PER- AND POLYFLUORINATED ALKYL SUBSTANCES

Key Takeaways

PFAS chemicals have been found to be widespread in the environment. They have been detected in Wisconsin groundwater, in some areas at very high levels. As you will see below, given the severity of PFAS there is a real need to determine the extent of PFAS contamination of Wisconsin's groundwater, and to assure that, in areas of concern, individual residents and public utilities test water supplies to ensure they are safe.

GCC member agencies are working on multiple initiatives related to reducing PFAS levels in groundwater (see groundwater management sections – DHS, DNR, UWS)

For actions to address PFAS contamination in groundwater, see the Recommendations Section of the report.

Sections in this document

What are PFAS?

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a large group of human-made chemicals that have been used in industry and consumer products worldwide since the 1940s. Their ability to repel water and oil and withstand high temperatures has made PFAS a particularly useful ingredient in industrial and commercial products, including non-stick products, stain- and water-repellent clothing, and aqueous film forming foams (AFFFs). These chemicals do not easily break down in the environment and have been known to accumulate in the environment and humans.

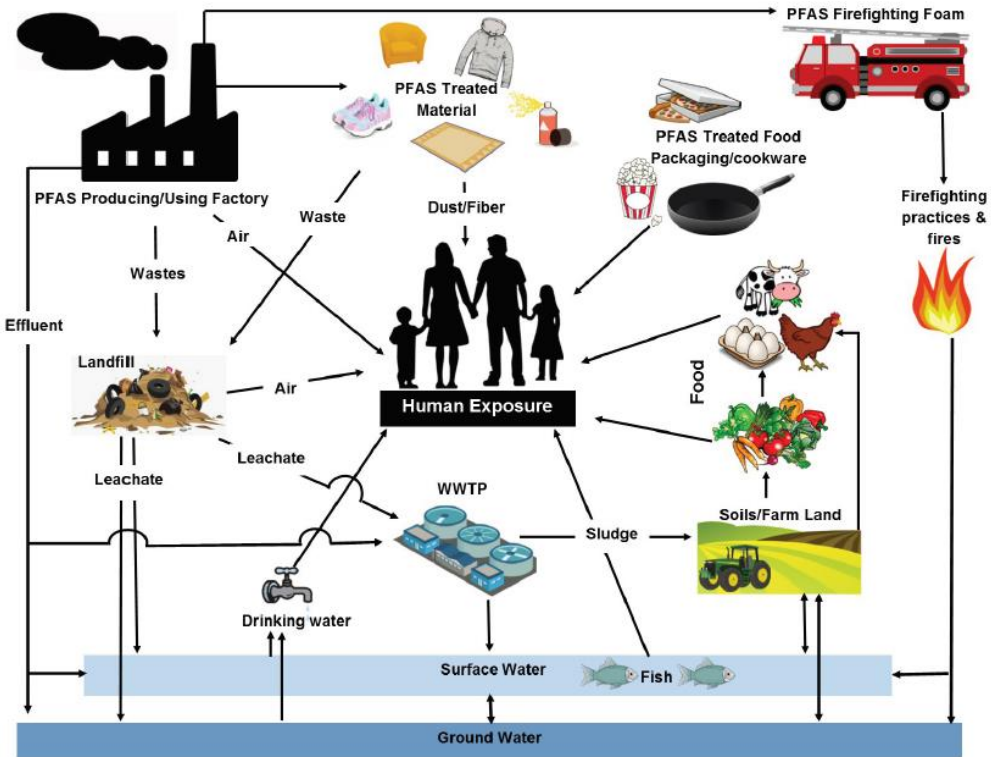
How might I come in contact with PFAS?

One of the main ways people come into contact with PFAS is by drinking contaminated water. Read the DNR PFAS brochure to learn more.

What are the sources of PFAS and how can I be exposed?

Sources of PFAS and modes of human exposure.

Image credit: Maine Drinking Water Program, Service Connection newsletter, Volume 25, Issue 4[1]



What are the human health concerns?

Although PFAS have been used extensively since the mid-20th century, in recent years the scientific health research community has made progress to better understand their potential impacts to human health. This understanding continues to evolve based on ongoing research. Perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) are the two most-studied individual PFAS chemicals. Current studies of these PFAS suggest exposure may:

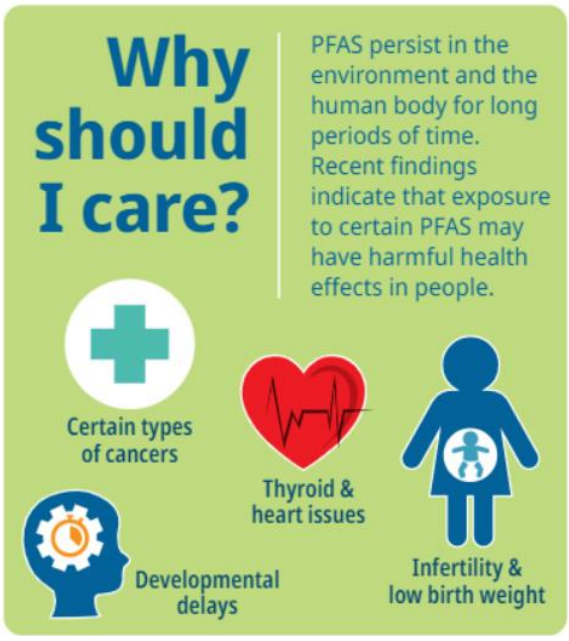
- affect childhood development,
- decrease female fertility,
- increase the risk of high blood pressure in pregnant women,
- increase cholesterol levels,
- increase the risk of thyroid disease,
- and decrease antibody response to vaccines.
- EPA research suggests that some PFAS may have the potential to cause cancer, but the topic requires further research.

Currently, there is limited regulatory authority regarding PFAS at the federal level. In 2016, the EPA issued a non-enforceable Lifetime Health Advisory level (HAL) for PFOA and PFOS of 70 parts per trillion (ppt) in drinking water. In June 2022, the EPA issued Interim updated lifetime HALs for PFOA and PFOS of 0.004 ppt and 0.02 ppt, respectively (four to five orders of magnitude lower than the previous HAL of 70 ppt). These health advisories are applicable to non-cancer health outcomes (the evaluation regarding cancer outcomes is still ongoing). Also in June 2022, EPA issued HALs for GenX chemicals, which refers to hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt, and perfluorobutanesulfonic acid (PFBS) of 10 ppt and 2,000 ppt, respectively.

The EPA Interim updated lifetime HALs for PFOA and PFOS are lower than currently available laboratory technology can measure. The PFOS HAL is about 10x lower than what instruments typically in use today can detect. The PFOA HAL is about 30x lower than what instruments typically in use today can detect. If future technology advances occur to detect at these lower levels, it remains to be seen if it will be possible to perform the analysis without contamination at sub-ppt levels. Although the new EPA HALs for PFOA and PFOS are below current detection limits, toxicity studies suggest that negative health effects may occur even at concentrations of PFOA or PFOS in water that are not currently detectable. EPA has stated in an FAQ on the HALs that it is known that the lower the levels of PFOA and PFOS, the lower the risk.

Should you be concerned about PFAS?

There is a growing public health concern over PFAS which do not occur naturally and are widespread in the environment. They are found in people, wildlife and fish all over the world. Because PFAS do not break down easily in the environment, and some PFAS can stay in the body for a long time, they are referred to as "forever chemicals." Read the DNR PFAS brochure to learn more.



On March 14, 2023, EPA announced proposed draft National Primary Drinking Water Regulation Maximum Contaminant Levels (MCLs) for six PFAS: perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA), perfluorobutane sulfonic acid (PFBS) and hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX Chemicals). Proposed is to regulate PFOA and PFOS as individual contaminants, at 4 ppt, and to regulate any mixture containing one or more of PFHxS, PFNA, PFBS,

and/or HFPO-DA (GenX Chemicals) using a hazard index approach to determine if the combined levels of these PFAS pose a potential health risk.

The WI Department of Health Services (DHS) has recommended state public health groundwater quality enforcement standards for 18 PFAS compounds. These recommended standards serve as state drinking water HALs. DHS has also recommended a cumulative risk assessment approach, called a hazard index (HI), for PFAS. The DHS PFAS HI takes into consideration all PFAS that have a recommended groundwater enforcement standard. The DHS PFAS HI is the summation of individual PFAS hazard quotients (HQs). The HQ is the ratio of the exposure dose (drinking water sample concentration) for: DONA, PFBS, PFHxS, PFNA, PFDA, PFTeA, PFUnA, PFDoA, PFODA, HFPO-DA , PFBA or PFHxA, or the combined concentration of NEtFOSE, NEtFOSAA, NEtFOSA, FOSA, PFOA, and PFOS, divided by their respective recommended public health enforcement standard. If the PFAS HI exceeds 1.0, DHS recommends that the water not be consumed.

The DNR, under Chapter 292, Wisconsin Statutes, has authority to require parties that discharge PFAS to the air, land, and waters of the State to take action to restore the environment to a practicable level. DNR's Water Quality Program has authority to regulate discharges to surface water in accordance with the federal Clean Water Act. New DNR administrative rules went into effect in 2022 to gradually phase in PFAS monitoring requirements for wastewater discharges. In some cases, these new regulations require some industrial sources to take action to reduce their PFAS discharge to municipal wastewater treatment facilities.

Following the EPA's June 15, 2022 issuing of interim HALs for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), and final HALs for perfluorobutane sulfonic acid and its potassium salt (PFBS) and hexafluoropropylene oxide (HFPO-DA) dimer acid and its ammonium salt ("GenX" chemicals), the DNR drafted a Statement of Scope proposing rulemaking to establish groundwater quality standards in ch. NR 140 for these four PFAS. Based on review of the current proposed EPA draft MCLs for PFAS, the department has decided to continue rulemaking for two of the four PFAS listed in the Statement of Scope, PFOA and PFOS. These proposed new groundwater quality standards for PFOA and PFOS are based on the existing recommendations developed by DHS.

How widespread are PFAS in Wisconsin?

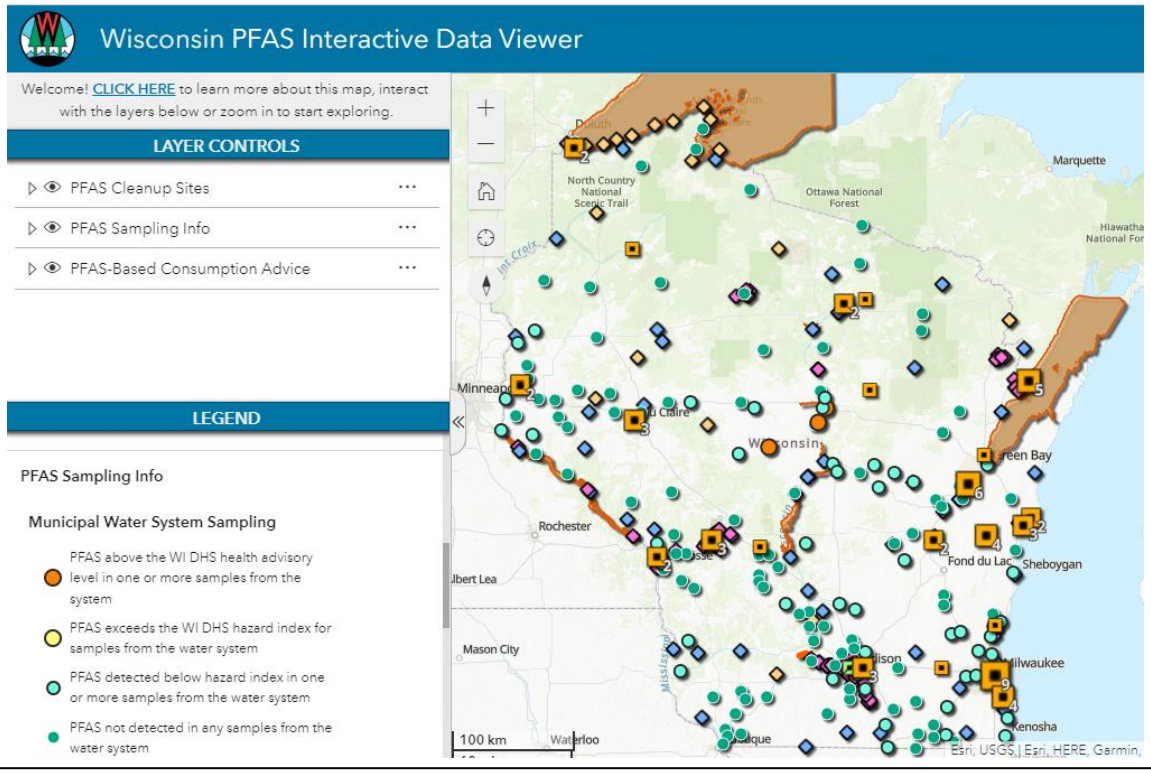
The DNR has conducted some sampling initiatives for PFAS in drinking water and ambient groundwater. These efforts included voluntary municipal drinking water sampling, open to all municipal systems, and a groundwater research study sampling private wells. Both projects were based on voluntary participation.

The municipal drinking water project sampled post-treatment water from about 130 municipal systems statewide. Laboratory analysis was done using EPA Method

537.1 for 18 PFAS, which includes 13 of the 18 PFAS that have established DHS drinking water HALs. Full results of the project will be available in 2024.

In June 2022, the DNR began a project to sample for PFAS and other water quality parameters in 450 private wells, spaced apart geographically across the entire state. The main objective of the research study was to determine concentrations of PFAS present in ambient groundwater, that is, groundwater in locations that are not near a known high concentration release of PFAS. Another objective was to evaluate the usefulness of several potential source indicator chemicals, chemicals that might be used to pinpoint what source(s) of PFAS to groundwater may be present in an area. Potential PFAS source indicators include some PFAS compounds that are environmental transformation products of fluorotelomer polymers, inorganic compounds such as nitrate and chloride, and some non-PFAS organic compounds. Those non-PFAS organics are the environmental transformation products of two herbicides (alachlor and metolachlor) that have been used extensively in Wisconsin, and a suite of human waste indicators that includes artificial sweeteners and pharmaceuticals. The project was a partnership between the DNR, Wisconsin State Laboratory of Hygiene and the Center for Watershed

The DNR maintains a Wisconsin PFAS Interactive Data Viewer a mapping tool that incorporates datasets from several DNR programs to show locations throughout Wisconsin that have been impacted by PFAS.



Science and Education at the University of Wisconsin-Stevens Point. The results of this study are currently under review and a project report is being drafted.

Prior to these two projects, limited information about the occurrence of PFAS in Wisconsin's groundwater resource had come mostly from the EPA's third Unregulated Contaminants Monitoring Rule (UCMR-3), conducted between 2013 and 2015, and from voluntary sampling by a few municipalities. In the UCMR-3 sampling, PFAS were detected in municipal water systems in La Crosse, West Bend, and Rhinelander. At the time, laboratory analysis was only done for six PFAS analytes, whereas since the beginning of 2020, laboratory analysis for Wisconsin samples has often been done for at least 33 PFAS analytes. Also, laboratory reporting limits were considerably higher in the UCMR-3 project than they are today. The data from UCMR-3 served as an initial indicator of the fact that both groundwater and drinking water supplies in Wisconsin have been impacted by PFAS. Voluntary sampling by a few municipalities (from 2019 through the first quarter of 2022) has shown additional impacts above Wisconsin DHS HALs in Madison, Eau Claire, Wausau and Rib Mountain. PFAS impacts in La Crosse and the Town of Campbell on French Island have also been documented during ongoing site investigations in those locations.

In the past several years, much work on PFAS in Wisconsin has focused on contaminated site investigations. As of July 2023, there are 95 open site investigations statewide (DNR Bureau for Remediation and Redevelopment BRRTS Tracking System at https://dnr.wisconsin.gov/topic/Brownfields/botw.html where one or more PFAS have been identified as a contaminant. Note that 33 PFAS investigation sites have now been closed (4 Environmental Repair Program cases and 29 NR 708 spill cases). PFAS related contaminated site investigations include former firefighting training areas (civilian, corporate and military), industrial facilities, landfills, and an area where biosolids were land applied.

The latter two types of sites are secondary sources, where PFAS were not produced or used directly but rather released to the environment due to their presence in consumer products or other waste streams. Among landfills, older unlined landfills may present a higher risk to groundwater. The environmental stability and lack of effective treatment of PFAS in municipal sewage plants may lead to their presence in biosolids, which might threaten the practice of biosolids land spreading as a beneficial reuse of municipal waste. In areas without municipal sewerage, PFAS may also be released to groundwater from septic systems due to their presence in numerous commercial products.

Where PFAS are discovered in groundwater and attributed to a responsible party, the site investigation and required remedial actions may result in a multi-year cleanup process, and for larger and more complex sites cleanup activities may take decades. This work includes all impacted media, not just groundwater. Despite the

fact that PFAS are exclusively created by industrial production and they do not occur naturally, PFAS have been found at relatively low levels in surface water (https://dnr.wisconsin.gov/topic/PFAS/SWFish.html), soil[2] and precipitation (in a study focused on Indiana and Ohio[3]; a Wisconsin-specific study of PFAS in precipitation was published in 2022[4]).

These studies indicate the potential that lower PFAS concentrations may also be found in ambient groundwater. The groundwater private well PFAS sampling project that finished up in the spring of 2023 should provide information about the chances of finding PFAS in private and small public (e.g., restaurants, schools, churches) drinking water systems. The project should also provide information to entities involved in PFAS site investigations that may help with determining if lower PFAS groundwater concentrations, more distal from the investigation site detections of PFAS, are from the site or may instead be coming from more disperse sources (e.g., consumer products).

Further Reading

- DNR PFAS page
- DHS Groundwater Contaminant recommendation process
- DHS Cycle 10 and Cycle 11 groundwater quality standard recommendations
- Interstate Technology and Regulatory Council fact sheets
- US Agency for Toxic Substances and Disease Registry PFAS page
- US Environmental Protection Agency PFAS page

References

1. Oliaei, F., Kriens, D., Weber, R., Watson, A., 2013. PFOS and PFC releases and associated pollution from a PFC production plant in Minnesota (USA). Environ. Sci. Pollut. Res. 20, 1977−1992. *https://doi.org/10.1007/s11356-012-1275-4*
2. Rankin, K., Mabury, S.A., Jenkins, T.M., Washington, J.W., 2016. A North American and global survey of perfluoroalkyl substances in surface soils: Distribution patterns and mode of occurrence. Chemosphere 161, 333−341. *https://doi.org/10.1016/j.chemosphere.2016.06.109*
3. Pike, K.A., Edmiston, P.L., Morrison, J.J., Faust, J.A., 2021. Correlation Analysis of Perfluoroalkyl Substances in Regional U.S. Precipitation Events. Water Research 190, 116685. *https://doi.org/10.1016/j.watres.2020.116685*
4. Pfotenhauer, D.; Sellers, E.; Olson, M.; Praedel, K.; Shafer, M. PFAS Concentrations and Deposition in Precipitation: An Intensive 5-Month Study at National Atmospheric Deposition Program − National Trends Sites (NADP-NTN) across Wisconsin, USA. *Atmospheric Environment* 2022, *291*, 119368. *https://doi.org/10.1016/j.atmosenv.2022.119368*.