

Screening study assesses pharmaceuticals and personal care products (PPCPs) at wastewater treatment plants

In August 2008, the Washington Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) conducted a study to characterize PPCPs at five municipal wastewater treatment plants that discharge to Washington State waters.

Ecology and EPA collaborated with the Puget Sound Partnership and local municipalities to look at a range of treatment processes and their effect on PPCP levels. The study looked at untreated wastewater, treated wastewater, reclaimed water, and treated solids (biosolids).

How PPCPs get into our wastewater

Residential, commercial, and agricultural pharmaceuticals can follow two primary pathways to the environment:

- **Excretion:** Humans and livestock consume – then excrete – drugs and their metabolites. The chemicals then get into our wastewater treatment plants, septic systems, and stormwater runoff.
- **Direct Disposal:** Humans may inappropriately flush unused pharmaceuticals down the toilet.

Why it matters

Pharmaceuticals are an important part of maintaining human health, but they can also pollute the environment. PPCPs are bioactive chemicals, meaning they have an effect on living tissue. Washington's population is growing as is the use of PPCPs, releasing more unwanted chemicals and creating increased environmental concerns. Researchers suspect that endocrine-disrupting compounds used in some PPCPs may be responsible for effects on wildlife including feminization of male fish, sluggish activity, or reduced appetite.

We do not know the short-term and long-term environmental and human-health effects of these substances.

What are PPCPs?

Pharmaceuticals and personal care products include:

- Prescription and over-the counter therapeutic drugs.
- Veterinary drugs.
- Fragrances.
- Cosmetics.
- Sun-screen products.
- Diagnostic agents.
- Nutraceuticals (for example, vitamins).

Where do PPCPs come from?

- People and their uses of the products.
- Residues from pharmaceutical manufacturing.
- Residues from hospitals.
- Illicit drugs.
- Veterinary drug use, especially antibiotics and steroids.
- Agribusiness.

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The study's framework

The primary goal of the study was to characterize the concentrations of PPCPs in wastewater and evaluate how efficient the different treatment processes are at removing individual PPCPs. Four of the five wastewater treatment plants in this study discharge treated wastewater and reclaimed water into the Puget Sound watershed. The fifth plant is located in Idaho and discharges seasonally into the Spokane River.

Scientists collected wastewater samples before and after treatment at each plant. Treatment ranged from secondary processes, such as activated sludge, to advanced treatment for nutrient removal using biological or chemical methods, and finally to reclaimed water technologies.

Scientists analyzed the samples for 172 organic compounds which included PPCPs, hormones, steroids, and semi-volatile organic chemicals. Nutrients and total suspended solids were also measured. The study used newly approved EPA methods to measure PPCPs, hormones, and steroids at low concentrations.

Findings

The study routinely found PPCPs in all samples, and their concentrations were comparable to those reported in the literature from other studies. Overall, conventional secondary treatment reduced 21 percent of the 172 organic compounds to below detection levels. Advanced nutrient removal and filtration technologies reduced the number of compounds detected by 53 percent.

A total of 20 percent of the 172 compounds were found only in the treated solids (biosolids) from the plants, suggesting that some PPCPs can concentrate in biosolids. None of the wastewater treatment technologies were able to remove three of the PPCP chemicals. These were the pharmaceuticals carbamazepine, fluoxetine, and thiabendazole.

Overall, the study suggests that a higher level of wastewater treatment, designed to remove nutrients, may also be successful in reducing PPCP chemicals.

Public education about disposal of pharmaceutical products

Group Health and Bartell Drugs are piloting drug collection programs, educating the public as follows:

Do *not* flush your leftover, unwanted, or expired drugs. Instead take them to a pharmacy that has a take-back program. If this is not available in your area, take your medicines out of their original containers, mix them with an undesirable substance such as kitty litter or coffee grounds, place this mixture in a watertight container, then put it in the garbage.

You can find consumer information about Washington's drug take-back program at:
www.medicinereturn.com/