Post Point Wastewater
Resource Recovery

Updated Winter 2022

EMERGING CONTAMINANTS OF CONCERN TEST RESULTS

Overview

At the request of City Council and local non-profit organization RE Sources, the Post Point Resource Recovery project team conducted testing in the fall of 2021 to better understand levels of emerging contaminants of concern in the city's wastewater (listed in the Summary section and Key Findings Summary Table).

Staff researched cost and availability of testing options for these compounds and contracted with ALS Environmental to conduct the tests.

Important note: When discussing these compounds and discussing test results, it is important to note Post Point Treatment Plant is not producing emerging contaminants of concern. A treatment plant is a recipient, not a generator of these compounds. The treatment process works to remove these contaminants to the degree possible with current affordable technology. The City is committed to keeping informed of emerging technology, testing, and regulations for all emerging contaminants of concern, as well as new and emerging uses for biosolids.

Summary

When possible, both an incinerator feed solids sample (solids that are currently incinerated but, after the project is implemented, would be treated to biosolids) and an effluent sample (treated liquid that returns to Bellingham Bay) were sent for testing.

Using the available methods for testing and comparisons with data in current scientific literature and relevant state and federal regulations, the tests showed the following:

- **Per-and Polyfluoroalkyl Substances (PFAS):** Post Point showed the lowest level of PFAS in effluent out of 14 sampled plants in Washington State. There are no adopted federal or state regulations for PFAS compounds in sewage solids or biosolids. When compared to Maine regulated levels, an incinerator feed solids sample was below acceptable screening levels. PFOA and PFOS, the most concerning and most-researched PFAS, have been mostly phased out of consumer products, eliminating new sources.
- **Polybrominated diphenyl ethers (PBDE):** Post Point has a long history of non-detects of PBDE in effluent. The results for solids testing showed levels in line with background levels from national testing. There are no adopted federal or state regulations for PBDE compounds in sewage solids or biosolids.
- **Polychlorinated biphenyls (PCB), dioxins, and furans:** Post Point has a long history of non-detects of PCBs in effluent. Results for PCBs and dioxins on solids samples are orders of magnitude below proposed (but never enacted) U.S. Environmental Protection Agency (EPA) limits for biosolids. There are no adopted federal or state regulations for PCBs, dioxins, or furans in sewage solids or biosolids.
- **Polycyclic Aromatic Hydrocarbons (PAHs):** Post Point showed a cumulative level of 0.888 mg/kg[1] of PAHs in incinerator solids. This amount is below standards established in Europe as safe for children playing in soil and established in the U.S. for invertebrates in soil (e.g., earthworms). There are no adopted federal or state regulations for PAHs in sewage solids or biosolids.
- **Microplastics:** An effluent sample contained 1,980 microplastic particles per liter, which is 67% fewer particles than was measured in a washing machine load from a cited study[2]. Western Washington University researchers are attempting to quantify the microplastics found in Post Point's solids. It has proven difficult as there are limitations in the current methods to quantify microplastics in sludge. There are no adopted federal or state standards for microplastics in treated effluent, sewage solids, or biosolids.

- **SARS-CoV-2:** None detected in treated effluent or incinerator solids. There are no adopted federal or state regulations for SARS-CoV-2 in sewage solids or biosolids.

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[1] mg/kg is equivalent to parts per million. A part per million is like one inch in 16 miles.

[2] Napper, Imogen E., Thompson, Richard C. (2016). Release of synthetic microplastic fibres from domestic washing machines: Effects of fabric type and washing conditions. Marine Pollution Bulletin, 2016 Nov. 15; 112(1-2):39-45.

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Discussion of Results

Per-and Polyfluoroalkyl Substances (PFAS)

As of July 2021, there were no EPA approved methods for analyzing PFAS in biosolids and there are no federal regulations for PFAS in biosolids. Post Point's effluent and incinerator solids were analyzed for a suite of PFAS. Neither sample indicates major sources of PFAS in the service area. Additionally, sources of Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) are declining due to point source regulations, controls and their elimination from consumer goods. Bellingham's drinking water, which could contribute PFAS to the wastewater stream, is non-detect for PFAS. Bellingham has no known industrial dischargers in high-risk PFAS use categories. Post Point's incinerator solids sample was shown to be the lowest for PFAS of 14 sampled plants in Washington State. The State of Maine does regulate three PFAS compounds and the Post Point sample tested was below Maine's acceptable limits for those compounds.

Polybrominated diphenyl ethers (PBDE)

Post Point's treated effluent has been analyzed for the PBDE 4-bromophenyl phenyl ether since 1991 with no detections. Enhanced monitoring was conducted (46 PBDE compounds) twice in 2009 with no detections. Results for the incinerator feed solids show levels in line with or below published ranges for biosolids from the U.S.[3] and Europe[4], and orders of magnitude lower than concentrations in household dust[5].

Polychlorinated biphenyls (PCB), dioxins, and furans

Post Point treated effluent has been analyzed for PCBs since 1991 with no detections. Enhanced monitoring was conducted twice in 2009. Results on incinerator solids show levels for PCBs (0.024 parts per million [ppm]) that are several orders of magnitude below a previously proposed (but never enacted) EPA limit (4.6 ppm).

Similarly, as shown in the table below, dioxins levels are in line with background levels seen for other utilities in the 2001 national biosolids survey and from published values for two plants in British Columbia, an order of magnitude below European regulatory limits, and below never enacted EPA limits. In 1999 the EPA considered regulations on dioxins in biosolids that would have prohibited land application of biosolids with 300 parts per trillion toxic equivalents (TEQ) of dioxins—nearly two orders of magnitude higher than the TEQ in Post Point solids.

[3] Gottschall, N.; Topp, E.; Edwards, M.; Payne, M.; Kleywegt, S.; Lapen, D.R. (2017). Brominated flame retardants and perfluoroalkyl acids in groundwater, tile drainage, soil, and crop grain following a high application of municipal biosolids to a field. Science of the Total Environment, 2017 Jan 1;574:1345-1359.

[4] Tavazzi, Simona; et al. (2012). Occurrence and levels of selected compounds in European Sewage Sludge Samples. European Commission Joint Research Centre.

[5] "Consuming Chemicals", Greenpeace. (2003).

Toxic Equivalent Concentration (picogram/gram)

	I-TEQ - DIOXIN	I-TEQ - FURAN	I-TEQ TOTAL
ANALYTICAL VALUES			
Bellingham[#]	6.2	2.6	8.7
2001 Targeted National Sewage Sludge Survey - min	1	0	1
2001 Targeted National Sewage Sludge Survey - max	449	493	682^
British Columbia Water Resource Recovery Facility (WRRF) 1[*#]			5.3
British Columbia WRRF 2[*#]			4.7
REGULATORY LIMITS – ACTUAL & PROPOSED			
Austria - biosolids land application limit			100
Germany - biosolids land application limit			100
EPA proposed monitoring limit (1999)			30
EPA proposed usage limit (1999)			300

**used lower TEF for 1,2,3,7,8-PeCDD*

^dioxin and furan maxima are from two different plants

[#]using method detection limit for non-detects (conservative assumption)

Polycyclic aromatic hydrocarbons (PAHs)

Post Point's incinerator solids were analyzed for the 18 most common PAH compounds using low-level detection methodology. There are no PAH regulations for sewage solids or biosolids, so results were compared against two safety standards. First, the EPA has established soil screening levels to protect wildlife. Lower molecular weight PAHs degrade faster in soil, so there are two acceptable levels based on the species present. The most stringent levels apply to terrestrial invertebrates (e.g., earthworms). Another standard established in Europe is based on research designating safe levels of PAHs for areas where children are in contact with soils. Post Point's 18-PAH cumulative level of 0.888 mg/kg is well below both standards.

Microplastics

Wastewater treatment plants can be very effective at reducing microplastic loads – one study[6] showing reductions of 88% by conventional treatment alone. Removed particles would be expected to be present in sewage solids. Western Washington University researchers are attempting to quantify the microplastics found in Post Point's incinerator solids. It has proven to be difficult. There are limitations in the current methods to quantify microplastics in sludge, with one recent study citing an inability to account for 96% of the expected microplastics in sewage sludge.

SARS-CoV-2

SARS-CoV-2 was not detected in plant effluent or incinerator solids. Current federal requirements for biosolids production help ensure that biosolids are processed, handled, and land-applied in a manner that minimizes the risk of exposure to pathogens, including viruses with level of treatment based on end use. Thermal destruction (including digestion), air drying and/or pH elevation methods are used to meet specific bacteria, viral and helminth ova reduction requirements. SARS-CoV-2 is susceptible to destruction by these means.

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[6] Iyare, Paul U., Ouki,Sabeha K., Bond, Tom (2020). Microplastics removal in wastewater treatment plants: a critical review. Water Research and Technology, 2020 Issue 10.

Key Findings Summary Table

Emerging contaminant of concern tested	Common Sources	Incinerator Feed Solids Sample (solids that will become biosolids rather than incinerated)	Treated Effluent Sample (treated water released through an outfall to Bellingham Bay)
Per-and Polyfluoroalkyl Substances (PFAS) *A family of compounds – 23 were analyzed in the tests*	• Nonstick cookware • Stain and water-resistant coatings • Plumbing tape • Fast-food wrappers • Industrial uses • Firefighting foam	Post Point's settled solids sample is the lowest for PFAS out of 14 sampled plants in Washington State. Maine does regulate three PFAS compounds and the sample tested met or was below Maine's Biosolids Soil Beneficial Use Screening levels for these compounds.	Post Point's effluent sample does not indicate major sources of PFAS in the service area and sources of Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) are declining, due to point source regulations and controls. Bellingham's drinking water, which could contribute PFAS to the wastewater stream, is non-detect for PFAS.
Polybrominated diphenyl ethers (PBDE)	• Flame retardants in furniture foam • Plastics • Consumer electronics Upholstery	In line with background levels from national sampling. Significantly below the levels in household dust.	No detections in the PBDE 4-bromophenyl phenyl ether in monitoring conducted since 1991.
Polychlorinated biphenyls (PCB), dioxins, and furans	• Transformers and capacitors • Fluorescent light ballasts • Cable insulation	PCBs: Orders of magnitude below never enacted EPA limit. Dioxins/furans: Order of magnitude below never enacted EPA and current European regulatory limits. In lower end of range from national testing.	No detections in monitoring conducted since 1991.
Polycyclic Aromatic Hydrocarbons (PAHs) *Over 100 hazardous substances from incomplete combustion of carbon-containing materials (e.g., wood, coal, oil, gas) –*	• Natural products: o Volcanoes o Forest fires • Human-made products: o Household products (e.g., mothballs, some shampoos) o Cigarette smoke o Oil-based heating	A cumulative level of 0.888 mg/kg was detected in incinerator feed solids. This is below standards established in Europe as safe for children playing in soil, and established in the U.S. for invertebrates (e.g., earthworms) in soil.	No detections in annual priority pollutant monitoring.

Emerging contaminant of concern tested	**Common Sources**	**Incinerator Feed Solids Sample** (solids that will become biosolids rather than incinerated)	**Treated Effluent Sample** (treated water released through an outfall to Bellingham Bay)
18 of the most common were analyzed	○ Indoor and outdoor grilling ○ Jet exhaust ○ Road paving		
Microplastics - polymerics (polyethylene, polypropylene, nylon, etc.) less than 5 millimeters in diameter.	• Clothes • Paints • Tire dust • Plastic litter (e.g., bags, bottles, straws) • Personal care products (e.g., microbeads in body wash)	Method for quantifying microplastics in incinerator solids is not available. The project team is working with Western Washington University researchers to quantify the microplastics found in the test sample, which has proven to be difficult.	The effluent sample contained 1,980 microplastic particles per liter. A liter equals 0.26 liquid gallons. For context, a typical washing machine load is 30 gallons and studies have shown 700,000 microplastic particles from an average wash load of acrylic fabric. Post Point's sample showed 67% less particles than what was measured in the wash load from the cited study.
SARS-CoV-2		SARS-CoV-2 was not detected in incinerator solids. SARS-CoV-2 does not appear to survive the treatment process, based on current science.	Effluent testing showed no detectable SARS-CoV-2 present.