Water Pollution Control Facility PFAS Sampling

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Original Analysis Performed by Weston and Sampson

INTRODUCTION

This project was managed by Weston and Sampson under contract with the DEEP. Field work and sample collection was subcontracted and performed by Anchor QEA. PFAS (per- and polyfluoroalkyl substances) are a group of stable, persistent, and highly mobile man-made chemicals that have been used since the 1940s and have been documented in surface water, groundwater, soils, food, plants, invertebrates, fish and mammals. This work focuses on analysis of PFAS associated with wastewater pollution control facilities (WPCFs). WPCFs are believed to be impacted by discharges of PFAS from residential, industrial, and commercial processes. Effluent, surface water, and fish tissue results are reviewed here. All sampling data, including influent, scrubber water and sludge results (not discussed here), are available in the final W&S project report, "Water Pollution Control Facility PFAS Sampling Study" dated June 2023.

METHODS

Site Selection

The WPCFs in this study were chosen by CTDEEP to represent a range of differing size communities, inputs, treatment processes, and geographic coverage. 35 WPCFs were included in the study. Fish tissue and surface-water samples were also collected from surface-water bodies at 10 WPCFs selected by CTDEEP.

Effluent and Surface Water Collection

The methods for collecting samples of effluent and surface water are described below. Sampling of effluent was completed in September 2021 and March 2022. Surface water samples were collected both upstream and downstream of the WPCF discharge point August-September 2021. The Dipper Pole method was used for all surface water sites and most effluent sites. The method entailed using a 250mL high-density polyethylene sample collection container was attached to the end of a plastic dipper pole, with was filled with flowing liquid. The liquid was then poured into the HDPE sample containers. When the Dipper Pole method could not be utilized, the Bailer Sample method was used instead.
A 1.5" HDPE bailer was used to collect samples where the dipper pole method could not be used. The bailer is lowered by nylon twine into the subsurface space until full or until it hits the bottom of the structure. The liquid was then poured into HDPE sample containers.

Fish Tissue Collection

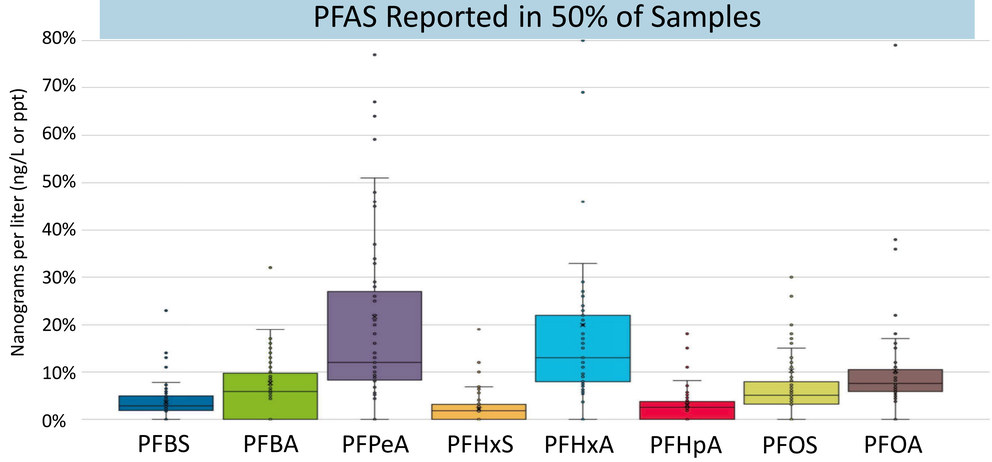
Samples were collected in accordance with CTDEEP Permit in August-September 2021. In wadeable streams, electrofishing was conducted from bank to bank. For larger streams requiring a boat or fishing vessel, sampling was conducted along the shoreline. Stunned fish were netted and transferred to buckets or totes to recover. Fish not used for chemical analysis were released back into the stream.

Sample Analysis

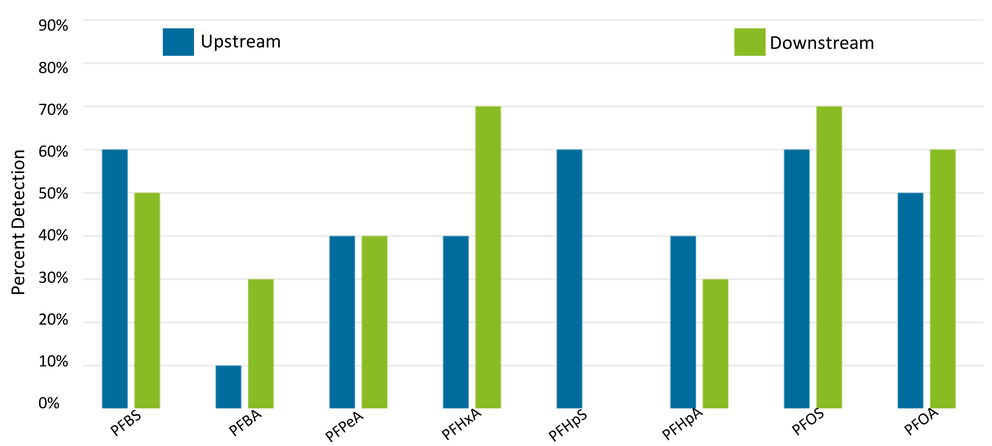
There are currently no EPA-certified methods for analysis of PFAS to single part per trillion levels in media other than drinking water. The analytical methods in this study were developed by and are specific to Con-Test/Pace. Sample analysis was conducted by Pace Laboratory using methods based upon EPA Method 533 and the DoD Quality Systems Manual 5.3, Table B-15. Fish were analyzed as composited left-side fillets, with the skin on.

RESULTS

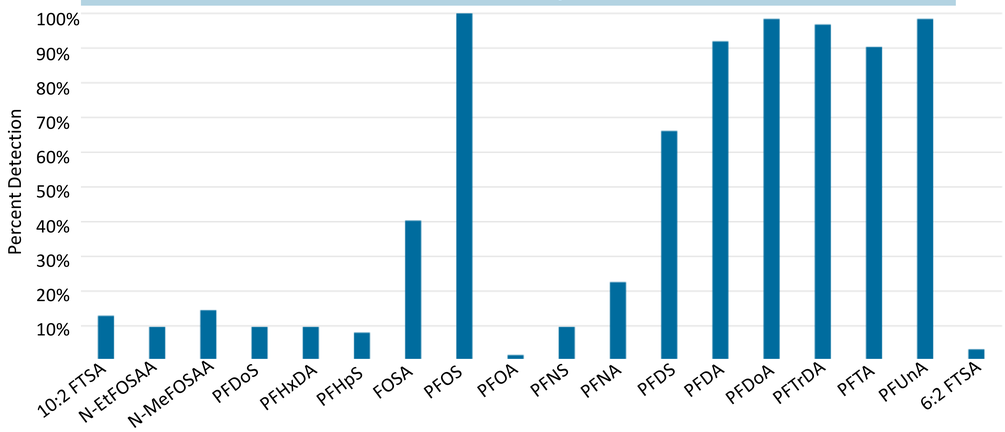
Effluent Concentration
PFAS Reported in 50% of Samples



Surface Water
% Detections PFAS Reported >50% of Samples



Fish Tissue
% Detection of Reported PFAS



CONCLUSIONS

- All WPCF discharges contain measurable concentrations of multiple individual PFAS
  - 8 individual PFAS were observed in at least 50% of the samples and appear to dominate the PFAS entering WPCFs
  - The individual PFAS quantified, and their concentrations, vary within an order of magnitude over time at an individual WPCF and between WPCFs, indicating commonality in PFAS discharge source(s)
- The impact of WPCF discharges on PFAS concentrations in receiving surface-water bodies cannot be determined with the limited sample set available
- Shorter chain PFAS were present in high concentrations in liquid samples, while longer chain PFAS were the most concentrated in solid samples
  - Shorter chain alkyl groups are more hydrophilic and lipophobic
- Fish tissues contain elevated levels of PFOS, which is prevalent in WPCF effluent
  - Many other PFAS are commonly found in fish tissue, but not observed in WPCF effluent
  - This may be a result of increased bioaccumulation properties, concentrating unquantified effluent-related PFAS in tissue
  - Concentrations of PFAS were significantly less in bottom dwelling fish species than in the upper trophic species

FUTURE DIRECTIONS

Recommendations 1-4 are offered by Weston & Sampson to further an understanding of the PFAS loading to WPCFs and receiving waters.

1. Continue developing the PFAS database of effluent, surface water and fish tissue through semiannual to annual sampling events. This will allow for statistical evaluation of PFAS fluctuations in wastewater, surface waters and biota to determine if measurable adverse PFAS-related impacts to surface water and biota are related to WPCF discharges.
2. Consider analyzing samples using Total Oxidizable Precursor Assay methods, to provide information about the potential mass of unidentified precursor PFAS present in the WPCF effluent.
3. Gather estimated flow rates at each of the WPCFs used in this study to estimate PFAS "mass loading" contributions to the receiving waters.
4. Gather info regarding potential PFAS users discharging to each WPCF to better evaluate influent PFAS concentration sources.
5. Run sample analysis using a matrix-matched calibration with replicates rather than a single-point external calibration for quantification. Due to the former quantification method, the results are more susceptible to variability in the instrument.

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REFERENCES

Water Pollution Control Facility PFAS Sampling Study, June 2023