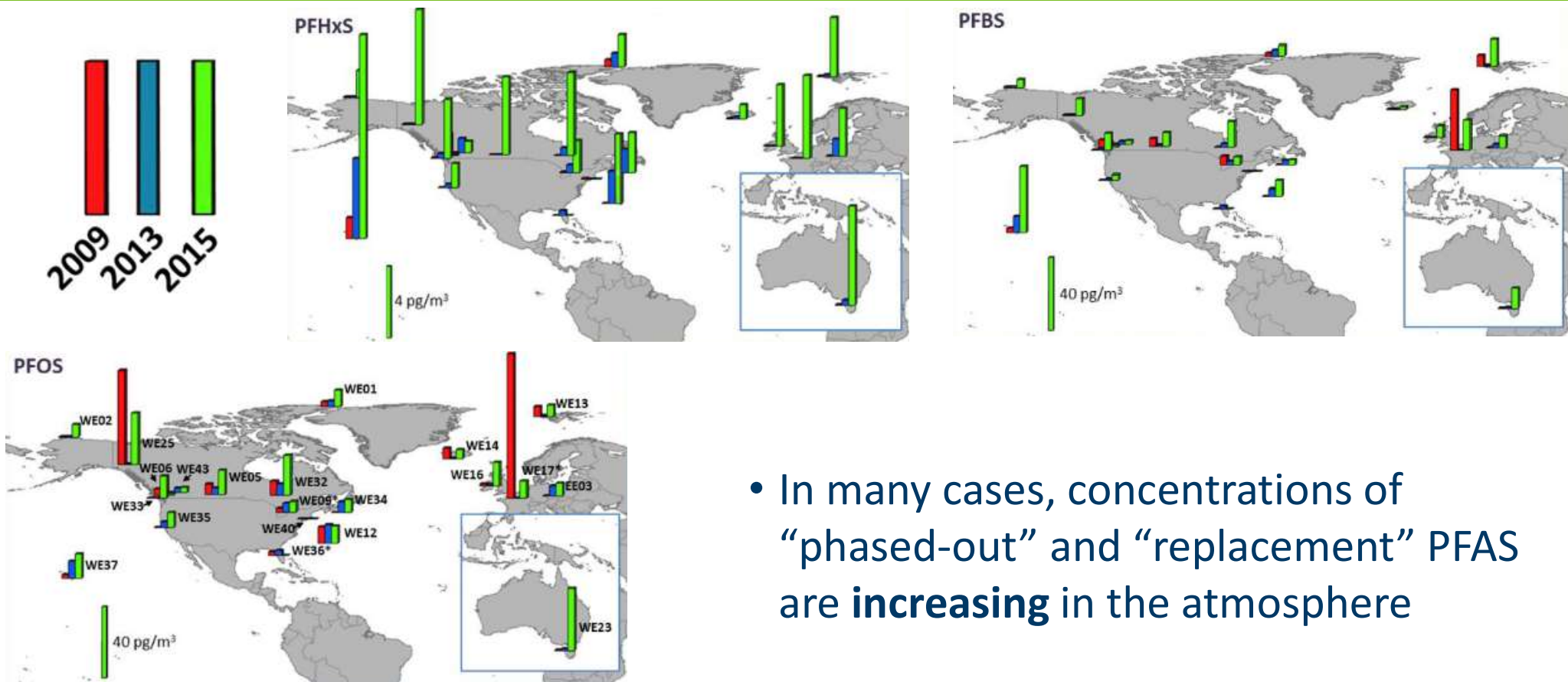
	“baseline” conditions observed in select studies	
Groundwater	Median detected concentration: 4 ng/L	Minnesota’s ambient groundwater network
Surface water	Median detected concentration: 2.1 ng/L	Gewurtz et al. 2019; study of precipitation and surface water in the Great Lakes region
Soil	Median detected concentration: 680 ng/kg	Vermont PFAS background study in shallow soils

“Baseline” / Background:

Nitrate example:



PFAS trends over time in the atmosphere



- In many cases, concentrations of “phased-out” and “replacement” PFAS are **increasing** in the atmosphere

Figure from Rauert et al. 2018

Every Phase 1 Sector Facility?: Refinement

1. Surveys?

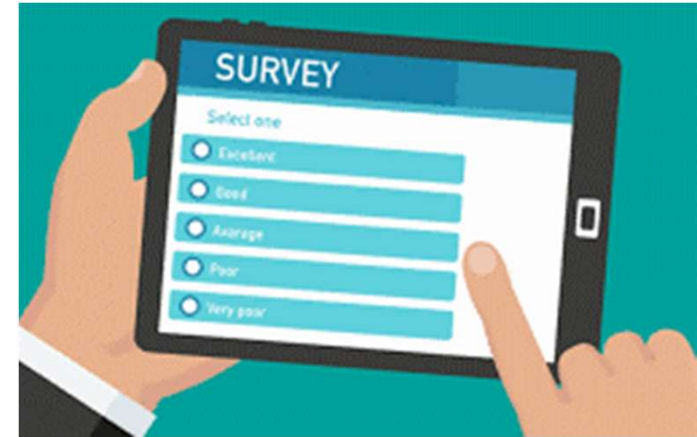
- SDS/MSDS sheets often don't list PFAS
- Not required to be reported on any safety data sheets (SDS), as they currently are not considered a hazardous substance.
- PFAS may not be listed under any active ingredients list, either.
- A good indicator that the firefighting foam for example contains PFAS is if it mentions:
 - fluorosurfactant, fluoroprotein, C6, or the use of "fluoro", however, not all fluorinated surfactants are made of PFAS.

2. Firefighting Foam:

- Note the brand and manufacturer of the foam and contact the manufacturer in writing to see if PFAS is used in its production and ask for the SDS.
- Screen for the entire family of PFAS, not just the single compound PFOS, and be sure to review the SDS.

3. Historical Use

- Facility staff may not have an accurate way of knowing



Sampling Guidance:

- MPCA (01-2022):
 - Not OK to use:
 - Teflon tape or wash bottles
 - Dry-erase markers
 - Clothing washed with fabric softeners
 - Clothing mad with stain-resistant chemicals
 - OK to use:
 - Powderless Nitrile Gloves



www.pca.state.mn.us

Guidance for Per- and Polyfluoroalkyl substances (PFAS): Sampling

The Minnesota Pollution Control Agency (MPCA) intends to update the information within this PFAS Guidance document as new information becomes available. Users of this PFAS Guidance are encouraged to visit the <https://www.pca.state.mn.us/about-mpca/mpca-quality-system> to access the current version of this document.

Sampling Guidance:

- Michigan also has some good guidance:
 - Powderless Nitrile Gloves
 - No clipboards coated with PFAS
 - No notebooks made with PFAS treated paper
 - No PFAS treated paper towel
 - No candy bars (in wrapper), other prepackaged food, fast food or microwave popcorn
 - URLs:
 - https://www.michigan.gov/documents/pfasresponse/General_PFAS_Sampling_Guidance_634597_7.pdf
 - https://www.michigan.gov/documents/pfasresponse/PFAS_Sampling_Quick_Reference_Field_Guide_634603_7.pdf

MDEQ PFAS SAMPLING QUICK REFERENCE FIELD GUIDE¹

All Items Used During Sampling Event

● Prohibited

- Items or materials that contain fluoropolymers such as
 - Polytetrafluoroethylene (PTFE), that includes the trademarks Teflon® and Hostafion®
 - Polyvinylidene fluoride (PVDF), that includes the trademark Kynar®
 - Polychlorotrifluoroethylene (PCTFE), that includes the trademark Neoflon®
 - Ethylene-tetrafluoro-ethylene (ETFE), that includes the trademark Tefzel®
 - Fluorinated ethylene propylene (FEP), that includes the trademarks Teflon® FEP and Hostafion® FEP
- Items or materials that contain any other fluoropolymer

GENERAL PFAS SAMPLING GUIDANCE

This document contains an introduction to PFAS, biosecurity recommendations, and general recommendations to decrease the possibility of cross-contamination.

Michigan
Department of
Environmental
Quality

What can I eat before or during PFAS sampling?

- Subset (50 food packing products) tested for 30 of the 9,000+ PFAS compounds:
 - PFOS = 5th most common PFAS compound
 - PFOA = most frequently detected
 - PFBA = highest concentrations
 - <1% = total organic fluorine found
 - >99% = PFAS compounds not individually identified

Dangerous PFAS Chemicals Are in Your Food Packaging

CR found 'forever' chemicals' in bowls, bags, plates, and wrappers, even from some companies that say they've phased them out.



A Bad Wrap

Eight restaurants in CR's tests had at least one type of food packaging at or above 100 parts per million total organic fluorine, a level that will not be allowed in California starting next year. Here is the product with the highest level at each of those restaurants.



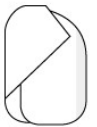
Arby's
Paper bag for cookies



Burger King
Paper bag for cookies



Cava
Fiber tray for kids meal



Chick-fil-A
Wrapper for sandwich wrap



McDonald's
Paper bag for french fries



Nathan's
Paper bag for sides



Sweetgreen
Paper bag for focaccia



Taco Bell
Paper bag for chips

What's EPA Doing and Planning?

Actions: Office of Water

- **Undertake nationwide monitoring for PFAS in drinking water.** Final rule expected Fall 2021.
- **Establish a national primary drinking water regulation for PFOA and PFOS.** Proposed rule expected Fall 2022, final rule expected Fall 2023.
- **Publish final toxicity assessment for GenX and five additional PFAS (PFBA, PFHxA, PFHxS, PFNA, PFDA).** Expected Fall 2021 and ongoing.
- **Publish health advisories for GenX and PFBS.** Expected Spring 2022.
- **Restrict PFAS discharges from industrial sources through a multi-faceted Effluent Limitations Guidelines program.** Expected 2022 and ongoing.
- **Leverage National Pollutant Discharge Elimination System permitting to reduce PFAS discharges to waterways.** Expected Winter 2022.
- **Publish improved analytical methods.** Expected Fall 2022 and Fall 2024.
- **Publish final recommended ambient water quality criteria for PFAS.** Expected Winter 2022 and Fall 2024.
- **Enhance data availability on PFAS in fish tissue.** Expected Summer 2022 and Spring 2023.
- **Finalize risk assessment for PFOA and PFOS in biosolids.** Expected Winter 2024.

Can We Make a Difference?

Begin assembling an inventory of PFAS potential:

- Past and ongoing firefighting, training, and maintenance activities. These can lead to groundwater and soil contamination by PFAS due to uncontained release of firefighting foam.
- Testing firefighting systems (e.g., deluge system, roof turrets).
- PFAS-containing hydraulic brake fluid historically used for aircrafts.



Can We Make a Difference?

02-2022: “‘Complete crisis’ as PFAS discovery upends life and livelihood of young Maine farming family”

- 20 acre organic vegetable farm
- Water they and their 3 yr. old son drink is 400x health threshold.
- Organic products pulled from stores.
- “...water that we are drinking is highly toxic, that food that we are selling to people has levels of chemicals in it, that from living here that Adam and myself and our child have industrial levels of chemical in our blood...”



Kevin Miller / Maine Public

Johanna Davis and Adam Nordell stand outside of their house at Songbird Farm, an organic vegetable and grain farm they have operated in Unity since 2014.

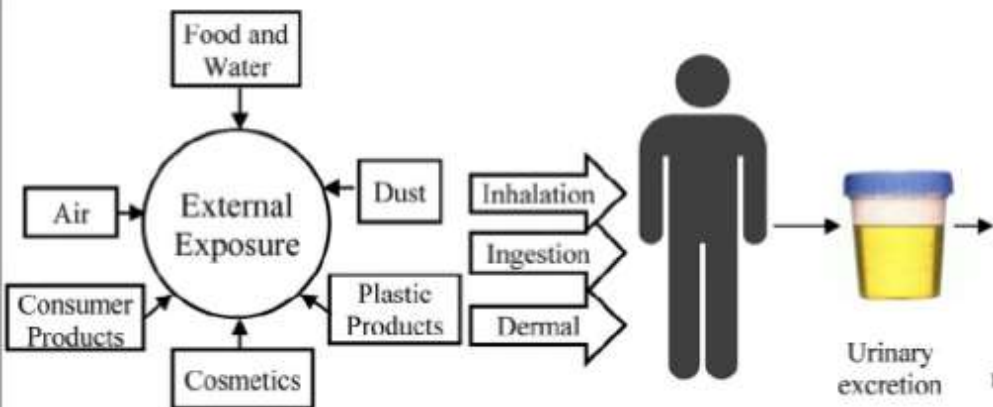
Can We Make a Difference?

Reduce and/or eliminate exposure:

Table 17-7. Half-lives of PFCAs, PFSA, and perfluoroethers in rodents, nonhuman primates, and humans

Notes: No information was located for PFPeA, PFDoA, PFTiDA, PFTeDA, PFPeS, PFNS, PFDS, ADONA; – indicates that data are not available; h–hour, d–day, y–year.

	Mouse		Rat		Nonhuman primate		Human	
	Male	Female	Male	Female	Male	Female	Male	Female
<i>PFCAs</i>								
PFBA	13 h ^a	2.9 h ^a	9.2 h ^a	1.8 h ^a	40 h ^a	41 h ^a	72 h ^a (O; mean)	87 h ^a (O; mean)
PFOS	40 d ^u	34 d ^u	47–67 d ^{u,v}	40–48 d ^{u,v}	132 d ^u	110 d ^u	5.4 y (O; mean); 4.8 y (O; GM) ^k 3.4 y ⁿ (DW; mean)	
							15–50 yrs. of age-4.6 y ⁿ (DW; mean)	15–50 yrs. of age-3.1 y ⁿ (DW; mean)



Can we make a difference?

southwestjournal
Southwest Minneapolis' Community Newspaper

NEWS FOCUS VOICES MORE

ENVIRONMENT

Agreement targets source of Lake Calhoun pollution

DYLAN THOMAS / DTHOMAS@SOUTHWESTJOURNAL.COM

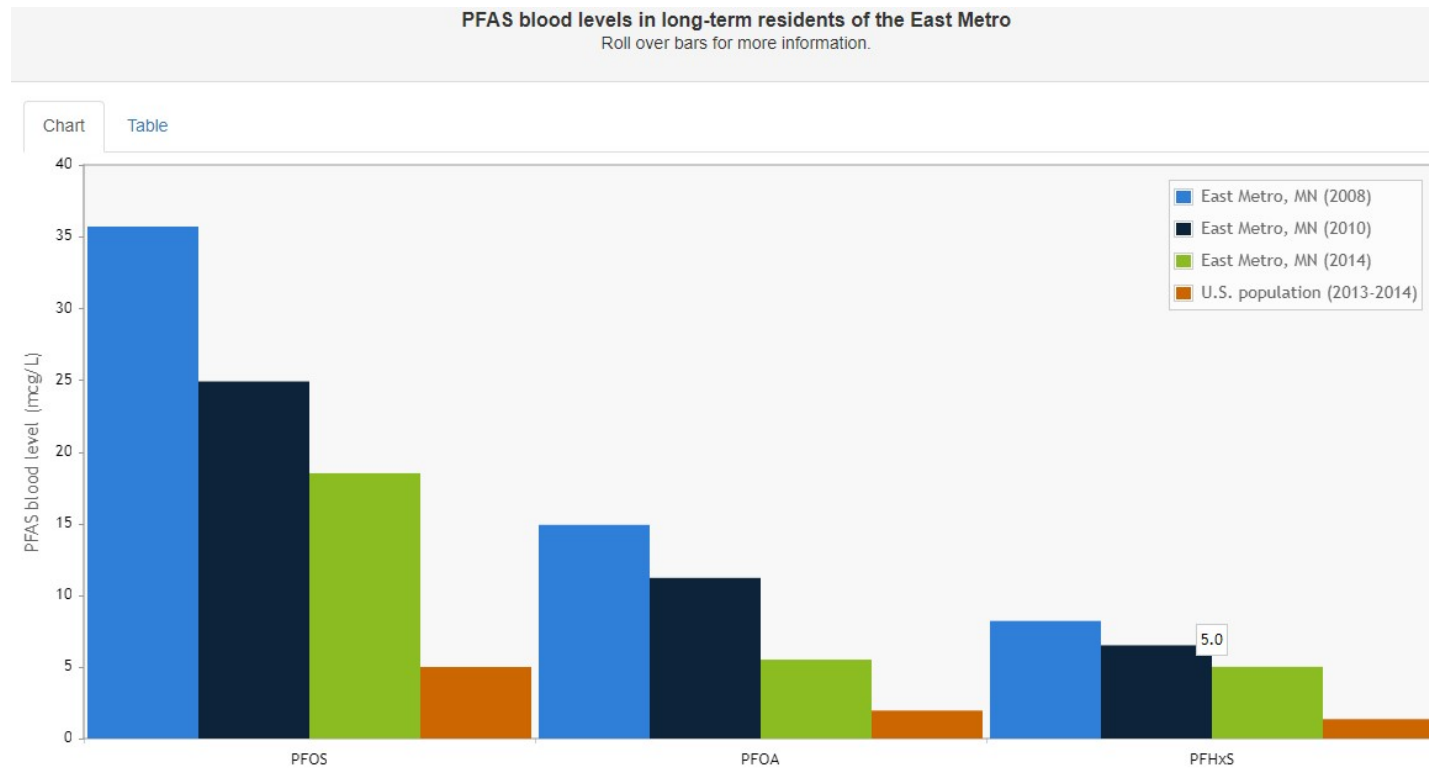
UPDATED: JULY 5, 2016 - 3:31 PM

JUNE 23, 2016



Lake Calhoun. File photo

- Long-chain PFAAs, with half-lives of one to several years, are slowly excreted in humans.



Wow...

1. Not the first time...



A truck sprays DDT in 1945 to eliminate mosquitoes on Jones Beach on Long Island, N.Y. (Keystone-France / Gamma-Keystone via Getty Images)



YouTube

U S Government Spraying DDT Insecticide on Children 1947 .

Questions, Discussion, Comments

Left: 1980s Pennsylvania Benefit – Spraying AFFF

Right: 1970s Cape Canaveral Fun Day

