PFAS Fact Sheet

San Francisco Bay Region Phase I Study Results

Per- and polyfluoroalkyl substances (PFAS) are a large group of human-made compounds that are very resistant to heat, water, and oil. Common PFAS-containing products are non-stick cookware, cardboard/paper food packaging, water-resistant clothing, carpets, personal care products, and fire-fighting foam. All PFAS are persistent in the environment, can accumulate within the human body, and have demonstrated toxicity at relatively low concentrations.

Publicly owned treatment works (POTWs) are receivers of PFAS from residential and industrial customers in their sewershed. PFAS in influent are transformed to other PFAS species, but are not destroyed during treatment. PFAS received in POTW influent ultimately partition into effluent or biosolids depending on the individual compound's chemical characteristics.

KEY POINTS

- PFAS are ubiquitous in numerous everyday products and in the environment
- The State Water Board is investigating the sources that could impact drinking water supplies
- We expect to measure low levels of PFAS in wastewater and from landfills as long as we continue to utilize these chemicals in common products

Region 2 PFAS Study – Phase I

In 2019, the State Water Board developed a phased investigation action plan requiring testing of drinking water systems and site investigations at high-risk locations for PFAS[i]. Investigative orders were issued as follows:

- Mar/Apr 2019 - Landfills and airports and adjacent public water systems
- Oct 2019 – Industrial Chrome-platers
- July 2020 - POTWs
- March 2021 - Refineries & bulk terminals

The July 2020 State Water Board Investigative Order for POTWs is not applicable to Water Board Region 2 (San Francisco Bay Area) agencies. Instead, the Bay Area Clean Water Agencies (BACWA) worked with Water Board staff and obtained approval to fund and conduct a regional study through the Regional Monitoring Program at the San Francisco Estuary Institute (SFEI)[ii]. SFEI is conducting this study in two phases:

- In Phase 1, fourteen representative facilities collected influent, effluent, and biosolids samples in Fall of 2020. SFEI is currently continuing to analyze the data and will issue a technical memorandum in September 2021.

- Phase 2 will be conducted in Fall 2021 and will be designed based on recommendations from Phase 1 technical memorandum.

The facilities participating in Phase 1 were selected based on their size, location, level of industry in their service area, treatment technology, and whether they had participated in previous SFEI PFAS studies, so that trends in individual PFAS compounds could be tracked over time. While the Water Board's Investigative Orders required 31 individual PFAS analytes to be measured, the SFEI study is looking at 40 individual analytes, as well as performing a total organic precursor (TOP) analysis on influent and biosolid samples. The TOP analysis involves oxidizing the sample to convert PFAS to their terminal transformation products, then measuring those products. The advantage of the TOP analysis is that it gives a better estimate of the total PFAS in a sample, and not just the individual analytes that are being targeted by a specific analytical method.

Phase I Results

In the Phase I data, total PFAS levels were generally comparable across all agencies treating municipal wastewater, although the levels of individual compounds differed. This result confirms that using a representative selection of POTWs is an appropriate strategy for this investigation.

In recent years new PFAS compounds, such as GenX and ADONA, have been introduced to replace other compounds, such as perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), that have been phased out in the United States. Some of these shorter chain replacement chemicals have been detected and others have not.

KEY POINTS

- Levels detected in wastewater effluent and biosolids from Bay Area agencies are lower than in other household products
- We are supporting research to understand if even these very, very low levels in land-applied biosolids could impact plants
- Maximum concentrations of individual PFAS in effluent are well below DDW drinking water response levels
- We can reduce PFAS in the environment by utilizing products that are PFAS-free

The median sum of the analytes as well as the results of the TOP analysis across all participating agencies are presented in Figures 1 and 2 below. There is a significant presence of non-targeted PFAS precursors in influent and biosolids. As expected based on data collected in other regions, the sum of effluent PFAS concentrations are higher than influent concentrations. This is not because POTWs are adding, making, or concentrating PFAS, but because of the transformation of precursors during biological treatment. These results highlight the need to consider PFAS as a class rather than as a sum of individual compounds, since there are more PFAS than are being measured by individual analytical methods, and the specific compounds are changing over time as industries shift to different PFAS mixtures.

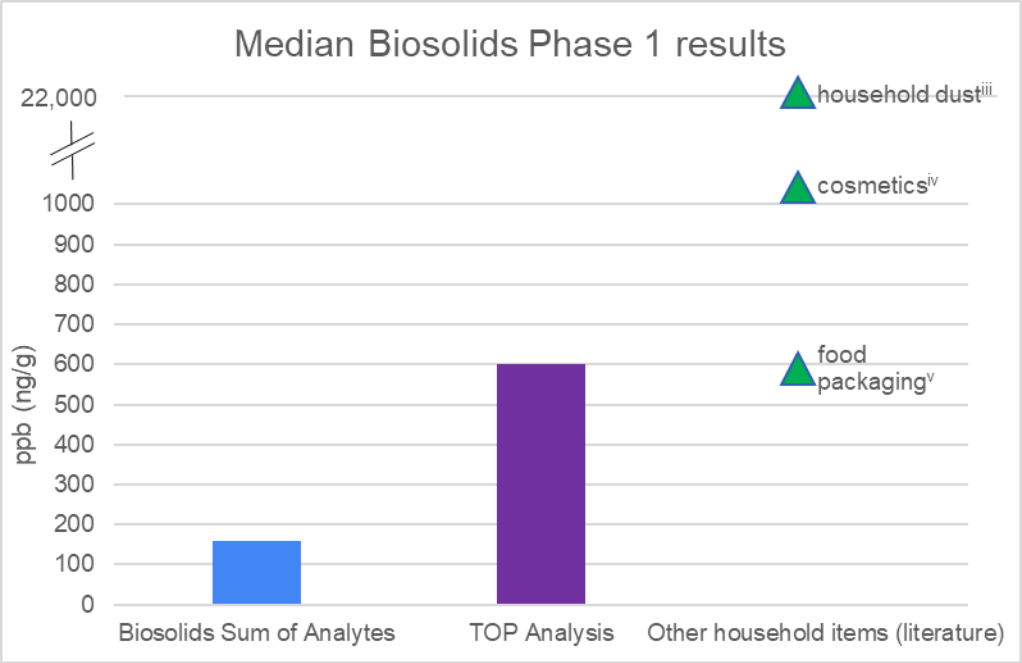

Figure 1: Median biosolids concentrations (ng/g) as measured as the sum of individual analytes, as well as total organic precursors (TOP) shown with typical concentrations found in other sources.

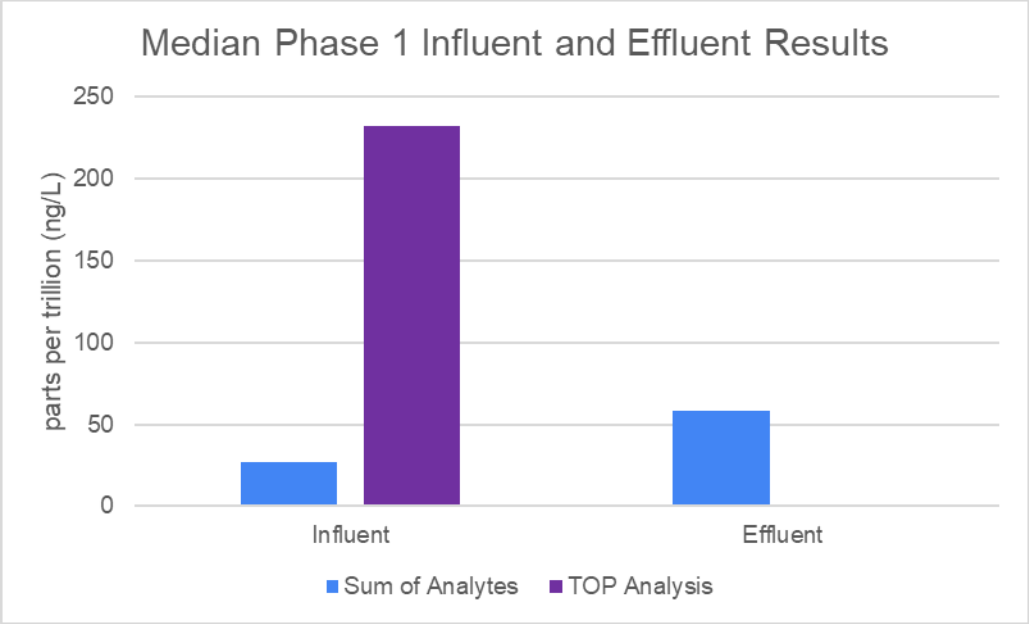

Figure 2: Median influent and effluent concentrations (ng/l) or parts per trillion as measured as the sum of individual analytes, as well as total organic precursors (TOP), which was only performed on influent samples

What does it mean?

Levels of PFAS in Biosolids

Biosolids concentrations, while detectable, are lower than concentrations in common consumer products and in household dust. Levels in some of these other matrices are listed below, although a true apples-to-apples comparison isn't possible since different studies look at different individual PFAS analytes.

- Median sum of analytes in biosolids = 178 ng/g
- Median TOP analysis in biosolids = 594 ng/g
- *Average sum of analytes in household dust = 22,000 ng/g*[iii]
- *Median sum of analytes in cosmetics = 1,050 ng/g*[iv]
- *Median sum of analytes in takeout food packaging > 580 ng/g*[v]

The Bay Area Biosolids Coalition (BABC), a project of Special Benefit of BACWA, is currently sponsoring research through UC Davis to investigate plant uptake rates of PFAS from fields amended with biosolids. This study will add to the existing body of research investigating if there is a health concern related to these levels of PFAS in biosolids. This study is unique in that it will include fields that are amended with food waste compost in addition to control fields that have not received any amendment.

Levels of PFOA, PFOS, and PFBS in Effluent

Most PFAS compound do not have a regulatory threshold. PFOS and PFOA are two types of PFAS that are no longer manufactured in the US although they still are measured in the environment, and have been found in the blood of nearly all people tested in several national surveys. The State Water Board's Division of Drinking Water (DDW) has set notification and response levels for PFOA, PFOS, and perfluorobutane sulfonic acid (PFBS). A response level is the level at which DDW recommends removal of a drinking water source from service. Although no major Bay Area POTW's effluent contributes to a drinking water supply, the median maximum levels of these compounds were compared to the drinking water response levels to provide context (Table 1). Maximum levels in effluent are below drinking water response levels.

Analyte Abbrev.	DDW Drinking Water Response Level (ppt or ng/L)	**Median Observed in Effluent (ng/L)**	**Max Observed in Effluent (ng/L)**
PFOS	40	5.6	9.7
PFOA	10	6.3	9.1
PFBS	5,000	4.1	4.8

Table 1. Bay Area POTW concentrations compared to drinking water response levels.

Phase II and other next steps

BACWA and its members are continuing to work with SFEI and the Water Board to make recommendations on the best use of resources for Phase 2 of the study. BACWA and its members are particularly interested in developing actionable data that will inform future source control or other management efforts. To this end, analysis may focus on the fate and transport within treatment processes or work to identify specific sources within sewersheds.

References

[i] SWRCB Investigative Order for POTWs: https://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2020/wqo2020_0015_dwq.pdf

[ii] Region 2 PFAS Study Phase 1 Sampling Plan: https://bacwa.org/wp-content/uploads/2020/12/SFEI-Final-PFAS-SAP-Phase-1-2020-11-23.pdf

[iii] Hall, S. et al., 2020, Per- and Polyfluoroalkyl Substances in Dust Collected from Residential Homes and Fire Stations in North America, *Ecotoxicology and Public Health;* Available at https://pubs.acs.org/doi/pdf/10.1021/acs.est.0c04869

[iv] Whitehead et al., 2021, Fluorinated Compounds in North American Cosmetics, *Ecotoxicology and Public Health;* Available at: https://pubs.acs.org/doi/10.1021/acs.estlett.1c00240?ref=pdf

[v] Strakova et al., 2021Throwaway Packaging, Forever ChemicalsEuropean wide survey of PFAS in disposable food packaging and tableware; Available at https://www.env-health.org/wp-content/uploads/2021/05/FINAL_pfas_fcm_study_web.pdf