PFAS in Kentucky Policy Brief

Executive Summary

PFAS are a class of chemicals found in many everyday objects, including firefighting gear, furniture, and food wrappers. These chemicals are extremely difficult to break down and tend to build up in the environment, especially in water sources. Current testing reveals PFAS to be found in the bodies of 97% of the population. Exposure to PFAS is linked to decreased fertility and increased rates of autoimmune diseases, cancer, thyroid conditions, and problems in fetal development. PFAS has been detected in numerous sites across Kentucky, in some cases at extremely high levels. Current federal efforts to mitigate PFAS contamination include recent maximum containment levels established by the EPA. Kentucky has taken steps to ban PFAS-containing firefighting foam used in trainings and provided some funding for ongoing research on the chemicals and how to reduce their effects.

Background

PFAS are long-lasting synthetic chemicals found in everyday products worldwide

Per- and polyfluoroalkyl substances (PFAS) are a group of almost 15,000 synthetic chemicals that have been manufactured since the 1950s but have recently gained more attention due to their overwhelming presence in the environment and in the bodies of organisms. The structure and properties of each PFAS is unique, but they are all characterized by the presence of at least one strong carbon-fluorine bond and a charged functional group, which make the compounds highly stable and resistant to water, oil, and dirt, as well as high temperatures (Gaines et al, 2023). These properties have led to the widespread use of PFAS in various cookware products, food packaging, carpets, and firefighting foam, among others, but also contribute to their resistance to degradation by acids, bases, oxidizing agents, and high temperatures (Zhang et al, 2022). This long-term environmental persistence has led to the common nickname of “forever chemicals” and is the primary reason these substances have become the subject of intense research and public debate in recent years. PFAS have been detected in environments, including food and water sources, and animals all around the world, and in 2015, the U.S. National Health and Nutrition Examination Survey estimated that PFAS are present in the blood of 97% of Americans (Lewis et al, 2015). The Agency for Toxic Substances and Disease Registry determined that most people are exposed to PFAS through drinking water, food with PFAS-containing packaging or grown near PFAS manufacturing locations, and inhaling particles from PFAS-treated products (Centers for Disease Control and Prevention, 2023).

Legacy vs emerging PFAS

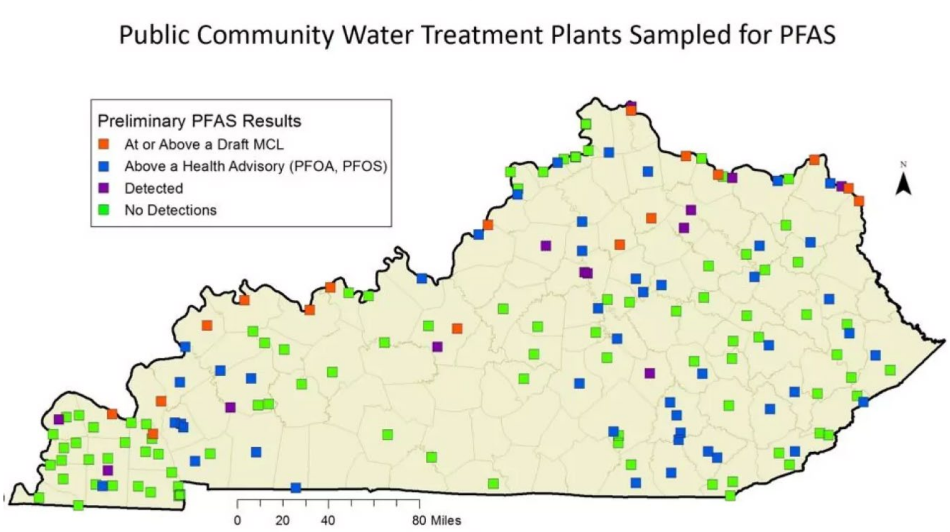
Two of the most studied, and formerly most common, PFAS are per-fluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). These two chemicals are classified as long-chain (or "legacy") PFAS because they have 8 or more carbon atoms, and due to the initial discoveries of high levels of PFOS and PFOA in ecosystems, as well as their toxicity to laboratory animals and association with adverse health effects, the EPA has restricted production of long-chain PFAS (Environmental Protection Agency, 2023). While this is a positive step to addressing this issue, PFOS and PFOA are still present in high levels throughout the world, and the restrictions have caused manufacturers to increase use of short-chain (or "emerging") PFAS, which are even less studied and understood than their long-chain counterparts. It is known, however, that as the length of the carbon chain decreases, water solubility increases, which means that these short-chain compounds could infiltrate water supplies even more potently than the long-chain chemicals (Wee and Aris, 2023).

PFAS have been associated with a multitude of adverse health effects

The accumulation of PFAS in human blood is primarily concerning because they appear to be associated with a number of negative health consequences. Studies using human data, including a large-scope epidemiological study on Mid-Ohio Valley communities, have linked PFAS exposure to elevated cholesterol, suppressed immune system function, decreased bone density, thyroid disease, ulcerative colitis, impaired fertility, and various types of cancer (von Holst et al, 2021; Ehsan et al, 2023; Kirk et al, 2021; Rickard and Fenton, 2022; Steenland et al, 2018; Steenland and Wilquist, 2021; C8 Science Panel, 2012). Exposure appears to be especially harmful to pregnant mothers and developing children. PFAS can pass the placenta and be detected in fetal blood, and high gestational and early-childhood exposure has been associated with a number of developmental impairments, including low birth weight, impaired motor development, and altered metabolism (Mamsen et al, 2019; Varsi et al, 2022). These chemicals have also been shown to cross the blood-brain-barrier, which means they can accumulate in the brain and possibly be involved in neurotoxic effects (Brown-Leung et al, 2022). There have been some mechanistic studies done in animal models to determine causality of PFAS and not just associations, and they have been shown to impair fertility, cholesterol synthesis, and normal development in mice, but most of these studies were done on the restricted long-chain compounds, and most of the direct effects of PFAS remain unknown (Singh and Singh, 2018; Zhang et al, 2017; Das et al, 2015). Because these chemicals are not immediately metabolized by the body and can accumulate for unknown periods of time, further studies are integral to understanding the entire scope of their effect on human health.

PFAS have been detected in multiple water sources across Kentucky

Multiple samples have been taken from water sources across the state of Kentucky in recent years, and PFAS have been found in varying concentrations in major rivers, lakes, watersheds, and drinking water supplies. From 2019-2022, the Department of Environmental Protection collected fish samples from streams and lakes across the state and detected PFAS in all 98 samples, with PFOS occurring in the highest concentrations (Kentucky Energy and Environment Cabinet, 2024). Further, the department also sampled public drinking water treatment plants in 2019 and 2023 and detected at least one type of PFAS in over 60 treatment plants across the state. The Energy and Environment Cabinet is continuing to monitor PFAS levels and work with public water systems to ensure ongoing sampling and determine potential treatment options.



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How have others addressed this?

Current EPA guidelines

The US Environmental Protection Agency has taken steps to begin mitigating the effects of PFAS in the environment and on human health. Most notably, in April 2024, they finalized drinking water regulations, establishing enforceable maximum contaminant levels (MCLs) for six of the most common PFAS, found in Table 1 (Environmental Protection Agency, 2024). These regulations require public water systems to complete monitoring for these contaminants and communicate the results to the public by 2027, and if contamination over the MCLs is detected, they must implement measures to reduce the PFAS levels by 2029. The EPA also made available $1 billion to help states meet these requirements. Based on the KEEC testing in 2019 and 2023, 20 water systems in Kentucky exceeded at least one of the MCLs established by the EPA (Kentucky Energy and Environment Cabinet, 2024).

Compound	Final MCLG	Final MCL (enforceable levels)
PFOA	Zero	4.0 parts per trillion (ppt) (also expressed as ng/L)
PFOS	Zero	4.0 ppt
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
HFPO-DA (commonly known as GenX Chemicals)	10 ppt	10 ppt
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index

Table 1: EPA National Primary Drinking Water Regulation

Examples from other states

Beyond the federal regulations, many states have begun addressing the PFAS issue with their own legislation. According to the environmental health alliance Safer States, 28 states have adopted policies related to protecting citizens from PFAS and similar chemicals (Safer States, 2024). Kentucky is one of many states that has banned the use of PFAS-containing firefighting foam for training purposes, and has specifically appropriated funds to help offset the costs of analyzing and regulating PFAS. Florida has enacted legislation to establish cleanup target levels for PFAS and to provide funding for remediation of both private and public water sources. Virginia requires all treatment plants to monitor PFAS levels quarterly and report that data, as well as any manufacturing of PFAS, to the Department of Environmental Quality. States like Florida and North Carolina have also provided funding to universities for use in further research on PFAS and their potential health implications. Other states, such as Minnesota, Maine, Colorado, and Vermont, have taken further action to begin phasing out the use of PFAS in manufactured products such as carpets, cookware, food packaging, and menstrual and cleaning products.

Other possible solutions

A simple step for starting to address the PFAS situation is to continue ongoing testing of surface and groundwater sources across the state and maintaining transparency with the public about where PFAS are detected and what the proposed next steps are. Filtering PFAS from public drinking water plants can be costly and time-consuming, especially as more chemicals continue to enter the water supply through sewage and industrial release, so it will take a large concerted effort and several funding sources to successfully clean our water supplies (American Water Works Association, 2023). Some home water filtration systems, including reverse osmosis and granular activated carbon filters, can successfully remove PFAS, so raising public awareness about PFAS exposure and how to mitigate it individually can help diminish the harmful effects until more large-scale solutions are developed (Wisconsin Department of Health Services, 2023). Overall, knowledge about the different types of PFAS, how long they can persist in an ecosystem, how to degrade them, and their exact effects on human health is still lacking, so encouraging and supporting research into all of these areas would be extremely beneficial to addressing this ongoing problem.

Helpful Resources

- Safer States PFAS Bill Tracker: https://www.saferstates.org/priorities/pfas/
- Household PFAS water filtration systems: https://www.ewg.org/research/getting-forever-chemicals-out-drinking-water-ewgs-guide-pfas-water-filters
- Kentucky Energy and Environment Cabinet: https://eec.ky.gov/Environmental-Protection/Water/Protection/Pages/PFAS.aspx#ctl00_ctl00_m_g_8f1d8ca0_94e9_416b_a817_641db87e79b0_ctl02_AccordionList_ctrl2_Collapse
- EPA National Primary Drinking Water Regulation: https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas

- 2023 Evaluation of Kentucky Drinking Water: https://eec.ky.gov/Documents%20for%20URLs/PFAS%20Drinking%20Water%20Report%20Final.pdf
- National Institute of Environmental Health Sciences: https://www.niehs.nih.gov/health/topics/agents/pfc#:~:text=PFAS%20are%20a%20group%20of,the%20U.S.%20Environmental%20Protection%20Agency.

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