

Uncertain Effects of PFOA and PFOS

By Kelly A. Reynolds, MSPH, PhD

A newly emerged group of chemicals is found to be common in municipal and private water supplies. While nearly everyone tests positive for exposure to these substances, health effects related to those exposure levels are unknown. Laboratory tests in animals suggest a probable cause for concern and consumers are seeking alternative options for cleaner drinking water sources.

What are PFOA and PFOS?

Perfluoroalkyl substances (PFAS) are a group of chemicals used broadly in manufacturing and consumer products. PFOA (perfluorooctanoic acid) and PFOS (perfluorooctane sulfonate) are fluorinated organic chemicals within the group of PFAS used in common materials such as non-stick cookware, water- and stain-repellent clothing, food packaging and more. Drinking water is also a source of exposure in localized communities, in particular those associated with an industrial site where the chemicals were used on a larger scale.

Blood tests show that Americans have been universally exposed. A Centers for Disease Control and Prevention (CDC) study found that out of 2,094 blood samples collected from volunteers over the age of 12, nearly all tested positive for PFOA.¹ Concentrations have been decreasing, however, since the early 2000s, as many major manufacturers voluntarily phased these chemicals out of production. At that time, 3M was the primary manufacturer. Eight more major manufacturers followed suit with phasing out their use by 2015. Data released in January from the US EPA indicated that out of over 36,000 samples, nearly 5,000 tested positive for PFOA and/or PFOS across a wide range of states. Only 379 and 292 samples, however, exceeded the minimum reporting level (MRL) for PFOA and PFOS, respectively and even fewer exceeded the health advisory limits (32 and 124 respectively).²

Some states have reported very high levels of contamination. In Vermont, tests from five private wells showed PFOA concentrations ranging from 40 to 2,880 ppt, orders of magnitude above the health advisory levels.³ Other high-profile events identifying unacceptable levels of the contaminant in drinking water have occurred in New York. Minnesota, Michigan and Alabama issued advisories warning of the toxicants in fish harvested from contaminated waters.

Are PFOA and PFOS dangerous?

The question of whether or not PFOA and PFOS are dangerous is difficult to answer. Studies performed in the laboratory on rats and mice showed adverse effects in developing fetuses and breast-fed infants related to low birth weight, accelerated puberty and skeletal changes.⁴ Other effects included testicular

and kidney cancer, as well as liver damage, immune disorders and thyroid changes. Scientists are uncertain if the same health effects in rats and mice, exposed at high levels of the contaminants, are likely in humans exposed to much lower levels. Epidemiological studies in exposed human populations suggest increases in testicular, kidney and thyroid cancers but the risk increase was small and potentially due to chance. Still, the International Agency for Research on Cancer has classified PFOA as a possible carcinogen, acknowledging that there is limited evidence of adverse effects in humans.

Overall, scientists are calling for more information and research studies. PFAS are currently being reviewed among the top-priority group of chemicals for inclusion in US EPA's Integrated Risk Information System (IRIS) database.⁵ The IRIS database considers scientific evidence of chemical contaminants' toxicology reports and dose-response relationships to characterize the risk of exposure and helps to set reference doses below which health effects are not likely to occur. Currently, PFOA's potential carcinogenic effect has not been classified in the IRIS system.

Home treatment systems that meet [American National Standards Institute and NSF International protocols] minimum requirements are certified as effective for reducing PFOA and PFOS to acceptable levels. Given the lack of clear adverse health effects in humans, use of POU devices to reduce exposures to PFOA and PFOS is purely precautionary.

Precautionary guidelines

US EPA is responsible for ensuring the safety of the US drinking water supply and implemented the *Safe Drinking Water Act (SDWA)* in 1974 to set criteria for evaluating water quality and responding to supplies that do not meet the standard. More than 90 contaminants are regulated via the SDWA with legally enforceable limits. General criteria for regulating contaminants includes whether they are known to cause adverse health effects, have a high likelihood of being present in water and may result in significant health risk reductions if controlled. Contaminants of uncertain risks may be placed on a list of unregulated items, known as the *Contaminant Candidate List (CCL)*. The CCL is extensively reviewed (which also includes a public comment period) to determine if the general criteria for regulation exists. Historically, few items on the CCL move into the regulatory realm. Often, regulatory determination is not made because more data is needed to establish if and when contaminants occur, what the exposure and health risks are and if regulation would reduce any health risks. More often, US EPA sets priorities for additional research on contaminants that might support regulatory determination in the future.

For waterborne contaminants of concern that do not meet the criteria for sufficient information toward regulatory determination, health advisories may be set. Health advisories are not legally enforceable standards but rather provide a guideline of levels at which health risks may occur. For PFOA and PFOS combined concentrations, US EPA established a health advisory

level at 70 parts per trillion (ppt) in drinking water. This level represents a margin of protection from adverse health effects for consumers over a lifetime of exposure. The agency first published a provisional guideline in 2009 but revised it in 2016 based on new scientific evidence. Health levels were considered based on higher volume drinking water consumption rates in lactating women who could pass the chemicals on to nursing infants via breastmilk. In addition, the chemicals were placed on the *Third Unregulated Contaminant Monitoring Rule (UCMR3)* to drive testing of drinking water supplied by public water systems.

POU solutions

Consumers of municipal water sources can find out if PFOA or PFOS are present by reviewing the *Consumer Confidence Report* publically available from water utilities. Utilities that test positive above 70 ppt (0.07 µg/L) should provide public health officials and their consumers with information about the exceedances and potential risks to fetuses and nursing infants, along with personal options to consider for avoiding exposure (i.e., treated or bottled water and pre-canned infant formula). Private well owners should have their water tested periodically for specific contaminants of concern. Resources related to testing and treatment for private well owners can be found on the US EPA website.⁶

Municipalities can manage contaminant levels by not utilizing contaminated wells, blending water sources or by treating with activated carbon or reverse osmosis. A precedence has also been set in some communities for supply of bottled water until utility management of the problem is in place. POU treatment devices offer simple solutions for removing PFOA and PFOS from tap water supplies.

The American National Standards Institute and NSF International have established protocols to evaluate POU performance to meet required PFOA and PFOS reduction standards.⁷ Home

treatment systems that meet these minimum requirements are certified as effective for reducing PFOA and PFOS to acceptable levels. Given the lack of clear adverse health effects in humans, use of POU devices to reduce exposures to PFOA and PFOS is purely precautionary.

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