



A Survey of Trace Metals and Organic Chemicals in Effluent from Oregon's Major Municipal Treatment Facilities

Lori A Pillsbury^a, Bruce K Hope^b, Brian Boling^a

^a Oregon Department of Environmental Quality, Laboratory & Environmental Assessment Division, 3150 NW 229th Ave. Ste 150, Hillsboro, OR 97124
^b CH2M Hill, Inc., 2020 SW 4th Ave., Portland, OR 97201



Abstract

Oregon's Senate Bill 737, enacted in 2007, required the state's 52 largest municipal wastewater treatment plants (WWTP) and water pollution control facilities (WPCF) to collect effluent samples in 2010 and analyze them for persistent organic pollutants. These facilities are located state-wide and represent a variety of treatment types, service population sizes, geographic areas, and flow conditions. Although this survey was constrained by legislative directives and operational practicalities to only two samples at each facility within the same year, it nonetheless represents a unique effort to examine effluent from all of the major municipal treatment facilities within a state's regulatory jurisdiction for over 400 chemical contaminants.

Of the chemicals ultimately analyzed, 114 were detected above the level of quantification (LOQ) in at least one sample. Few persistent pollutants were found possibly because of their diminished environmental presence, their diversion from effluent via sorption to sludge (solids phase), or high LOQs for certain chemicals. For several classes of contaminants, most notably PBDEs and polycyclic aromatic hydrocarbons (PAHs), as well as phthalate esters, certain pharmaceuticals, and common consumer products, our findings are consistent with those of others. Conversely, we report the presence of several commercial and consumer pesticides, as well as of benzene and phenol degradation products, not previously reported in municipal effluent. Ten polychlorinated biphenyls (PCB) congeners were present at low concentrations in ≤ 10 samples, while polychlorinated naphthalenes and dioxins/furans were not detected at all. Twenty-one polybrominated diphenyl ether (PBDE) congeners were found, nine of which have been reported in Osprey eggs in Oregon and Washington. Methylmercury was present in 65% of samples, with average and maximum concentrations of 0.18 ng/L and 1.36 ng/L, respectively. Although they are generally assumed to be innocuous by-products of sewage treatment, additional research is needed on potential impacts to aquatic ecosystems from high loadings of coprostanol and cholesterol.

These results suggest that effluent, rather than just receiving waters, should itself be analyzed for a wide range of contaminants in order to understand how upstream sources, conveyed through WWTPs and WPCFs, could be impacting aquatic ecosystems.

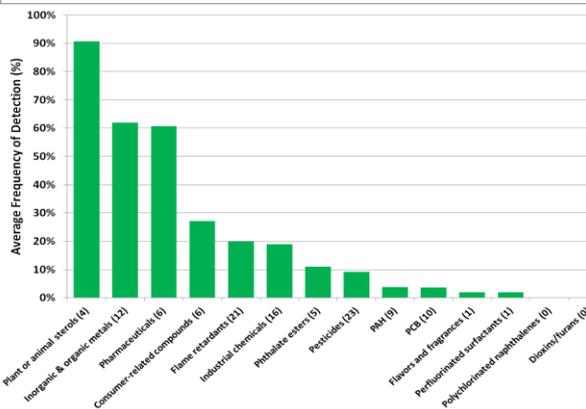
Overview

- Senate Bill 737 mandated investigation of persistent pollutants in effluent from major wastewater facilities
- Project scope was limited by timeline outlined in legislation
- Sampling occurred twice in 2010 (summer & fall)

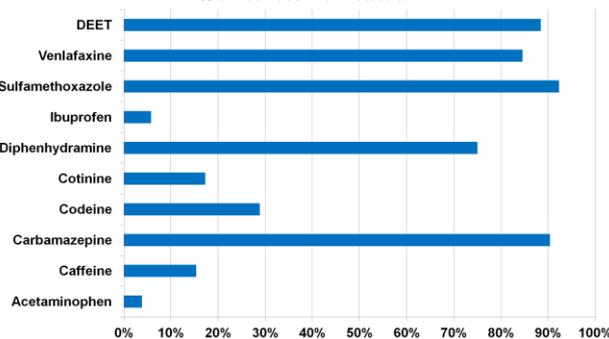
Analytical Methods

- All samples analyzed by DEQ laboratory
- 15 laboratory methods using 6 different instrumental technologies
- > 1000 individual samples analyzed

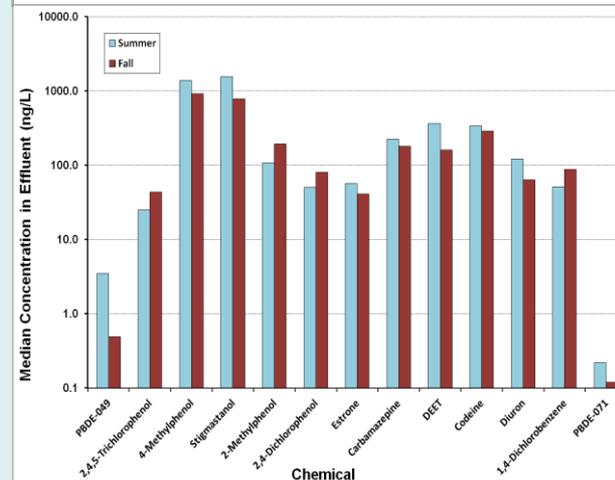
Average Frequency of Detection of Classes of Compounds



Pharmaceuticals / Personal Care Products



Seasonality of Detections



Results

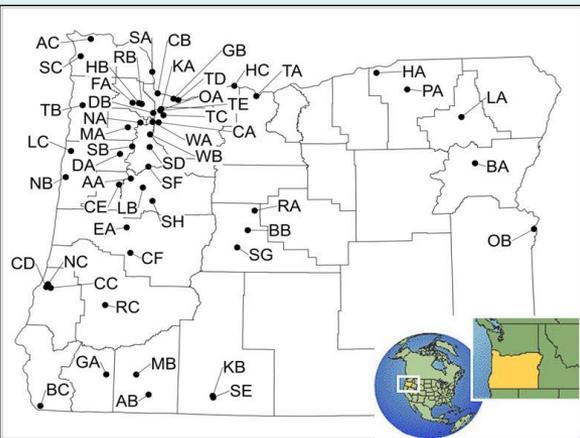
- Over 400 chemicals were included in the analyses
- 114 chemicals were detected over the laboratory's level of quantification (LOQ)

Conclusions

- Seasonal variations exhibited in some chemicals, particularly current use pesticides
- Variations in chemicals detected likely related to population size served, more than geography within state
- Additional information needed on the possible effects of cholesterol and coprostanol to aquatic systems
- Effluent may contain chemicals from upstream sources, additional investigation is required to identify these sources

Reference:

Hope, BK, Pillsbury, L, Boling, B. A state-wide survey in Oregon (USA) of trace metals and organic chemicals in municipal effluent. *Sci Total Env* 2012 (417-418):263-272.



Sampling Locations

- 52 Major Municipal Treatment Facilities, > 1 MGD dry weather flow
- Represented a wide range of treatment types, population sizes, geographic areas, and flow conditions