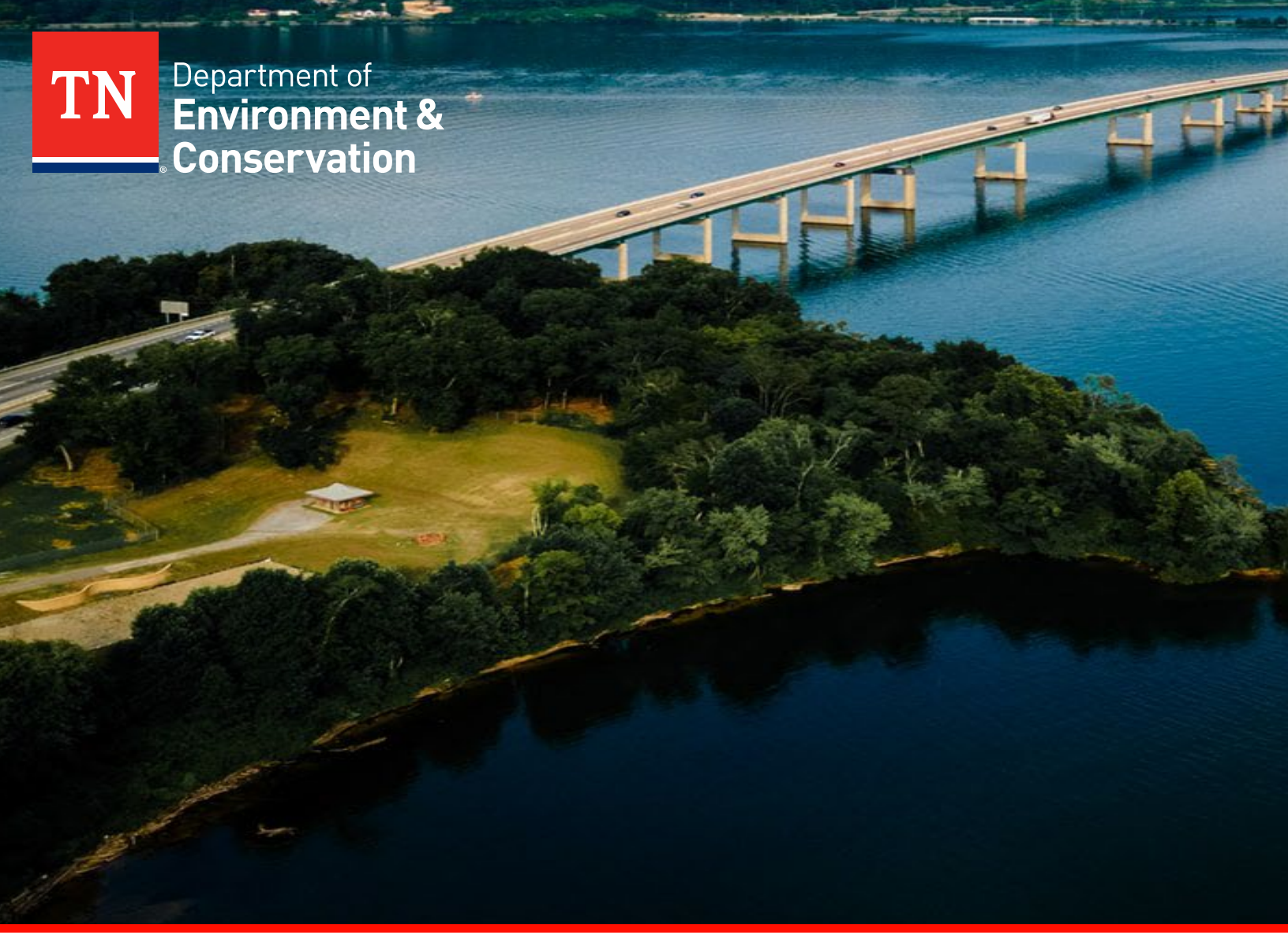


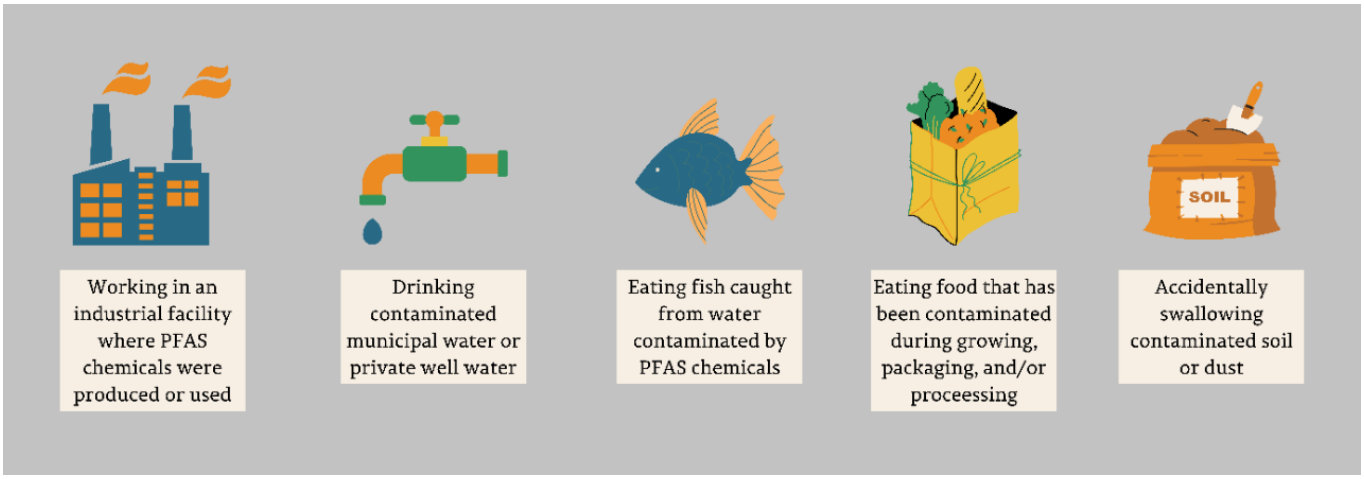
TDEC's Strategy to Assess the Impact of Per- and Polyfluoroalkyl Compounds on Public Drinking Water Sources in Tennessee

Tennessee Department of Environment & Conservation | August 2023

Executive Summary

The Tennessee Department of Environment and Conservation (TDEC) is working to protect Tennesseans from potential risks posed by per- and polyfluoroalkyl (PFAS) chemicals. PFAS are a large and diverse family of over 5,000 manmade chemicals that have been manufactured for a variety of consumer and industrial uses in the United States since the 1940s. PFAS are widely used in consumer products such as water-resistant clothing, cookware, carpets, and food packaging. PFAS chemicals have also been widely used in firefighting foams at military installations and fire training facilities.

An individual may be exposed to PFAS through several routes, including:



As an initial effort to better understand these contaminants of emerging concern, TDEC is currently performing a statewide initiative to test public drinking water sources for 29 PFAS compounds. This document serves as an overview of TDEC's approach to conducting statewide sampling for PFAS in public drinking water sources and TDEC's plan for communicating sampling results. The results of this effort will help TDEC better understand the presence of PFAS in Tennessee and how to reduce potential human exposure to PFAS in drinking water.

Overview of PFAS

- PFAS chemicals are a large and diverse group of manmade chemicals used in a variety of consumer goods, such as food packaging, stain-resistant fabrics, personal care products, nonstick cookware, and water-resistant clothing. PFAS manufacturing and use is widespread globally.
- According to the Environmental Protection Agency (EPA) and Agency for Toxic Substances and Disease Registry (ATSDR), there is some evidence that prolonged exposure to certain PFAS can cause pregnancy complications, liver damage, high cholesterol, cancer (for perfluorooctanoic acid or PFOA), immune system effects, and thyroid hormone disruption (for perfluorooctane sulfonate or PFOS).
- PFAS have previously been detected in groundwater, surface water, finished public drinking water, private wells, and in fish tissue samples in Tennessee.
- TDEC is sampling raw public drinking water sources throughout the state to determine the presence and concentration of 29 PFAS compounds. TDEC will suggest that water systems investigate PFAS detections in raw water by sampling finished drinking water as necessary.
- TDEC will publish the results of this assessment on TDEC's PFAS webpage to allow public access to sampling information as it becomes available. TDEC will publish a report summarizing all data and results at the conclusion of the assessment.

What is the concern?

PFAS and Human Health

PFAS chemicals have been in use since the 1940s and are found in many consumer products used by the general public. Human contact with some of these chemicals has been widespread and frequent, and according to ATSDR, nearly all people in the United States have some detectable levels of PFAS chemicals in their blood.

> *While PFAS do not occur naturally, PFAS may be found throughout the environment due to their long history of use.*

PFOA and PFOS are the most studied PFAS chemicals and have been partially, voluntarily phased out by industry,[1] though PFOA and PFOS are persistent in the

[1] In 2002, industry began reducing the production of PFOS. Subsequently, in 2015, industry phased out the production of PFOA. According to the National Toxicology Program, PFOA and

environment. There are many other PFAS, including GenX chemicals and perfluorobutane sulfonate (PFBS), in use throughout the country. Human health toxicity information is only available for a small portion of PFAS chemicals, but, according to EPA and ATSDR, there is some evidence that prolonged exposure to certain PFAS can cause pregnancy complications, liver damage, high cholesterol, cancer (for PFOA), immune system effects, and thyroid hormone disruption (for PFOS).

In 2016, the EPA established health advisories (HA) for PFOA and PFOS at a combined threshold of 70 ppt (parts per trillion). In June 2022, EPA issued new and updated non-regulatory drinking water HAs for four PFAS chemicals as follows:

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

These HA levels are meant to provide a level of protection to American citizens throughout their lives from potential adverse health effects resulting from exposure to PFAS in drinking water.

What do we currently know about PFAS contamination in Tennessee?

EPA's Third Unregulated Contaminant Monitoring Rule (UCMR3) required sampling for six PFAS analytes in finished drinking water nationwide from 2013 to 2015. In Tennessee, 131 Public Water Systems were monitored under this rule for the occurrence of the PFAS compounds and other published contaminants. Two Public Water Systems had PFAS detections, but both detections were below the established HA levels for PFOA and PFOS at the time (2016 levels). Some water systems in Tennessee will be sampled for 29 PFAS analytes through the EPA's Fifth Unregulated Contaminant Monitoring Rule (UCMR5) sampling event from 2023 to 2025.

EPA's 2008-2009 National Rivers and Streams Assessment detected PFAS in multiple fish species in several of the State's rivers, including the Tennessee, Cumberland, Wolf, and Mississippi Rivers. The U.S. Department of Defense (DOD) also conducted groundwater sampling in Tennessee, specifically around facilities where aqueous film forming foams, a fire-suppressant known to

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PFOS emissions have reduced drastically in the U.S. and Western Europe since these phase downs but less is known about the global emissions impact.

often contain PFAS compounds, have been used. Results for several sites indicate shallow ground water contamination near Public Water System wells and intakes.

In 2022, the United States Geological Survey (USGS) published a study that investigated PFAS in groundwater used as a source of drinking water in the eastern United States. In 2019, the USGS sampled for 24 PFAS analytes in five aquifer systems, including the Memphis Sands Aquifer located in West Tennessee. A total of 27 samples were taken from the Memphis Sands Aquifer. Only one of the 27 samples (3.7%) resulted in a detection (PFOS = 2.2 ppt). This was the lowest detection rate of any of the five aquifer systems sampled. The researchers found that detection of PFAS in groundwater decreased as wells got deeper and noted that the Memphis Sands Aquifer is characterized by deep wells.

For information on existing data about PFAS in Tennessee, see TDEC's PFAS web resources.

How are PFAS regulated?

The State of Tennessee currently does not regulate PFAS in drinking water. On March 14, 2023, the EPA released a proposed a National Primary Drinking Water Regulation (NPDWR) and health-based Maximum Contaminant Level Goals (MCLGs) at the levels below for six PFAS: PFHxS, HFPO-DA, GenX, PFNA, PFOA, and PFOS. EPA anticipates finalizing the rule by the end of 2023 or early 2024. Tennessee will have to adopt any final EPA Maximum Contaminant Level (MCLs) for PFAS.

Compound	Proposed MCLG[2]	Proposed MCL (enforceable)[3]
PFOA	Zero	4.0 ppt
PFOS	Zero	4.0 ppt
PFNA PFHxS	1.0 (unitless) Hazard Index	1.0 (unitless) Hazard Index

[2] EPA defines an MCLG as the level of a contaminant in drinking water below which there is no known or expected risk to health. MLCGs allow for a margin of safety and are non-enforceable public health goals.

[3] EPA defines an MCL as the highest level of a contaminant that is allowed in drinking water. MCLs are set as close as technologically possible to MCLGs.

PFBS HFPO-DA (GenX)		

What is TDEC doing to reduce risks posed by PFAS?

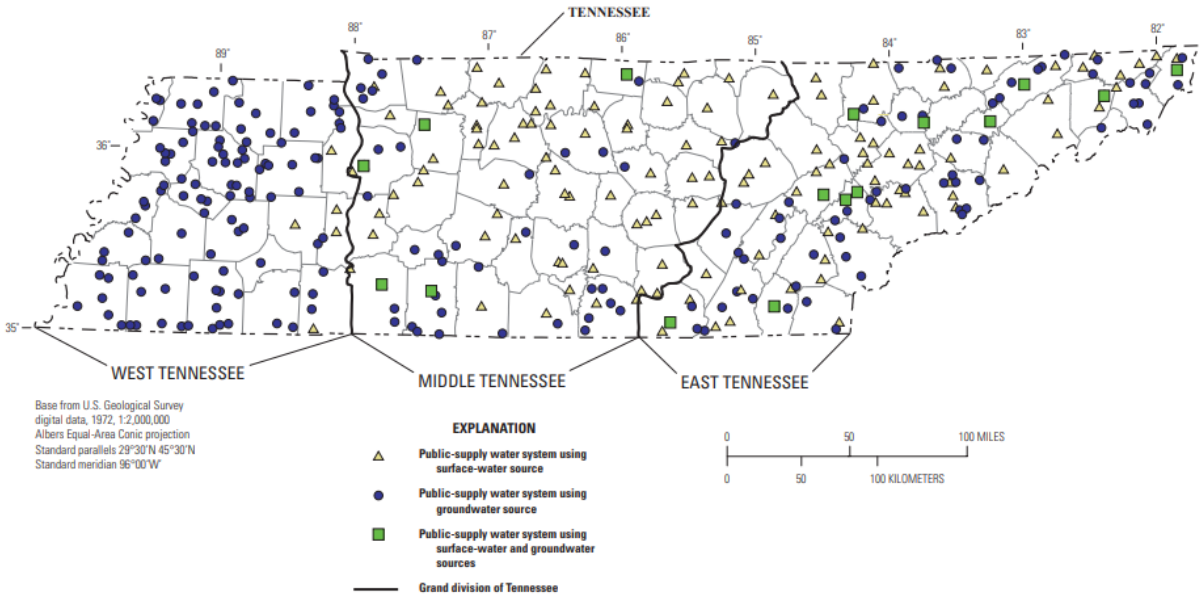
> *TDEC plans to sample every public drinking water source in the state for the presence of PFAS compounds.*

TDEC works closely with its local, state, and federal partners to stay informed of the latest scientific developments involving PFAS. To increase understanding of PFAS contamination, ***TDEC is sampling for 29 PFAS compounds in raw public drinking water sources in a statewide sampling effort***. As this sampling event focuses on source (raw) water at public drinking water systems, TDEC will not be testing water quality of private drinking water wells. DOD is engaged in sampling for PFAS in private drinking water wells adjacent to military facilities to determine if PFAS contamination is present. TDEC continues to provide support for federal and state partners who are studying the potential impacts of PFAS contamination on private wells in Tennessee.

Public Water Supply Sampling

Understanding any impacts to public drinking water sources is critical to identifying potential PFAS contamination in Tennessee. Tennessee has a population of approximately 6,975,000. Approximately 6,000,000 Tennesseans (88%) receive drinking water from 784 regulated Public Water Systems (Figure 1), utilizing 1,295 water intakes, including 178 surface water intakes, 66 springs and 1,051 water wells. Due to the large number of sources to be sampled, TDEC anticipates that this sampling effort will take approximately two years and will be complete by summer 2025.

Figure 1: Distribution of public-supply water systems using surface water or groundwater in Tennessee (U.S. Geological Survey, https://doi.org/10.3133/sir20185009)



TDEC will conduct sampling of source (raw) water at public water systems as a part of this effort. Confirmation sampling will be conducted on a case-by-case basis, as determined by the TDEC PFAS Working Group, an internal multi-disciplinary group of TDEC staff members. Water systems may be directed to conduct confirmation sampling, or that sampling may be conducted by TDEC staff depending on available resources. If any of the six PFAS analytes included in the EPA's proposed drinking water regulations are detected, TDEC will suggest that finished drinking water be sampled.

Sampling Procedures and Sample Analysis

TDEC has contracted with a private, EPA-certified laboratory (PACE) to test for the 29 PFAS utilizing EPA methods 533 and 537.1 (Appendix 1). These EPA methods were selected for this project due to the extensive list of analytes, low detection limits, and use of isotope dilution which corrects for interferences or errors. PACE has multiple instruments that have been specifically manufactured for dedicated use in PFAS testing. TDEC Division of Water Resources staff will collect samples on-site and ship the samples to PACE for analysis.

The results of these sampling events will be communicated to the water system and published on TDEC's PFAS webpage as they become available to allow public access to data. TDEC will publish a report summarizing all data and results at the conclusion of the assessment.

Additional Resources:

- If you have questions or comments on this assessment strategy, please contact Jeremy Hooper, Environmental Consultant 3, TDEC Division of Solid Waste Management, at Jeremy.Hooper@tn.gov.
- TDEC webpage serving as the main resource for PFAS sampling results in Tennessee, www.tn.gov/environment/policy/pfas.
- Tennessee Department of Health webpage including an overview of PFAS and information on exposure, health effects, and links to additional resources, www.tn.gov/health/cedep/environmental/environmental-health-topics/eht/pfas.html.
- ATSDR webpage including health information, exposure, and links to additional resources, www.atsdr.cdc.gov/pfas.
- EPA webpage including basic PFAS information, EPA actions, and links to informational resources, www.epa.gov/pfas.

Appendix 1 – PFAS Analytes to be Tested

Analyte	Abbreviation	CASRN
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Perfluorobutanoic acid	PFBA	375-22-4
Perfluorobutanesulfonic acid	PFBS	375-73-5
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4
Perfluorodecanoic acid	PFDA	335-76-2
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7
Perfluoroheptanesulfonic acid	PPFHpS	375-92-8
Perfluoroheptanoic acid	PFHpA	375-85-9
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Perfluorononanoic acid	PFNA	375-95-1
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorooctanoic acid	PFOA	335-67-1
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluoropentanesulfonic	PFPeS	2706-91-4
Perfluoroundecanoic acid	PFUnA	2058-94-8
*N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
* N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
* Perfluorotetradecanoic acid	PFTA	376-06-7
*Perfluorotridecanoic acid	PFTrDA	72629-94-8
Total Number of Analytes – 29		

A CASRN, or CAS Registry Number, is a unique numeric identifier that corresponds with one chemical substance and associated information about that substance.

Asterisks (*) indicate additional analytes from Method 537 to be included in sampling events.