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for Wisconsin's Natural Resources

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PFAS in Wisconsin Drinking Water:

A Summary of Current Detections
and their Implications for Wisconsin

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About this Work:

Opportunities Now is an issue paper series published by Wisconsin's Green Fire that summarizes the science and background of key conservation and environmental issues and makes policy recommendations that support pro-conservation outcomes. Each of the papers in our Opportunities Now series is the product of an analysis of current literature, interviews with agency staff and experts, and the consensus of our subject matter teams.

Policy makers, conservation organizations, and concerned citizens are all welcome to use and distribute Opportunities Now papers without restrictions.

The primary focus of this paper is PFAS in Wisconsin Drinking Water. This paper builds on our 2021 Opportunities Now publication "PFAS – Forever Chemicals in Wisconsin."

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Note: This report was updated Dec. 8th 2023 to correct an error on page 13 in the title of Map 1 from PFAS "detections" to "exceedances."

PFAS in Wisconsin Drinking Water:

A Summary of Current Detections and their Implications for Wisconsin

I. Summary of Findings

Drinking Water and Groundwater Standards

- Upcoming federal drinking water standards are likely to be significantly more restrictive than current Wisconsin standards and include more compounds than are currently included in Wisconsin drinking water standards. **Wisconsin drinking water standards will need to be modified to be at least as restrictive as federal standards and include the same contaminants.**
- Some of the most pronounced PFAS contamination in Wisconsin have been found in private wells. However, PFAS testing of private wells is still limited and understanding of PFAS contamination of private wells is incomplete. **Wisconsin currently has no standard for PFAS in groundwater that would address the health risks of PFAS in private wells.**
- Municipal and industrial biosolids can be significant sources of PFAS contamination. Although the Wisconsin Department of Natural Resources (WDNR) is beginning to implement an interim biosolids program of limited scope, **the WDNR has not developed a comprehensive PFAS biosolids sampling program or initiated regulatory actions or rulemakings to address biosolids.**

PFAS Extent in Wisconsin

- PFAS contamination in Wisconsin's water supplies is not ubiquitous and is generally limited to areas near specific PFAS releases or known sources. Nonetheless, when PFAS contamination occurs, it creates **significant human health risks**, and triggers **significant costs to affected communities**.
- Most PFAS currently being detected in water systems are "legacy" PFAS resulting from releases which may have occurred as early as the 1970s and up until 2016, when some early forms of PFAS in common use were discontinued by manufacturers.
- Given the legacy of over 50 years of widespread PFAS use, their persistence in the environment, and a growing number of PFAS compounds that may be captured in testing as laboratory capabilities continue to grow, **the extent of PFAS contamination today in drinking water systems, and in groundwater and surface waters is not static and could continue to grow as more testing for more PFAS chemicals occurs.**

Costs of PFAS Treatment

- Wisconsin's Green Fire estimates **the capital cost** for treatment of **public water systems and alternative water supplies contaminated with PFAS is $208 Million**. This number will change as sample results become available for more non-municipal systems and as inflation pushes the costs of future treatment systems higher.
- Because the burden of costs to affected parties is high and because liability cases are time consuming to resolve, it is unlikely that the costs of addressing PFAS contamination can be timely and fully recovered through responsible party liability. **The full burden of addressing PFAS in Wisconsin is likely to be shared between federal, state, and local funding provided by taxpayers, business expenses, costs borne by private citizens, and ultimately, settlements achieved with responsible parties.**

Conclusions

- Low-income communities, communities of color, and otherwise vulnerable communities may be disproportionately exposed to PFAS contamination due to their close proximity to sites where PFAS are present, or due to limitations on their ability to recognize or respond to PFAS exposure. **The risk of disadvantaged communities and vulnerable people or populations in Wisconsin experiencing inordinate health impacts or cost burdens due to PFAS exposure has still not been fully evaluated.**
- **The process under current law, by which state and federal agencies identify, evaluate, and establish standards for individual contaminants is too slow to respond and is not capable of effectively addressing the full risk from PFAS in the environment.**
- Responding to the large and growing number of PFAS chemicals in current use demands more efficient and effective approaches. **Regulation of PFAS collectively as a class of chemicals based on each chemical's fluorine composition is one promising approach.**
- Like similar complex problems, **addressing the impacts of PFAS will require investment, coordination, and most of all, cooperation across all sectors.** State and federal government, the manufacturing and business community, academia, health care systems, non-governmental organizations, local units of government, and members of the public will all need to work together to create effective responses.

II. Background

Per- and Polyfluoroalkyl Substances (PFAS) refers to a large class of chemicals, many of which have been in production and use in a wide variety of consumer products and industrial applications since at least the 1950s (table 1). PFAS are often called "forever chemicals" due to their unique molecular structure that gives them extraordinary persistence in the environment and the ability to resist decomposition.

PFAS are especially valued for their ability to resist grease, stains, oil, water, and heat and are found in many everyday products such as firefighting foam, carpeting, coated paper, chrome metal plating, nonstick cookware, dental floss, and a wide variety of food packaging.

Because of their extreme environmental persistence and their longstanding and widespread use in a wide variety of products and applications, PFAS are now detected in the environment and in humans, animals, and other organisms worldwide.

PFAS Compounds

Broadly, the U.S. EPA lists over 10,000 unique PFAS compounds in the agency's CompTox Chemical Library. Of those, at least 1,462 PFAS compounds were covered by the Toxic Substances Control Act (TSCA) as of February 2023.

Of the PFAS chemicals on the TSCA list, 770 have been identified as being used in commerce, mostly in a wide variety of consumer products and industrial applications.

PFAS Sources

There are numerous points within manufacturing and distribution systems and waste streams where PFAS, and products containing PFAS, enter the environment. Once in the environment, there are numerous pathways by which PFAS impacts all forms of life. PFAS have been found in all exposure pathways – air, land and water.

In addition to ingestion of PFAS from drinking water, humans can also be exposed to PFAS through consumption of foods prepared in non-stick cookware, food packaged in PFAS-containing material, or food grown near a PFAS source. Exposure can also occur by breathing PFAS-laden dust from fabrics (figure 1). As PFAS-containing items are discarded, they enter the environment through the solid waste stream or directly to the air or water (figure 2). Once PFAS-containing products are discarded, the PFAS will remain in the air, water, and soil indefinitely, regardless of the method of disposal, due to their persistent chemical makeup.

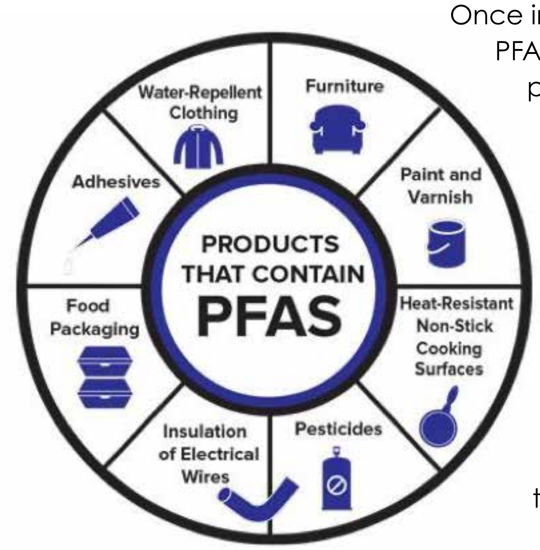


Figure 1: *Products containing PFAS. Source: New York State Department of Health, 2022.* https://www.health.ny.gov/environmental/chemicals/chemicals_and_health/

Table 1: *PFAS and Common PFAS Chemicals in Use*

PFAS: Per- and Polyfluoroalkyl Substances include a large class of chemicals, many of which have been in production and use in a wide variety of consumer products and industrial applications since at least the 1950s.

PFAS Chemical	Use	History
PFOA (perfluorooctanoic acid)	Non-stick and stain-resistant coatings, coated paper, firefighting foam	EPA voluntarily phased out PFOA in the early 2000s, and use ended in the United States between 2015-2018.
PFOS (perfluorooctane sulfonate)	Stain and water-resistant products (e.g. Scotchgard and floor wax), chrome plating, aqueous film-forming foams used for fire fighting, coated paper	3M was a large manufacturer of PFOS and PFOS-containing products in the mid 20th century, but stopped production of firefighting foams with PFOS in the early 2000s. By the 2010s, the EPA ended use of PFOS imports and chrome plating.
PFHxS (perfluorohexane sulfonic acid)	Water- and stain-resistant coatings, food packaging, firefighting foams, and industrial surfactants	3M was a large manufacturer of PFHxS and PFHS-containing products in the mid 20th century. By the early 2000s, 3M stopped production of firefighting foams with PFHxS. By the 2010s, the EPA ended use of PFOS imports and chrome plating.
PFNA (perfluorononanoic acid)	Stain and grease-proof coatings on food packaging, textiles	No longer in production. EPA and certain states have set limits/MCLs for PFNA in public drinking water systems.
GenX chemicals (trade name for a processing aid technology used to make high-performance fluoropolymers without the use of PFOA, EPA)	Used as an alternative in the manufacturing of products that use PFAS, such as food packaging, nonstick coatings, and firefighting foam (NCDHHS).	Manufactured today. Known exposure in drinking water, but other exposure routes are still being determined.
PFBS	Used as an alternative to PFOS. Detected in carpeting and carpet cleaners and floor wax.	No longer in production. 3M recently discontinued use of PFBS in Scotchgard.

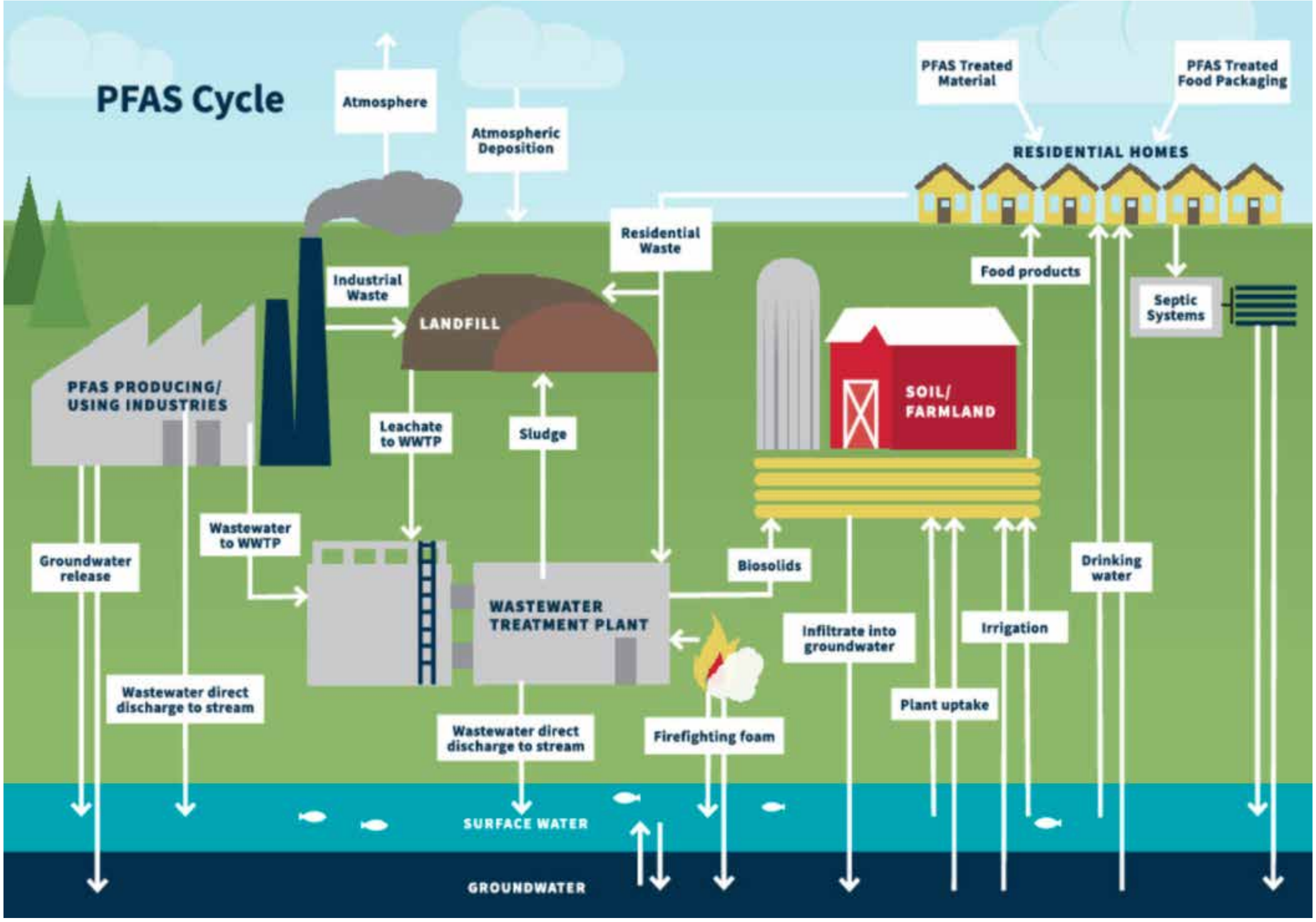


Figure 2: *How PFAS cycle through the environment, their fate and transport. Credit: Michigan Department of Environment, Great Lakes, and Energy*

Health Effects and Exposure Pathways

PFAS chemicals can cause human health effects because the compounds bind to proteins, particularly in the liver and blood. Current research suggests that high levels of PFAS may increase cholesterol levels, interfere with natural hormone levels, decrease how well the body reacts to vaccines, change liver enzymes, increase the risk of certain cancers, and increase the risk of pregnancy complications such as pre-eclampsia and lower average birth weights in newborns.

Due to their environmental persistence, PFAS compounds have high potential for bioaccumulation, biomagnification, and toxicity to organisms. Human exposures to PFAS are most closely associated with ingestion from contaminated water supplies. However, exposure to PFAS from dust in homes is one of several other exposure pathways.

PFAS and Disadvantaged Communities

PFAS contamination can be indiscriminate and affect communities and populations of all income levels and all demographics. Yet, some studies outside Wisconsin have shown that low-income communities, communities of color, and otherwise vulnerable communities are disproportionately exposed to PFAS contamination due to their close proximity to sites where PFAS are present. The risk of vulnerable people or populations in

Wisconsin experiencing increased health impacts due to PFAS exposure has still not been fully evaluated.

Individuals with known health risks, people exposed regularly to particular consumer products containing PFAS, or people practicing subsistence fishing in PFAS affected water bodies are just a few examples of groups who may be at higher risk. Also, people who lack the financial resources or the knowledge to identify and effectively limit exposure to PFAS in water in their home environment (especially in areas not served by public water systems) may also be at risk.

More work is needed to assess the particular risks faced by disadvantaged populations of all types in Wisconsin, and to design policies that best address those vulnerabilities.

PFAS testing equipment, image courtesy of WDNR

III. Drinking Water and Groundwater Standards

To the extent that environmental standards exist for PFAS in drinking water (water used for human consumption), they are applied through two distinct regulatory concepts – Drinking Water and Groundwater.

Drinking Water Standards

Federal Standards

The US Environmental Protection Agency (EPA) has proposed but not yet formally enacted environmental standards for six PFAS under the Safe Drinking Water Act (table 2). For two compounds: PFOA and PFOS, the proposed level is four parts per trillion (ppt), the lowest level that can be consistently measured in laboratory testing. For other compounds, PFNA, PFHxS, PFBS and GenX Chemicals, the federal regulation proposes to limit a mixture containing one or more of these compounds using a Hazard Index calculation to determine if the combined levels of these PFAS pose a potential risk.

Wisconsin Standards

In 2022, Wisconsin adopted surface water quality standards and drinking water standards of 70 ppt for only two PFAS compounds: PFOA and PFOS. The use of PFOS and PFOA in manufacturing was suspended in 2016 and as a result they are considered legacy PFAS.

Although PFOS and PFOA are important contaminants to address, the current standards are still incomplete and not sufficient to protect public health.

Once the U.S. EPA's proposed drinking water standards are formally adopted, WDNR will need to revise the state drinking water standards to match the federal standards. Until then, the current Wisconsin standard of 70 ppt will remain in effect.

Table 2: *PFAS Compounds Currently Identified by EPA for National Drinking Water Standards and their associated standards under federal and state rules. PPT = Parts per Trillion, or ng/L.*

	PFOA	PFOS	PFHxS	PFNA	Gen X	PFBS
Wisconsin DNR Enforcement Standard	70 ppt	70 ppt	none	none	none	none
Wisconsin DHS Hazard Index Maximum Contaminant Levels (MCL)	20 ppt	20 ppt	40 ppt	30 ppt	300 ppt	450,000 ppt
EPA Proposed Maximum Contaminant Levels (MCL) and Health Based Water Concentrations (HBWCs)	4 ppt	4 ppt	9 ppt	10 ppt	10 ppt	2,000 ppt

Public water supply systems, include **community** (municipal and non-municipal) and **non-community** systems (see below) are regulated at the federal and state level through Drinking Water standards.

Community Water Systems include municipal (those owned by a municipality) and non-municipal (privately owned) systems. Community Water Systems supply water to the same population year-round and serves at least 25 people at their primary residences or at least 15 residences that are primary residences (i.e. mobile home parks).

Non-Community Water Systems include **transient** systems (serving 25 or more people at least 60 days/year but not to the same people on a regular basis (e.g. campgrounds or gas stations) and **non-transient** systems (serving at least 25 of the same people at least 6 months/year, but not year-round (e.g. schools, small businesses, etc.).

Private wells and water systems serving single family homes, farms, and small businesses, and other users not served by community or non-community water systems. As many as one third of Wisconsin residents obtain water from private wells and private water systems, most of which are supplied by groundwater.

The Wisconsin Department of Health Services (WDHS) has a non-enforceable guidance known as the WDHS Hazard Index. In addition to the promulgated standards for PFOA and PFAS, other compounds with a value greater than "1" on the WDHS Hazard Index are considered a non-enforceable "exceedance." The WDHS Hazard Index divides the laboratory concentration by the recommended Maximum Contaminant Level (MCL) for each of 13 PFAS and then adds the values. See WDNR's publication, *Wisconsin's Community Response to PFAS in Drinking Water* for further information.

Groundwater Standards

Federal Groundwater Standards

The U.S. Environmental Protection Agency (EPA) does not regulate groundwater quality and thus, there are no uniform federal groundwater standards for use by states. Individual states choose whether and how to regulate the water consumed by their residents through private drinking water wells.

State Groundwater Standards

The WDNR is responsible for promulgating groundwater standards in Wisconsin, however Wisconsin currently has no standard for PFAS in groundwater. Proposed rules establishing groundwater standards for PFOA and PFOS were rejected by the Natural Resources Board in the spring of 2022.

Several Wisconsin communities have found extremely high levels of PFAS within private wells serving their residents. In the Town of Campbell (La Crosse County), more than 500 private wells are impacted with a suspected source being fire-fighting foam used at a nearby airport. In the Town of Stella (Oneida County), a significant number of private wells are also contaminated at very high levels, with investigations ongoing as to the source of the PFAS.

The process for developing state groundwater standards in Wisconsin involves both the Department of Health Services (WDHS) and WDNR. Proposed groundwater standards must be approved as rules by both the Wisconsin Natural Resources Board and the State Legislature, a process which under current governing law takes as much as three years to complete.

Direct risks of PFAS contamination are not limited to homes or businesses that use private wells for drinking water. Agricultural operations that use groundwater for livestock, dairy and food production are also at risk due to lack of groundwater standards or sampling requirements.

Private Water Systems – Unregulated and At Risk

Adoption of a PFAS groundwater standard will be an important first step, however if or when such a standard is adopted it will not by itself ensure that private well users will be protected from contamination.

The practicality of ensuring compliance with a standard for residents and water users served by the more than 800,000 private wells in Wisconsin is a unique challenge that will be more complex, difficult, and slower to address effectively than it will be professionally managed public water systems.

Property owners who obtain water from private wells have unique disadvantages with regard to PFAS. There is no private well testing requirement and voluntary testing is both expensive and complex to manage for well-owners. Many owners may not want their wells sampled due to concerns that disclosure requirements could affect property values or even property marketability at the time of sale. In addition, the cost for both well sampling and PFAS treatment options may not be affordable to homeowners.

Private well-owners with PFAS detections may find it necessary to install in-home treatment systems, replace existing wells, or in some cases secure alternate water supply sources altogether. There are limited sources of financial support currently in place to cover such expenses. Many home, farm, and business owners on private wells with PFAS contamination will be covering those costs themselves with no immediate prospect for reimbursement.

Based on the limited information on the extent of PFAS contamination for residents on private water supplies, it is difficult to estimate the total costs that could be incurred for treatment. However, the current availability of public funding for well replacement or in-home treatment due to contaminated water is almost certain to be insufficient to address the need.

IV. PFAS Extent in Wisconsin Water Supplies

Our analysis of PFAS detections in Wisconsin indicates PFAS contamination of drinking water supplies is not ubiquitous but rather occurs mostly in association with known sources of PFAS release.

PFAS in Public Water Systems

To date, 559 (98%) of the estimated 570 municipal public water systems in Wisconsin have conducted and reported PFAS test results as required by the 2022 Drinking Water rules updates.

42 systems (7.6%) currently exceed or have exceeded the EPA's more stringent proposed Maximum Contaminant Level (MCL) standards (table 2).

When measured against the WDHS Hazard Index, 18 (3.3%) of 570 municipal drinking water systems currently exceed or have exceeded the MCL standards.

Less than 10 (1.7%) of Wisconsin's municipal water systems have exceeded the current Wisconsin drinking water enforcement standards of 70 ppt.

In some cases, communities with reported exceedances have taken actions to address them. This result means these communities are no longer considered to have an exceedance from a regulatory standpoint.

In many cases, exceedances are caused by PFAS other than PFOA and PFOS, such as PFHxS and PFNA, for which there is no Wisconsin regulatory standard.

(See Map 1.)

Evaluating the extent of detections today indicates that most communities with PFAS contamination are associated with a specific source of contamination that is either positively identified or indicated based on known PFAS-related activities (table 3).

Both large water systems (e.g. Wausau, Eau Claire), and small water systems (e.g. Edgar, Adams, Pewaukee) have identified PFAS contamination. Edgar has the **highest PFOA levels found in a municipal drinking water system at 48.5 ppt** and the city of Pewaukee has very high PFHxS concentrations at **43.3 ppt, 47 ppt and 52 ppt**, respectively (a compound for which there is no WI drinking water standard).

Examples of non-municipal public water systems include a Merrill preschool, reporting PFOS of **78 ppt (the highest found in any system in 2023)** and a subdivision in southeast Wisconsin, with **PFHxS over 300 ppt, including one of 410 ppt** (over **40 times EPA's proposed value** and over **10 times the DHS recommended value).**

PFAS in Groundwater

Despite notable occurrences of groundwater contamination from PFAS affecting private water supplies, little systematic sampling has been done on private wells until recently.

A study released on October 9th, 2023 based on systematic sampling of 450 wells throughout all 72 counties in Wisconsin detected PFAS in 71% of samples, however slightly less than 4 percent of samples (17) exceeded the EPA's proposed drinking water limits of 4 parts per trillion for PFOA and PFOS or 9 parts per trillion for PFHxS. Patterns observed in the study indicate potential risks of PFAS contamination can be higher in developed areas.

Potential Source Identification

PFAS contamination can in some cases be identified through understanding likely sources and source activities, knowledge of which can help inform the need for additional land and water sampling or investigations of site histories. Activities associated with past PFAS releases include some manufacturing activities such as chrome plating, manufacturing coated paper and packaging products, and metal manufacturing. Airports and other locations where AFFF foams have been used in testing or training are also known sources for PFAS detections.

Not all potential source activities have used PFAS or released PFAS to the environment. Potential source activities almost all have unique histories that need to be investigated, together with testing where warranted, to determine the degree of risk or contamination that may have occurred.

Maintaining state authority to require PFAS testing where warranted is an important safeguard to protect public health and facilitate use of public funds for remediation.

PFAS in Municipal and Industrial Biosolids

Two known sources of water supply contamination result from land-based spreading of PFAS containing biosolids from municipal and industrial wastewater treatment plants, resulting in PFAS entering surface water and groundwater.

Municipal biosolids are defined as the "nutrient-rich organic materials resulting from the treatment of domestic sewage in a wastewater treatment facility." Industrial sludges are defined as "solid, semi-solid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility."

As PFAS-containing materials are processed at water treatment plants (both municipal and industrial), PFAS are retained in the solids that remain after treatment. These "biosolids" can contain high levels of PFAS and are of concern because often they are spread onto land as nutrient enhancements.

Research conducted by the State of Michigan indicates that PFAS-contaminated municipal and industrial biosolids leach PFAS into the soil and groundwater. The EPA is currently conducting a risk-based assessment of PFAS in biosolids, and research is also underway at universities in Maine and Wisconsin to determine if PFAS in biosolids are taken up by plants grown in fields where biosolids are spread.

Maine and Michigan have been the most active states in addressing PFAS in biosolids. Maine recently dedicated $70 Million to be used to compensate farmers affected by PFAS contamination and to further study PFAS contamination issues. Michigan conducted research on the leaching effects of PFAS

Further Biosolids Resource links:

Michigan: Biosolids and PFAS

Minnesota: Biosolids and agriculture

Interstate Technology Regulatory Council: Biosolids fact sheet

Environmental Council of the States: PFAS in biosolids from biosolids and developed "interim guidance" that sets forth "action steps" to be followed by treatment plant operators. These action steps are based on PFAS testing of biosolids.

Legacy PFAS and Limitations of PFAS Testing

The most common PFAS used in the early years of PFAS manufacturing (AKA legacy PFAS) are now showing up as contaminants in Wisconsin water supplies. While the commercial use of the two most common legacy PFAS, PFOA and PFOS, were suspended by all U.S. manufacturers in 2016, the use of other PFAS chemicals continues in manufacturing and other commercial uses.

Fully assessing the risks from PFAS will require understanding a much broader range of PFAS chemicals in common use to determine how they differ chemically from other known PFAS, how they enter the environment, and their particular health risks. Thorough understanding of these risks is necessary so appropriate standards, prevention and remediation treatments can be developed.

Testing for PFAS chemicals and interpreting testing data is complicated by the extremely low levels (parts per trillion or ppt) at which PFAS chemicals are measured, the number of PFAS compounds involved, an evolving list of analytical targets, and the significantly different health impacts of different PFAS chemicals.

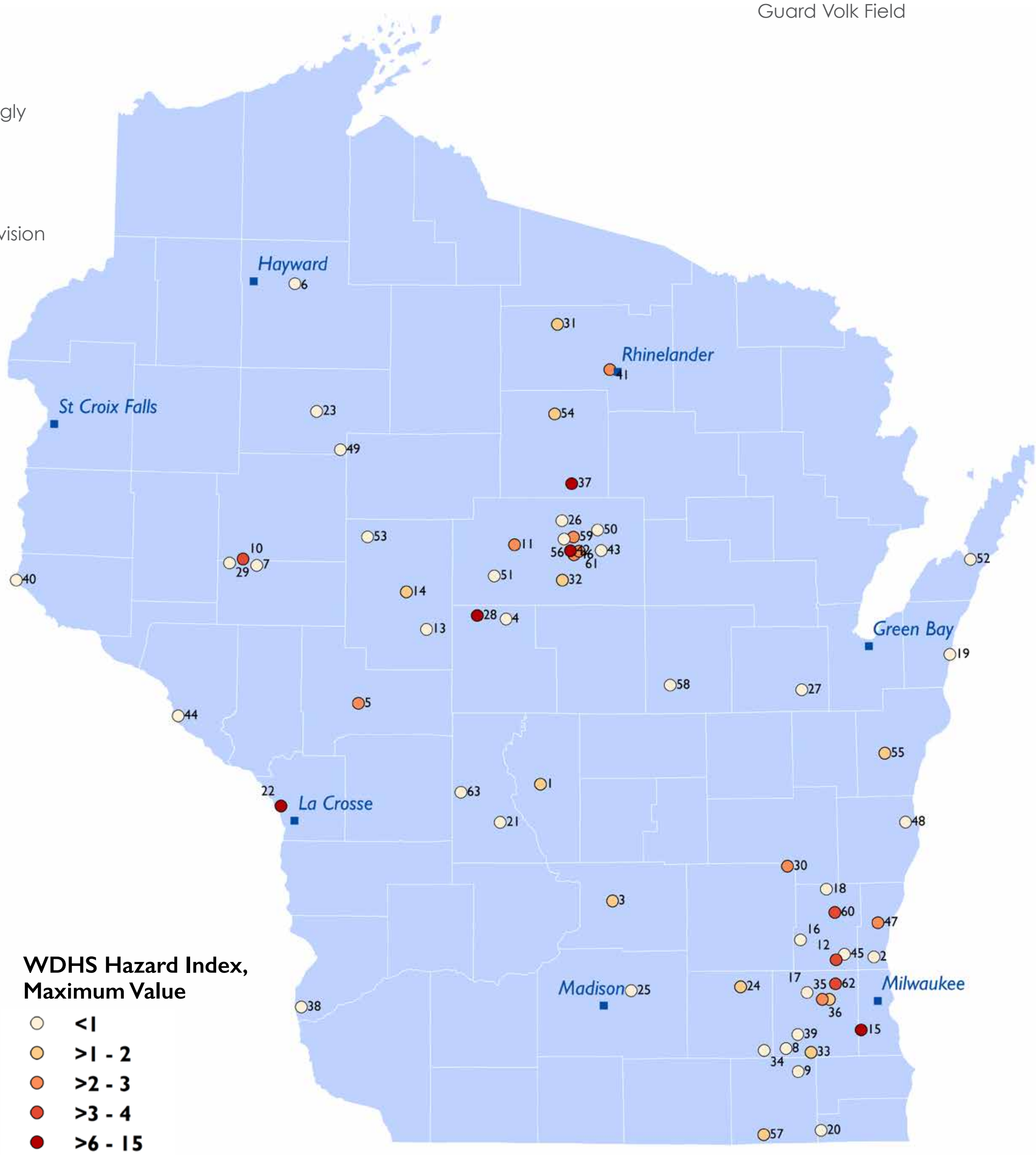
While laboratories use published analytical methods to accurately measure specific compounds, such methods have not been established for all PFAS compounds. As a result, when testing PFAS for which no analytical method has been established, testing labs may use published analytical methods established for other similar compounds, which may result in less reliable results or interpretation for some chemicals.

Map1: *Wisconsin Water Systems with PFAS Exceedances.*

Wisconsin Water Systems with PFAS Exceedances

WELL SYSTEM DATA AS OF OCTOBER 2023

1 Adams
2 Alberta Subdivision
3 Alliant Energy Columbia Plant
4 Auburndale Elementary School
5 Brockway
6 Concor Tool and Machine
7 Cozy MHP Front
8 Eagle
9 East Troy
10 Eau Claire
11 Edgar
12 Fox Brothers Piggly Wiggly Hubertus
13 Granton
14 Grassland Dairy Office
15 Hales Happiness Subdivision
16 Hartford
17 Hartland
18 Kewaskum
19 Kewaunee
20 Knolls Water Coop
21 Kountry Aire Estates MHP 1
22 La Crosse
23 Ladysmith
24 Little Dumplings Early Learning Center
25 Madison
26 Maine Elementary School
27 Maplewood Village MHP
28 Marshfield
29 Menards Old Mill Center
30 Michels Corp Trenchless Facility
31 Minocqua Hazelhurst School
32 Mosinee East
33 Mukwonago
34 Palmyra
35 Pewaukee, City
36 Pewaukee, Village
37 Pine River School for Young Learners
38 Prairie du Chien
39 Prairie Village Water Trust
40 Prescott
41 Rhinelander
42 Rib Mountain
43 Riverside Elementary School
44 Riverview Park MHP
45 Rockfield Elementary School
46 Rothschild
47 Saukville
48 Sheboygan, Town
49 Sheldon
50 St Johns Lutheran School Church
51 Stratford
52 Sturgeon Bay
53 Thorp
54 Tomahawk
55 Valders
56 Veritas Steel 1
57 Walworth
58 Waupaca
59 Wausau
60 West Bend
61 Weston
62 Willow Springs MHP
63 Wisconsin Air National Guard Volk Field



Map created Nov. 6, 2023.

Table 3: *PFAS in Wisconsin Water Systems Summary. Estimated numbers of tested water systems and DHS Hazard Index results using publicly available data as of October 10th, 2023.*

PFAS in Wisconsin Water Systems Summary							
10/10/2023							
Type	**Estimated Number**	**% with Lab Results Reporting**	**Projected Number Reporting**	**Exceeding DHS Hazard Index = 1.0**	**Exceeding DHS Hazard Index = 1.0**	**Exceeding EPA Proposed MCLs**	**Exceeding EPA Proposed MCLs**
				Number	%	Number	%
Municipal	559	99	554	18	3.2%	42	7.6%
Mobile Home Parks	224	72	162	2	1.2%	11	6.8%
Subdivisions	57	80	45	1	2.2%	3	6.7%
Apartments	111	51	57	0	0.0%	0	0.0%
Schools	275	77	211	3	1.4%	10	4.7%
Day Care Centers	77	64	49	1	2.0%	1	2.0%
Industries	223	66	148	3	2.0%	5	3.4%
Commercial	268	40	108	2	1.9%	3	2.8%
Institutions	42	64	27	0	0.0%	0	0.0%
Other	8	75	6	0	0.0%	0	0.0%
Totals	**1844**	**74%**	**1367**	**30**	**2.2%**	**75**	**5.5%**
Notes:							
1. 3 of the 17 Municipal systems that exceeded the DHS Hazard Index are now under interim treatment and, hopefully, no longer exceed the index value of 1.0							
2. Over 50 municipal systems obtain water from other systems, and therefore are not required to have their water tested for PFAS. A small number of systems do not have PFAS sampling requirements.							

V. Costs of PFAS Treatment

Wisconsin's Green Fire has generated preliminary cost estimates for treatment and filtration of PFAS-contaminated water in public water systems in Wisconsin (table 4). We used publicly available information as of 2023 for communities and other water systems that have reported PFAS detections.

WGF currently estimates that, as of October 2023, the total capital cost for PFAS treatment of public water systems and alternative water supplies will be at least $208 Million.

This estimate is informed from a variety of sources, including publicly available estimates and funding requests, supplemented with estimated costs of treatment based on prevailing technologies for communities and systems that have not reported cost estimates independently.

For some water systems, we used preliminary capital cost estimates provided in financial assistance applications to WDNR. For other systems for which applications were lacking, we generated estimates based on reported information together with estimates based on costs reported from comparable systems.

The estimated costs will likely continue to change as test results become available for more non-municipal systems. Estimates will also likely continue to change as costs for systems change due to inflation or a result of newer technologies becoming more readily available.

Table 4. *Estimated Costs of Treatment for Public Water Systems in Wisconsin.*

Water Utility Types Treated for PFAS[1]	Estimated Initial Treatment Cost
Municipal Community Public Water Systems[2]	$157,400,000
Non-community Water Systems, including schools, day care centers, industries, subdivisions, mobile home parks[3]	$11,500,000
Alternative Water Systems supplying water to residents using private water supplies (e.g. the Towns of Peshtigo, Stella, and Campbell).[4]	$40,000,000
Total Public Water Systems and Alternative Water Systems	$208,900,000

1. Water utilities are grouped using categories defined under the Clean Drinking Water Act.

2. To date 98% of municipal community water systems have reported testing results. The estimate for municipal systems does not include grants and loans made to the City of Wausau.

3. Testing and data available for non-community water systems is largely incomplete so the precision of our estimates for these systems is significantly lower than for municipal systems.

4. These costs are working estimates for possible needs for new water systems in places where PFAS concentrations are too high to allow for reliable protection from point of use filtration systems.

PFAS Treatment Cost Estimates by Water System Type

Community (Municipal) Water Systems

For treatment of municipal public water supply systems, the **$157 Million** cost estimate is due in part to the large volumes of water treated in municipal systems, which typically provide water for residential, commercial, and industrial uses, including water used for purposes like watering lawns, flushing toilets, and washing clothes, in addition to drinking water.

While some communities will need extensive redesign of water treatment systems, other municipal public water systems will be able to comply with drinking water standards at a relatively low cost by shutting down affected wells or blending water from multiple wells.

Non-community (Non-municipal) Water Systems

For non-community public water systems such as schools, day care centers, industries, subdivisions, and mobile home parks, our preliminary treatment cost estimate is **$12 Million.** This estimate is based on less complete testing and is expected to grow as more sample information becomes available in the last months of 2023 and early 2024. Many of these typically smaller systems will be able to employ less costly point-of-use filtration systems that only treat drinking water, rather than treating all water coming from wells or incoming water supplies.

Alternative Water Systems

WGF has included a placeholder estimate of **$40 Million for costs of alternative water systems** in areas served by private water systems where a large number of private wells have been impacted by high levels of PFAS. Known examples include PFAS contamination in the Town of Peshtigo (Marinette County), Town of Campbell (La Crosse County), and Town of Stella (Oneida County).

For example, in the Town of Stella, the point-of-use filtration systems in many residences are not sufficiently effective or certified for use to treat high concentrations. A long-term solution for the Town of Stella may require piping water from a clean source some distance to the impacted residences along with possibly installing a water distribution system.

Operation and Maintenance Costs

Capital costs for PFAS treatment are front loaded, but do not account for the ongoing operations and maintenance (O&M) costs of PFAS treatment systems.

O&M costs are a function of both the volume of water treated and the amount of PFAS (mass) to be controlled, which affects the need to manage or replace filtration media. Thus, high water volumes and high PFAS concentrations will generally result in higher O&M costs.

For example, the City of Wausau estimates an O&M expense for changing out resins twice per year in their newly installed Ion Exchange System of at least $2 Million per year – an annual cost operating expense about 11% of the initial capital cost of their $17 Million system.

In most situations, available funding for PFAS remediation is unlikely to cover O&M costs and such costs are likely to be reflected in increased water user rates.

VI. Recommendations

Science-based Standards

As noted throughout this report, current Wisconsin environmental standards for PFAS are inadequate to protect public health for several reasons. Current standards do not reflect current science-based health advisory levels; they do not address all commonly detected PFAS chemicals; they do not address PFAS in groundwater; and they only partially address PFAS in surface water.

WDNR needs to propose—and the Wisconsin Legislature needs to approve—science-based statewide standards that are protective of human health and the environment for both drinking water and groundwater.

- WDNR should establish science-based environmental standards for drinking water at least as protective as the federal standards and ensure groundwater standards mimic those protective levels so all Wisconsin residents can access clean water.
- WDHS should continue to study health impacts from PFAS compounds and recommend health-based standards to the WDNR and the Legislature for the PFAS compounds that the WDHS studies, including those compounds currently in use.

Adequate and Targeted Funding

In the 2023-2025 State Budget, the Wisconsin Legislature appropriated $125 Million in a dedicated trust fund for addressing PFAS in Wisconsin. As of this publication in November 2023, no legislation has become law to direct spending of the $125 Million. Currently, there also is no legislation to resolve related questions of liability or to clarify WDNR authority with regard to PFAS contamination.

To assure the PFAS Trust Funds can be used effectively, Wisconsin needs legislation to:

- Ensure eligibility for financial assistance for municipal water systems.
- Ensure eligibility for financial assistance to schools, daycares, and subdivisions impacted by PFAS contaminated water.
- Provide grants to private well owners to test for PFAS while protecting their privacy and help fund household treatment technologies.
- Ensure funding and authority for the Wisconsin Well Compensation program to include PFAS contamination as an eligibility criteria.
- Add funding for future operation and maintenance costs of capital projects for municipal wastewater and water supply systems.
- Provide funding or assistance for PFAS remediation efforts for firefighting systems, municipalities, small businesses, and wastewater treatment plants.
- Ensure utility rate increases associated with responses to PFAS contamination are equitable and affordable to all.
- Ensure funding (including staffing) for state agencies and academic institutions to develop a coordinated effort to address PFAS across state government.

Treatment, Remediation, and Destruction

PFAS treatment and remediation will represent extraordinary expenses for many affected communities at a time when treatment technologies are still rapidly evolving. PFAS destruction technologies are still emerging and there is a significant need for research and development work and pilot testing of promising technologies.

To assure the PFAS treatment, remediation, and destruction can be conducted effectively, Wisconsin needs legislation to:

- Ensure PFAS Trust Funds are adequate to manage environmental contamination from PFAS, help fund PFAS clean-up, and devise cleanup and destruction procedures for PFAS-containing media.
- Provide funding through Universities of Wisconsin and private sector collaborations to test PFAS destruction and experimental pilot projects or field demonstration projects.

Monitoring, Testing, and Environmental Assessment

Although 99% of Wisconsin community water systems have now begun testing for PFAS, understanding of PFAS contamination is still incomplete in non-community water systems, and in communities served by private water supplies. In addition, PFAS release and exposure can occur via many other potentially significant routes for which very little information is available.

Wisconsin needs to take a proactive approach to predicting and identifying areas of PFAS exposure and understanding the human health and environmental risks they pose.

As the lead agency for PFAS management, WDNR needs authority and resources to:

- Establish a program to proactively identify areas with a high likelihood of groundwater contamination from PFAS and conduct targeted groundwater sampling to confirm any releases of PFAS into the groundwater. For example, the results of public water supply sampling could be used to investigate and categorize sources of PFAS contamination.
- Amend the Cooperative Agreement between WDNR and the Department of Defense (DOD) to ensure a full evaluation of the fate and transport of PFAS associated with contaminated DOD sites across the state.
- Reaffirm Wisconsin's One Cleanup Memorandum of Understanding with EPA to assure remediation of PFAS sites in Wisconsin is consistent with EPA's approach under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- Accelerate the evaluation and testing of biosolids and industrial sludges in order to ensure new sources of PFAS contamination do not reach surface waters and groundwater.
  - Facilitate statewide standard setting for use in future rulemaking (if needed).
  - Identify areas where private wells using groundwater may be at risk.
- Expand understanding of the prevalence of PFAS in the environment through PFAS sampling in air, water, soils, plants, fish, and wildlife. Information gathered can serve as a basis for developing environmental standards and identifying potential source areas for further testing.

Support for Affected Communities

When a community water system is impacted by PFAS, it is often a new experience both to those affected and for those responsible for managing public response. Communities affected by PFAS need to access consistent and reliable information and resources that enable rapid assessment, transparent communication, and effective short-term actions and long-term solutions.

- As the lead agency for PFAS management, WDNR needs authority and resources to support communities affected by PFAS with public information, technical support, and regulatory certainty.
- WDNR should coalesce responsibilities for support to communities with PFAS in a single office reporting to the WDNR Secretary.
- The Governor should establish an office dedicated to PFAS response for consumers and businesses with cross-program authority to provide consistent information on regulatory requirements, technical resources, and funding. The Wisconsin PFAS office would serve as a conduit for affected communities to access resources from state agencies and as a conduit to federal agencies.

Research Needs

As this report has made clear, there are numerous needs for research to better understand the full scope of risks posed by PFAS and their fate in the environment. Both state and federal funds, as well as private funding should be directed through Universities of Wisconsin and other research institutions to help:

- Coordinate PFAS-related research throughout programs and across all campuses.
- More fully assess a broader range of PFAS compounds and their respective risks.
- Support additional research into both legacy PFAS as well as PFAS currently in use that have not been evaluated in drinking water/groundwater, surface water and wastewater.
- Promote research for PFAS destructive treatment technologies.
- Support continued research on PFAS health and environmental impacts. This includes sampling fish tissues and blood serum from wildlife near suspected sources.

PFAS Education

Understanding of PFAS chemicals and their environmental impacts is still emerging among municipal officials who are charged with managing water supplies and wastewater treatment programs. Public alarm over PFAS and their risks is growing, both as a result of the experiences of residents in affected communities and through increased media coverage of PFAS issues.

WDNR, WDHS, University of Wisconsin - Extension and other NGO partners all have a role to play in providing effective and actionable information to water users, water system managers, and policy makers.

Effective education efforts for PFAS should include:

- Assisting consumer groups, consumers, and partner organizations in making informed decisions about PFAS in consumer products, alternative products, and proper disposal.
- Coordinating state agency development of PFAS-related educational material for the classroom.
- Continuing to provide technical support and training programs for municipal managers and local elected officials on PFAS information.

VII. Conclusions

While PFAS are not everywhere in Wisconsin and currently fewer than 10% of Wisconsin communities have detected PFAS contamination, PFAS are present in a wide range of environments and conditions, creating complex challenges for effective regulation and treatment.

The human health and environmental risks posed by PFAS are challenges that cannot be adequately addressed via the systems and policies that currently exist to address contaminants.

Liability for Remediation

Since at least 1980, environmental contamination issues have been addressed through the concept of responsible party liability in which business and government entities responsible for contamination are ultimately required to pay for clean-up and remediation.

In Wisconsin, responsible party liability is based primarily on state law. While common law claims such as nuisance, trespass and negligence are available in Wisconsin, WDNR may use the Wisconsin Spill Law (Wisconsin Statute Chapter 292.11) and Wisconsin Environmental Repair Act (Wisconsin Statute Chapter 292.31) to engage responsible parties to take appropriate remedial action.

At the federal level, the primary legal framework for responsible party law is the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), often referred to as the Superfund Law.

Because the burden of costs borne by communities, businesses, and individuals for remediating PFAS contamination is so potentially large, and because liability cases are time consuming to resolve, it is unlikely that the costs of addressing PFAS contamination can be fully recovered in a timely way through responsible party liability alone.

The full burden of addressing PFAS in Wisconsin is likely to be shared between federal, state, and local funding provided by taxpayers, business expenses, costs borne by private citizens, and ultimately, settlements achieved with manufacturers and responsible parties.

Single Chemical-based Regulatory Response

There are more than 10,000 unique recognized PFAS chemicals, and over 700 PFAS chemicals in current commercial use. The relatively slow process under current law by which state and federal agencies identify, evaluate, and establish standards for individual contaminants is not capable of effectively addressing the significant and immediate and risk from hundreds of PFAS compounds in the environment. Responding to PFAS contamination demands a more efficient and effective approach.

Treating and regulating [PFAS as a Class of Chemicals] is a subject of a growing discussion within the scientific and regulatory community. For example, because fluorine is a unifying component of all PFAS compounds, use of a Total Organic Fluorine (TOF) analysis could provide an efficient method for screening PFAS compounds. Standards established for PFAS as a class based on TOF could be an effective way to address both current and future PFAS chemicals that are currently unregulated.

Unique Burdens for Vulnerable Populations and Disadvantaged Communities

PFAS contamination has affected communities across the ethnic and demographic spectrum in Wisconsin. While PFAS emergence in a community may seem indiscriminate, the costs, risks, and health impacts of PFAS may fall especially heavily on vulnerable people and populations within affected communities.

For many people, factors such as underlying health conditions will increase the risk of more profound health impacts from PFAS. For others, the lack of resources, time, or knowledge of PFAS can be barriers to the ability to take even simple precautionary actions to limit exposure. The particular burdens PFAS creates for vulnerable people and disadvantaged communities are not well understood, but they are no less important.

Future funding and policies to address PFAS should reflect these particular burdens.

A Vision for Managing PFAS and Future Environmental Challenges

Like any complex societal problem, addressing the impacts of PFAS will require investment, coordination, and most of all, cooperation across all sectors including state and federal government, the manufacturing and business community, academia, health care systems, non-governmental organizations, local units of government, and members of the public.

Fortunately, there are many successful examples of the kind of coordinated campaigns that address complex challenges in society from chemical contaminations. Some 20th century examples include campaigns to eradicate the CFCs that caused the ozone hole, DDT pesticides that killed countless fish and birds, carcinogenic PCBs, and other widespread public health threats. Sustained efforts involving all sectors of society were essential to successfully dealing with these compounds, and the same will be true for managing PFAS in Wisconsin's water systems.

A positive beginning for effectively addressing PFAS in Wisconsin would be initiation of meaningful conversations between policy makers, state and federal agencies, and the business community to look forward toward a safer future.

Glossary

Glossary of Terms & Abbreviations

A

AFFF (or "A triple F"): Aqueous film-forming foams used in municipal airport and airfield firefighting.

B

Biosolids: Biosolids are a product of the wastewater treatment process. During wastewater treatment the liquids are separated from the solids. Those solids are then treated physically and chemically to produce a semisolid, nutrient-rich product known as biosolids. The term "biosolids" in this report refers to industrial and municipal biosolids.

C

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act or "Superfund Law".

Community Water Systems: A public water system that supplies water to the same population year-round.

Cooperative Federalism: A model of intergovernmental relations that recognizes the overlapping functions of the national and state governments. In general, governmental power is not concentrated at any governmental level or in any agency. Instead, the national and state governments share power

D

DHS: Wisconsin Department of Health Services

DOD: Department of Defense

G

GAC: Granulated Activated Carbon Filtration PFAS treatment system

H

Hazard Index: A method used by the Wisconsin DHS to evaluate the health risk from exposure to hazardous chemicals, calculated by comparing the levels of given PFAS chemicals in drinking water to an established health guideline (Level of PFAS 1/Health Guideline for PFAS 1 + Level of PFAS 2/Health Guideline for PFAS 2… = Hazard Index). HI > 1 = take action.

HBWCs: Health Based Water Concentrations

I

Industrial Sludges: Solid, semi-solid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility (EPA).

IXR: Ion Exchange Resins PFAS treatment system

L

LOD: Limit of Detection, see MDL.

LOQ: Limit of Quantitation. The level at which a compound can be accurately quantitated.

M

MCL: Maximum Contaminant Level

MDL: Method Detection Limit, interchangeable with LOD. A statistically-based limit that determines at what level a given compound can be detected.

Municipal Biosolids: The nutrient-rich organic materials resulting from the treatment of domestic sewage in a wastewater treatment facility.

N

Non-Community Water Systems: Non-Community systems include transient systems (serving 25 or more people at least 60 days/year but not to the same people on a regular basis (i.e. campgrounds, gas stations) and non-transient systems (serving at least 25 of the same people at least 6 months/year, but not year-round (i.e. schools, workplaces, etc.).

P

ppt: Parts Per Trillion, a unit of measuring the quantity of a substance in air, soil, or water

Public Water Supply Systems: Community (municipal and non-municipal) and non-community systems. Wisconsin's drinking water standards apply to public water supply systems.

R

RO: Reverse Osmosis PFAS treatment system

S

SDWA: Safe Drinking Water Act established in 1974. SDWA authorizes the United States Environmental Protection Agency to set national health-based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water.

Spills Law: Wisconsin Spills Law (Wisconsin Statute Chapter 292.11)

U

US EPA: United States Environmental Protection Agency

W

WDNR: Wisconsin Department of Natural Resources

Wisconsin Environmental Repair Act: Wisconsin Statute Chapter 292.31

WPDES: Wisconsin Pollutant Discharge Elimination System. WDNR-administered permit system regulating the discharge of pollutants in the state's waters. Permits contain all the monitoring requirements, special reports and compliance schedules appropriate to the facility in question.

WWTP: Wastewater Treatment Plant

Appendix I - Wisconsin Water Systems with PFAS Detections Exceeding EPA's Proposed Contaminant Levels

Wisconsin Water Systems with PFAS Detections Exceeding EPA's proposed Maximum Contaminant Levels					
System Name	**County**	**Year Determined**	**Exceeded/ Exceeds WI Enforcement Standards**	**Exceeds / Exceeded DHS Hazard Index**	**Highest DHS Hazard Index**
Municipal Water Systems (99% Reporting)					
Marshfield	Wood	2022	X	X	**8.2**
La Crosse	La Crosse	2014	X	X	**7.8**
Rib Mountain	Marathon	2021	X	X	**6.31**
Eau Claire	Eau Claire	2021		X	**5.6**
West Bend	Washington	2014		X	**4.34**
Rhinelander	Oneida	2014		X	**2.87**
Wausau	Marathon	2019		X	**2.83**
Pewaukee, Village	Waukesha	2023		X	**2.74**
Edgar	Marathon	2023		X	**2.68**
Adams	Adams	2022		X	**2.5**
Saukville	Ozaukee	2022		X	**2.23**
Brockway	Jackson	2023		X	**2.02**
Weston	Marathon	2022		X	**2.02**
Rothschild	Marathon	2022		X	**2.01**
Mosinee East	Marathon	2022		X	**1.98**
Pewaukee, City	Waukesha	2023		X	**1.93**
Green Lake	Green Lake	2023		X	**1.89**
Mukwonago	Waukesha	2023		X	**1.86**
Tony	Rusk	2023		X	**1.54**
Valders	Manitowoc	2023		X	**1.49**
Walworth	Walworth	2023		X	**1.13**

Legend	
	Exceeds DHS Hazard Index, and Exceeds/ Exceeded Enforcement Standard
	Exceeds DHS Hazard Index (1.0 is Considered an Exceedence)
	Does not Exceed DHS Hazard Index

Values are reported from publicly available test report records and Hazard Indexes determined by WDHS as of October 10, 2023. Some communities / water systems have made adjustments since first reporting including installing treatment systems, blending water, or removing wells to result in systems no longer being in exceedence. Ongoing testing and reporting continues to result in new occurrences being detected. For current reports on PFAS detections see the WDNR PFAS Interactive Data Viewer. https://dnr.wisconsin.gov/topic/PFAS/DataViewer

System Name	County	Year Determined	Exceeded/ Exceeds WI Enforcement Standards	Exceeds / Exceeded DHS Hazard Index	Highest DHS Hazard Index
Tomahawk	Lincoln	2023		X	**1.08**
Prairie Village Water Trust	Waukesha	2023		X	**1.01**
Madison	Dane	2017			**0.98**
Eagle	Waukesha	2023			**0.96**
East Troy	Walworth	2022			**0.93**
Wisconsin Air National Guard Volk Field	Juneau	2023			**0.87**
Thorp	Clark	2023			**0.78**
Kewaskum	Washington	2023			**0.71**
Sturgeon Bay	Door	2023			**0.7**
Sheboygan, Town	Sheboygan	2022			**0.62**
Prairie du Chien	Crawford	2023			**0.58**
Prescott	Pierce	2022			**0.56**
Waupaca	Waupaca	2023			**0.53**
Hartland	Waukesha	2023			**0.52**
Ladysmith	Rusk	2023			**0.51**
Stratford	Marathon	2023			**0.5**
Kewaunee	Kewaunee	2023			**0.44**
Palmyra	Jefferson	2023			**0.41**
Hartford	Washington	2022			**0.4**
Granton	Clark	2023			**0.3**
Sheldon	Rusk	2023			**0.21**

Legend	
	Exceeds DHS Hazard Index, and Exceeds/ Exceeded Enforcement Standard
	Exceeds DHS Hazard Index (1.0 is Considered an Exceedence)
	Does not Exceed DHS Hazard Index

Values are reported from publicly available test report records and Hazard Indexes determined by WDHS as of October 10, 2023. Some communities / water systems have made adjustments since first reporting including installing treatment systems, blending water, or removing wells to result in systems no longer being in exceedence. Ongoing testing and reporting continues to result in new occurrences being detected. For current reports on PFAS detections see the WDNR PFAS Interactive Data Viewer. https://dnr.wisconsin.gov/topic/PFAS/DataViewer

System Name	County	Year Determined	Exceeded/ Exceeds WI Enforcement Standards	Exceeds / Exceeded DHS Hazard Index	Highest DHS Hazard Index
Schools and Day Care Centers (73% Reporting)					
Pine River School for Young Learners	Lincoln	2023	X	X	**7.18**
Willow Springs Elementary School	Waukesha	2023		X	**2.78**
Little Dumplings Early Learning Center	Waukesha	2023		X	**1.51**
Minocqua Hazelhurst School	Oneida	2023		X	**1.49**
Riverside Elementary School	Marathon	2023			**0.82**
Auburndale Elementary School	Wood	2023			**0.8**
Rockfield Elementary School	Washington	2023			**0.73**
Blooming Grove Montessori	Dane	2023			**0.63**
Maine Elementary School	Marathon	2023			**0.62**
NTC Ag Center	Marathon	2023			**0.38**
Tibbets Elementary School	Walworth	2023			**0.36**
St Johns Lutheran School Church	Marathon	2023			**0.35**
Mobile Home Park/Subdivision/Apartments (67% Reporting)					
Hales Happiness Subdivision	Milwaukee	2023		X	**12.8**
Willow Springs MHP	Waukesha	2023		X	**3.82**
Westwind Mobile Home	Adams	2023		X	**2.78**
Maple Grove MHP	Dodge	2023		X	**1.12**
Lakewood Village MHP	Jefferson	2023			**0.73**
Countryside Estates #3	Eau Claire	2023			**0.7**
Knolls Water Coop	Kenosha	2023			**0.58**
Kountry Aire Estates MHP 1	Juneau	2023			**0.56**
Cozy MHP Front	Eau Claire	2023			**0.52**
Oak Ridge MHP 3	Jefferson	2023			**0.5**
Oak Ridge MHP 4	Jefferson	2023			**0.49**
Alberta Subdivision	Ozaukee	2023			**0.47**
Fisherman's Paradise MHP	Oneida	2023			**0.43**
Riverview Park MHP	Buffalo	2023			**0.37**
Maplewood Village MHP	Outagamie	2023			**0.27**

Legend	
	Exceeds DHS Hazard Index, and Exceeds/ Exceeded Enforcement Standard
	Exceeds DHS Hazard Index (1.0 is Considered an Exceedence)
	Does not Exceed DHS Hazard Index

Values are reported from publicly available test report records and Hazard Indexes determined by WDHS as of October 10, 2023. Some communities / water systems have made adjustments since first reporting including installing treatment systems, blending water, or removing wells to result in systems no longer being in exceedence. Ongoing testing and reporting continues to result in new occurrences being detected. For current reports on PFAS detections see the WDNR PFAS Interactive Data Viewer. https://dnr.wisconsin.gov/topic/PFAS/DataViewer

System Name	County	Year Determined	Exceeded/ Exceeds WI Enforcement Standards	Exceeds / Exceeded DHS Hazard Index	Highest DHS Hazard Index
Industrial / Commercial (53% Reporting)					
3M Greystone	Marathon	2023	X	X	**28.36**
Fox Brothers Piggly Wiggly Hubertus	Washington	2023		X	**3.88**
Michels Corp Trenchless Facility	Dodge	2023		X	**2.37**
Alliant Energy — Columbia Plant	Columbia	2023		X	**1.69**
Veritas Steel 2	Marathon	2023		X	**1.25**
Grassland Dairy — Office	Clark	2023		X	**1.07**
Concor Tool and Machine	Sawyer	2023			**0.71**
Menards Old Mill Center	Eau Claire	2023			**0.62**
Veritas Steel 1	Marathon	2023			**0.46**

Legend	
	Exceeds DHS Hazard Index, and Exceeds/ Exceeded Enforcement Standard
	Exceeds DHS Hazard Index (1.0 is Considered an Exceedence)
	Does not Exceed DHS Hazard Index

Values are reported from publicly available test report records and Hazard Indexes determined by WDHS as of October 10, 2023. Some communities / water systems have made adjustments since first reporting including installing treatment systems, blending water, or removing wells to result in systems no longer being in exceedence. Ongoing testing and reporting continues to result in new occurrences being detected. For current reports on PFAS detections see the WDNR PFAS Interactive Data Viewer. https://dnr.wisconsin.gov/topic/PFAS/DataViewer

Appendix II - PFAS Treatment and Destruction

Available treatment technologies do not destroy PFAS, but instead remove PFAS from water supplies. Technologies for destroying PFAS (i.e. converting PFAS to non-toxic by-products) are still in research and development.

PFAS treatment technologies for water systems are expensive and still evolving PFAS treatment may thus result in downstream issues, such as PFAS containing filter materials entering waste streams. These downstream waste management issues remain unresolved.

Ongoing operation and maintenance costs of PFAS treatment systems are significant but are often not fully considered in costing out PFAS treatment investments.

Common Treatment Technologies

The most frequently used treatment systems include granulated activated carbon filtration (GAC), ion exchange resins (IXR), and reverse osmosis (RO). Each treatment system is effective at reducing the impact of PFAS and is largely dependent on water chemistry and the type of PFAS contamination. Municipal systems will use a combination of these treatments to ensure the broadest protection against PFAS. Capital costs of treatment equipment generally are tied to the extent of the contamination and the amount of water produced through the system.

Treatment byproducts, such as GAC filters or IXR spent resins, will require management as a waste. Currently, these waste products are not considered hazardous wastes and may be disposed of in solid waste landfills. However, due to liability concerns some landfills are evaluating limiting certain PFAS-contaminated wastes as the PFAS are cycled back into the system as landfill leachate going to wastewater treatment facilities.

Treatment options for private, well-sourced water supplies are similar in nature to municipal systems, but on a smaller scale. Tabletop water pitchers with GAC filters range in price from $25-$200. Whole house GAC or RO systems can cost several thousands of dollars. Systems can be self-installed, or can be installed by a licensed plumber.

City of Wausau IXR/GAC System

- 2019-2022 Testing indicated all wells with PFAS above proposed drinking water standards.
- All municipal wells impacted.
- Provided households with GAC filter water pitchers.
- Study found new ion exchange resin system, installed to remove organic carbon, worked to manage PFAS.
  - Estimated $800,000 a year to operate for PFAS removal.
- Installing GAC system to extent life of resin and provide greater PFAS removal.
  - Capital costs = $17 million

City of Marshfield IXR System

- May 2022 found PFAS at pumping station above DHS Health Advisory Limits
- Shut down 4 wells feeding pumping station.
- Fall 2023- installing temporary ion exchange treatment.
  - Expected to treat up to 1 billion gallons over 5 years.
  - $1.3 million capital costs
  - One time resin change-out costs $500,000
- Permanent treatment system study/evaluation underway.

Figure 3. *City of Wausau and City of Marshfield PFAS treatment systems using IXR and GAC with capital cost summaries.*

Figure 4: *Commonly used PFAS treatments. Primary considerations for choosing a treatment system include, but are not limited to: cost, reliability, flexibility, and waste generation/management.*

Whole house systems in particular require maintenance and monitoring to assure effective operation, which may be beyond the skills or capability of many people using private water supplies, such as tenants in rental properties served by private wells.

According to the EPA's Drinking Water Treatment Database, other treatment technologies exist, but range considerably in their efficacy, costs, and scalability. These technologies include foam fractionation, thermal desorption, electrocoagulation, biological filtration, and ozone-hydrogen peroxide treatment.

PFAS Destruction

Treatment technologies can remove PFAS from water, making it safe to drink. However treatment does not eliminate PFAS contamination, it only sequesters PFAS into residuals that must be managed as PFAS waste.

PFAS destruction is more challenging than treatment and available technologies are still largely still in development.

In 2021, the EPA developed interim guidance on destroying and disposing of PFAS and PFAS-containing materials from non-consumer products. Destruction of the carbon-fluorine bond in the PFAS chemical chain is essential to eliminating future risks of PFAS. A National Institutes of Health paper evaluates these destructive technologies, which are currently in the development phase, but which have significant potential to destroy PFAS in a variety of contaminated media:

- Electrochemical oxidation
- Plasma
- Photocatalysis
- Sonolysis
- Supercritical water oxidation

Research and development into affordable, scalable, and realistic destructive technologies will be essential for human and environmental health.

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