

# Perfluorocarbons (PFCs) in Drinking Water

## Frequently Asked Questions For Health Care Providers



## Background

This technical memo has been developed as a resource to help Navy Medicine health care providers prepare for health related questions from stakeholders concerned about their potential exposures to perfluorochemicals (PFCs) in drinking water.

As you will see from your review of the existing Federal and State fact sheets, the judgments/statements of the regulatory agencies are not always consistent. Moreover, information is changing as more data are obtained. If you have specific questions about the information provided, please contact the POCs provided below.

On 8 January 2009, the EPA's Office of Water released a Provisional Health Advisory (PHA) establishing health-based screening levels for PFOS and PFOA. They reflect health-based concentrations above which action should be taken to reduce exposure to these unregulated contaminants in drinking water. The PHA for PFOS is 0.2 micrograms per liter ( $\mu\text{g/L}$ ) and the PHA for PFOA is 0.4  $\mu\text{g/L}$ .

The Navy and Marine Corps have begun testing for PFCs in drinking water systems at certain installations CONUS, followed by all installations OCONUS.

As per attached BUMED Memo 6280 Ser M3B7/15UM30462 of 24 Dec 2015, in preparation for addressing potential high PFOS/PFOA sampling results, Navy Medicine Regions and medical treatment facilities (MTFs) must take the following steps:

Ahead of drinking water sampling, Regions must ensure each MTF identifies a POC who is knowledgeable of this program, is experienced in risk communication, and can answer questions regarding health risks and significance of testing results. The POC should coordinate with the regional or installation Drinking Water Manager prior to initiation of sampling and testing. Navy Medicine Regions should also identify a regional POC.

If PFOS or PFOA sampling results are above the EPA PHA, then MTFs should anticipate medical inquiries. The medical POC should also prepare to visit the affected facilities to address any concerns.

The medical POCs should be prepared to discuss the potential health risks due to PFOS/PFOA exposure, reasons why PFOS/PFOA blood testing is not recommended, as well as how to obtain a medical evaluation.

Blood testing for PFOS/PFOA is not medically necessary. While PFC blood tests can measure the level of PFCs in person's body at the time of the test, and one can compare those levels to those found through other U.S. testing programs, they cannot:

- (1) Tell a person where or how they were exposed to PFCs since there are many other sources of PFC exposure in a person's living and working environment.



- (2) Tell a person what, if any, health problems might occur, or have occurred, because of PFC exposure.
- (3) Be used by a health care provider to guide individual treatment decisions or additional medical tests. There are no medically approved “treatments” or ways to remove PFCs from a person’s body other than to decrease total exposure in order to reduce body burden over time.

Healthcare providers should perform any routine diagnostic or screening tests as medically indicated, based on their patients’ history, physical examination, and assessment, and not based on PFOS/PFOA levels.

The NMCPHC can provide assistance in the areas of toxicology, risk assessment, risk communication, preventive medicine, and occupational and environmental medicine. NMCPHC POC is Dr. Paul Gillooly, Environmental Programs, at (757) 953-0664 or DSN (312) 377- 0664 or paul.b.gillooly.civ@mail.mil.

BUMED POC is LCDR Jaime Vega, MC, USN, Occupational Medicine, at (703) 681-5467 or Jaime.Vega2.mil@mail.mil.

## Contents

Background .....	2
US EPA NAWC Warminster & NAS JRB Willow Grove Oct 2015 Fact Sheet .....	4
EPA Emerging Contaminants PFOS and PFOA Fact Sheet March 2014 .....	5
Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Statement – Perfluoroalkyls August 2015 Fact Sheet .....	7
New Hampshire Department of Health and Human Services Perfluorochemical (PFC) Fact Sheet Aug 13, 2015 .....	12
Frequently Asked Questions: Perfluorochemicals (PFCs) Detected in the Pease Tradeport Water System June 17, 2015 .....	14
Minnesota Department of Health .....	17
New Jersey Environmental and Occupational Health Surveillance Program .....	20
Massachusetts Department of Environmental Programs (MassDep) Fact Sheet – 5 Aug 2015 - PFOS in Drinking Water: Questions and Answers.....	22
Delaware Division of Public Health – Drinking Water Notice – PFOS Above Provisional Health Advisory – 12 June 2014 .....	24



## US EPA NAWC Warminster & NAS JRB Willow Grove Oct 2015 Fact Sheet

### **Q: Can I use my private well for showering/bathing children?**

**A:** Yes. Our primary concern is the ingestion of PFOS and PFOA in drinking water above the provisional HALs. When brushing teeth, monitor children so they do not ingest the water.

### **Q: Can I use my private well to water my vegetable garden?**

**A:** From a health perspective, the ingestion of PFOS and PFOA in drinking water, above the provisional HALs, is the primary exposure pathway of concern. PFOS and PFOA are unlikely to be taken up by plant roots via contaminated water. As a prudent public health action for all produce, vegetables and/or fruits should be washed thoroughly prior to consumption.

### **Q: Can I prepare baby formula with water contaminated with PFOS/PFOA above the HAL, or at any level?**

**A:** To reduce potential exposure to infants, caregivers should use pre-mixed baby formula or reconstitute formula using alternative water sources not containing PFOS and/or PFOA.

### **Q: How long have I been exposed to PFOS and PFOA in my drinking water?**

**A:** Unfortunately, there is no way to determine how long this chemical has been present in the water supply. The drinking water production wells, where PFOS and PFOA were detected at or above the HALs, have been taken off line to prevent further exposure. The Navy, EPA and PADEP continue to investigate potential sources.

### **Q: Do PFOS and PFOA cause cancer?**

**A:** There is evidence that both chemicals, in large doses, have caused tumors in animal studies. At this time, there is not enough information to determine, with certainty, if cancers and other adverse health effects in humans are caused by PFOS and PFOA.

There are some epidemiology data that indicate a link between PFOA (but not PFOS) and kidney and testicular cancers in humans however, more research is underway to evaluate the impacts of these compounds on human health. We do know that studies show that nearly all people have some level of PFCs in their blood, regardless of age. People may be exposed to PFCs through food, water, or from using certain commercial products.



## EPA Emerging Contaminants PFOS and PFOA Fact Sheet March 2014

[http://www.epa.gov/sites/production/files/2014-04/documents/factsheet\\_contaminant\\_pfos\\_pfoa\\_march2014.pdf](http://www.epa.gov/sites/production/files/2014-04/documents/factsheet_contaminant_pfos_pfoa_march2014.pdf)

### **What are the routes of exposure and the health effects of PFOS and PFOA?**

Based on the limited information available, fish and fishery products seem to be one of the primary sources of human exposure to PFOS (EFSA 2008).

While a federal screening level or toxicity value for the consumption of fish has not yet been established, the Dutch National Institute for Public Health and the Environment has calculated a maximum permissible concentration for PFOS of 0.65 nanograms per liter (ng/L) for fresh water (based on consumption of fish by humans as the most critical route) (Moermond and others 2010).

Potential pathways, which may lead to widespread exposure, include ingestion of food and water, use of commercial products or inhalation from long-range air transport of PFC-containing particulate matter (ATSDR 2009; EPA 2009c).

### **What are the environmental impacts of PFOS and PFOA?**

The wide distribution of PFCs increases the potential for bioaccumulation and bioconcentration as they are transferred from low to higher trophic level organisms. Because of their persistence and long-term accumulation, higher trophic level wildlife such as fish, piscivorous birds and other biota can continue to be exposed to PFOS and PFOA (EPA 2006a; UNEP 2006).

The bioaccumulation potential of PFCs increases with increasing carbon chain length (ATSDR 2009; Furdui and others 2007).

PFOS is the only PFC that has been shown to accumulate to levels of concern in fish tissue. The estimated bioconcentration factor in fish ranges from 1,000 to 4,000 (EFSA 2008; MDH 2011; OECD 2002).

### **References:**

US Environmental Protection Agency. Provisional Health Advisories for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) is available at:



[http://water.epa.gov/action/advisories/drinking/upload/2009\\_01\\_15\\_criteria\\_drinking\\_ph-PFOA\\_PFOS.pdf](http://water.epa.gov/action/advisories/drinking/upload/2009_01_15_criteria_drinking_ph-PFOA_PFOS.pdf)

US Environmental Protection Agency. Health Effects Document for Perfluorooctane Sulfonate (PFOS). February, 2014. Available at: [http://peerreview.versar.com/epa/pfoa/pdf/Health-Effects-Documnet-for-Perfluorooctane-Sulfonate-\(PFOS\).pdf](http://peerreview.versar.com/epa/pfoa/pdf/Health-Effects-Documnet-for-Perfluorooctane-Sulfonate-(PFOS).pdf)



# Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Statement – Perfluoroalkyls August 2015 Fact Sheet

<http://www.atsdr.cdc.gov/toxprofiles/tp200-c1-b.pdf>

## What recommendations has the federal government made to protect human health?

The EPA has recommended provisional drinking water health advisories of 0.4 µg/L for PFOA and 0.2 µg/L for PFOS. OSHA has not set any legal limits for perfluoroalkyl compounds in air. NIOSH has not set any recommended limits for perfluoroalkyl compounds in air.

## How can perfluoroalkyls enter and leave my body?

Perfluoroalkyls can enter your body if you breathe air, eat food, or drink water containing them. We do not know how much will enter your body through your lungs or your digestive tract. If your skin comes into contact with dusts or aerosols of perfluoroalkyl or with liquids containing perfluoroalkyls, it is possible that a small amount may enter the body through your skin. Once in your body, perfluoroalkyls tend to remain unchanged for long periods of time. The most commonly used perfluoroalkyls (PFOA and PFOS) stay in the body for many years. It takes approximately 4 years for the level in the body to go down by half, even if no more is taken in. It appears that, in general, the shorter the carbon-chain length, the faster the perfluoroalkyl leaves the body. Perfluoroalkyls leave the body primarily in the urine.

## How perfluoroalkyls can affect your health?

A large number of studies have examined the possible health effects of PFOA and PFOS in humans. The effect of inhalation exposure to PFOA and PFOS has been examined in workers exposed to high concentrations of these compounds. Studies have also examined a large community exposed to high levels of PFOA in the drinking water and compared this community to the general population; ingestion was the primary route of exposure for these two groups. Most human studies have looked for a relationship between levels of perfluoroalkyls in the blood and a health effect. It is difficult to interpret the results of these studies because they are not consistent; some studies have found associations, but others looking at the same health effect have not found these associations. Even though some studies have found significant associations between serum perfluoroalkyl levels and adverse health effects, it does not mean that perfluoroalkyls caused these effects. The effects may have been due to other factors that were not considered by the researchers. The available studies suggest that increases in blood cholesterol levels are associated with higher PFOA or PFOS blood levels in workers inhaling PFOA and/or PFOS as well as in people ingesting these compounds. There are data to suggest



an association between serum PFOA and PFOS levels and increased uric acid levels, which may be associated with an increased risk for high blood pressure. There is also some evidence that PFOA and PFOS exposure may cause liver damage.

Humans and rodents react differently to PFOA and PFOS, and not all of the effects observed in rats and mice may occur in humans. The liver appears to be the most sensitive target in animals ingesting perfluoroalkyls. The effects include increases in liver weight, changes in the liver cells, and changes in blood cholesterol and triglyceride levels. Studies in mice also found that the immune system is a sensitive target of PFOA and PFOS; effects include decreases in the size of the spleen and thymus and impaired immune function.

A short exposure of rats to very high levels of PFOA in the air caused irritation of the eyes and nose. Damage to the liver and weight loss were observed in rats exposed to lower levels of PFOA in the air.

Short-term application of large amounts of PFOA to the skin of animals has caused skin irritation and changes in the liver. These liver effects indicate that PFOA can be absorbed into the body through the skin and affect other parts of the body. There is limited information on whether perfluoroalkyls can cause cancer in humans. Some increases in prostate, kidney, and testicular cancers have been found in workers or in community members living near a PFOA facility. These results should be interpreted cautiously because the effects were not consistently found and most studies did not control for other potential factors such as smoking. Feeding PFOA and PFOS to rats caused them to develop tumors. Some scientists believe that, based on the way this happens in rats and the differences between rats and humans, humans would not be expected to get cancer. Others believe that it is possible for perfluoroalkyls to cause cancer in humans, and the studies in rats should not be dismissed. More research is needed to clarify this issue. The International Agency for Research on Cancer and the Department of Health and Human Services have not yet evaluated the carcinogenicity of perfluoroalkyls. The EPA has begun an evaluation.

Shortened version from: **ToxFAQs™ for Perfluoroalkyls**  
<http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=1116&tid=237>

### **How can perfluoroalkyls affect my health?**

A large number of human studies have examined possible relationships between levels of perfluoroalkyls in blood and adverse health effects. It is difficult to interpret these results because they are not consistent; some studies have found an effect and others have not found the same effect. Even though some studies have found associations between serum perfluoroalkyl levels and adverse health effects, it does not mean that perfluoroalkyls caused these effects; they may be due to other factors not considered by researchers. The available human studies suggest that increases in blood cholesterol levels are associated with higher PFOA or PFOS blood levels. There is also some indication that serum PFOA or PFOS may be





associated with increased uric acid levels, which may be associated with an increased risk of high blood pressure. PFOA or PFOS exposure may also cause liver damage. Humans and animals react differently to PFOA and PFOS and not all effects observed in rats and mice may occur in humans. The liver appears to be the most sensitive target in animals ingesting perfluoroalkyls. Studies in mice found that the immune system is a sensitive target of PFOA and PFOS.

### **How can perfluoroalkyls affect children?**

*This section discusses potential health effects of perfluoroalkyls exposure in humans from when they're first conceived to 18 years of age, and how you might protect against such effects.*

No associations between serum PFOA and birth defects were observed in children of mothers living in an area with high PFOA levels in the water. Some studies of the general population and people living near a PFOA manufacturing facility have found that higher levels of serum PFOA or PFOS are associated with lower infant birth weights. However, the decrease in birth weight is small and may not affect the infant's health. A study in children exposed to high levels of PFOA in drinking water found increases in blood cholesterol, which was similar to the findings in adults.

Birth defects were seen in mice born to females that ingested relatively high amounts of PFOS during pregnancy. The blood PFOS levels associated with these effects were at least 10 times higher than the highest PFOS levels measured in workers. Oral exposure to PFOA and PFOS has resulted in early death and delayed development of mouse and rat pups, but this did not occur in animals exposed to PFBA or PFHxS. Alterations in motor activity have also been observed in mouse pups exposed to PFOA, PFOS, or PFHxS, but not PFDeA. Scientists believe that some of the effects observed in rats and mice exposed to PFOA or PFOS may not be relevant to humans.

Shortened version from: **ToxFAQs™ for Perfluoroalkyls**

### **How can perfluoroalkyls affect children?**

No associations between serum PFOA and birth defects were observed in children of mothers living in an area with high PFOA in the water. Some studies of the general population and people living near a PFOA manufacturing facility have found that higher levels of serum PFOA or PFOS are associated with lower infant birth weights. However, the decrease in birth weight is small and may not affect the infant's health. A study of children exposed to high levels of PFOA in drinking water found increases in blood cholesterol, which is similar to the findings in adults.

Birth defects, delayed development, and early deaths have been observed in mouse and rat pups exposed to PFOA or PFOS, but not in animals exposed to perfluorobutyric acid (PFBA) or



PFHxS. Scientists believe that some of the effects observed in rats and mice exposed to PFOA or PFOS may not be relevant to humans.

## **ToxFAQs™ for Perfluoroalkyls**

### **How likely are perfluoroalkyls to cause cancer?**

There is no conclusive evidence that perfluoroalkyls cause cancer in humans. Some increases in prostate, kidney, and testicular cancers have been seen in individuals exposed to high levels. These results should be interpreted cautiously because the effects were not consistently found and most studies did not control for other potential factors such as smoking.

Rats that ingested PFOA and PFOS for a long time developed tumors. However, some scientists believe that based on the way this happens in rats and the differences between rats and humans, humans should not be expected to get cancer. Others believe that it is possible for perfluoroalkyls to cause cancer in humans.

The International Agency for Research on Cancer and the Department of Health and Human Services have not yet evaluated the carcinogenicity of perfluoroalkyls. The EPA has begun an evaluation.

### **ATSDR Toxicokinetics**

<http://www.atsdr.cdc.gov/toxguides/toxguide-200.pdf>

- Limited data indicate that perfluoroalkyls are absorbed from the respiratory tract. Studies in animals suggest that many perfluoroalkyls (including PFOA and PFOS) are almost completely absorbed from the gastrointestinal tract.
- The available data suggest that perfluoroalkyls are not metabolized or undergo chemical reactions in the body.
- Perfluoroalkyls are primarily excreted in the urine.
- There are substantial differences in the elimination half-times across perfluoroalkyl compounds and animal species. The estimated elimination half-times for PFOA, PFOS, perfluorohexane sulfonic acid (PFHxS), perfluorobutane sulfonic acid, and perfluorobutyric acid in humans are 3.8 years, 5.4 years, 8.5 years, 665 hours, and 72 hours, respectively. Much shorter half-times have been estimated in experimental animals.



## Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2015. Toxicological Profile for Perfluoroalkyls (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.



## New Hampshire Department of Health and Human Services Perfluorochemical (PFC) Fact Sheet Aug 13, 2015

<http://www.dhhs.state.nh.us/dphs/documents/pfc-fact-sheet.pdf>

### **There is no medical need to get your blood tested for PFCs.**

- DHHS is offering blood testing for concerned individuals who consumed contaminated drinking water at the Pease Tradeport.
- A PFC blood test **can** tell you about how much of which PFCs are in your body at the time of the test.
- A PFC blood test **cannot**:
  - tell you where or how you were exposed to PFCs found in your body
  - tell you what, if any, health problems might occur, or have occurred, because of PFCs in your body
  - be used by your doctor to guide treatment decisions or additional medical tests
- There is no treatment for PFCs found in your body and no way to more quickly remove them.

### **You can reduce your potential exposure to PFCs by:**

- Limiting use of products that may contain PFCs
- Avoiding foods that come packaged in grease-repellent wrappings and containers
- Testing your home's drinking water if it comes from a private well and you are concerned about PFC contamination
- Installing water treatment devices shown to remove PFCs if levels in your home drinking water are high. More information about testing and treating water can be found at the following link: <http://www.dhhs.state.nh.us/dphs/documents/reducing-exposure.pdf>

### **Finding PFCs in your body does not mean you will get sick.**

- Most people have some PFCs in their bodies because these chemicals are in so many of our products and don't leave our bodies quickly.
- The current science can't tell us if PFCs cause health problems in people.
- Scientists continue to study how PFCs might affect people's health, including study of whether PFCs affect children's growth and development; interfere with the body's natural hormones; increase cholesterol levels; affect the immune system; or increase the risk of some types of cancer.



- DHHS will continue to monitor the scientific research and keep the community informed of new health information about PFCs.



## Frequently Asked Questions: Perfluorochemicals (PFCs) Detected in the Pease Tradeport Water System June 17, 2015

<http://www.dhhs.nh.gov/dphs/documents/pease-water-faqs.pdf>

### What health effects have been associated with exposure to PFCs?

- Some animal studies have shown adverse effects in animals, but this does not necessarily predict effects in people. Human studies have evaluated whether PFCs can cause a variety of health effects, including:
- Changes to the liver (increased liver enzymes)
- Increased cholesterol
- Changes in sex hormone levels, and delayed puberty and reproductive development
- Changes in thyroid hormone levels and reported thyroid disease
- Effects on immune function (lower antibody response to immunization)
- Effects on growth and development (lower birth weight in infants, obesity in adolescents/adults)
- Decreased kidney function
- Higher incidence of diabetes
- Occurrence of cancers (discussed further below)

These studies have been limited in their ability to determine whether PFCs cause the studied health effects. These limitations include:

- Study designs that are not meant to determine whether an identified health concern is actually caused by PFCs
- Lack of accounting for other factors (e.g., other chemicals) that could cause the health outcome
- Reporting only weak relationships between PFC exposure and the studied health effect, where the health effect:
  - is not medically important (too small of a health change to matter)
  - is not statistically significant (the effect might not be related to PFCs)

While there are some studies that inconclusively suggest a relationship between PFC exposure and a health effect, there are also many studies looking at the same health outcome that do not show a relationship with PFC exposure. Given the inconsistent and sometimes contradictory findings in the medical literature, no one can be sure about the health effects of PFCs on humans. Further study is needed to say whether PFCs cause health changes in humans.



## Do PFCs cause cancer?

Because of inconsistencies and contradictory findings between studies, there have not been any definitive conclusions by the EPA about a link between PFC exposure and cancer in people. Additional studies are needed to determine the risk of cancer.

Animal studies have suggested an increase in certain types of glandular cancers, called adenomas, related to PFOA and PFOS exposure. These include liver, testicular, pancreatic, and thyroid adenomas. However, the way that animals' bodies process these PFCs is not necessarily the same way that humans' bodies do. In addition, most of the animal studies evaluated significantly higher levels of exposure than those typically seen in humans. For these reasons, data on health effects in animals cannot be assumed to predict health effects in people. So far, studies of PFCs in humans have not shown conclusive evidence that PFC exposure leads to various cancers. Some studies have suggested a possible connection between PFC exposure and cancers of the prostate, kidney, testicles, bladder, breast, and thyroid. These include studies of workers exposed to high levels of PFCs and studies of people exposed to lower levels through environmental contamination. These studies have the same limitations mentioned above in the "health effects" section, which limit their ability to determine whether PFCs cause cancer.

Connections found between PFC exposure and cancers tend to be weak and not consistent, meaning that some studies suggest a connection and others do not. Further study is needed to more definitively say whether PFCs cause cancer in humans.

## Are children more susceptible to potential health effects from PFCs?

Hand-to-mouth exposure from environmental sources (carpets, dust, etc.) is a more significant source of PFC exposure for infants and toddlers, who crawl on the ground and often put their hands or objects into their mouths. Because they are smaller, children also can be exposed to higher doses of PFCs for their body weight than an adult.

A variety of health outcomes in children have been studied related to PFOA and PFOS exposure, including fetal growth and development, cognitive and behavioral development, immune function, thyroid function, and reproductive development and function. While some studies have suggested a relationship between PFC exposure and these health outcomes, there are also many studies that do not show a relationship with PFC exposure. Given the inconsistent findings, no one can be sure about the health effects of PFCs on humans, and further study is needed.



## **Do PFCs pose a health risk to pregnant women?**

There has not been any convincing evidence that PFOA or PFOS exposure has an effect on miscarriage or birth defect rates. One of the most studied health outcomes has been the effect of PFOA and PFOS exposure on weight and size of fetuses (unborn babies). Some studies have found that PFOA and PFOS exposure may lead to decreased fetal weight and size, but others have not shown this relationship. Follow-up studies have also suggested that these children with low birth weight grow at normal rates.

## **How long does it take these chemicals to be eliminated from the body? Is there anything I can do to speed up this process?**

It takes about four years for the PFOA, five years for the PFOS, and eight years for the PFHxS in your body to decrease by half if there is no additional exposure to the chemicals. There is no treatment to remove PFCs from a person's body. There is no action an individual can take to speed up the elimination of PFCs from the body.

## **Are PFCs passed to a baby through breast milk?**

PFCs can be passed from mother to child through breast milk, but PFCs are not thought to build up in breast milk. The decision to breastfeed or bottle feed should not be based on a concern for PFC exposure. The benefits of breastfeeding are expected to outweigh any possible health effects from PFCs that may be in breast milk.

## **How do I reduce my family's exposure to PFCs in the future?**

Families can reduce their exposure to PFCs by limiting their use of consumer products that may contain PFCs. This includes:

- Greasy or oily food that comes packaged in material that may use PFC-containing grease repellant linings, such as microwave popcorn bags, fast food containers, and pizza boxes.
- Use of stain resistant sprays that may contain PFCs on furniture, carpets, and clothing.
- Use of other products with the words "fluoro" or "perfluoro" in their ingredients list.

Additionally, because PFCs can easily contaminate ground water, residents with drinking water supplied by private wells can have their water tested for PFCs if there is suspicion for PFC contamination. Residents with private wells contaminated by PFOS and PFOA above the EPA's Provisional Health Advisory levels should find an alternate source of drinking water or install point-of-use treatment devices to filter their tap water.





## Minnesota Department of Health

<http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcshealth.html>

### Are PFCs harmful?

While researchers are studying this question, there is not scientific agreement yet on whether PFCs cause illnesses in people and, if they do cause illness, what levels in the body are of health concern. Researchers are actively evaluating whether a range of health effects in different groups of people are associated with exposure to PFCs. PFCs may be toxic to the liver and thyroid gland and may also affect development.

Scientists investigated a number of possible health effects in people exposed to high levels of PFOA in a West Virginia/Ohio community. A panel of 3 scientists chosen as part of a legal settlement was charged with making a determination about whether there is a “probable link” – whether it is “more likely than not” that a link exists – between exposure to PFOA and disease in the Ohio River Valley community. The panel found that there is a “probable link” for a small number of health conditions, and that there is not a “probable link” for many others. For example, the panel found that there was a probable link between exposure to PFOA and diagnosed high cholesterol but not between exposure to PFOA and hypertension or coronary artery disease. These findings are part of a court settlement and not a definitive scientific conclusion. More work needs to be done to determine if the links are truly cause-and-effect or if they are due to other factors.

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.



**The HRL values for these four PFCs are:**

**PFOA: 0.3 micrograms per liter (µg/L)**

**PFOS: 0.3 micrograms per liter (µg/L)**

**PFBS: 7 micrograms per liter (µg/L)**

**PFBA: 7 micrograms per liter (µg/L)**

The United States Environmental Protection Agency (EPA) has set similar short-term provisional health advisory values for PFOA and PFOS of 0.4 and 0.2 ug/L, respectively. These advisory levels for drinking water are guidance values only and are currently being re-evaluated by the EPA.

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.

MDH information about Health Risk Limits:

[Health Risk Limits \(for Groundwater\)](#) (Explanation)

[Perfluorobutyrate \(PFBA\)](#)

[Perfluorooctanoic Acid \(PFOA\) and salts](#)

[Perfluorooctane Sulfonate \(PFOS\) and salts](#)

[Perfluorobutane sulfonate \(PFBS\) and salts](#)

Environmental Protection Agency: [Perfluorinated Chemical \(PFC\) Research](#)

At the request of MDH, 3M funded studies to evaluate the toxicity of PFBA: [Toxicological Studies for PFBA](#)

### **Minnesota Fish: Benefits and Risks**

What contaminants are found in Minnesota fish?

In the [site-specific consumption advice tables](#).

[Perfluorochemicals \(PFCs\)](#) are a family of manmade chemicals that have been used for decades to make products that resist heat, oil, stains, grease and water. Common uses include nonstick cookware, stain-resistant carpets and fabrics, as components of fire-fighting foam, and other industrial applications.



Perfluorooctane sulfonate (PFOS) is the PFC that accumulates to levels of concern in fish. The [Minnesota Pollution Control Agency](#) is investigating the sources of perfluorochemicals in fish. MDH has [site-specific meal advice](#) for fish from waters where fish have been tested for PFOS.

In scientific studies of PFCs, laboratory animals are given much higher doses than we would ever expect people to consume. At these very high concentrations, in laboratory studies, PFCs cause harmful changes, including cancer, in the liver and other organs. Developmental problems (e.g., delays in growth and maturation) have been seen in the offspring of rats and mice exposed to PFCs while pregnant.

PFOS is the PFC that accumulates in fish. When scientists look at laboratory studies they look for the lowest dose at which a health effect was seen. For PFOS, the health effects seen at the lowest dose were a decrease in high-density lipoprotein (HDL or "good" cholesterol) and changes in thyroid hormone levels in some animals. This lowest dose is the starting point for determining what level is safe for people to consume. The level is lowered to take into consideration the possibility that people may react differently to PFOS than laboratory animals. The level is further reduced to reflect concern that some people might be more sensitive to PFOS than people in general.

The MDH continually reviews ongoing research on PFCs to ensure that our guidelines reduce exposures and protect public health. As new studies and science become available, our advice may be revised to reflect additional information.

PFCs are very stable chemicals that do not change or break down in the environment. As a result, they may build up in soil, sediments, or in other places. There are a few studies indicating that PFCs easily enter groundwater and move long distances. Some experts suggest that PFCs in air can also travel long distances, deposit on soil and leach into groundwater. PFCs have been found in the blood of many species of wildlife around the world, including fish, bald eagles and mink in the midwestern United States. The exact way PFCs get into fish is not known at this time. As with mercury, removing the fat when cleaning or cooking does not reduce the amount of PFOS in the edible parts of the fish.

#### Meal Advice Categories Based on Levels of PFOS in Fish

<u>Level of PFOS in Fish (ppb)</u>	<u>Meal Frequency</u>
< = 40	Unrestricted
> 40 - 200	1 meal / week
> 200 - 800	1 meal / month
> 800	DO NOT EAT



## New Jersey Environmental and Occupational Health Surveillance Program

[http://www.state.nj.us/health/eohs/pfc\\_in\\_drinkingwater.shtml](http://www.state.nj.us/health/eohs/pfc_in_drinkingwater.shtml)

Accessed January 12 2016

### ***Drinking Water Facts: Perfluorinated Chemicals (PFCs) in Public Water Systems*** **Are PFCs harmful to my health?**

Much of the information on the health effects of PFCs in humans and animals is recent and new studies are continually becoming available. More data about possible health effects are available for PFOA and PFOS than for PFNA, PFHxS, and other PFCs.

In experimental animals, PFCs have been found to cause developmental, immune, neurobehavioral, liver, endocrine, and metabolic toxicity, generally at levels well above human exposures. Studies of the general population, communities with drinking water exposures, and exposed workers suggest that PFCs increase the risk of a number of health effects. The most consistent human health effect findings for PFOA – the most well-studied of the PFCs – are increases in cholesterol and uric acid levels.

In humans, exposure to PFCs before birth or in early childhood may result in decreased birth weight, decreased immune responses, and hormonal effects later in life. More research is needed to understand the role of PFCs in developmental effects.

PFOA and PFOS studies revealed tumors in rodents. In a community significantly exposed to PFOA through drinking water, PFOA exposure was associated with higher incidence of kidney and testicular cancers.

### **How can PFCs affect children?**

Infants and children consume more water per body weight than older individuals, so their exposures may be higher than adults in communities with PFCs in drinking water.

In experimental animals, PFCs cause developmental effects. In humans, exposure to PFCs before birth or in early childhood may result in decreased birth weight, decreased immune responses, and hormonal effects later in life. More research is needed to understand the role of PFCs in developmental effects.

PFCs are present in breast milk. However, since the benefits of breast-feeding are well-established, infants should continue to be breast-fed. When PFCs are elevated in a drinking water supply, it is advisable to use bottled water to prepare infant formula for bottle-fed babies. Beverages for infants, such as juice made from concentrate, should also be prepared with bottled water.



## What levels of PFCs found in drinking water are harmful to my health?

USEPA developed Provisional Health Advisory levels protective for ***short-term*** exposures to **PFOA** of 400 parts per trillion (ppt) or (ng/L) and for **PFOS** of 200 ppt (ng/L)

The New Jersey Department of Environmental Protection (NJ DEP) developed a guideline for ***chronic (lifetime)*** exposures to **PFOA** of 40 ppt (ng/L). NJ DEP has also developed an interim specific ground water criterion for **PFNA** of 10 ppt (ng/L) - see [http://www.nj.gov/dep/wms/bears/gwqs\\_interim\\_criteria\\_table.htm](http://www.nj.gov/dep/wms/bears/gwqs_interim_criteria_table.htm).



## Massachusetts Department of Environmental Programs (MassDep) Fact Sheet – 5 Aug 2015 -PFOS in Drinking Water: Questions and Answers

<http://www.mass.gov/eea/docs/dep/water/drinking/standards/pfos-fs.pdf>

### What are the health effects of PFOS?

In laboratory studies, animals exposed to levels of PFOS far above the US EPA's Provisional Health Advisories exhibited low birth weight and slow growth, increased liver weights, and effects on thyroid hormones. Some studies have suggested that PFOS may cause certain types of cancer but the evidence is limited. The levels at which PFOS may cause health effects due to long-term exposures are a matter of ongoing research.

### What is the health guideline for PFOS in drinking water supplies?

In 2009, the USEPA set a Provisional Health Advisory<sup>1</sup> of 0.2 ug/L (micrograms per liter, sometimes described as parts per billion, or ppb) of PFOS in drinking water. The Provisional Health Advisory is set to protect public health from short-term exposures and is used to determine when action should be taken to reduce exposures to the contaminant when the advisory limit is exceeded.

### What is the basis of the US EPA Provisional Health Advisory for PFOS?

The US EPA Provisional Health Advisory is set to protect public health and focuses on children's exposures. It assumes that a child consumes 1 liter (approximately four 8-oz glasses) per day of water containing PFOS. These exposures were used to set the Health Advisory for PFOS in drinking water because children consume more water per body weight than adults, so their relative exposures may be higher than adults.

### Can I drink, cook and make ice and infant formula with water that contains PFOS?

If your water is at or below the provisional health advisory, you can use it to drink, cook, and make ice and infant formula. If it is above, the answer to these questions will depend upon the level of PFOS in the water and must be considered on a case-by-case basis. If the level exceeds the US EPA Provisional Health Advisory, as a precaution, you may choose to use bottled water (see more on this below) or water from another clean source for these uses, in particular to make infant formula or other infant foods or beverages. If you have concerns about your health status, you should talk to your family doctor and/or an occupational doctor familiar with chemical exposures (see [http://www.aoc.org/content/directory\\_MA.htm](http://www.aoc.org/content/directory_MA.htm)). When you meet with them, provide a copy of your PFOS sampling results and this factsheet.



### **Should I be concerned about breastfeeding my child if PFOS is in my drinking water?**

Studies have shown that PFOS is present in most breast milk and can be an exposure route for nursing infants. For most people, the levels are very low and since the benefits of breastfeeding are well-established, infants should continue to be breast-fed. If you have concerns about breastfeeding, you should talk to your family doctor and/or an occupational doctor familiar with chemical exposures (see [http://www.aoec.org/content/directory\\_MA.htm](http://www.aoec.org/content/directory_MA.htm)). When you meet with them, provide a copy of your PFOS sampling results and this factsheet.

### **Can I safely use the water to brush my teeth, rinse food, and for other household uses?**

Yes. You are unlikely to consume enough PFOS to be of concern when brushing teeth. The use of water containing PFOS for dish washing and rinsing of fruits and vegetables will not result in significant exposures especially if they are dried to remove excess water

### **Does bottled water contain PFOS?**

Consumers should contact the bottler with specific questions about the possible PFOS content of their water.



## Delaware Division of Public Health – Drinking Water Notice – PFOS Above Provisional Health Advisory – 12 June 2014

<http://dhss.delaware.gov/dph/hsp/alerts/artesianwatercopfos061214.html>

### Are there adverse health effects with exposure to PFOS and PFOA?

Studies of broad negative impact on humans are inconclusive. Given its common use, the Centers for Disease Control and Prevention, estimates that perfluorinated chemicals, like PFOS and PFOA, are present in the blood of 98% of the United States population.

A few studies of pregnant women found higher levels of PFOA and PFOS to be associated with slightly lower weight babies, meaning it may or may not have been the cause of the slightly lower birth weights. The most consistent findings from studies are elevated blood cholesterol levels among exposed populations.

In laboratory animals, studies indicate that PFOA and PFOS can cause developmental, reproductive, and other adverse effects, including tumors. There is no conclusive evidence that PFOA or PFOS causes cancer in humans. Some increases in prostate and bladder cancer have been seen in workers with significant exposure through their job but the actual cause of the cancers is unknown. Based upon the differences between animals and humans, scientists have not determined a direct link between the chemicals and cancer in humans.

### How are people exposed to PFOA and PFOS?

Exposure comes from many different sources. Both PFOA and PFOS have been found widely in the environment, including in the Arctic and Antarctic. People may be exposed to the chemicals via household products and in drinking water supplies, private wells and fish tissue, among other sources. PFOS and PFOA can also enter the water supply from industrial facilities, firefighting foam, run off from landfills, wastewater treatment and other sources. Neither chemical is biodegradable.

These chemicals remain in the environment for a long time and also appear to remain in people's and animal's bodies (e.g., blood, liver, and kidney) for a long time.

### How much PFOA and/or PFOS does it take to make me sick?

There is no proven, broad-based link to illness in humans. The EPA issued provisional health advisories in 2009 for PFOA and PFOS to protect people against potential risk from exposure to these chemicals through drinking water. The advisories reflect reasonable, health-based hazard concentrations above which action should be taken to discontinue use of water for drinking or





cooking. The provisional health advisory concentrations are 0.4 ppb for PFOA and 0.2 ppb for PFOS. They are based on analysis of a limited number of studies and apply only to short-term exposures (weeks to months). Provisional health advisories are not lifetime exposure values.

For more information, please contact Virginia Eisenbrey of Artesian at (302) 453-6925 or Allison Diggins, Environmental Health Specialist II with the Office of Drinking Water at (302) 741-8581. Additional information may also be available from the EPA Safe Drinking Water Hotline at 1-800-426-4791.

*Please share this information with all the other people who drink this water, especially those who may not have received this notice directly.*

**Public Water System ID#:** DE0000552

