

## ENDOCRINE DISRUPTING CHEMICALS

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### BACKGROUND

News reports about the presence of drugs in America's water supply may come as a surprise to some. However, it has been known since the 1970's that water throughout the United States and the world contains trace amounts of both pharmaceutical compounds and natural hormones, some of which may be endocrine disrupting chemicals (EDCs).

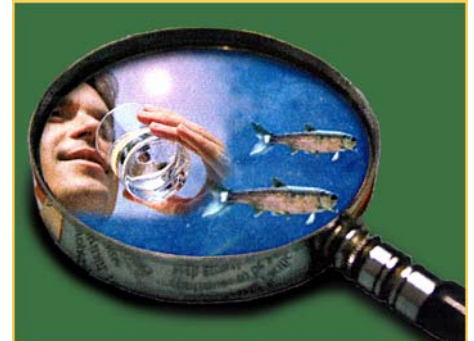
EDCs are natural or synthetic chemicals that interfere with or mimic the hormones responsible for growth and development of an organism. The endocrine system is the network of structures and glands (including the pancreas, ovaries, testes, pituitary, adrenal and thyroid glands) that produce hormones which regulate important biological processes including sexual development. The presence of estrogenic (feminizing) compounds in wastewater is an international concern because of potential adverse effects on exposed wildlife and humans. The occurrence of feminized fish has been associated with effluent discharges and the incidence and severity has been found to correlate with the proportion of treated sewage effluent in receiving waters.

### Relevance and Biological Impact

Some EDCs are synthetic hormones (such as ethynylestradiol, found in birth control pills) and natural hormones (such as estrogen and testosterone). Some EDCs are found in commonly used products such as personal-care products like soaps and cosmetics, industrial by-products, plastics (phthalates) and pesticides.

These chemicals enter into the environment from various sources: industrial and municipal effluents, agricultural runoff, hospital residues, etc. Wastewater treatment plants are not currently designed to remove these chemicals. Certain chemicals, such as estrogens, can interfere with the endocrine system of aquatic life including fish by mimicking, interfering, or inhibiting hormonal systems. Potential biological impacts on wildlife include:

- ◆ feminization of male fish or masculinization of female fish;
- ◆ delayed sexual development in fish;
- ◆ intersex of frogs;



### AP ARTICLE

**March 9th, 2008** - A vast array of pharmaceuticals — including antibiotics, anti-convulsants, mood stabilizers and sex hormones — have been found in the drinking water supplies of at least 41 million Americans, an Associated Press investigation shows. [HTTP://WWW.ihf.com/articles/ap/2008/03/09/america/PharmaWater-I-ABRIDGED.php?page=1](http://www.ihf.com/articles/ap/2008/03/09/america/PharmaWater-I-ABRIDGED.php?page=1)

- ◆ delayed metamorphosis in frogs;
- ◆ embryo mortality;
- ◆ abnormal hormone levels;
- ◆ impaired reproductive systems and immune systems;
- ◆ structural and neurological damage;

Existing literature indicates that some chemicals can induce endocrine-mediated changes in aquatic life at concentrations as low as one part per trillion. Although these adverse effects on aquatic organisms have been observed, the health impacts on humans have not been observed because concentrations of these chemicals in the environment are very low. A recent study conducted by Dr. Shane Snyder at Southern Nevada Water Authority has shown that Pharmaceuticals and Personal Care Products (PPCPs) at the levels found in municipal wastewater effluents do not pose a health risk to humans (presented at the 21st Annual WaterReuse Symposium). Currently these PPCPs are not regulated by US EPA.

### Evaluations by Snyderville Basin Water Reclamation District

There are currently no regulations requiring removal of these chemicals from wastewater effluent. The Snyderville Basin Water Reclamation District is being proactive in evaluating the effects of Endocrine Disrupting Compounds.

To better understand the effect of these chemicals and their potential impact to aquatic life, Snyderville Basin Water Reclamation District has sampled the incoming wastewater and the treated wastewater and found the following chemicals:

#### East Canyon WRF Influent

Acetaminophen	250	ng/l
Caffeine	15000	ng/l
Esterone	330	ng/l
Estradiol	73	ng/l
Gemfibrozil	13	ng/l
Ibuprofen	30	ng/l
Progesterone	32	ng/l
Sulfamethoxazole	13	ng/l
Triclosan	45	ng/l
4-Methylphenol	41700	ng/l



SBWRD and DWR staff collecting Brown Trout from East Canyon Creek.



Fish sampling in East Canyon Creek.

Caffeine by GCMS LLE	80001	ng/l
DEET	6385	ng/l
Pyhenol	30444	ng/l
Triclosan	6610	ng/l
Desisopropylatrazine (DIA)	460	ng/l
Diaminochlorotriazine (DACT)	160	ng/l

**East Canyon WRF Treated Effluent**

Carbamazepine	89	ng/l
Ethyl Estradiol	80	ng/l
Gemfibrozil	24	ng/l
Sulfamethoxazole	30	ng/l
Triclosan	9.3	ng/l
DEET	437	ng/l
TDCPP	222	ng/l
Tris (2-chlorethyl) phosphate	166	ng/l

**Silver Creek WRF Treated Effluent**

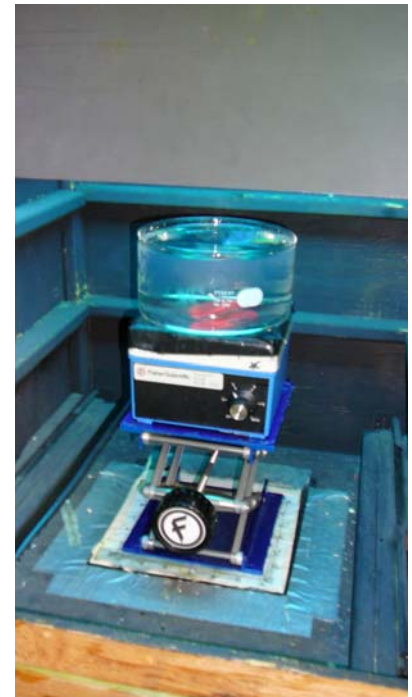
Caffeine	2.4	ng/l
Carbamazepine	86	ng/l
Esterone	56	ng/l
Estradiol	8.8	ng/l
Ethyl Estradiol	79	ng/l
Fluoxetine	27	ng/l
Gemfibrozil	84	ng/l
Ibuprofen	19	ng/l
Progesterone	4	ng/l
Sulfamethoxazole	22	ng/l
DEET	318	ng/l
Pyhenol	119	ng/l
TDCPP	179	ng/l
Tris (2-chlorethyl) phosphate	288	ng/l

The concentrations of chemicals listed above are measured in nanograms per liter, or parts per trillion. One part per trillion is the equivalent of one drop diluted into 20 Olympic sized swimming pools. Put another way, one part per trillion is equivalent to one second of time every 31,7000 years.

Based on the sampling results, the District contracted with the Utah



A concentration of one part per trillion is equivalent to one drop diluted into 20 Olympic sized swimming pools.



Benchscale UV/peroxide test to evaluate oxidation of EDC's.

Division of Wildlife Resources to evaluate the health of fish in East Canyon Creek and Silver Creek. Utah Division of Wildlife Resources, staff together with SBWRD staff, sampled fish from upstream and downstream of the District's Water Reclamation Facilities. The fish were evaluated to determine potential impacts from EDC's. Preliminary results indicated that health and general condition of the fish were good. Results of cellular level intersex evaluation of male fish testes were negative. Additional testing is in progress.

The District also contracted with Carollo Engineers to evaluate treatment options for removal of EDC's and PPCP's. Carollo is evaluating advanced treatment options including Granular Activated Carbon Absorption, and advanced oxidation processes which utilize hydrogen peroxide in combination with ozone or UV light. Carollo has completed eight weeks of pilot testing using Granular Activated Carbon to remove the EDC's. Results from the pilot study are still pending. Advanced oxidation processes were also evaluated using bench scale testing equipment. Results from all testing are expected by August 2008.

### What Can You Do?

The Office of National Drug Policy recommends that many drugs not be poured down the drain or flushed down the toilet. However, the policy also recommends that certain drugs be flushed, which we believe is misguided. We recommend:

- ◆ Never flush unused or expired pharmaceuticals or other health care products down the toilet or wash them down the sink.
- ◆ Take unused, unneeded, or expired prescription drugs out of their original containers and mix them with an undesirable substance, such as used coffee grounds or kitty litter, and place them in non-descript containers, such as empty cans or sealable bags; this will further help reduce the risk that drugs are improperly used.
- ◆ Take advantage of community pharmaceutical take-back programs that allow the public to bring unused drugs to a central location for proper disposal. Some communities have pharmaceutical take-back programs or community solid-waste programs that allow the public to bring unused drugs to a central location for proper disposal. Where these exist, they are a good way to dispose of unused pharmaceuticals.



Granular Activated Carbon Pilot Testing at the ECWRF.

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### For More Information

The following web sites contain information about this issue.

- ◆ For pharmaceuticals and personal care products as pollutants (PPCPs), visit the U.S. Environmental Protection (EPA) web page at <http://www.epa.gov/ppcp/>
- ◆ For EDCs, visit the EPA web page at <http://www.epa.gov/endo> and the Natural Resources Defense council (NRDC) web page at <http://www.nrdc.org/health/effects/gendoc.asp>