PFAS Water Resources Characterization Study

Per- and Polyfluoroalkyl Substances (PFAS) Surface Water Sampling Results, 2019–2020

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Executive Summary

The Philadelphia Water Department began voluntary, proactive testing for per- and polyfluoroalkyl substances, or PFAS, in the city's rivers and creeks in 2019. The goal was to better understand the occurrence of these compounds in the city's water supply.

- PWD has not detected concentrations at or above the U.S. Environmental Protection Agency's health advisory level of 70 ppt (parts per trillion) for two of the most commonly found and widely studied PFAS compounds called perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), combined.
- Separate from PWD testing, independent studies led by the EPA and the Pennsylvania Department of Environmental Protection indicate non-detectable PFAS concentrations in Philadelphia's drinking water.

The information below details the methodology and results of PWD's nearly year-long study.

Overview

PFAS, which stands for per- and polyfluoroalkyl substances, are a broad group of man-made chemicals that have been widely used around the world since the mid-20th century to manufacture industrial and consumer products including cookware, fabrics, furniture, paper goods and firefighting foams. Because they are resistant to heat, oil, and water, they do not break down easily and can remain in the environment for years.

In recent years, these contaminants have gained international attention as they've been detected in soil, water, air, and living organisms including the human body across the world—even in remote locations such as the Arctic. In short, they are all around us.

Research suggests some PFAS compounds may be linked to serious health problems, including an increased risk of cancer. Yet, despite the everyday use of these chemicals, scientists know relatively little about the health effects of most PFAS. This emphasizes the universal need for additional research and environmental management strategies. As with many emerging contaminants, advances in technology used to detect these substances has evolved faster than research that can help us better understand the public health effects from these low-level concentrations. Numerous PFAS substances are currently being studied to fully understand and better regulate these chemicals.

In the greater Philadelphia area, PFAS has been detected in groundwater near some military bases that once used firefighting foams called AFFF (aqueous film forming foams) that contained PFAS. Philadelphia's drinking water is sourced from the Delaware and Schuylkill rivers, not groundwater. Nevertheless, the existence of these contaminants in water supplies across the globe means drinking water can be a potential route for exposure.

While there are no federal or state drinking water regulations for PFAS in Pennsylvania, in 2016, the U.S. Environmental Protection Agency (EPA) set a health advisory level of 70 parts per trillion for two of the most commonly found and widely studied PFAS compounds called perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). For context, one part per trillion (ppt) is roughly equivalent to one grain of sugar in an Olympic-sized swimming pool. The EPA guideline is not a regulation, but rather a public health guideline.

In 2019, PWD began voluntarily and proactively testing for PFAS in the city's rivers and creeks to better understand the occurrence of these compounds in the city's water supply. This document details the methodology and results of the nearly year-long study. **PWD has not detected concentrations at or above the EPA's health advisory level of 70 ppt (parts per trillion) for PFOA and PFOS combined. Furthermore, results from independent studies led by the EPA and the Pennsylvania Department of Environmental Protection indicate non-detectable PFAS concentrations in Philadelphia's drinking water.**

Methodology and Sampling Locations

Monthly surface water samples were collected at all three PWD drinking water intakes on the Schuylkill and Delaware Rivers and from one location on each of the Wissahickon, Poquessing, and Pennypack Creeks starting in April 2019 (Figure 1). These samples were analyzed for PFAS concentrations using EPA Method 537.

Site ID	Location Description
WISS	Wissahickon Creek at Ft. Washington
PENN	Pennypack Creek at Pine Rd.
POQU	Poquessing Creek at Holy Family University
DELA	Delaware River at Baxter WTP intake
SCHU1	Schuylkill River at Queen Lane WTP intake
SCHU2	Schuylkill River at Belmont WTP intake

Figure 1. PFAS Watershed Characterization Sampling Site Locations and Descriptions

Results Summary

Samples collected from the water treatment plant intake on the Delaware River demonstrated an average combined PFOA and PFOS concentration of 8.1 ppt, ranging from 5.3 to 12.2 ppt. Results from the Schuylkill River water treatment plant intakes exhibited an average combined PFOA and PFOS concentration of 12.1 ppt and 9.7 ppt, respectively, ranging from 6.8 to 16.2 ppt.

Even assuming no removal by conventional water treatment, these results indicate that concentrations in Philadelphia's drinking water are far below the EPA lifetime health advisory level of 70 ppt for PFOA and PFOS combined.

No surface water sample taken by PWD from any site during this characterization study exceeded the EPA lifetime health advisory level of 70 ppt for PFOA and PFOS combined in drinking water (Table 1, Figures 2 and 3). Upstream tributary locations exhibited higher PFAS concentrations than locations near PWD intakes, primarily due to lower flows and, consequently, less dilution.

Table 1. Combined Concentration of PFOS + PFOA Summary (ppt)

Location ID	Description	Number of Samples	Average (ppt)	Min (ppt)	Max (ppt)
DELA	Delaware River at Baxter intake	11	8.1	5.3	12.2
SCHU1	Schuylkill River at Queen Lane intake	11	12.1	8.6	14.5
SCHU2	Schuylkill River at Belmont intake	11	9.7	6.8	16.2
PENN	Pennypack Creek at Pine Rd.	11	28.7	19.7	51.0
POQU	Poquessing Creek at Holy Family University	11	29.9	15.5	41.0
WISS	Wissahickon Creek at Ft. Washington	11	20.0	16.8	24.0

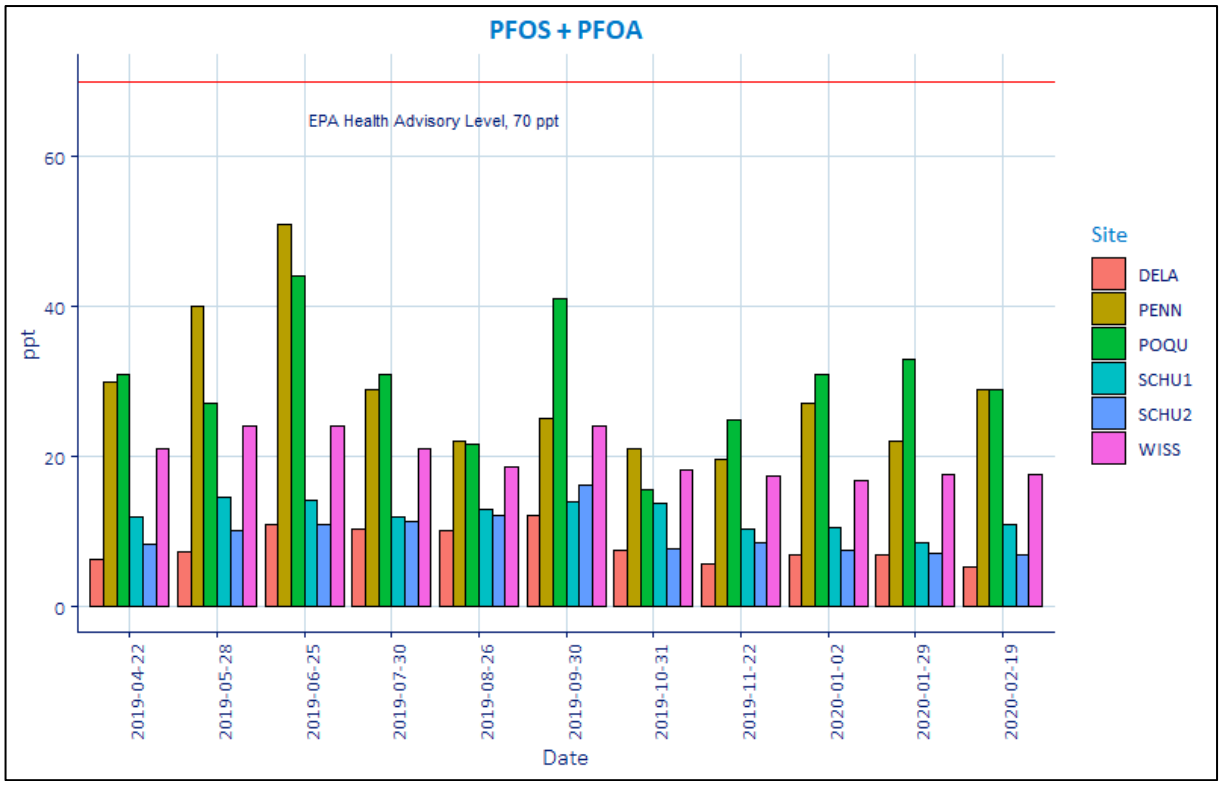
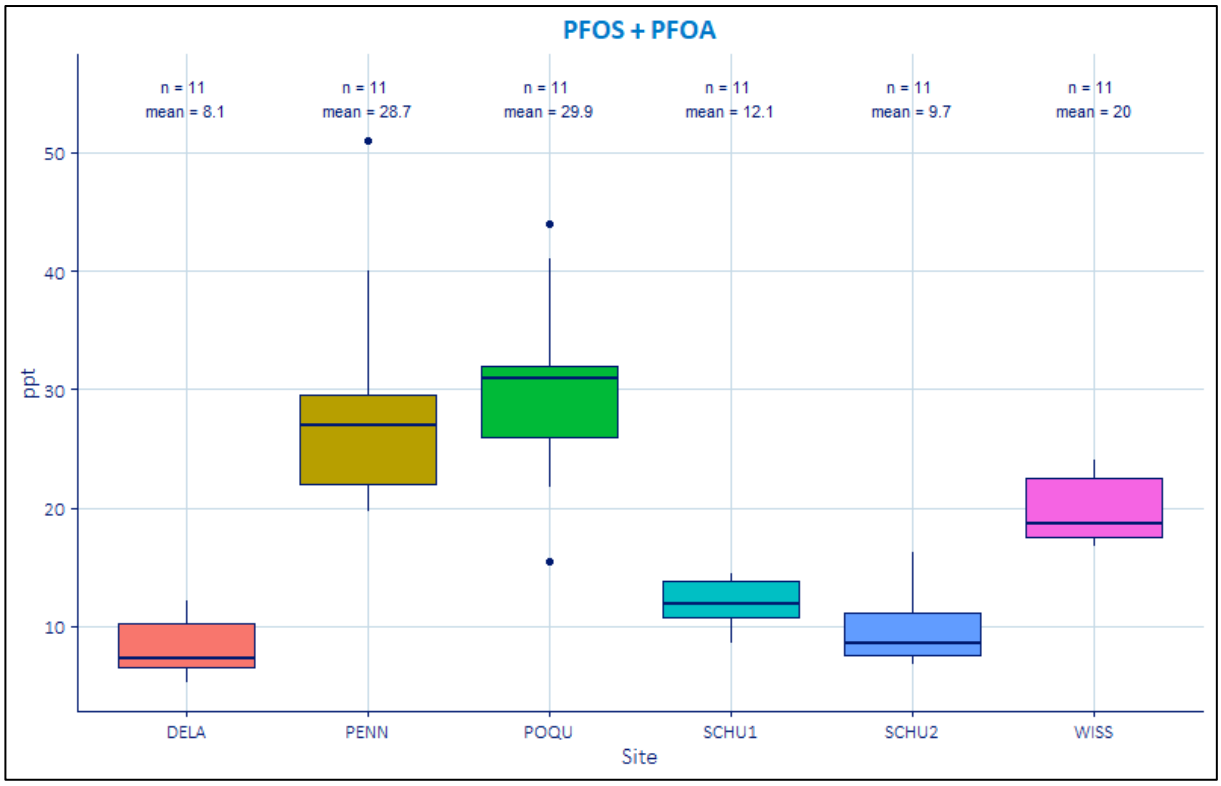


Figure 2. Combined PFOS and PFOA Results for Each Site by Sample Date (ppt)

The summary statistics from each sampling site are presented as boxplots in Figure 3. Boxplots are useful in looking at the variability of the data at each site. The end of each line extending from the box indicates that site's minimum and maximum normal results value; the majority of each site's results fall within the range shown by the box itself. The horizontal line within each box is the median, or middle, value. The single dots appearing for two sites (PENN and POQU) represent results considered statistical outliers. Tributary sites exhibited greater variability in their results than water treatment intake sites.

Figure 3. Combined PFOS and PFOA results summarized by sampling site (ppt)



Discussion and Conclusion

The primary goal of the Water Resources Characterization Study is to determine baseline levels of PFAS occurring in the city's source waters. **Results show that all samples were safely below the 70 ppt EPA health advisory level for PFOS and PFOA combined, with water resource samples taken at PWD intakes being far below this level.**

It should be noted that the ability to detect the presence of PFAS compounds is advancing faster than the ability to understand their public health implications. Advances in analytical methods allow us to detect concentrations in the parts per trillion (ppt) magnitude – the equivalent of one grain of sugar in an Olympic-sized swimming pool. As the science surrounding PFAS is constantly evolving, we are working to ensure that we are following the latest scientific advances. We are also collaborating with neighboring water utilities to better understand the influence of regional groundwater contamination in the greater Philadelphia area.

We continue to voluntarily test Philadelphia's source waters for PFAS. We will continue to follow public health research and track both federal and state regulatory developments as this issue evolves so that we can best protect the integrity of our drinking water for generations to come.

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Table 2. Results from grab samples taken from the Delaware River near the Baxter Treatment Plant intake (ppt)

Sampling Date	4/22/2019	5/28/2019	6/25/2019	7/30/2019	8/26/2019	9/30/2019	10/31/2019	11/22/2019	1/2/2020	1/29/2020	2/19/2020
PFOS	3.2	3.8	5.6	5.3	5.1	6.3	3.7	2.8	3.6	3.2	2.6
PFOA	3	3.5	5.3	5.0	5.1	5.9	3.7	2.9	3.2	3.4	2.7
PFOS+PFOA*	6.2	7.3	10.9	10.3	10.2	12.2	7.4	5.7	6.8	6.6	5.3

Combined for comparison to 70 ppt EPA Health Advisory (May 2016) for treated drinking water

Table 3. Results from grab samples taken from the Schuylkill River near the Queen Lane Treatment Plant intake (ppt)

Sampling Date	4/22/2019	5/28/2019	6/25/2019	7/30/2019	8/26/2019	9/30/2019	10/31/2019	11/22/2019	1/2/2020	1/29/2020	2/19/2020
PFOS	5.3	6.2	6.1	5	5.5	5.6	6.1	4.3	4.6	3.7	4.8
PFOA	6.6	8.3	8.1	6.9	7.5	8.3	7.6	6.1	6	4.9	6.1
PFOS+PFOA*	11.9	14.5	14.2	11.9	13	13.9	13.7	10.4	10.6	8.6	10.9

Combined for comparison to 70 ppt EPA Health Advisory (May 2016) for treated drinking water

Table 4. Results from grab samples taken from the Schuylkill River near the Belmont Treatment Plant intake (ppt)

Sampling Date	4/22/2019	5/28/2019	6/25/2019	7/30/2019	8/26/2019	9/30/2019	10/31/2019	11/22/2019	1/2/2020	1/29/2020	2/19/2020
PFOS	3.7	4.3	4.3	5	5.1	8.2	3.1	3.4	3	2.8	2.7
PFOA	4.7	5.9	6.6	6.4	7	8	4.5	5.2	4.5	4.2	4.1
PFOS+PFOA*	8.4	10.2	10.9	11.4	12.1	16.2	7.6	8.6	7.5	7	6.8

Combined for comparison to 70 ppt EPA Health Advisory (May 2016) for treated drinking water

Table 5. Results from grab samples taken from Poquessing Creek at Holy Family University (ppt)

Sampling Date	4/22/2019	5/28/2019	6/25/2019	7/30/2019	8/26/2019	9/30/2019	10/31/2019	11/22/2019	1/2/2020	1/29/2020	2/19/2020
PFOS	13	10	20	13	8.7	14	7.6	8.9	17	18	12
PFOA	18	17	24	18	13	27	7.9	16	14	15	17
PFOS+PFOA*	31	27	44	31	21.7	41	15.5	24.9	31	33	29

Combined for comparison to 70 ppt EPA Health Advisory (May 2016) for treated drinking water

Table 6. Results from grab samples taken from Pennypack Creek at Pine Rd (ppt)

Sampling Date	4/22/2019	5/28/2019	6/25/2019	7/30/2019	8/26/2019	9/30/2019	10/31/2019	11/22/2019	1/2/2020	1/29/2020	2/19/2020
PFOS	17	23	31	16	11	12	11	9.7	17	12	16
PFOA	13	17	20	13	11	13	10	10	10	10	13
PFOS+PFOA*	30	40	51	29	22	25	21	19.7	27	22	29

Combined for comparison to 70 ppt EPA Health Advisory (May 2016) for treated drinking water

Table 7. Results from grab samples taken from Wissahickon Creek at Fort Washington (ppt)

Sampling Date	4/22/2019	5/28/2019	6/25/2019	7/30/2019	8/26/2019	9/30/2019	10/31/2019	11/22/2019	1/2/2020	1/29/2020	2/19/2020
PFOS	10	11	12	10	8.7	11	10	7.8	8.7	9.4	9.1
PFOA	11	13	12	11	10	13	8.3	9.5	8.1	8.1	8.5
PFOS+PFOA*	21	24	24	21	18.7	24	18.3	17.3	16.8	17.5	17.6

Combined for comparison to 70 ppt EPA Health Advisory (May 2016) for treated drinking water