

---

## Troubled Waters: Pharma Products in Our Water Supply

By: GSWA Science & Technology Committee

Principal author: Paul Hackett

Many of us instantly recognize the headline hazards to clean drinking water such as lead, mercury, benzene, or PCBs that have been studied, tested for, regulated, and in the news for decades. Now a recent Associated Press article has highlighted a new area of concern in the gamut of drugs that are being discovered in our water supplies. These un- or partially metabolized drugs are being recycled back into the water environment after either passing through their human hosts or simply being flushed down the drain. The question is what harm these compounds introduce to the water systems and what the impact is to water's most important end user: us.

The pharmaceuticals and personal care products or PPCPs (the acronym used by the NJ Department of Environmental Protection) that we ingest or apply to our bodies are all showing up in our nation's waterways including poster-child compounds like estrogen, antibiotics, anti-depressants, testosterone, heart medications, anti-epilepsy drugs – you name it – even caffeine. If we pop it in, we inevitably excrete it out and the sum of the mix is defying standard wastewater treatment processes. PPCPs are a particular concern because these drugs are created for treating specific human conditions, unlike industrial toxins which have a much different genesis.

There are numerous studies across the entire water geography of the United States from Boulder Creek, Colorado to Lake Mead, Nevada and even in our own backyard in the Passaic Valley. These examinations are discovering all types of drug compounds and their resulting effects on aquatic life. One study investigated the effects of estrogen – the main compound in birth control pills - on the male Fat Head Minnow. It required introducing minute amounts of estrogen into a pristine Canadian lake to determine if in fact it was the cause of endocrine and subsequently gender disruption in male Fat Head minnows that were observed in streams containing the female sex hormone. The result - yes! Within seven weeks, the male minnows were creating egg-yolk proteins while exhibiting female characteristics and reproduction of the species completely stopped. In another study on Boulder Creek, the sex ratio of male-to-female carp was the expected 50/50 above the town's wastewater treatment facility but a mismatched 10/90 in the stream below.

But estrogen is not alone. In Lake Mead, Nevada thirteen drugs were discovered including many anti-depressants and anti-epileptic drugs. These evidently are prone to incomplete metabolism and demonstrated arrested brain development in young fish. A study of twenty-five drugs and other questionable compounds found in sludge spread on Midwestern farms found that twenty-two of the twenty-five substances were immediately present in earthworms. Yet another found human antibiotics in the kernels of corn. PPCPs are showing up everywhere. While these compounds can be detected in water systems usually at very low levels, in most cases, the effect on the environment or on human health has not yet been determined.

Government organizations are not far along with any standard tests, monitoring procedures or conclusions in this new area of drugs in the water. The EPA at [www.epa.gov/safewater](http://www.epa.gov/safewater) states that while there have been demonstrated effects in the water ecology, no evidence

has proven similar effects on human health. Digging deeper in the FAQ section, however, they admit 'the risks are uncertain' and show particular interest on drugs that could affect pregnant woman and young children. Ironically, just below the topic of PPCPs, the EPA reviews it's Contaminant Candidate Lists of over one hundred suspected dangerous chemicals and microbes not yet studied – but not one drug or other personal care product made their way onto this roster. Meanwhile, the NJDEP has seven areas of Surface Water Quality Standards including – pathogens, nutrients, pesticides, volatile organic compounds, inorganics, radio-nuclides and disinfection byproducts but no program is currently monitoring pharmaceuticals like estrogen or other recycled molecules like caffeine. Some web pages do include diagrams of molecules like the antibiotic erythromycin and our favorite stimulant – caffeine - but that is it. Refer to <http://www.state.nj.us/dep/wms/bwqsa/> for additional information.

Our drug usage is also not declining. A recent Star-Ledger article listed the top ten most widely prescribed drugs, with the leading anti-depressant prescriptions rising to 232 million last year with other top nine prescriptions adding to over 1 billion prescriptions in total. Prescriptions for cardiac, seizures and cholesterol rounded out the categories.

So, what can be done? The White House Office of National Drug Control Policy (<http://www.whitehousedrugpolicy.gov/index.html>) tells us that proper PPCP disposal will help prevent pollution and to find Take-Back programs for our leftover drugs. Barring finding any of those programs in your community, they recommend contacting state and local authorities and provide links to NJDEP websites. The NJDEP offers guidelines for the proper disposal of household medication which can be found at <http://www.state.nj.us/dep/dshw/rrtp/disposal.pdf>.

Regional water suppliers are also just coming into the age of PPCP concern. Of the 62 large water suppliers in the exhaustive AP research, many are not testing for these products although some water authorities are more proactive than others. The Passaic Valley Water Commission was even mentioned. The GWSA itself monitors sodium, chloride and total dissolved solids. At the end of the day no one is monitoring for dissolved pharmaceutical compounds. It is clear that more definitive information is needed to understand what levels should be targeted to facilitate any broad scale screening program.

There have not been any public water supply attempts at filtration of pharma compounds however there are substances that some studies have used to reduce pharma to create control water groups for their studies including a product called XD8 which is no longer manufactured. One type of bacteria in the laboratory has also shown promise for feasting on estrogen. Home water treatment advertisements make no claims on filtration of these products either.

What effects do extremely low doses of PPCPs have on humans and over long periods of time is a key question that remains unanswered. Man-made compounds including drugs, are in our water systems – the EPA officially found over 100 PPCPs in 2007 alone. Are the young and elderly more susceptible to health effects from drinking water contaminated with trace levels of PPCPs? What tests need to be developed to monitor concentrations in effluent? What will be the standard? It will take more articles, research, awareness and grass roots action to further studies and increase the knowledge base in this growing area of concern.

These are all good questions and the only test of relevance may be the one we are currently all participating in....drinking from our taps! At a minimum, we should be aware that the cycling of water from evaporation, to rain, to river, includes all that we put in – including our recycled drugs. For now, let all of us do our part in properly disposing of our unused medications as instructed in the NJDEP's flyer.