State of Alaska Epidemiology Bulletin

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Per- and Polyfluoroalkyl Substances in Three Alaska Communities

Background

Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals that have been used for residential and industrial purposes since the 1950s. In the past, PFAS were used in a wide range of consumer products (e.g., non-stick coatings on cookware and surface-protective coatings on clothing, carpets, and paper packaging) as well as industrial manufacturing products. They have also been an important component of aqueous firefighting foams (AFFF). Among the many different types of PFAS, long-chain compounds such as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are the most frequently studied because they persist in the environment and bioaccumulate in wildlife and humans. The half-life of these chemicals in the human body is about 5–6 years for PFOS and 2–4 years for PFOA. In the early 2000's, because of toxicity concerns, leading manufacturers committed to phasing out PFOS and PFOA.[1]

Exposure Sources

As a consequence of their widespread use and resistance to environmental degradation, PFAS are ubiquitous in the environment. According to the Centers for Disease Control and Prevention's (CDC) Fourth Report on Human Exposure to Environmental Chemicals (2009), PFOA and PFOS were detected in 99.7% and 99.9% of the U.S. population, respectively.[2] However, subsequent reports indicate that PFOA and PFOS levels have started decreasing in the U.S. population in recent years, likely due to their decreased use.[3]

The main exposure pathway for PFAS is the ingestion of contaminated drinking water or food. Less frequently, exposure can occur through inhalation of contaminated dust originating from stain- or fire-resistant fabrics. Infants and children can be exposed to PFAS through breastmilk and hand-to-mouth transfer after touching PFAS-containing chemicals (e.g., stain-resistant coatings used on carpets and upholstery). Finally, fetuses can be exposed to PFAS via placental transfer from exposed mothers.[4]

Potential Health Effects

High-level exposure to some PFAS has been shown to be toxic to laboratory animals, producing reproductive, developmental, and systemic effects in laboratory tests.[5] Studies linking lower-level PFAS exposure to adverse health outcomes in humans have been inconclusive; however, some, but not all studies have shown that certain PFAS may affect the developing fetus and child, including possible changes in growth, learning, and behavior; decrease fertility and interfere with the body's natural hormones; increase cholesterol; affect the immune system; and increase the risk of certain cancers.[4,5] Further studies are needed to better understand the human health implications of PFAS exposure.

EPA Drinking Water Health Advisory

The Environmental Protection Agency (EPA) has published a Lifetime Health Advisory (LTHA) recommending that the combined concentrations of PFOA and PFOS in drinking water should not be greater than 0.07 parts per billion (ppb).[6] The LTHA does not represent a definitive cut-off point between safe or unsafe conditions, but rather provides a margin of protection from possible adverse health effects for individuals who might be exposed to PFAS via drinking water throughout their lifetime (i.e., chronic exposure). EPA health advisories represent non-regulatory recommendations.[4,6]

Contaminated Sites in Alaska

PFAS-contaminated drinking water has been identified in three Alaska communities, most likely due to the use of AFFF.

- In 2014, PFOA and PFOS contamination was discovered near the Regional Fire Training Center (RFTC) in Fairbanks. In 2016, PFOA and PFOS levels exceeding the LTHA (range: 0–0.37 ppb) were discovered in 40 of 140 wells tested in a local community. AFFF was used by the RFTC for training purposes for many years, likely starting in the 1980s. Persons living in affected households were advised not to drink their well water and were provided bottled water. The City of Fairbanks has connected many of the households to the public water system, and plans to connect all household and businesses with PFAS concentrations in drinking water that exceeds the LTHA.

- In 2015, PFOA and PFOS levels exceeding the LTHA were found in 150 of 152 tested drinking water wells in Moose Creek (range: 0.01–2.24 ppb), a community located adjacent to Eielson Airforce Base. AFFF was used by the Base for many years, likely starting in the 1980s. The Air Force provided bottled water to the households exceeding the LTHA, and later equipped them with granulated activated carbon filters or a water tank.

- In August 2017, PFOA and PFOS levels exceeding the LTHA were discovered in Imikpuk Lake in Utqiaġvik (range: 0.14–0.26 ppb). The lake serves as an intermittent water source for community members engaged in subsistence activities. The U.S. Navy National Arctic Research Laboratory used AFFF in the area for many years, likely starting in the 1970s. The Navy advised community members to use an alternate source of drinking water. Longer-term solutions to prevent PFAS exposure from lake water are being reviewed.

Discussion

Residents of three Alaska communities have been exposed to water containing PFAS that exceeds EPA's LTHA. Members of these communities have been advised not to drink the water, and alternate water sources have been provided. AFFF is the likely source of the elevated PFAS levels in drinking water in all three of these locations. More research is needed to better understand how PFAS affect human health.

Recommendations

1. People should not drink, cook, or rinse food with water known to exceed the PFAS LTHA of 0.07 ppb.
2. People can shower, bathe, wash clothes/dishes, and clean with water containing PFAS above the LTHA, as PFAS do not readily enter the body through the skin.[4,7]
3. Nursing women who have been exposed to PFAS should continue breastfeeding.[4]
4. Refer to CDC's guidance to address exposure concerns.[4]

References

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