



Snyderville Basin Water  
Reclamation District

# Pharmaceuticals, personal care products and natural hormones

Michael D. Luers  
General Manager  
Snyderville Basin Water Reclamation District  
2800 Homestead Road  
Park City, UT 84098  
[mluers@sbwr.org](mailto:mluers@sbwr.org)



# Presentation Summary

- SBWRD Background information
- Introduction to endocrine disrupting compounds (EDCs), pharmaceuticals and personal care products (PPCPs)
- Implications for aquatic life
- SBWRD's research efforts







## Introduction to Contaminants: Pharmaceuticals and Personal Care Products (PPCPs)

Medications

Perfumes

Detergents

Insect repellent

Antibiotics



# AP Story March 2008: Pharmaceuticals in Water

**Ap** Associated Press [Go to Google News](#)

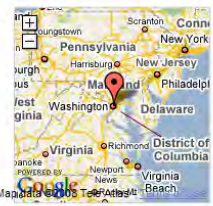
**Related News**

[AWWA Urges Science-Based Approach in Addressing Pharmaceutical...](#)  
FOXBusiness - 6 hours ago

[A Glass of H2O-Mr](#)  
Washington Post - Apr 14, 2008

[Feds Not Addressing Drugs in Water](#)  
The Associated Press - Apr 13, 2008

[Full coverage >](#)



**Senators rip EPA over lack of knowledge on drugs in water**  
By MARTHA MENDOZA – 17 hours ago

WASHINGTON (AP) — The Environmental Protection Agency's failure to require testing for drugs and for public health risks in the nation's drinking water was the focus of a Senate hearing Tuesday for allowing the American public to know what is in their water.

Sen. Barbara Boxer, D-Calif., who chairs the Senate Committee on Environment and Public Works, angrily chided Benjamin H. Grumbles, EPA assistant administrator, for the agency's failure to require testing for drugs and for public health risks in the nation's drinking water.

"When a story like this breaks, why is it necessary for someone to be hearing on this? Why aren't you working on this right now?" Boxer asked. "Associated Press did your work — and they're telling us you're not doing it."

Boxer set the critical tone in her opening remarks, when she asked Grumbles, "What is the Geological Survey, which has conducted extensive testing of water supplies can contain a mixture of pharmaceuticals?"

Responding to the aggressive questioning in a packed hearing room, Grumbles testified, "We're very concerned. It does send a big red flag. We're very concerned. He said the EPA was 'drastically expanding the testing of drinking water across the nation.'

"Your concern is not comforting. I can tell you that," said Sen. Frank Lautenberg, D-N.J., chair of the Subcommittee on Transportation Safety, Infrastructure and Safety. "We're trying to get."

The subcommittee convened the hearing in response to a report by the National Investigative Team that detailed test results showing high concentrations of drugs in drinking water in 24 major metropolitan areas.

**thespec.com**

HOME NEWS SPORTS GO A & E OPINION MULTIMEDIA

Local | Canada/World | Business | Weekend Reader | Special Reports

**Pharmaceuticals found in water**  
**Concentrations are low, but 'we can never say there is no risk'**

March 24, 2008

**ERIC MCGUINNESS**  
THE HAMILTON SPECTATOR  
(Mar 24, 2008)

There's more and more evidence that active ingredients in prescription and non-prescription drugs and personal-care products are finding their way into our drinking water.

While the levels are tiny — measured in parts per billion or trillion — scientists don't know the human health effects of long-term exposure or if there's a greater risk to children than adults.

The Associated Press reports one European study exposed developing human kidney cells to a mix of 13 drugs at levels mimicking those in Italian rivers and found they slowed growth by up to a third, yet surprisingly the same effect was not seen at higher levels.

A study appearing in the current issue of the Water Quality Research Journal of Canada found painkillers such as ibuprofen, cholesterol-lowering drugs and the common household antibacterial agent triclosan in treated drinking water from 15 plants within a short distance of Environment Canada's National Water Research Institute (NWRI) in Burlington.

**Intersex Fish Raises Pollution Concerns in US**

[Mail this story to a friend](#) | [Printer friendly version](#)

US: September 8, 2008

**WASHINGTON - The discovery of intersex fish -- males with some female characteristics, including some carrying eggs -- in Washington's Potomac River is raising concerns about pollution from chemicals that can affect hormones.**

A preliminary investigation by the US Geological Survey found a high incidence of intersex among smallmouth bass in the South Branch of the Potomac and Shenandoah Rivers, both near Washington.

"We ended up identifying a problem that is typical of endocrine disruption, that is, seeing eggs in the testes of sexually mature fish," Chris Ottinger, an immunologist at the Geological Survey's National Fish Health Research Laboratory, said on Thursday. "It was something that warranted further investigation."

These so-called endocrine disrupting chemicals are used widely in industry and in consumer products including pharmaceuticals, cosmetics, perfumes, plastics and even materials used to keep barnacles from clinging to boat bottoms.

**TODAY'S ENVIRONMENT NEWS**

- AUSTRALIA: [Coral Flourishing At Bikini Atoll Atomic Test Site](#)
- AUSTRALIA: [Xstrata Cuts Lead Emissions As Australia Suits Leases](#)
- AUSTRIA: [World Sea Levels To Rise 1.6m By 2100 - Scientists](#)
- BELGIUM: [EU Environment Chief Raises New Biofuels Condition](#)
- COLOMBIA: [Thousands Evacuated After Colombian Volcano Erupts](#)
- FRANCE: [FACTRIX - Paris Talks On Global Warming April 18-19](#)
- GIBRALTAR: [Gibraltar To Cull Some Of Its Monkeys](#)

• In France, ultra-thinness is passe  
 • Police Blotter  
 • Lotteries



## Why are these compounds an issue at this time?

- Water professionals have the technology today to detect more substances - at lower levels - than ever before. As analytical methods improve, many compounds are being found at extremely low levels, typically single-digit parts per trillion (ppt).



## Are some compounds more of an issue than others?

- The group of substances known as endocrine disrupting compounds (EDC's) appear to be the most worrisome at this time.
- EDC's are natural and manmade compounds that affect the way an organism reproduces, grows and develops.
- EDC's can be found at very low levels in a number of drinking water supplies.

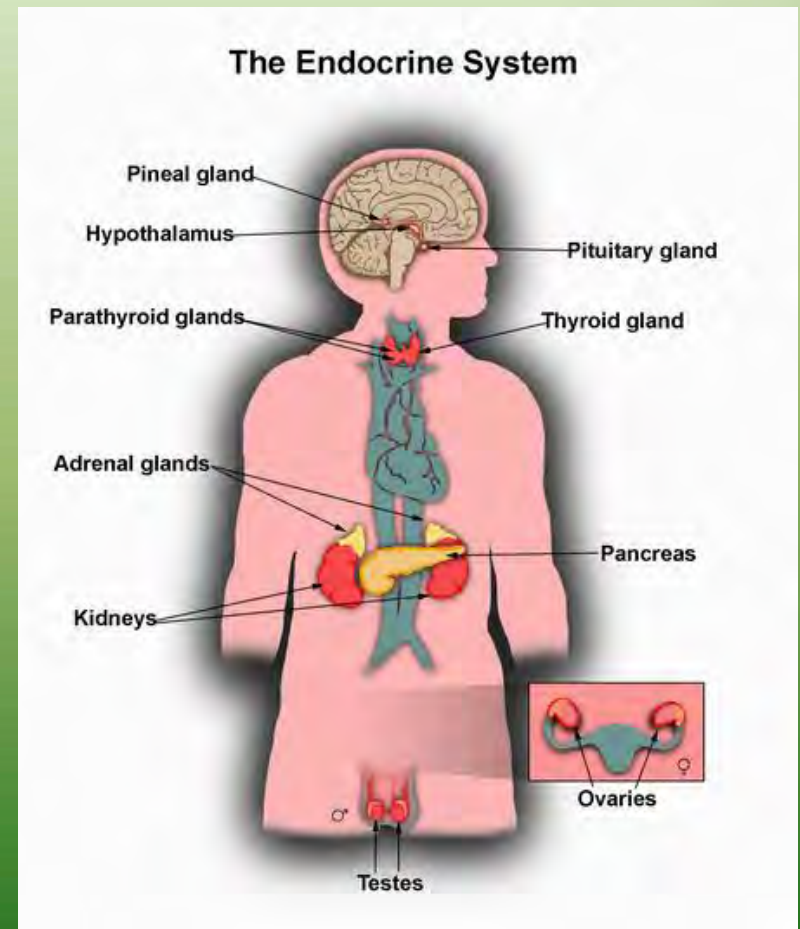




# What is the Endocrine System?

Endocrine system: hormones used to regulate growth and sexual development processes

Natural and synthetic hormones  
Estrogen based compounds of greatest concern





## What are the specific concerns with EDC's?

- The presence of estrogenic (feminizing) compounds in wastewater is an international concern because of potential adverse effects on exposed wildlife.



## Initial Occurrence Of Estrogenicity

- First gained public attention when male fish collected downstream of WWTPs in the UK were found to have elevated levels of vitellogenin, a female-specific egg yolk protein, in their blood.



Source: National Drinking Water Clearing House, *On Tap*, Winter 2003.



## Estrogenicity of Treated Wastewater

- Over the past 15 years feminization of male fish have been detected in Europe, US, Japan and other locations.
- “The occurrence of feminized fish is associated with effluent discharges ... the incidence and severity is positively correlated with the proportion of treated sewage effluent in receiving waters.”
- Both natural and synthetic steroid hormones can be found in wastewater.



## Local Impact of EDC's?

- Are EDC's and PPCP's causing a problem with the downstream ecosystem of East Canyon Creek?



## Historical Stream Flows

<u>Year</u>	<u>7Q10</u>
1988	16.0 cfs
1993	3.5 cfs
2003	1.8 cfs



## Concentrations of Estrogens that begin to affect Male Fish

- inducement of vitellogenin production
  - $\approx 5$  ng/L  $17\beta$ -estradiol
  - estriol is 30 times less potent than above
  - $\approx 3.2$  ng/L for estrone
  - $\geq 1$  ng/L for  $17\alpha$ -ethinylestradiol
- Inducement of intersex
  - $\approx 10$  ng/L for estrone, or  $17\beta$ -estradiol
  - estriol is 100 times less potent than above
  - $\approx 4$  ng/L for  $17\alpha$ -ethinylestradiol
  - estrogenic substances are additive



White  
sucker



Boulder Creek





# Sources of Estrogens

- **Mature woman**
  - 4.8  $\mu\text{g}$  estriol
  - 3.5  $\mu\text{g}$  estradiol
  - 8.0  $\mu\text{g}$  estrone
- **Post Menopause Woman**
  - 7  $\mu\text{g}/\text{day}$  (all 3)
- **Men**
  - 7  $\mu\text{g}/\text{day}$  (all 3)
- **Pregnant Woman**
  - 6,000  $\mu\text{g}$  estriol
  - 600  $\mu\text{g}$  estrone
  - 259  $\mu\text{g}$  estradiol
- **Synthetic Hormones**
  - 26% of ethyl estradiol in birth control pills is excreted
- **Hormone & estrogen replacement therapy**
  - 65% estradiol excreted
  - 15% estrone excreted



## Where has Estrogenicity of Treated Wastewater been detected?

- Lake Mead
- Boulder Creek, Colorado (white sucker)
- Southern California (hornyhead turbot, english sole)
- Potomac River, Maryland (largemouth & smallmouth bass)
- Columbia River, Washington (wild chinook salmon, carp)
- Mississippi River (walleye, smallmouth bass, carp, shovelnose sturgeon)
- Hudson River, New York (carp)
- Europe (roach, gudgeon, chub, brown & rainbow trout, bream, carp, cod)



## Sources of EDC's

- WWTP effluents are not the only sources of EDC's to the environment.
- Examples of other sources include septic tanks, storm water, industrial effluents, landfill leachate, and agricultural operations.



## Have EDC's been detected in the District's discharges?

- The District has sampled the influent and effluent from both water reclamation facilities and a number of endocrine disrupting compounds have been detected.



## EDCs/PPCPs That Have Been Detected Include, But Not Limited To:

### Effluent values for East Canyon Water Reclamation Facility:

**Tegretol (carbamazepine) - seizure treatment (73 ppt)**

**Estrone - natural hormone (55 ppt)**

**Estradiol - natural hormone (1.6 ppt)**

**Ethyl estradiol - synthetic hormone (12 ppt)**

**Prozac (fluoxetine) - anti-depressant (69 ppt)**

**Gemfibrozil - cholesterol control (116 ppt)**

**Progesterone - natural hormone (5 ppt)**

**Triclosan (5-chloro-2-phenol) - antibacterial (32 ppt)**

**DEET (N,N-diethyl-*m*-toluamide) - insect repellent (437 ppt)**

**TDCPP (tris phosphate) - fire retardant (222 ppt)**

**Ibuprofen (iso-butyl-propanoic acid) - anti-inflammatory (27 ppt)**



Snyderville Basin Water  
Reclamation District

# Stream Sampling





# On-Site Histology Laboratory





Snyderville Basin Water  
Reclamation District

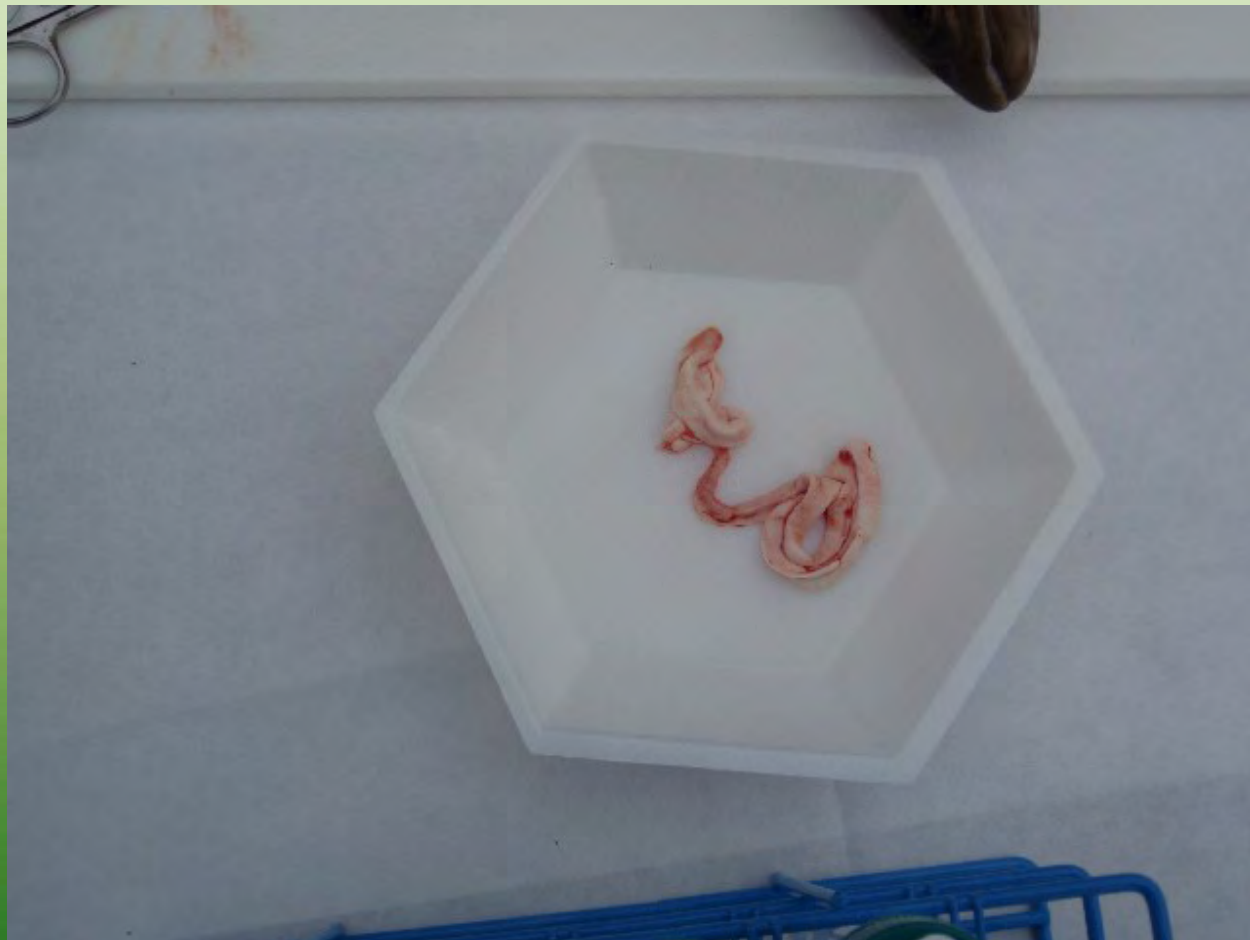
# Collecting Blood to Determine Vitellogenin Levels







# Gonadosomatic Index





# What Is SBWRD's Position Concerning EDC's?

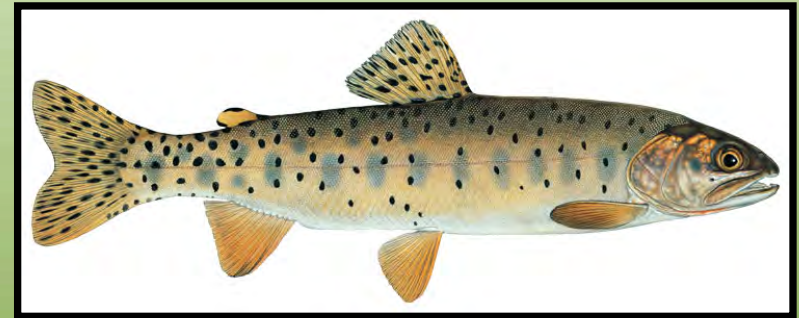
- Currently there are no state or federal regulatory requirements to address or remove EDC's.
- The District has spent millions of dollars to improve water quality. It only makes sense to be proactive in addressing the EDC issue.
- The District is concerned about the potential hormonal impacts of treated effluent on sensitive fish species.
- The District has conducted bench and pilot studies on how to remove EDC's.
- The District is working with the DWR Fisheries Experiment Station to conduct studies of various species of fish to determine if estrogenicity is taking place.



## Reason for Concern: East Canyon Creek is a Cold Water Fishery



**Brown Trout**  
(*Salmo trutta*)



**Bonneville Cutthroat**  
(*Oncorhynchus clarki*)

# Current Research

## Sex Ratio Investigation and Sentinel Study





Snyder Basin Water  
Reclamation District





Snyder Basin Water  
Reclamation District





Snyder Basin Water  
Reclamation District





## SBWRD's Board Of Trustee's Direction

- District is taking a proactive position in dealing with this issue.
- District will most likely install and operate activated carbon filters at the ECWRF to remove EDC's.
- District will continue to monitor native fish populations for estrogenicity.





# Questions?

