



Vision:
To be the Healthiest State in
the Nation

PFAS

Per- and Polyfluoroalkyl Substances

PFAS (per- and polyfluoroalkyl substances) are a group of man-made chemicals found in air, soil, ground and surface water and in people around the world. Studies about health effects of PFAS exposure in humans and animals have not reached clear conclusions. However, results do suggest that certain PFAS may be related to specific health problems, so researchers continue to study them.

The purpose of this factsheet is to provide an overview of frequently asked questions regarding PFAS in the environment and their possible health effects, as well as regulatory guidance and biomonitoring information.

***Note:** Questions discussed in this factsheet mainly focus on perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) as these are the most common and well-studied PFAS.

GENERAL FACTS

What are PFAS?

PFAS are manufactured chemicals¹ and have been used in:

- Surface protection of non-stick cookware.
- Stain resistant carpets and fabrics.
- Waterproof mattresses and clothing.
- Grease-resistant food packaging.
- Some firefighting materials.
- Photo imaging, metal plating, printers and copy machines.

The most common and well-studied PFAS are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). Information needed for investigating PFAS such as toxicity values, screening levels and lifetime health advisory levels (HAL) as provided by the U.S. Environmental Protection Agency (EPA) are only available for these two compounds.

Why are PFAS a concern?

PFAS are widespread and global. Once released, they are very persistent in the environment and the human body. They can be found in:

- | | |
|---------|------------------------|
| ▪ Air | ▪ Urine |
| ▪ Soil | ▪ Breast milk |
| ▪ Water | ▪ Umbilical cord blood |
| ▪ Blood | |

How can I be exposed to PFAS?

The main way you can be exposed to PFAS is by swallowing them when you:

- Drink contaminated water.
- Eat fish caught from waters contaminated with PFAS.
- Eat food packed in PFAS-containing material (e.g., popcorn bags).
- Transfer them hand-to-mouth from surfaces treated with PFAS, such as carpets.

If you work with PFAS you can also be exposed to them by breathing them in or through skin contact. The uptake of PFAS through skin contact is slow and not considered significant.

For infants and toddlers, hand-to-mouth is considered the most significant source of exposure.

How long do PFAS remain in the body?

On average, PFAS can remain in the body between two and nine years.

How can PFAS potentially affect health?

Health impacts from exposure to low levels of PFAS are not well known. Studies in humans and animals are inconclusive but suggest that certain PFAS may cause health effects.

¹ not naturally occurring in the environment

Possible non-cancer effects include:

- Increased cholesterol levels
- Changes in liver enzymes
- Impacts on human immune system
- Increased risk of high blood pressure and pre-eclampsia in pregnant women
- Small decreases in infant birth weight

Can PFAS cause cancer?

The U.S. Environmental Protection Agency (EPA) has determined there is **some** evidence that PFAS can cause cancer.

The International Agency for Research on Cancer has classified PFOA as **possibly** cancer causing, although, there is currently no consistent scientific evidence that PFOS and PFOA cause cancer in humans.

Some animal studies have suggested a higher risk of certain cancers, such as, kidney or testicular cancer. Humans and animals often react differently to chemicals (including PFAS) and not all the effects seen in animal tests may occur in humans.

Some increases in kidney, prostate and testicular cancers have been seen in individuals exposed to higher PFAS levels, mostly in occupational exposures. Most of these exposures were in people

who worked in, or lived near, PFAS manufacturing facilities.

How certain are the studies that showed health risks?

Correlations between exposure to PFAS and health effects have been inconsistent. More research is needed to fully understand any health effects in humans.

Animals (mostly rats and mice) exposed to much higher levels than most people showed several health problems, such as:

- Liver damage
- Developmental effects
- Reproductive effects
- Changes in hormone levels

Some human studies have found increases in prostate, kidney and testicular cancers in workers exposed to PFAS and people living near facilities producing PFAS. However, other studies did not report a link between cancer and PFAS.

Studies should be interpreted carefully, since the effects were not consistent across studies, there were contradictory findings among studies, and exposure levels were much higher than seen in the general population.

REGULATION AND ADVISORY

What are the current EPA regulations and/or advisories for PFOA and PFOS in drinking water and soil?

Currently, PFAS are not federally regulated by the EPA. However, it has been included in the list of proposed chemicals to be federally regulated in the near future. Furthermore, the EPA has developed a lifetime drinking water health advisory level (HAL) for PFOA and/or PFOS of 70 nanogram per liter (ng/L). The level is equal to the amount of PFOA and PFOS in a shot glass (1.5 ounce) mixed in approximately 150 million gallons of water. Per EPA, drinking water at or below this advisory level for a lifetime is not expected to harm your health. There are currently no EPA advisories for PFAS in soil.

The Agency for Toxic Substances and Disease Registry (ATSDR) also develops recommendations on environmental exposures that might harm people's health.

Based on a scientific data review they published environmental screening values for PFOA and PFOS in drinking water and soil:

Contaminant	Groundwater (ng/L)		Soil (mg/kg)	
	Child	Adult	Child	Adult
PFOA	21	78	0.16	2.4
PFOS	14	52	0.10	1.6

ng/L = nanogram per liter

mg/kg = milligram per kilogram

Per ATSDR, exposure to levels at or below these screening values is not expected to harm your health.

What are the current state regulations and/or advisories for PFOA and PFOS in drinking water and soil in Florida?

The Florida Department of Environmental Protection (FDEP) is the state’s lead agency for environmental management of Florida’s air, water and land.

As per Florida Administrative Code, Chapter 62-780, FDEP developed provisional cleanup target levels (CTLs) for PFOA and PFOS in groundwater and soil:

Contaminant	Groundwater (ng/L)	Soil	
		Residential (mg/kg)	Commercial (mg/kg)
PFOA	70	1.3	25
PFOS	70	1.3	25
PFOA + PFOS	70	NA	NA

ng/L = nanogram per liter

mg/kg = milligram per kilogram

Per FDEP, levels lower than the CTL are expected to be safe for human health and the environment.

BIOMONITORING AND BLOOD TESTING

Can a test determine whether I have been exposed to PFAS?

PFAS can be measured in blood, serum and urine. However, doctors do not conduct this test to make a diagnosis or decide on treatment.

When is testing of PFAS useful and what can the results tell me?

Testing for PFAS can be useful when they are part of a scientific investigation or a health study to determine how often and at what levels the chemical is found in the population. One such study is the National Health and Nutrition Examination Survey.

Blood tests can be helpful when researching health effects from PFAS among persons who have been exposed to very high concentrations of the chemical, such as workers in industries where PFAS were used.

Results of biomonitoring can compare the PFAS results from individuals tested with national averages established through these types of studies.

What can the results from blood testing for PFAS NOT tell me?

Most people in the United States (U.S.) will have measurable amounts of PFAS in their blood. We do not know how this impacts our health. These blood tests **will not**:

- Provide information to pinpoint whether PFAS caused a particular health problem or to decide on treatment.
- Predict or rule-out the development of future health problems related to a PFAS exposure.
- Identify how or where the PFAS exposure occurred.

What is currently known about PFAS blood levels in U.S. population?

The National Report on Human Exposure to Environmental Chemicals has reported that serum levels of PFAS appear to be higher in the U.S. than in some other countries.

For the average American the PFAS level is 2,100 and 6,300 ng/L per liter of blood, respectively. The level is equal to the amount of 30 to 90 shot glasses (1.5 oz), respectively, in approximately 150 million gallons of water.

These levels have been shown to be higher if a person's drinking water source is contaminated with PFAS or if a person is exposed at a workplace that produces the PFAS product.

More information can be found at: atsdr.cdc.gov/pfas/docs/ATSDR_PFAS_ClinicalGuidance_12202019.pdf or at: pehsu.net/

COMMUNITY CONCERNS

What should I do if my drinking water test results show PFOA and/or PFOS above EPA and/or FDEP levels?

If drinking water testing shows that your drinking water contains PFOA and/ or PFOS above the EPA HAL or FDEP's provisional CTLs, use other water sources for drinking, preparing food, cooking, brushing teeth and other uses where you might swallow water. Because the HAL is based upon long-term exposure, a short-term exposure to a level above the HAL should not increase your risk to develop adverse health effects.

If my drinking water is above the PFAS HAL, should my pets drink it?

No. Pets should be given the same drinking water you drink. As with humans, if the drinking water contains PFAS contaminant levels above the EPA HAL, use alternative water sources.

I drank water that exceeded the HAL for PFAS while I was pregnant and lactating. What impact could it have on my child?

We do not have data to assess past risks to you and your family.

Exposure to PFAS from drinking water with concentrations above the HAL may affect children's developmental health, including impaired growth, learning and behavior.

Studies in humans and animals are inconclusive and further, intense research is needed to know for sure about possible health effects related to duration and frequency of exposure.

We have tried to get pregnant for a long time without success. Could it be due to drinking water levels above the HAL for PFAS?

Infertility can be caused by many factors, both natural and chemical. At this time, we don't know if

exposure to PFAS in drinking water above the HAL can affect infertility.

If PFAS have been found in my soil and water, should I be concerned?

While garden fruits and vegetables should be considered when evaluating the risk to exposure of PFAS, no data are currently available for Florida to evaluate possible risks. However, the Florida Department of Health would consider evaluation when data become available.

Can I water my residential lawn with water containing PFAS?

Neither breathing in vapors nor skin contact with PFAS contaminated irrigation water are likely to cause health problems. Therefore, watering a lawn with non-edible plants and grass poses a low risk .

Remember that some well water specifically used for lawn maintenance only is usually not to be used for drinking purposes. For PFAS, drinking is a main route of exposure.

Can I use reuse water for watering my home produce?

No. Reuse water should never be used for home-grown produce due to the concern for human microbial pathogens. Reuse water should also not be used for drinking.

Can I swim in my pool if it is contaminated with PFAS?

Skin contact with and breathing PFAS (PFOA and PFOS) are minor concerns because these exposures are either uncommon or very low. You can drain and replace pool water with clean water from a different source. However, if you are careful to avoid swallowing pool water which is always a good practice, the risk of exposure to PFAS from swimming should be very low.

REFERENCES:

[ATSDR] Agency for Toxic Substances and Disease Registry. 2019. Per- and Polyfluoroalkyl Substances and Your Health. Atlanta GA [updated 2020 June 30; accessed 2021 April]. Available from: <https://www.atsdr.cdc.gov/pfas/index.html>.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2019. PFAS: An Overview of the Science and Guidance for Clinicians on Per- and Polyfluoroalkyl Substances (PFAS). Atlanta GA [updated 2019 December 6; accessed 2021 April]. Available from: <https://www.atsdr.cdc.gov/pfas/docs/clinical-guidance-12-20-2019.pdf>.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2021. Toxicological Profile for Perfluoroalkyls. Atlanta GA [updated 2020 March; accessed 2021 May 18]. Available from: <https://www.atsdr.cdc.gov/ToxProfiles/tp200.pdf>

[PEHSU] Pediatric Environmental Health Specialty Unit. 2020. Per- and Polyfluoroalkyl Substances (PFAS) Resources. Atlanta GA [updated unknown; accessed 2021 April]. Available from: https://www.pehsu.net/PFAS_Resources.html.

[EPA] U.S. Environmental Protection Agency. 2016. Fact Sheet - PFOA & PFOS Drinking Water Health Advisories. Washington DC [updated 2016 November; accessed 2021 April]. Available from: https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf.

[EPA] U.S. Environmental Protection Agency. 2019. Drinking Water Health Advisories for PFOA and PFOS. Washington DC [updated 2021 February 18; accessed 2021 April]. Available from: <https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos>.

This publication was made possible by Grant Number 6 NU61TS000310-02-01 from the Agency for Toxic Substances and Disease Registry. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Agency for Toxic Substances and Disease Registry, or the Department of Health and Human Services.

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