

Per- and polyfluoroalkyl substances (PFAS) and Health

PFAS are a family of chemicals that have been widely used for decades. PFAS are extremely stable and do not break down in the environment. PFAS have been found in the water, air and soil around the world, including Minnesota. Some PFAS can build up and stay in the human body for many years, but can also slowly decline if the exposure stops.

PFAS can be measured in the blood of most people around the world, including Minnesotans. For most people, consumer products that are grease, oil, stain and/or water resistant are a much greater source of PFAS exposure than drinking water. PFAS chemicals are commonly used in non-stick and stain-resistant consumer products, food packaging, fire-fighting foam, and industrial processes.

People can be exposed to PFAS in many ways including drinking water where the source has been impacted by PFAS contamination. For most Minnesotans, the majority of PFOS exposure comes from non-drinking water sources. These can include:

- using consumer products treated with PFAS such as stain resistant carpeting and water-repellent clothing.
- eating food packaged in material that contains PFAS.
- eating fish caught from water contaminated by PFOS.
- eating food grown or raised near places with PFAS exposure.

Health Risks Associated with PFAS

There are many different PFAS, and each may impact health differently. Most studies about their effects on human and animal health have been done on two PFAS chemicals, PFOA and PFOS.

Recent epidemiology studies have consistently observed associations between PFOA and PFOS exposure and effects on the immune system (such as decreased vaccination response in infants and children), changes in liver function (such as higher cholesterol, elevated liver enzymes), and lower birth weight. In addition, lifetime exposure to PFOA has been associated with the development of kidney cancer. There is limited evidence for additional health effects from different PFAS, including: nonalcoholic liver disease and dyslipidemia, preeclampsia and pregnancy-related hypertension, and hypothyroidism and increased thyroid disease. Factors such as diet, genetics, and exposure to other environmental contaminants can also cause some of these health outcomes. Determining which PFAS chemicals cause health effects in humans and at what levels is an active area of research.

A limited number of PFAS chemicals have been studied in laboratory animals. These studies show strong evidence that high exposures to PFAS can cause harmful health effects in animals both early in life and as animals get older. The effects seen in animals largely overlap with those observed in epidemiology studies.

While we believe the immediate health risks for most people exposed to PFAS are low, the latest information indicates that fetuses and infants are more vulnerable and can be among the most highly exposed. Several PFAS are known to cross the placenta and concentrate within breastmilk. Long-term exposure to several PFAS, including PFOA, PFOS, and PFHxS, leads to a buildup of these chemicals in people of child-bearing age, which then increases exposure to fetuses and breastfed babies. Breastfeeding is a healthy activity for both baby and parent. If you have concerns about possible risks from PFOS during breastfeeding, consult with your physician. MDH recommends that women currently breastfeeding and pregnant women who plan to breastfeed continue to do so. MDH recommends that women who plan to become pregnant follow the recommendations in

[Reducing Exposures: Per- and Polyfluoroalkyl substances \(PFAS\) \(PDF\)](#)

[\(https://www.health.state.mn.us/communities/environment/hazardous/docs/pfas/pfasreducingexp.pdf\)](https://www.health.state.mn.us/communities/environment/hazardous/docs/pfas/pfasreducingexp.pdf).

Consumption of infant formula mixed with water containing PFAS can result in higher exposure to PFAS because babies drink more water per body weight than adults. If you are concerned about exposure to PFAS by consumption of infant formula and would like to lower your baby's exposure to PFAS, consider using bottled water or water that has been filtered to remove PFAS as your water source.

PFAS in Minnesota Waters

PFOA and PFOS has been detected in Minnesota surface water and groundwater for more than 20 years. MDH recently completed a major effort to collect and test water samples from 920 community water supplies (CWS) around the state, representing 99% of the state's CWS users. PFOA and PFOS have been detected in ~5% and ~6%, respectively, of CWS statewide. Additional information about PFAS Testing of Public Water Systems is available online at [PFAS Testing of Public Water Systems](#)

[\(https://www.health.state.mn.us/communities/environment/water/pfas.html\)](https://www.health.state.mn.us/communities/environment/water/pfas.html).

MDH and MPCA have measured PFOS levels in private wells, mostly in areas known to have been contaminated in the past. Additional information about PFAS and Private Wells is available online at [Monitoring PFAS \(https://www.pca.state.mn.us/air-water-land-climate/monitoring-pfas\)](https://www.pca.state.mn.us/air-water-land-climate/monitoring-pfas).

Health-Based Values for PFAS

MDH develops guidance values to protect people who are most highly exposed and people who are most sensitive to the potentially harmful effects of a contaminant, including pregnant people, fetuses, infants, and children. A person drinking water at or below the guidance value would be at little or no risk for harmful health effects. A full list of guidance values can be found online at the [Human Health-Based Water Guidance Table webpage \(https://www.health.state.mn.us/communities/environment/risk/guidance/gw/table.html\)](https://www.health.state.mn.us/communities/environment/risk/guidance/gw/table.html).

Table of Health-based Values for PFAS in Drinking Water

PFAS Detected in Minnesota	Drinking Water Guidance Value (ppb)
perfluorobutane sulfonate (PFBS)	0.1 [same as 100 ppt]
perfluorobutanoic acid (PFBA)	7 [same as 7000 ppt]
perfluorohexane sulfonate (PFHxS)	0.047 [same as 47 ppt]
perfluorohexanoic acid (PFHxA)	0.2 [same as 200 ppt]
perfluorooctanoic acid (PFOA)	0.0000079 [same as 0.0079 ppt]
perfluorooctane sulfonate (PFOS)	0.0023 [same as 2.3 ppt]

Evaluating Multiple Chemical Exposures

In some cases, water may contain multiple contaminants. Exposure to multiple contaminants may cause health effects that would not be predicted based on separate exposures to the individual concentrations of each contaminant present. When more than one PFAS is present in drinking water, MDH evaluates the “additive” risk that is created by the presence of multiple contaminants.

For more information: [Evaluating Concurrent Exposures to Multiple Chemicals \(www.health.state.mn.us/communities/environment/risk/guidance/gw/additivity.html\)](http://www.health.state.mn.us/communities/environment/risk/guidance/gw/additivity.html).

PFAS In Air

MDH develops health-based air guidance values to evaluate potential human health risks from exposures to chemicals in ambient air. An air guidance value is a concentration of a chemical in ambient air that is likely to pose little or no risk to human health. Air guidance values are developed using public health protective practices that protect susceptible portions of the population (including children, pregnant women and their fetuses, individuals compromised by pre-existing diseases, elderly persons, and others). Air guidance values apply to short time periods as well as a lifetime of exposure.

MDH has not previously derived air guidance values for PFAS. Currently, there is insufficient inhalation data available for PFAS to derive air guidance directly; however, PFAS information via the oral exposure route is more robust. Route-to-route extrapolation was implemented using MDH’s health-based guidance values information for PFAS in drinking water to derive air values.

More information can be found on the MDH website at [MDH Air Guidance Values \(https://www.health.state.mn.us/communities/environment/risk/guidance/air/table.html\)](https://www.health.state.mn.us/communities/environment/risk/guidance/air/table.html).

Table of Health-based Values for PFAS in Air

PFAS Detected in Minnesota	Drinking Water Guidance Value (ppb)
perfluorobutane sulfonate (PFBS)	0.3
perfluorobutanoic acid (PFBA)	10
perfluorohexane sulfonate (PFHxS)	0.034
perfluorohexanoic acid (PFHxA)	1 (short-term) 0.5 (subchronic and chronic)
perfluorooctanoic acid (PFOA)	0.0063
perfluorooctane sulfonate (PFOS)	0.011

Talking with your health care provider

Exposure to PFAS above health-based values does not necessarily mean you will experience health problems in the future. You can talk with your health care provider and ask if you need to be monitored for symptoms or conditions that may be related to PFAS exposure.

[Testing Your Blood for PFAS \(PDF\)](https://www.health.state.mn.us/communities/environment/hazardous/docs/pfas/indbltest.pdf)

(<https://www.health.state.mn.us/communities/environment/hazardous/docs/pfas/indbltest.pdf>) - It is possible to get your blood tested for PFAS, but the results have some important limitations. In general, MDH does not recommend blood testing for PFAS. This information sheet will help you understand what blood testing for PFAS.

[You can share the PFAS Resources for Health Care Providers](https://www.health.state.mn.us/communities/environment/hazardous/topics/pfaschproviders.html)

(<https://www.health.state.mn.us/communities/environment/hazardous/topics/pfaschproviders.html>) resource with your health care provider. The webpage has information for health care providers when counseling patients with known occupational, environmental, and residential exposures to PFAS.

For more information

On the web:

[MDH Per- and Polyfluoroalkyl Substances \(PFAS\) webpage](https://www.health.state.mn.us/communities/environment/hazardous/topics/pfcs.html)

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For questions about health-based guidance values:

Contact the MDH Health Risk Assessment Unit at health.risk@state.mn.us or call 651-201-4899.

For questions about health and contaminated sites:

Contact MDH Site Assessment and Consultation Unit at health.hazard@state.mn.us or call 651-201-4897.

Minnesota Department of Health
Health Risk Assessment Unit
PO Box 64975, St. Paul MN 55164
651-201-4899
health.risk@state.mn.us
www.health.state.mn.us



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To obtain this information in a different format, call: 651-201-4899.