Pharmaceuticals in Water and Wastewater

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Emerging Health Concerns

- **Pharmaceuticals**: N-nitrosodimethylamine (NDMA), 1,4-dioxane, bisphenol A, alkylphenol polyethoxy carboxylates (APECs), dioxin, disinfection by-products, ...

- **Cosmetics, hormones, nanomaterials**

- **Endocrine disruptors**, a class of compounds that perturb the normal functioning of endocrine systems including those that affect growth, reproduction and behavior.

Partial removal requires capital, energy-intensive processes:

- (GAC adsorption; ozonation; micro-, ultra-, nano-filtration; reverse osmosis; membrane bioreactors; advanced oxidation (hydrogen peroxide - UV))
Pharmaceuticals in drinking water

- Water tested positive for pharmaceuticals
- Water not tested for pharmaceuticals
- Water tested negative for pharmaceuticals
- Test results pending

NOTE: All places include some surrounding areas except: Albuquerque, N.M.; Arlington, Texas; Fresno, Calif.; Long Beach, Calif.; Los Angeles; Memphis, Tenn.; New Orleans; New York City; and Orlando, Fla.

SOURCES: Drinking water providers' responses to Associated Press questions; AP review of scientific literature.
Over-the-Counter Drugs in Drinking Water

Caffeine was found at the highest concentration of all drugs tested by Philadelphia Water

If you drink eight glasses of water a day for more than 1,200 years, you'll get the amount of caffeine in a single cup of coffee (~100 mg)
Over-the-Counter Drugs in Drinking Water

If you drink eight glasses of water a day for more than 40,000 years, you'll get the amount of acetaminophen in a single infant dose (80 mg) of Tylenol.

There is currently no indication that such extremely low concentrations pose any public health risk.
Recreational Drugs in Wastewater

Oregon State University drug-tested influent at 40 wastewater plants:

- A "city with a gambling industry" used five times more methamphetamines
- A "fairly affluent community" scored low for everything except cocaine
- Cocaine and ecstasy levels peaked on the weekends, but the meth and prescription drugs were constant
Pharmaceuticals

"Ask your doctor if _____ is right for you"...

- take pills ⇒ pee 'em out (& dispose extras) ⇒ toilet ⇒ wastewater plant ⇒ river ⇒ drinking water treatment plant intake ⇒ tap

Concentrations in drinking water are in the parts-per-bazillion range.

The real story here is:

- How amazing the detection methods of modern analytical equipment are.
- This stuff that we make persists and is incorporated into the environment.