



Drinking Water Facts:

Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water

*formerly titled PFCs in Drinking Water

- Per- and polyfluoroalkyl substances (PFAS) are a group of chemicals with many commercial and industrial uses.
- PFAS have been associated with a variety of adverse health effects in humans, but it has not been definitively established that PFAS cause these effects.
- PFOA, PFNA, and PFOS have drinking water regulations in New Jersey.

What are PFAS and perfluorinated chemicals (PFCs)?

PFAS are a group of manmade chemicals which include a smaller group of chemicals called PFCs. PFAS repel water and oil and are resistant to heat and chemical reactions. They therefore have important industrial and commercial uses. PFAS are used in production of some non-stick cookware, in waterproof and stain proof coatings, in “leak-proof” coatings on food packaging materials, in fire-fighting foams, and in other uses. PFAS can enter drinking water through industrial release to water, air, or soil; discharges from sewage treatment plants; land application of contaminated sludge; and use of fire-fighting foam.

PFCs are not broken down in the body. Four types of PFCs have been found in the blood (serum) of greater than 98% of the United States population. **These PFCs build up and stay in the human body for many years, and the amount goes down very slowly over time.**

- **PFOS** – perfluorooctane sulfonate
- **PFOA** – perfluorooctanoic acid
- **PFNA** – perfluorononanoic acid
- **PFHxS** – perfluorohexane sulfonate

How can I be exposed to PFAS?

Some PFAS can dissolve in water. Therefore, drinking water may be a major source of exposure to PFAS for people living in communities with contaminated drinking water. Other sources of PFAS exposure include food, food packaging, consumer products, house dust, indoor and outdoor air, and at workplaces where PFAS are made or used.

Exposure to PFAS in drinking water is primarily from ingestion. Exposure to PFAS through other household uses of water such as showering, bathing, laundry and dishwashing is not significant.

Are PFAS harmful to my health?

There is considerable information on the health effects of PFAS in humans and animals, and more information is continually becoming available. In experimental animals, some PFAS have been found to cause developmental, immune, neurobehavioral, liver, endocrine, and metabolic toxicity, generally at levels well above human exposures. Some studies of the general population, communities with drinking water exposures, and exposed workers suggest that PFAS increase the risk of a number of health effects. The most consistent human health effect findings for PFOA – the most well-studied of the PFAS – are increases in serum cholesterol, some liver enzymes, and uric acid levels. For PFOS, the most consistently found human health effects include increased serum cholesterol and uric acid levels. PFOA and PFOS have been associated with decreased antibody response following vaccination.

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

How can PFAS affect children?

In experimental animals, some PFAS cause developmental effects. In humans, exposure to PFAS 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 PFAS in developmental effects.

Infants and children consume more water per body weight than older individuals, so their exposures may be higher than adults in communities with PFAS in drinking water. They may also be more sensitive to the effects of PFAS.

Continued...

When PFAS 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. PFAS are present in breast milk. Based on the scientific understanding at this time, since the benefits of breast-feeding are well-established, infants should continue to be breast-fed. Pregnant, nursing, and women considering having children may choose to use home water filters or bottled water for drinking and cooking to reduce exposure to PFAS in your water. However, exposure to fetuses and nursing infants is influenced by past exposures and slow excretion of these substances from the body, so risk reduction will not be immediate.

What levels of PFAS in drinking water are safe?

In 2018, NJ became the first state to establish a drinking water standard for a PFAS chemical when it set a Maximum Contaminant Level (MCL) for **PFNA, at 13 parts per trillion (ppt) [ng/L]**. The New Jersey Department of Environmental Protection (NJDEP) has also established enforceable MCLs for **PFOA (14 ppt) and PFOS (13 ppt)**. These levels are based on current scientific information and are intended to protect for lifetime exposure.

USEPA has issued a lifetime drinking water Health Advisory for **PFOA and PFOS of 70 ppt** individually or when concentrations of PFOA and PFOS are combined. A Health Advisory is non-enforceable guidance that identifies the concentration of a contaminant in drinking water at which USEPA has concluded adverse health effects are not anticipated to occur. NJ's MCLs are more stringent.

How do I know if I have PFAS in my drinking water?

Large public water systems in the U.S. and a subset of smaller water systems were required to test for some PFAS as part of the USEPA Unregulated Contaminant Monitoring program. All of the water systems which tested for PFAS have reported their results in your annual Consumer Confidence Report (CCR) which may be available online or provided by your water provider. The only way to know whether your private well has PFAS is to have it tested. To find a laboratory certified to test, you can contact NJDEP Office of Quality Assurance at 609-292-3950 or at <https://www13.state.nj.us/DataMiner>

What should I do if I am concerned about PFAS in my drinking water?

PFAS are **not** removed from water by boiling. **If tap or well water is found to contain PFAS, people may choose to use home water filters or bottled water for drinking and cooking to reduce exposure to PFAS in their water.**

Granular activated carbon filters or reverse osmosis water treatment devices are technologies that can reduce the level of PFAS in drinking water. If a treatment is used, it is important to follow the manufacturer's guidelines for maintenance and operation. NSF International, an independent and accredited organization, certifies products proven effective for reducing PFOA and PFOS below the USEPA Health advisory level (70 ppt) (<http://info.nsf.org/Certified/DWTU/>).

What can blood testing for PFAS tell me?

PFAS can be measured in your blood serum but this is not a routine test. While a blood test may indicate whether you have been exposed to PFAS, results cannot be used to predict your health effects nor can they be linked to specific health problems. Also test results alone cannot be used to specifically identify sources of exposure, and there is no treatment to reduce levels of PFAS in blood. A national program has been measuring PFAS in blood among the U.S. population. This information can be used to determine if the levels of PFAS in your blood are higher than national background levels. For example, if your concentration is higher than the 95th percentile, this means your blood serum concentration is higher than the concentration found in 95% of the U.S. population.

Estimates of four most common PFAS measured in the U.S. general population, 2013-2014 (ng/ml [ppb])

PFAS	Geometric Mean	50 th Percentile	95 th Percentile
PFOS	4.99	5.20	18.42
PFOA	1.94	2.00	5.51
PFNA	0.67	0.64	1.99
PFHxS	1.35	1.33	5.54

Additional Resources:

<http://www.nj.gov/health/ceohs/environmental-occupational/drinking-water-public-health/>

Overview

EPA has established health advisories for PFOA and PFOS based on the agency's assessment of the latest peer-reviewed science to provide drinking water system operators, and state, tribal and local officials who have the primary responsibility for overseeing these systems, with information on the health risks of these chemicals, so they can take the appropriate actions to protect their residents. EPA is committed to supporting states and public water systems as they determine the appropriate steps to reduce exposure to PFOA and PFOS in drinking water. As science on health effects of these chemicals evolves, EPA will continue to evaluate new evidence.

Background on PFOA and PFOS

PFOA and PFOS are fluorinated organic chemicals that are part of a larger group of chemicals referred to as perfluoroalkyl substances (PFASs). PFOA and PFOS have been the most extensively produced and studied of these chemicals. They have been used to make carpets, clothing, fabrics for furniture, paper packaging for food and other materials (e.g., cookware) that are resistant to water, grease or stains. They are also used for firefighting at airfields and in a number of industrial processes.

Because these chemicals have been used in an array of consumer products, most people have been exposed to them. Between 2000 and 2002, PFOS was voluntarily phased out of production in the U.S. by its primary manufacturer. In 2006, eight major companies voluntarily agreed to phase out their global production of PFOA and PFOA-related chemicals, although there are a limited number of ongoing uses. Scientists have found PFOA and PFOS in the blood of nearly all the people they tested, but these studies show that the levels of PFOA and PFOS in blood have been decreasing. While consumer products and food are a large source of exposure to these chemicals for most people, drinking water can be an additional source in the small percentage of communities where these chemicals have contaminated water supplies. Such contamination is typically localized and associated with a specific facility, for example, an industrial facility where these chemicals were produced or used to manufacture other products or an airfield at which they were used for firefighting.

EPA's 2016 Lifetime Health Advisories

EPA develops health advisories to provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. EPA's health advisories are non-enforceable and non-regulatory and provide technical information to states agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination. In 2009, EPA published provisional health advisories for PFOA and PFOS based on the evidence available at that time. The science has evolved since then and EPA is now replacing the 2009 provisional advisories with new, lifetime health advisories.

FACT SHEET

PFOA & PFOS Drinking Water Health Advisories

EPA's 2016 Lifetime Health Advisories, continued

To provide Americans, including the most sensitive populations, with a margin of protection from a lifetime of exposure to PFOA and PFOS from drinking water, EPA established the health advisory levels at 70 parts per trillion. When both PFOA and PFOS are found in drinking water, the combined concentrations of PFOA and PFOS should be compared with the 70 parts per trillion health advisory level. This health advisory level offers a margin of protection for all Americans throughout their life from adverse health effects resulting from exposure to PFOA and PFOS in drinking water.

How the Health Advisories were developed

EPA's health advisories are based on the best available peer-reviewed studies of the effects of PFOA and PFOS on laboratory animals (rats and mice) and were also informed by epidemiological studies of human populations that have been exposed to PFASs. These studies indicate that exposure to PFOA and PFOS over certain levels may result in adverse health effects, including developmental effects to fetuses during pregnancy or to breastfed infants (e.g., low birth weight, accelerated puberty, skeletal variations), cancer (e.g., testicular, kidney), liver effects (e.g., tissue damage), immune effects (e.g., antibody production and immunity), thyroid effects and other effects (e.g., cholesterol changes).

EPA's health advisory levels were calculated to offer a margin of protection against adverse health effects to the most sensitive populations: fetuses during pregnancy and breastfed infants. The health advisory levels are calculated based on the drinking water intake of lactating women, who drink more water than other people and can pass these chemicals along to nursing infants through breastmilk.

Recommended Actions for Drinking Water Systems

Steps to Assess Contamination

If water sampling results confirm that drinking water contains PFOA and PFOS at individual or combined concentrations greater than 70 parts per trillion, water systems should quickly undertake additional sampling to assess the level, scope and localized source of contamination to inform next steps

Steps to Inform

If water sampling results confirm that drinking water contains PFOA and PFOS at individual or combined concentrations greater than 70 parts per trillion, water systems should promptly notify their State drinking water safety agency (or with EPA in jurisdictions for which EPA is the primary drinking water safety agency) and consult with the relevant agency on the best approach to conduct additional sampling.

Drinking water systems and public health officials should also promptly provide consumers with information about the levels of PFOA and PFOS in their drinking water. This notice should include specific information on the risks to fetuses during pregnancy and breastfed and formula-fed infants from exposure to drinking water with an individual or combined concentration of PFOA and PFOS above EPA's health advisory level of 70 parts per trillion. In addition, the notification should include actions they are taking and identify options that consumers may consider to reduce risk such as seeking an alternative drinking water source, or in the case of parents of formula-fed infants, using formula that does not require adding water.

FACT SHEET

PFOA & PFOS Drinking Water Health Advisories

Recommended Actions for Drinking Water Systems, continued

Steps to Limit Exposure

A number of options are available to drinking water systems to lower concentrations of PFOA and PFOS in their drinking water supply. In some cases, drinking water systems can reduce concentrations of perfluoroalkyl substances, including PFOA and PFOS, by closing contaminated wells or changing rates of blending of water sources. Alternatively, public water systems can treat source water with activated carbon or high pressure membrane systems (e.g., reverse osmosis) to remove PFOA and PFOS from drinking water. These treatment systems are used by some public water systems today, but should be carefully designed and maintained to ensure that they are effective for treating PFOA and PFOS. In some communities, entities have provided bottled water to consumers while steps to reduce or remove PFOA or PFOS from drinking water or to establish a new water supply are completed.

Many home drinking water treatment units are certified by independent accredited third party organizations against American National Standards Institute (ANSI) standards to verify their contaminant removal claims. NSF International (NSF®) has developed a protocol for NSF/ANSI Standards 53 and 58 that establishes minimum requirements for materials, design and construction, and performance of point-of-use (POU) activated carbon drinking water treatment systems and reverse osmosis systems that are designed to reduce PFOA and PFOS in public water supplies. The protocol has been established to certify systems (e.g., home treatment systems) that meet the minimum requirements. The systems are evaluated for contaminant reduction by challenging them with an influent of $1.5 \pm 30\%$ $\mu\text{g}/\text{L}$ (total of both PFOA and PFOS) and must reduce this concentration by more than 95% to $0.07 \mu\text{g}/\text{L}$ or less (total of both PFOA and PFOS) throughout the manufacturer's stated life of the treatment system. Product certification to this protocol for testing home treatment systems verifies that devices effectively reduces PFOA and PFOS to acceptable levels.

Other Actions Relating to PFOA and PFOS

Between 2000 and 2002, PFOS was voluntarily phased out of production in the U.S. by its primary manufacturer, 3M. EPA also issued regulations to limit future manufacturing, including importation, of PFOS and its precursors, without first having EPA review the new use. A limited set of existing uses for PFOS (fire resistant aviation hydraulic fluids, photography and film products, photomicro lithography process to produce semiconductors, metal finishing and plating baths, component of an etchant) was excluded from these regulations because these uses were ongoing and alternatives were not available.

In 2006, EPA asked eight major companies to commit to working toward the elimination of their production and use of PFOA, and chemicals that degrade to PFOA, from emissions and products by the end of 2015. All eight companies have indicated that they have phased out PFOA, and chemicals that degrade to PFOA, from emissions and products by the end of 2015. Additionally, PFOA is included in EPA's proposed Toxic Substance Control Act's Significant New Use Rule (SNUR) issued in January 2015 which will ensure that EPA has an opportunity to review any efforts to reintroduce the chemical into the marketplace and take action, as necessary, to address potential concerns.

FACT SHEET

PFOA & PFOS Drinking Water Health Advisories

Other Actions Relating to PFOA and PFOS, continued

EPA has not established national primary drinking water regulations for PFOA and PFOS. EPA is evaluating PFOA and PFOS as drinking water contaminants in accordance with the process required by the Safe Drinking Water Act (SDWA). To regulate a contaminant under SDWA, EPA must find that it: (1) may have adverse health effects; (2) occurs frequently (or there is a substantial likelihood that it occurs frequently) at levels of public health concern; and (3) there is a meaningful opportunity for health risk reduction for people served by public water systems.

EPA included PFOA and PFOS among the list of contaminants that water systems are required to monitor under the third Unregulated Contaminant Monitoring Rule (UCMR 3) in 2012. Results of this monitoring effort are updated regularly and can be found on the publicly-available National Contaminant Occurrence Database (NCOD) (<https://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3>). In accordance with SDWA, EPA will consider the occurrence data from UCMR 3, along with the peer reviewed health effects assessments supporting the PFOA and PFOS Health Advisories, to make a regulatory determination on whether to initiate the process to develop a national primary drinking water regulation.

In addition, EPA plans to begin a separate effort to determine the range of PFAS for which an Integrated Risk Information System (IRIS) assessment is needed. The IRIS Program identifies and characterizes the health hazards of chemicals found in the environment. IRIS assessments inform the first two steps of the risk assessment process: hazard identification, and dose-response. As indicated in the 2015 IRIS Multi-Year Agenda, the IRIS Program will be working with other EPA offices to determine the range of PFAS compounds and the scope of assessment required to best meet Agency needs. More about this effort can be found at <https://www.epa.gov/iris/iris-agenda>.

Non-Drinking Water Exposure to PFOA and PFOS

These health advisories only apply to exposure scenarios involving drinking water. They are not appropriate for use, in identifying risk levels for ingestion of food sources, including: fish, meat produced from livestock that consumes contaminated water, or crops irrigated with contaminated water.

The health advisories are based on exposure from drinking water ingestion, not from skin contact or breathing. The advisory values are calculated based on drinking water consumption and household use of drinking water during food preparation (e.g., cooking or to prepare coffee, tea or soup). To develop the advisories, EPA considered non-drinking water sources of exposure to PFOA and PFOS, including: air, food, dust, and consumer products. In January 2016 the Food and Drug Administration amended its regulations to no longer allow PFOA and PFOS to be added in food packaging, which will likely decrease one source of non-drinking water exposure.

Where Can I Learn More?

- EPA's Drinking Water Health Advisories for PFOA and PFOS can be found at: <https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos>
- PFOA and PFOS data collected under EPA's Unregulated Contaminant Monitoring Rule are available: <https://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule>
- EPA's stewardship program for PFAS related to TSCA: <https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/and-polyfluoroalkyl-substances-pfas-under-tsca>
- EPA's research activities on PFASs can be found at: <http://www.epa.gov/chemical-research/perfluorinated-chemical-pfc-research>
- The Agency for Toxic Substances and Disease Registry's Perfluorinated Chemicals and Your Health webpage at: <http://www.atsdr.cdc.gov/PFC/>

