Minnesota Department of Health
ENVIRONMENTAL HEALTH DIVISION

Perfluorochemicals (PFCs) and Health

ALSO REFERRED TO AS PERFLUOROALKYL SUBSTANCES (PFAS)

PFCs are a family of manmade chemicals that have been used for decades as an ingredient to make products that resist heat, oil, stains, grease and water and are extremely resistant to breakdown in the environment. Common uses of PFCs include: 1) nonstick cookware, stain-resistant carpets and fabrics, 2) coatings on some food packaging (especially microwave popcorn bags and fast food wrappers), 3) as components of fire-fighting foam, and 4) many industrial applications.

PFCs commonly detected in Minnesota include:

perfluorooctane sulfonate (PFOS; C8F17SO3),
perfluorobutane sulfonate (PFBS; C4F9C03),
perfluorooctanoic acid (PFOA; C8F15O2H),
perfluorobutanoic acid (PFBA; C4F7O2H),
perfluoropentanoic acid (PFPeA; C5F9O2H), and
perfluorohexane sulfonate (PFHxS; C6F13SO3).

What do we know about PFCs in the environment?

- *In the environment:* Because PFCs are so stable, they may be found in soil, sediments, water or in other places. Studies indicate that some PFCs travel through soil and easily enter groundwater where they may move long distances. Some experts suggest that PFCs can also travel long distances in air, deposit on soil and leach into groundwater. For more information about where PFCs have been found in Minnesota, see the Minnesota Pollution Control Agency Web page: Perfluorochemicals.
- *In wildlife:* PFCs have been found in the blood of many species of wildlife around the world, including fish, bald eagles and mink in the mid-western United States.
- *In fish:* PFOS is the PFC that accumulates to levels of concern in fish. Most fish have low levels of PFOS. However, the fish in some lakes have levels of PFOS that require restrictive fish consumption advice of only one meal of fish per month. For information on the Minnesota Department of Health (MDH) fish consumption guidelines, visit the Fish Consumption Guidance webpage: Minnesota Fish: Benefits and Risks. Information about PFCs in fish and site-specific meal advice are available.
- *In Minnesota lakes and rivers:* PFCs may be present in lakes and rivers at very low levels. MDH has determined that exposure to PFCs through swimming is not of concern. PFCs are poorly absorbed through skin and incidental ingestion of surface water while swimming will not result in a significant exposure. Also, because there is very little evaporation of PFCs

from water into the air, breathing them in while swimming or bathing is not a health concern.

- *In people:* Studies show that nearly all people have some PFCs in their blood, regardless of age. The PFCs most commonly found in human blood are PFOS, PFOA, and PFHxS. People are exposed through food, water, dust or from using commercial products. Some PFCs stay in the human body for many years. MDH conducted studies that measured PFCs in the blood of East Metro residents. For more information about the studies, see visit the MDH webpage: PFC Biomonitoring Projects.

Are PFCs harmful to people?

On May 19, 2016, the United States Environmental Protection Agency (EPA) released Drinking Water Health Advisories (HAs) for PFOA and PFOS. The HAs are based on noncancer and cancer health effects. The HAs were developed based on studies of PFOS and PFOA in laboratory animals, and they were informed by studies in humans. Studies in animals have found effects on the liver, development, and immune system responses. PFOA and PFOS were also associated with tumors in laboratory animals exposed long-term to high levels.

In humans, scientists are still studying whether PFCs cause health problems. Researchers have found links between PFCs and some human health outcomes. More work needs to be done to determine if PFCs cause health outcomes like cholesterol levels, birth weight, and immune system function or if they are due to other factors. Studies in PFC workers have not found consistent evidence that PFCs cause health problems.

EPA recommends that the HAs for PFOS and for PFOA apply to short periods of time (i.e., weeks to months) during pregnancy and breastfeeding, as well as over a lifetime of exposure. This recommendation reflects that PFOA and PFOS 1) stay in the human body for years and can increase with additional exposures and 2) can cross the placenta and are secreted in breastmilk.

MDH will continue to monitor the growing body of science about PFCs and adjust our health advice if needed.

What levels of PFCs are safe to drink?

MDH is responsible for ensuring safe drinking water for all Minnesotans. One way MDH does this is through regular testing of public water supplies for contaminants. MDH also works with the Minnesota Pollution Control Agency (MPCA) to investigate situations where groundwater contaminants may affect private wells.

Because PFCs are known to be in the environment in Minnesota, MDH has developed drinking water criteria, known as Health Risk Limits (HRLs) for PFOA, PFOS, PFBA, and PFBS. HRLs represent levels of chemicals in drinking water that MDH considers safe for people, including sensitive populations. Visit the MDH webpage for more information about Health Risk Limits (for Groundwater).

The HRL values for these four PFCs are:

Developed in 2009:
Perfluorooctanoic Acid (PFOA): 0.3 micrograms per liter (µg/L)
Perfluorooctane Sulfonate (PFOS): 0.3 micrograms per liter (µg/L)
These HRL values are currently under review due to the May 19, 2016 release of EPA Drinking Water Health Advisories for PFOA and PFOS.

Developed in 2011:
Perfluorobutane sulfonate (PFBS) and salts: 7 micrograms per liter (µg/L)
Perfluorobutyrate (PFBA): 7 micrograms per liter (µg/L)

Due to limited toxicological research on the other PFCs for which MDH's Public Health Laboratory currently tests, there is not enough scientific information to develop HRLs. MDH continues to follow ongoing research activities on other PFCs of concern and may develop guidance if sufficient toxicological data becomes available. Levels of these other PFCs have been very low in area groundwater samples.

More information about Perfluoroalkyl Substances (PFAS) Research is available on the US Environmental Protection Agency website.

EPA Health Advisory for PFOA and PFOS – May 2016

The United States Environmental Protection Agency (EPA) set a lifetime drinking water Health Advisory (HA) for PFOA of 0.07 micrograms per liter (µg/L) and for PFOS of 0.07 micrograms per liter (µg/L).

The EPA HAs for PFOA and PFOS are based on similar effects and are identical numbers. In drinking water where both PFOA and PFOS are found together, EPA recommends that the concentrations be added together. The HA for combined PFOS and PFOA is set at 0.07 micrograms per liter (µg/L). HAs are set to protect the population at large including sensitive individuals and are protective of both short-term as well as a lifetime of drinking water at these concentrations.

HAs serve as the informal technical guidance for unregulated drinking water contaminants to assist Federal, State and local officials, and managers of public or community water systems in protecting public health as needed. MDH is reviewing the EPA Drinking Water Health Advisories for PFOA and PFOS in order to determine the best action to protect the health of Minnesotans.

More information about the EPA Drinking Water Health Advisories for PFOA and PFOS can be found on the US EPA website.

The Water Research Foundation (WRF) recently released findings of a study addressing methods for removing poly- and perfluoroalkyl substances (PFASs) from water and wastewater. The research report, "Treatment Mitigation Strategies for Poly- and Perfluorinated Chemicals" can be found on the Water Research Foundation Website.

How can I reduce my exposures to PFCs?

PFCs are found in people and animals all over the world. They are found in some food products and in the environment (air, water, soil, etc.). Completely stopping exposure to PFCs is unlikely. If you live near sources of PFC contamination, you can take steps to reduce your risk of exposure to PFCs.

- If your water contains PFCs, you can reduce exposure by using an alternative or treated water source for drinking, food preparation, cooking, brushing teeth, and any activity that might result in ingestion of water. It is safe to shower and bathe in PFC-contaminated water. Neither routine showering or bathing are a significant source of exposure. Studies have shown very limited absorption of PFCs through the skin.
  - There are different types of bottled water-including purified water, spring water and others. Purified water is generally filtered using different methods including reverse osmosis and activated carbon. Spring water may also be filtered using activated carbon. While bottled water has not been tested for PFCs, both of these filtration methods have been shown to be effective at removing PFCs.
  - Filters containing activated carbon or reverse osmosis membranes have been shown to be effective at removing PFCs from water supplies. Other types of common water treatment systems, such as water softeners, are not likely to remove PFCs. Boiling water will not remove PFCs. MDH has information about water treatment devices on the MDH website page: Home Water Treatment Units: Point of Use Devices. Use a reliable installer to insure proper installation, operation and maintenance of the water filter system which will work best for your needs.
- People can reduce their exposure to PFCs in fish by following MDH's Fish Consumption Guidance. Fish are an excellent source of low-fat protein and most fish are healthy to eat. Special cleaning and cooking precautions used to reduce contaminants like polychlorinated biphenyls (PCBs) that concentrate in fat are not effective with PFOS.
- A variety of consumer products, including non-stick coatings on cookware and coatings on clothing, carpets, and paper packaging, have contained different types of PFAS in the past. While recent efforts to remove certain PFCs from many of these products have reduced the possibility of exposure, exposure may still be possible. However, research has suggested that exposure from consumer products is usually low, especially when compared to the impact of exposure in contaminated drinking water or contaminated food such as fish.

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