

Pharmaceuticals and Personal Care Products in the Environment



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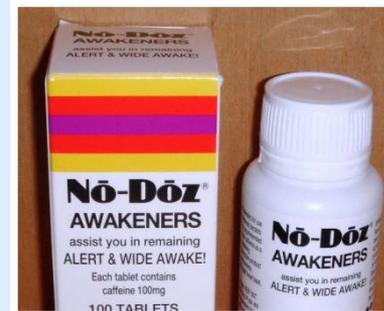
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- Laura Kammin, Kirsten Walker, & Sarah Zack (IISG/U of I Extension)
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What are Pharmaceuticals and Personal Care Products (often called PPCPs)?

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



Why are we concerned?

- PPCPs as well as steroid hormones have been detected in over 80% of the lakes, rivers, and streams in the United States, though usually at very low levels (ppt, ppb, ppm).
- There have been reports of a variety of impacts on aquatic species such as fish, invertebrates, bacteria (antibiotic-resistance).
- Unknown human health effects; concentrations low but could be synergistic effects.
- Treatment systems such as WWTPs are not usually designed to remove most PPCPs/hormones.
- Leachates from landfills have been found to contain PPCPs and steroid hormones along with other hazardous chemicals.



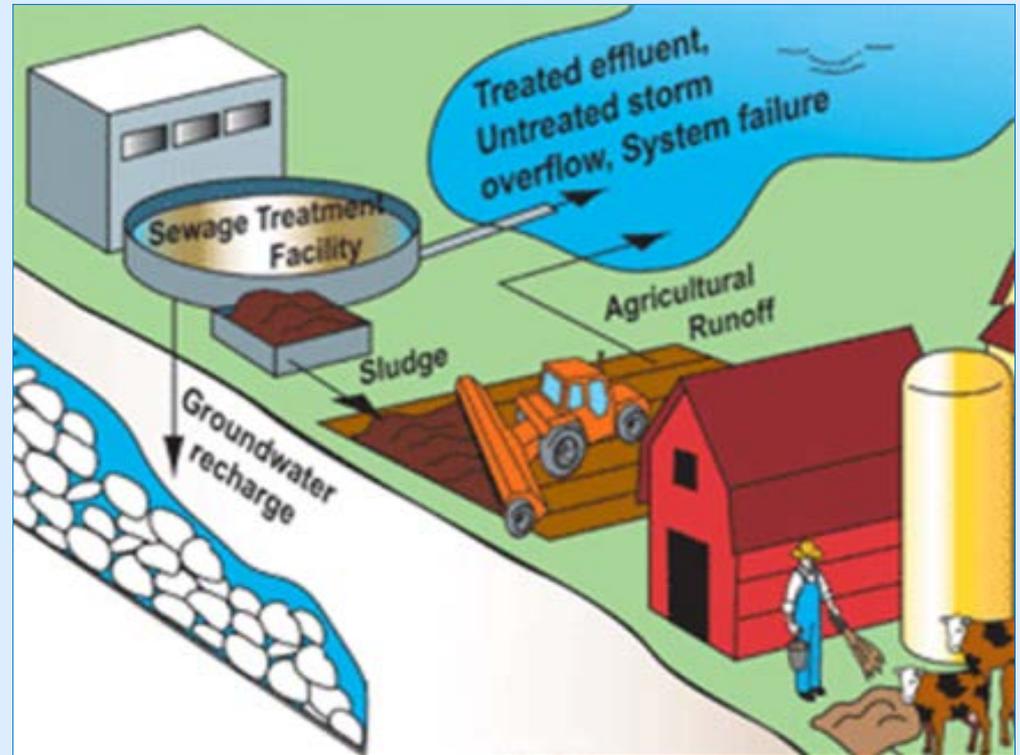
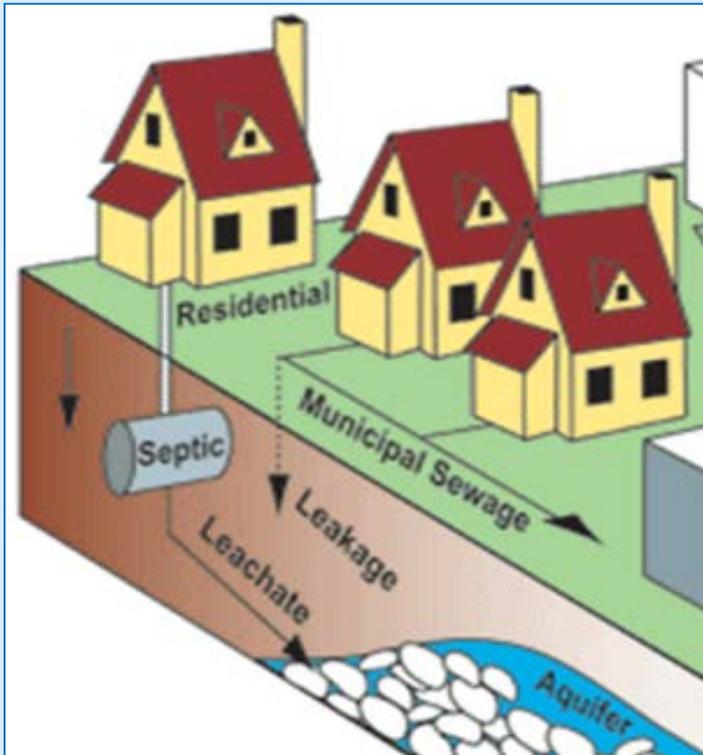
How do PPCPs get into the environment?

Two major sources:

- Effluents from municipal sewage treatment plants
- Manure from animal feeding operations (AFOs)



Sources of PPCPs to the Environment



From U.S. EPA



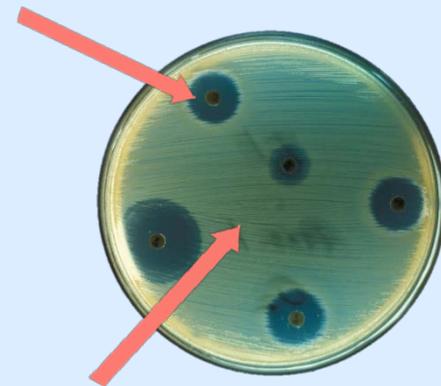
Multi-Pronged Approach:

Research

- Occurrence, Fate, and transport of PPCPs and hormones in water and soil
- Antibiotic Resistance in Bacteria
- Mitigation Strategies



Bacteria



Growth media with antibiotics

Common PPCP and Hormones Analyzed

Acetaminophen

Caffeine

Carbamazepine (anticonvulsant and mood stabilizer)

Diphenhydramine (antihistamine)

Erythromycin (antibiotic)

Fluoxetine (anti-depressant)

Gemfibrozil (used to lower lipid levels)

Ibuprofen

Naproxen

Sulfamethazine (antibacterial)

Sulfamethoxazole (antibacterial)

Triclocarban (antibacterial)

Triclosan (antibacterial)

Trimethoprim (antibiotic)

17 α -estradiol

17 β -estradiol

Estradiol-3-sulfate

Estriol

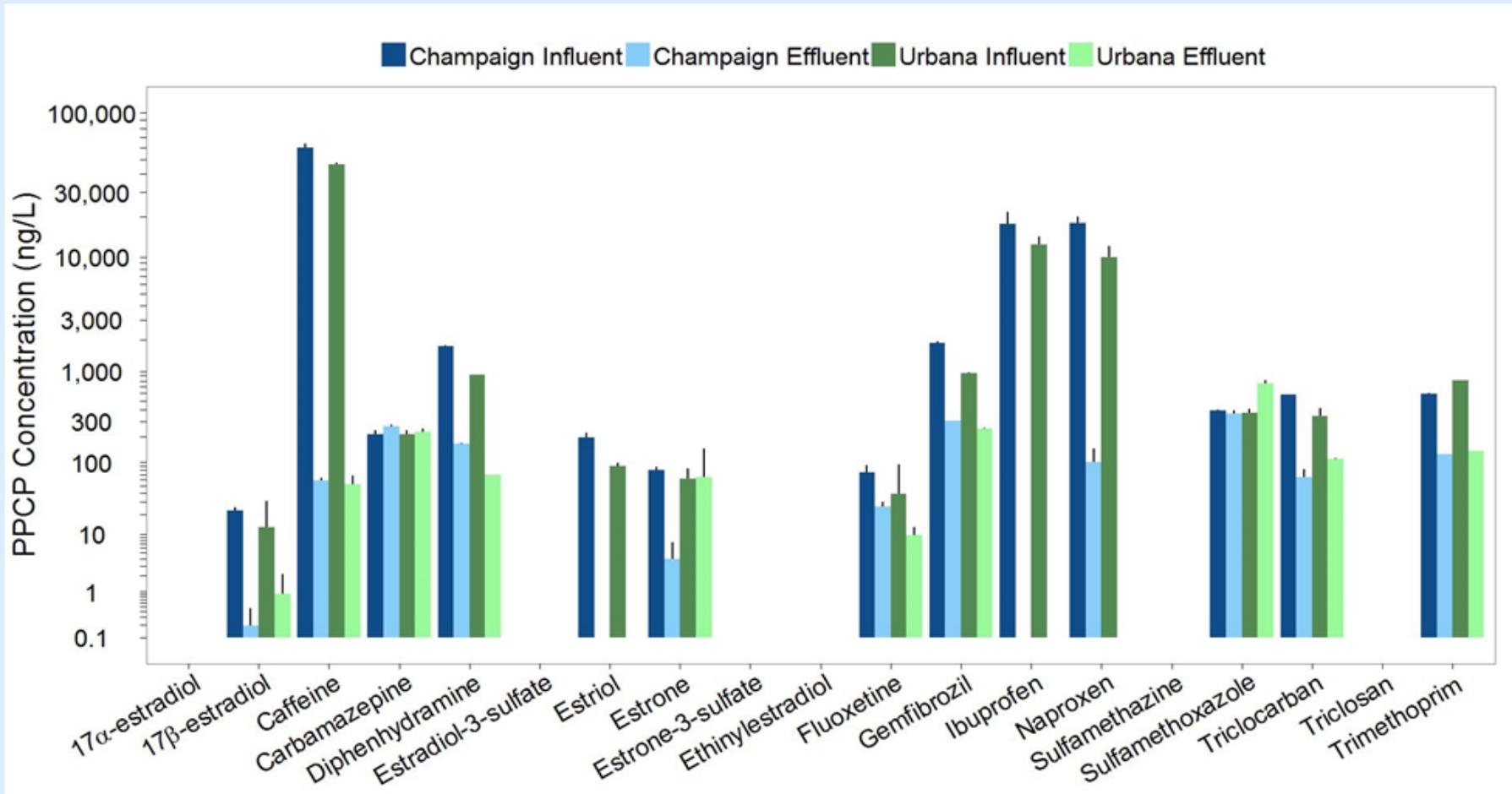
Estrone

Estrone-3-sulfate

Ethinylestradiol

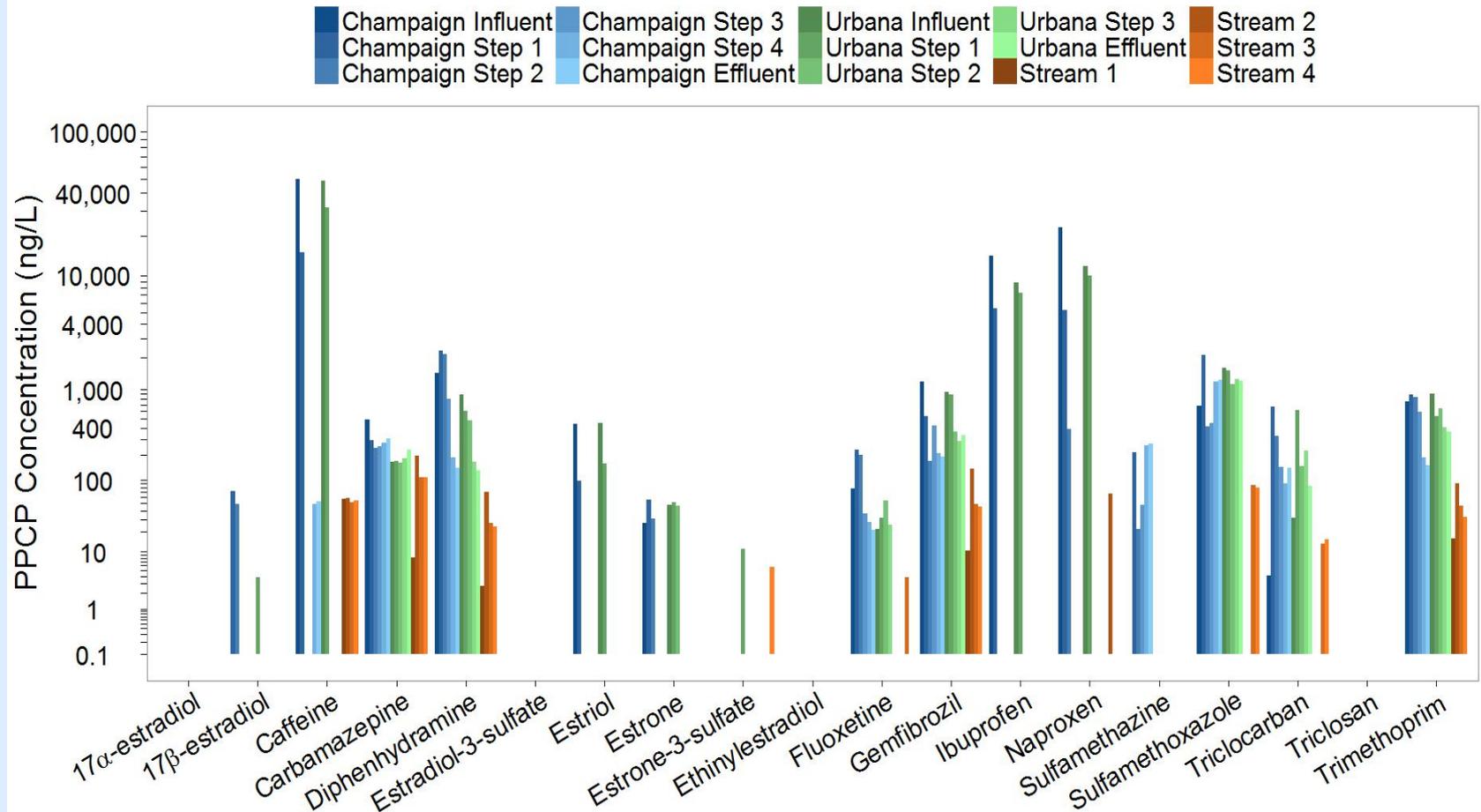


Results of Research on WWTP Influent and Effluents



Summer 2014. PPCPs detected in water samples from Champaign and Urbana sewage treatment plants.

Results of Research on WWTP Influent, Effluents, and Stream



Fall 2014. PPCPs detected in water samples from Champaign and Urbana sewage treatment plants and receiving stream of Champaign effluent.

Prevalence of PPCP and Hormones Analyzed*

Acetaminophen

Caffeine[^]

Carbamazepine[^]

Diphenhydramine[^]

Erythromycin

Fluoxetine[^]

Gemfibrozil[^]

Ibuprofen

Naproxen

Sulfamethazine

Sulfamethoxazole[^]

Triclocarban[^]

Trimethoprim[^]

17 α -estradiol

17 β -estradiol

Estradiol-3-sulfate

Estriol

Estrone[^]

Estrone

Estrone-3-sulfate

Ethinylestradiol

***Orange for AFO wastewater**; **Blue for municipal WWTP influent**;

[^]Municipal WWTP Effluent



Multi-Pronged Approach:

Education and Outreach

- PPCP Consortium – meets 2 - 3x/yr. – discussion and networking at ISTC on UIUC campus
- PPCP Conference – April 4, 2016; upcoming one May 31-June 1, 2017
- Educator Workshops – June 2016; today's session
- Webinars (e.g., May 3, Dr. Alistair Boxall, Univ. of York)
www.istc.illinois.edu/about/sustainability_seminars.cfm



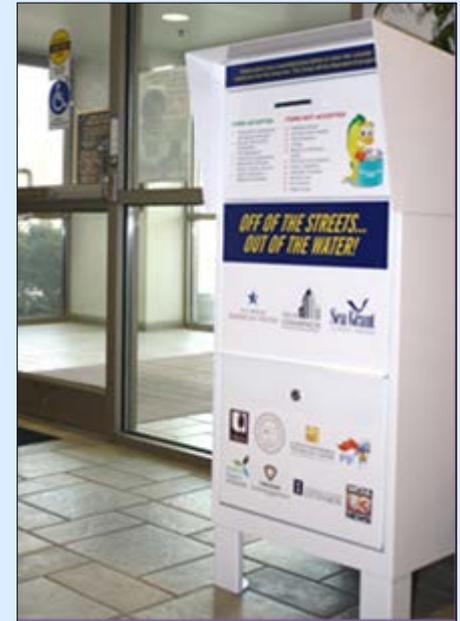
Multi-Pronged Approach:

Education and Outreach

- Establishing unwanted medicine drop-boxes – working with IISG to set up around the state; new regulations allowing pharmacies to collect also
- Developing videos on our research and on proper medicine disposal; distributing information via brochures, flyers, and our websites

www.unwantedmeds.org

www.istc.illinois.edu/research/ppcps/



Preliminary Results of General Public and Health Care Providers Surveys

General Public:

- **70%** reported that they had prescription or over the counter medication that they wanted to dispose of
- **70%** reported that they felt proper disposal methods were very important
- **53%** reported that they had little to no knowledge of correct disposal methods
- **90%** reported that they were likely to use a drop-off location if it was convenient
- **90%** reported that none or very few healthcare professionals had mentioned disposal



Preliminary Results of General Public and Health Care Providers Surveys

Health Care Providers:

- 99% reported that proper pharmaceutical disposal was moderately or very important
- 44% reported that they only felt they had some information about proper disposal
- 39% reported that they felt that patients had no understanding of proper disposal
- 65% reported that they rarely or never spoke to patients about proper disposal
- 94% were moderately or very willing to speak to patients more about disposal



Preliminary Results of General Public and Health Care Providers Surveys

Results indicate that:

- Improper disposal is common
- Lack of knowledge of proper disposal methods among both the general public and healthcare providers
- Lack of discussion about disposal between patients/providers
- Desire for more information among the general public and healthcare providers



Consequences of Improper Storage and Disposal of Unwanted Medicines

- ❖ **Environmental Impacts** - from flushing down the toilet or improper disposal in the trash
- ❖ **Accidental Poisonings** - Stockpiling of unwanted medicines can cause accidental poisonings at home. Children, adults, and pets are all at risk.
- ❖ **Drug Abuse** - from stored or discarded medicines getting into the wrong hands



Accidental Poisonings of Children



According to the Centers for Disease Control and Prevention, or CDC, over 60,000 young children are treated in emergency rooms every year because they consume improperly stored medicines while unsupervised.



Accidental Poisonings of Pets



For the past 7 years, accidental ingestion of human prescription and over-the-counter medications is the most common cause of pet poisoning, based on a 2015 report - Animal Poison Control Center of the American Society for the Prevention of Cruelty to Animals.



Prescription Drug Abuse is on the Rise

- Prescription drug abuse is particularly on the rise among teens, many of whom mistakenly believe that prescription pills are safer than street drugs.
- The majority of new users obtain prescription painkillers in their homes from family members -- usually without permission.
- Also, the Drug Enforcement Administration has noted that unused prescription drugs thrown in the trash can be retrieved and abused or illegally sold.



Drugfree.org

The Elderly and Medicines



Concierge.carefl.com

The CDC estimates that 76% of adults over age 60 use two or more prescription drugs per month, while 37% use five or more. This greatly increases the opportunities for drug misuse from self-medication, dosage confusion, or use of old medications.



ILLINOIS SUSTAINABLE
TECHNOLOGY CENTER
PRAIRIE RESEARCH INSTITUTE

Unwanted Medicine Collection Programs



One Day Event



Permanent Drop-box



Mail-in Envelopes

One of the ways to prevent the negative consequences of unwanted medicines in the environment is by proper medicine disposal.

Safe Disposal in Trash at Home

If you do not have access to a collection event or drop-box:

1. Take your unwanted medicines out of their original containers and mix them with an unpalatable substance, such as kitty litter or used coffee grounds. Do not crush tablets or capsules.
2. Seal the mixture in a leak-proof container, such as a plastic bag, coffee can, or an empty margarine tub.
3. Dispose of the sealed container with the drug mixture with your household garbage as close to trash pick-up day as possible.
4. Remove or black out any personal information, including Rx number, on the empty containers, and recycle or dispose according to your local regulations.



Actions you can take on this issue:

- ❖ **Learn if your community had a permanent drop-box and, if it does not, help set one up working with local police station.**
- ❖ **Work with others in the community to have a one-day collection event in consultation with proper authorities.**
- ❖ **Talk with students and the public about the impacts of PPCPs and hormones in the environment and educate them about the importance of proper medicine storage and disposal.**



Thank you!

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