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PFOA, PFOS, and Related PFAS Chemicals

- [What are PFOA and PFOS?](#) PFOA, PFOS, and Related PFAS

Some PFAS, such as PFOA, can be found at low levels in some foods, drinking water, and in household dust. Although the levels in drinking water are usually low, they can be higher in certain areas, such as near industrial plants that have used these chemicals.

Do PFOA and other PFAS cause cancer?

There are many PFAS, but the ones that have been made and used the most in the United States are PFOA and PFOS. While these 2 chemicals are no longer made in the US, people can still be exposed to them (see “What is being done about PFOA and other PFAS?”).

Most of the studies so far that have looked at possible health effects of PFAS have focused on PFOA, mainly because it has been used the most. Many studies have looked at whether PFOA can cause cancer.

Researchers use 2 main types of studies to try to figure out if a substance might cause cancer.

Studies in the lab

Studies in lab animals have found exposure to PFOA increases the risk of certain tumors of the liver, testicles, mammary glands (breasts), and pancreas. While not always the case, well-conducted studies in animals generally do a good job of predicting which exposures might cause cancer in people, too.

Studies in humans

Studies have looked at cancer rates in people living near or working in PFOA-related chemical plants. Some of these studies have suggested an increased risk of [testicular cancer](#)¹ and [kidney cancer](#)² with increased PFOA exposure. Studies have also suggested a possible link to [thyroid cancer](#)³, but the increases in risk have been small and could have been due to chance.

Other studies have suggested possible links to other cancers, including [prostate](#)⁴, [bladder](#)⁵, [breast](#)⁶, and [ovarian cancer](#)⁷. But not all studies have found such links, and more research is needed to clarify these findings.

What expert agencies say

In most cases, the American Cancer Society does not determine if something

causes cancer (that is, if it is a *carcinogen*). Instead, we look to other respected organizations that classify potentially cancer-causing exposures.

The **International Agency for Research on Cancer (IARC)** is part of the World Health Organization (WHO). One of its goals is to identify causes of cancer.

IARC has classified PFOA as “carcinogenic to humans” (Group 1), based on sufficient evidence it can cause cancer in lab animals and strong evidence that it has some of the key properties of a carcinogen in people who are exposed to it. IARC also notes there is limited evidence in people that PFOA can cause testicular and kidney cancer.

IARC has classified PFOS as “possibly carcinogenic to humans” (Group 2B), based on strong evidence that it has some key properties of a carcinogen in people who are exposed to it, and on limited evidence that it can cause cancer in lab animals. IARC also notes there is inadequate evidence that PFOS can cause cancer in people.

(For more information on the classification system IARC uses, see [Determining if Something Is a Carcinogen](#)⁸.)

The US **Environmental Protection Agency (EPA)** maintains the Integrated Risk Information System (IRIS), an electronic database that contains information on human health effects from exposure to various substances in the environment. The EPA has not officially classified PFOA as to its carcinogenicity.

In a draft (not final) report, the EPA’s Scientific Advisory Board examined the evidence on PFOA, mainly from studies in lab animals, and stated that there is “suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential.” The board agreed that new evidence would be considered as it becomes available.

Other agencies have not yet formally evaluated whether PFOA can cause cancer.

To learn more about how cancer causes are studied and classified, see [Determining if Something Is a Carcinogen](#)⁹ and [Known and Probable Human Carcinogens](#)¹⁰.

What is being done about PFOA and other PFAS?

While the possible long-term health effects of PFAS are still being studied, there has been enough concern to phase out the use of some of them.

For example, PFOA and some closely related chemicals (such as PFOS) are now no longer made in the US, although they are still made in some other countries and could

potentially reach US consumers in certain types of products.

Another potential concern is that other PFAS are now in use. For example, hexafluoropropylene oxide (HFPO, also known as a 'GenX' chemical) is often used to replace PFOA in manufacturing processes, while perfluorobutane sulfonic acid (PFBS) is used as a replacement for PFOS. New PFAS also continue to be developed. These chemicals haven't been around long enough for researchers to fully understand if they might have the same (or even different) health effects.

Drinking water

Drinking water is one of the main sources of PFAS exposure for some people.

Federal regulations

In the US, the EPA regulates contaminants in public drinking water systems on the federal level. The EPA has set federal limits on the levels of some PFAS in drinking water.

Health advisories

The EPA has established **health advisories** for some PFAS in drinking water, based largely on the health effects seen in studies of lab animals (rats and mice). There are lifetime health advisory levels for 4 PFAS, in parts per trillion (ppt):

- PFOA: 0.004 ppt
- PFOS: 0.02 ppt
- GenX chemicals: 10 ppt
- PFBS: 2,000 ppt

These advisories are not legally enforceable federal standards. They are meant to provide drinking water system operators, as well as state and other agencies responsible for overseeing these systems, with information on the health risks of these chemicals, so they can take appropriate actions to protect their residents.

Drinking water standards

As of April of 2024, the EPA has finalized **drinking water standards** for some PFAS, which set legally enforceable **maximum contaminant levels (MCLs)** for these PFAS in drinking water:

- PFOA: 4 ppt
- PFOS: 4 ppt
- PFHxS: 10 ppt
- PFNA: 10 ppt
- HFPO-DA (Gen X chemical): 10 ppt
- Mixtures containing 2 or more of PFBS, PFNA, PFHxS, and HFPO (GenX chemicals): a 'hazard index' limit, based on combined levels of these chemicals

(The MCLs are different from those in the health advisories above, because the drinking water standards use levels at which these substances can be reliably measured.)

These standards will be implemented over the next several years:

- Public water systems must start monitoring for these PFAS by 2027. The systems must also provide the public with information on the levels of these PFAS in their drinking water starting in 2027.
- If monitoring shows that drinking water levels exceed these MCLs, public water systems must take measures to reduce these PFAS by 2029.
- Starting in 2029, public water systems that have PFAS levels exceeding one or more of these MCLs must take action to reduce levels of these PFAS in their drinking water and must notify the public of the excess levels.

State regulations

Many states have their own regulations regarding PFAS (most commonly PFOA and PFOS) in drinking water. Some of these are enforceable drinking water standards, while others are just guidance levels, or they just require public water systems to regularly test for certain PFAS and to notify consumers if they are above certain levels.

The specific PFAS that are regulated and the levels that are allowed vary among states that have these regulations. All state standards have to be at least as strict as the EPA drinking water standards that have been enacted on the federal level.

Foods

Food appears to be one of the main sources of exposure to PFAS for many people. This might be from the food itself (depending on where it's grown), or from the packaging the food comes in.

In the United States, the Food and Drug Administration (FDA) is responsible for the

the FDA.

Foods: As noted above, the FDA has detected PFAS in some seafood samples, particularly in some canned clams. For people wondering if they should change what they eat because of this, the FDA still recommends eating a variety of age-appropriate healthy foods, including seafood. Seafood as a part of a healthy diet can provide many nutritional benefits for both children and adults. According to the FDA, people who regularly eat canned clams from China may want to reduce their overall intake until more information becomes available.

Drinking water: Drinking water is a main source of exposure for people in communities with contaminated water. According to the US Centers for Disease Control and Prevention (CDC), people whose regular source of drinking water is found to have higher than normal levels of PFOA or similar chemicals might consider using bottled water or installing activated carbon water filters. If you do not know if your water is contaminated, ask your local health department.

Can I be tested for PFAS exposure?

For people who are concerned they might have been exposed to high levels of PFOA or other PFAS, blood levels can be measured, but this is not a routine test that can be done in a doctor's office. Even if the test is done, it's not yet clear what the results might mean in terms of possible health effects.

Still, if you have reason to be concerned about your exposure, such as having worked or lived in a place where PFAS exposure was likely, talk to your doctor to learn more about testing and what the results might mean for your health.

Hyperlinks

1. www.cancer.org/cancer/types/testicular-cancer.html
2. www.cancer.org/cancer/types/kidney-cancer.html
3. www.cancer.org/cancer/types/thyroid-cancer.html
4. www.cancer.org/cancer/types/prostate-cancer.html
5. www.cancer.org/cancer/types/bladder-cancer.html
6. www.cancer.org/cancer/types/breast-cancer.html
7. www.cancer.org/cancer/types/ovarian-cancer.html

8. www.cancer.org/cancer/risk-prevention/understanding-cancer-risk/determining-if-something-is-a-carcinogen.html
9. www.cancer.org/cancer/risk-prevention/understanding-cancer-risk/determining-if-something-is-a-carcinogen.html
10. www.cancer.org/cancer/risk-prevention/understanding-cancer-risk/known-and-probable-human-carcinogens.html
11. www.atsdr.cdc.gov/
12. www.atsdr.cdc.gov/toxfaqs/tfacts200.pdf
[www.atsdr.cdc.gov/pfas/data-research/facts-. 0 0.ys/irstxml](http://www.atsdr.cdc.gov/pfas/data-research/facts-.00.ys/irstxml)

References

Agency for Toxic Substances and Disease Registry. ToxFAQs for perfluoroalkyls. 2021. Accessed at <https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=1116&toxid=237> on June 16, 2022.

Agency for Toxic Substances and Disease Registry. Per- and Polyfluoroalkyl Substances (PFAS) and Your Health. 2020. Accessed at <https://www.atsdr.cdc.gov/pfas/index.html> on June 23, 2022.

Barry V, Winquist A, Steenland K. Perfluorooctanoic acid (PFOA) exposures and incident cancers among adults living near a chemical plant. *Environ Health Perspect.* 2013;121:13131318.

Environmental Protection Agency. Drinking Water Health Advisories for PFAS: Fact Sheet for Communities. 2022. Accessed at <https://www.epa.gov/system/files/documents/2022-06/drinking-water-ha-pfas-factsheet-communities.pdf> on June 22, 2022.

Environmental Protection Agency. Health Effects Document for Perfluorooctanoic Acid (PFOA). 2014. Accessed at <https://nepis.epa.gov/Exe/ZyNET.exe/P100IRZ1.txt?ZyActionD=ZyDocument&Client=EPA&Index=2011%20Thru%202015&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C11THRU15%5CTXT%5C0000010%5CP100IRZ1.txt&Use r=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1> on June 22, 2022.

Environmental Protection Agency. Per- and Polyfluoroalkyl Substances (PFAS): Final PFAS National Primary Drinking Water Regulation. April 2024. Accessed at <https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas> on April 15, 2024.

Fenton SE, Ducatman A, Boobis A, et al. Per- and polyfluoroalkyl substance toxicity and human health review: Current state of knowledge and strategies for informing future research. *Environ Toxicol Chem.* 2021;40(3):606-630.

Vieira VM, Hoffman K, Shin HM, et al. Perfluorooctanoic acid exposure and cancer outcomes in a contaminated community: A geographic analysis. *Environ Health Perspect.* 2013;121:318–323.

Zahm S, Bonde JP, Chiu WA, et al. Carcinogenicity of perfluorooctanoic acid and perfluorooctanesulfonic acid. *Lancet Oncol.* 2024;25(1):16-17. Epub 2023 Nov 30.

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