

## PFAS Frequently Asked Questions

### WHAT ARE PFAS?

- Per- and polyfluoroalkyl substances (PFAS) are a group of human-made chemicals that do not occur naturally in the environment. PFAS, previously referred to as perfluorochemicals (PFCs), have a similar chemical structure and contain a fluorinated carbon chain.
- Currently, there are thousands of chemicals that are considered PFAS.
- PFAS have been widely used in consumer, commercial, and industrial products since the 1940s.
- Many PFAS break down very slowly in the environment.

### WHAT ARE PFOS AND PFOA?

- Perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) are two chemicals in the PFAS family. They are also human-made chemicals that do not occur naturally in the environment.
- PFOS and PFOA were produced in the largest amounts in the U.S. and are commonly found in our environment.
- PFOS and PFOA can also be formed by environmental microbial degradation or by metabolism in larger organisms from a large group of related chemicals or precursor compounds.
- Companies have stopped production or have begun changing manufacturing practices to reduce releases and to reduce the amounts of PFOA and PFOS chemicals in their products.

### WHAT ARE THE USES OF PFOS AND PFOA?

- PFOS and PFOA have been used in surface protection products, such as carpet, clothing, and cookware (Teflon<sup>®</sup>, Nonstick) treatments, and coating for paper, furniture and some food packaging materials (e.g., microwave popcorn bags, fast food containers, candy wrapper and pizza boxes), and personal products like shampoo, dental floss, nail polish, eye makeup, etc.
- Industrial uses of these chemicals are in photo imaging, metal plating, semiconductor coatings, aviation hydraulic fluids, medical devices, insect baits, printer and copy machine parts, chemically driven oil production, rubber and plastic industries.
- Both chemicals have also been present in some foam firefighting materials.

### WHAT ARE THE ENVIRONMENTAL IMPACTS OF PFOS AND PFOA?

- PFOS and PFOA can be found in air, soil, and water (ground and surface water) after release from the manufacture, use, and disposal of products that contain these chemicals.
- PFAS (including PFOS and PFOA) in air are expected to settle to the ground within days to weeks.
- They breakdown very slowly in the environment and are often characterized as persistent.

## ARE THERE PFAS BESIDES PFOA AND PFOS THAT ARE COMMONLY FOUND OR REGULATED?

- Perfluorononanoic acid (PFNA), perfluorohexane sulfonic acid (PFHxS), hexafluoropropylene oxide dimer acid (HFPO-DA), and perfluorobutane sulfonic acid (PFBS) are PFAS that have been commonly detected in the environment.
- These chemicals have similar properties as PFOA and PFOS and are used in many of the same applications.
- Production of PFNA (second to PFOA for its use as a surfactant) and PFHxS in the United States was phased out beginning in the early 2000's.
- Due to discontinued use of PFOA and PFNA, HFPO-DA and PFBS are used as alternatives. HFPO-DA and its ammonium salt are commonly referred to as "GenX" chemicals. GenX is the trade name process that uses HFPO-DA to make fluoropolymers for manufacturing. PFBS is used as a surface protectant and may be found in carpets, leather, and porous hard surfaces.
- Like PFOA and PFOS, PFNA, PFHxS, HFPO-DA, and PFBS are expected to remain in the environment for long periods of time both alone, and in mixture.

## HOW ARE PEOPLE EXPOSED TO PFOS, PFOA, AND OTHER PFAS?

- Exposure to PFOS, PFOA, and other PFAS such as PFNA, PFHxS and HFPO-DA are widespread and have been detected in blood samples of the general U.S. population and wildlife. These chemicals have been detected in 95-100% of samples of people's blood in the years 1999-2000 and 2003-2004. Recent monitoring data show the levels of these chemicals in people's blood appear to be declining. From 1999-2000 to 2017-2018, blood PFOS and PFOA have declined by more than 85% and 70%, respectively. Based on the recent [National Health and Nutrition Examination Survey data \(2017-2018\)](#) the average (geometric mean) serum levels for the total population are as follows:
  - PFOA: 1.42 ppb (95% of the general population at or below 3.77 ppb)
  - PFOS: 4.25 ppb (95% of the general population at or below 14.6 ppb)
  - PFHxS: 1.08 ppb (95% of the general population at or below 3.70 ppb)
  - PFNA: 0.411 ppb (95% of the general population at or below 1.40 ppb)
  - HFPO-DA: Not calculated (most sample results were below the detection limit of 0.1 ppb)
  - PFBS: Not calculated (most sample results were below the detection limit of 0.1 ppb. Total population serum levels for PFBS were last measured in 2013-2014.)  
*(ppb - parts per billion; 1 ppb = 1 µg/L)*
- People may be exposed to PFAS from the air, indoor dust, water, food, and numerous consumer products. Also, people may be exposed to these chemicals from treated carpets and upholstery; this is especially true for children.
- Food is anticipated to be a source of exposure to these chemicals. Environmental contamination or through migration from food packaging are two pathways for PFAS to enter the food chain.
- Since PFAS have been detected in human breast milk, infants may be exposed to these chemicals through breast milk.

- Workers in the perfluorochemical industry can be exposed to greater amounts of PFAS than in general population.

## **HOW CAN PFOS AND PFOA ENTER AND LEAVE THE BODY?**

- PFOS, PFOA, and other PFAS can enter your body if you breathe air, eat food or drink water containing them. It is not known how much will enter your body through your lungs or your gut.
- Also, if PFAS comes in contact with skin, it is possible that a small amount may enter the body through your skin.
- PFAS tend to remain unchanged in the body for long periods of time. PFOA and PFOS stay in the body for many years. It takes nearly four years for the level in the body to go down by half. PFAS leave the body mainly through urine.

## **HOW CAN PFOS, PFOA, AND OTHER PFAS AFFECT PEOPLE'S HEALTH?**

- The human health effects from exposure to low environmental levels of PFOS and PFOA are not fully known.
- There are some human epidemiological studies that suggest a possible relationship between exposure to PFAS and health effects, but other studies do not show a correlation between exposure to PFAS and health effects. Because of the contradictory findings, more research is needed to understand the health effects of exposure to PFAS on humans.
- Some of the available studies suggest that an increase in blood cholesterol levels is associated with higher PFOS, PFOA, PFNA and perfluorodecanoic acid (PFDA) blood levels.
- There is some indication that serum PFOS and PFOA may be associated with increased uric acid levels, which may be associated with an increased risk of high blood pressure.
- PFOA and PFOS may be associated with pregnancy-induced hypertension/pre-eclampsia. PFAS may also be associated with a decrease infant and fetal growth.
- Human epidemiologic studies have shown PFOA, PFOS, and PFHxS may be associated with increased serum liver enzymes, such as alanine aminotransferase (ALT), and decreases in serum bilirubin levels.
- There is some epidemiologic evidence that PFOS and PFOA increase autoimmune disease incidence (rheumatoid arthritis and ulcerative colitis).
- PFOA, PFOS, PFHxS, and PFDA have been associated with decreased antibody response to vaccines in children.
- Exposure to PFOS, PFOA, and HFPO-DA may cause liver damage. Studies in mice found that the immune system is a sensitive target for PFOS and PFOA; health effects include decreases in the size of the spleen, thymus, and impaired immune system. Multiple rodent studies show hematological effects of HFPO-DA exposure, such as lowered red blood cell count and hemoglobin. The ingestion of PFOA contaminated water was found to cause adverse health effects on mammary gland development in mice. Also, oral studies on rodents have raised concerns about potential developmental, reproductive, and other systematic effects of PFOA, PFOS, PFNA, and HFPO-DA.
- Humans and rodents react differently to PFAS 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 PFAS. The health effects include increases in liver weight, changes in liver cells, change in blood cholesterol, and triglycerides levels.

## **ARE PFOS AND PFOA LIKELY TO CAUSE CANCER?**

- The International Agency for Research on Cancer has concluded that PFOA is possibly carcinogenic to humans (Group 2B) based on limited evidence in humans and limited evidence in experimental animals as to the carcinogenicity of PFOA.
- The U.S. Environmental Protection Agency (U.S. EPA) concluded that there was suggestive evidence of carcinogenic potential of PFOA and PFOS in humans.
- Currently, there is no consistent scientific evidence that PFOS and PFOA cause cancer in humans. Some increases in kidney and testicular cancers have been seen in highly exposed individuals, mostly occupational exposures. These results should be interpreted carefully since the effects were not found consistently across studies, there were contradictory findings between studies, and exposure levels were much higher than generally seen in the general population.

## **HOW ARE CHILDREN MORE SUSCEPTIBLE TO POTENTIAL EXPOSURES FROM PFOS AND PFOA?**

- Carpets treated with PFOS and PFOA can be an important source of exposure for children, because of hand-to-mouth exposure from environmental sources (carpets, dust, etc.). Children also can be exposed to higher doses of PFOS and PFOA for their body weight than an adult.
- It can also pass to a nursing infant through breast milk since these chemicals have been detected in human breast milk.
- Possible effects in children include changes in growth, learning, decreased antibody response to vaccines, and behavior.
- Health effects observed in children are similar to adults. A study of children exposed to high levels of PFOA in drinking water found increases in blood cholesterol.
- 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.
- Based on animal studies, oral exposure to PFOA and PFOS has resulted in early death and delayed development of pups (mouse and rat). Also, alterations in motor activity have been observed pups (mouse) exposed to PFOA and PFOS. Scientists believe that some of the effects observed in animals exposed to PFOA and PFOS may not be relevant to humans. Further, most adverse health effects in animal studies have been associated with exposures that resulted in blood levels of PFAS that were significantly higher than those observed in PFAS workers or the general population.
- Currently, 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, although more study is needed.

## HOW CAN PEOPLE REDUCE THE RISK OF EXPOSURE TO PFAS?

- People may choose to use consumer products that do not contain PFOS, PFOA, and other PFAS.
- People whose well water contains these chemicals above U.S. EPA's drinking water advisory levels or regulations, may choose to install an activated carbon filtration system or reverse osmosis system. For filtration or water treatment options, see [EPA Fact Sheet](#) for reducing PFAS in drinking water with a home filter.
- U.S. Food and Drug Administration (FDA) has not established standards for PFAS contaminants in bottled water. Therefore, U.S. EPA does not currently support bottled water use for communities based solely on concentrations of PFAS in drinking water that exceed U.S. EPA drinking water regulations.

## IS THERE A MEDICAL TEST TO DETERMINE WHETHER A PERSON HAS BEEN EXPOSED TO PFAS?

- PFOS and PFOA as well as other PFAS can be measured in blood. The presence of these chemicals in your blood may indicate that you have been exposed to these chemicals. PFOA and PFOS have been measured in blood samples in 2017-2018 from a representative sample of the U.S. population; the geometric mean serum of PFOA and PFOS concentrations were 1.42 µg/L and 4.25 µg/L, respectively.
- Analysis of PFAS chemicals is not included in routine blood testing. If you suspect you have been exposed to elevated levels of PFAS, consult with your physician or healthcare provider for guidance on testing. The National Academies of Sciences, Engineering, and Medicine (NASEM) released a [guidance document](#) for PFAS exposure, testing, and clinical follow-up in July 2022. According to NASEM guidance, PFAS levels in blood ranging from 2 – <20 µg/L or ≥20 µg/L, suggest reducing potential sources of PFAS exposure and may indicate additional health screening or assessment for other health effects such as dyslipidemia, hypertensive disorders, thyroid function, kidney or testicular cancer, and/or ulcerative colitis. It should be noted that PFAS levels found in blood do not predict what health effects might occur.

## DOES PENNSYLVANIA HAVE REGULATORY STANDARDS FOR ANY PFAS IN DRINKING WATER?

- The final-form rulemaking regarding state maximum contaminant levels (MCL) in drinking water for PFOA and PFOS was published in the [Pennsylvania Bulletin](#) on January 14, 2023. The established regulatory MCLs are as follows:
  - PA MCL for PFOA: 14 ppt (or 14 ng/L)
  - PA MCL for PFOS: 18 ppt (or 18 ng/L)

*(ppt - parts per trillion; 1 ppt = 1 ng/L)*

- On April 10, 2024, U.S. EPA announced the final National Primary Drinking Water Regulation (NPDWR) for six PFAS. The final NPDWR MCLs for PFOA, PFOS, PFHxS, PFNA, HFPO-DA, and PFBS are as follows:
  - EPA MCL for PFOA: 4.0 ppt (or 4.0 ng/L)
  - EPA MCL for PFOS: 4.0 ppt (or 4.0 ng/L)
  - EPA MCL for PFHxS: 10 ppt (or 10 ng/L)
  - EPA MCL for PFNA: 10 ppt (or 10 ng/L)
  - EPA MCL for HFPO-DA: 10 ppt (or 10 ng/L)
  - EPA MCL for mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS: 1 (unitless) Hazard Index
- U.S. EPA final rule requires that public water systems:
  - monitor for these PFAS and have three years (by 2027) to complete initial monitoring followed by ongoing compliance monitoring;
  - beginning in 2027, provide the public with information of the levels of these PFAS in their drinking water;
  - implement solutions to reduce these PFAS if monitoring shows that drinking water levels exceed the MCLs by 2029; and
  - that have PFAS in drinking water which violates one or more of the MCLs take action to reduce levels of these PFAS in their drinking water and provide notification to the public of the violation by 2029.
- U.S. EPA has developed resources for [public water systems](#) to aid in the transition to lower standards and calculation of the [hazard index](#). Additional information regarding the final PFAS drinking water regulation can be found on the [EPA Safe Drinking Water Act webpage](#).
- The newly established NPDWR MCLs supersede those put into effect by the PA DEP in 2023.

### WHY ARE PFAS MIXTURES BEING REGULATED?

- Oftentimes, PFAS can be found together in a water sample or drinking water source at various concentrations and combinations. Instances where one or more chemical are found, in this case one or more PFAS, it is referred to as a mixture. Mixtures of different PFAS may have additive health effects and result in adverse health outcomes that may otherwise not manifest from exposure to a single PFAS. Importantly, these additive effects have the potential to occur even when individual PFAS are at low concentrations.

### WHAT IS A HAZARD INDEX?

- A hazard index is used to determine the health risk from chemical mixture exposure. When two or more of PFHxS, PFNA, HFPO-DA and PFBS are present the hazard index can be calculated. A hazard index greater than one indicates a potential human health risk. More information on how to calculate a hazard index can be found on the [EPA webpage](#).

### ARE THERE ANY OTHER RELEVANT STATE OR FEDERAL REGULATIONS FOR PFAS?

- The U.S. Food and Drug Administration (FDA) has not established standards for any PFAS in bottled water at this time.
  - Under the PA [final-form rulemaking for PFOA and PFOS](#), monitoring requirements under the rule are applicable to bottled, vended, retail, and bulk systems (BVRBs). Therefore, bottled water in PA is required to follow PA PFAS monitoring requirements.
- In April 2024, U.S. EPA finalized a [rule](#) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, to designate PFOA and PFOS as hazardous substances. This designation will allow U.S. EPA to take action at a site earlier and respond to and cleanup contamination. This will protect public health and the environment from potentially harmful exposure to PFOA and PFOS and hold polluters accountable.
- The Occupational Safety and Health Administration (OSHA) has not set any legal limits for PFAS including PFOA and PFOS in air.
- The National Institute of Occupational Safety and Health (NIOSH) has not set any recommended limits including PFOA and PFOS in air.

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