May 2nd, 10:30 AM - 12:00 PM

What Goes Down the Drain Eventually Reaches the River: Characterizing Contaminants of Emerging Concern (CECs) in the Columbia River Basin

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WHAT GOES DOWN THE DRAIN EVENTUALLY REACHES THE RIVER: CHARACTERIZING CONTAMINANTS OF EMERGING CONCERN IN THE COLUMBIA RIVER BASIN

Jennifer Morace, USGS Oregon Water Science Center
First Steps...

- Targeted at known knowledge gaps
- Characterize important pathways of contaminant transport to Columbia River
- Begin to offer information on a broad suite of toxics that will help water managers and policy makers make informed decisions

http://www.epa.gov/columbiariver
Columbia River Inputs Study

- Characterize pathways contributing directly to the Columbia River
  - WWTP effluent
  - Stormwater runoff
Contaminants analyzed in WWTP effluent

- Pharmaceuticals
- Anthropogenic-indicator compounds
- Organochlorine compounds
- PCBs
- PBDEs
- Mercury
- Currently used pesticides
- Estrogenicity
Contaminants measured in WWTP effluents

<table>
<thead>
<tr>
<th>Contaminant Type</th>
<th>Percent of Compounds Detected</th>
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</thead>
<tbody>
<tr>
<td>Plasticizers</td>
<td>4/4</td>
</tr>
<tr>
<td>Steroids</td>
<td>4/4</td>
</tr>
<tr>
<td>Detergent metabolites</td>
<td>7/8</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>50/59</td>
</tr>
<tr>
<td>Personal care products</td>
<td>12/15</td>
</tr>
<tr>
<td>PAHs</td>
<td>8/9</td>
</tr>
<tr>
<td>Flame retardants</td>
<td>14/17</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>14/17</td>
</tr>
<tr>
<td>PCBs</td>
<td>9/18</td>
</tr>
<tr>
<td>Pesticides</td>
<td>27/104</td>
</tr>
<tr>
<td>Overall</td>
<td>149/255</td>
</tr>
</tbody>
</table>

Note: The numbers represent the count of detected compounds over the total possible compounds.
## Percent of detection at each WWTP sampled

<table>
<thead>
<tr>
<th></th>
<th>Total # analyzed</th>
<th>Wenatchee</th>
<th>Richland</th>
<th>Umatilla</th>
<th>The Dalles</th>
<th>Hood River</th>
<th>Vancouver</th>
<th>Portland (am)</th>
<th>Portland (noon)</th>
<th>Portland (pm)</th>
<th>St. Helens</th>
<th>Longview</th>
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<td>50</td>
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<tr>
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<td>13</td>
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<td>9</td>
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<td>29</td>
<td>32</td>
<td>30</td>
<td>33</td>
<td>40</td>
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</tbody>
</table>
Compounds found at all WWTPs
maximum concentrations shown in micrograms per liter (ppb)

- Tri(2-chloroethyl)phosphate – 0.65
- Tri(dichloroisopropyl)phosphate – 0.69
- Benzophenone – 0.28
- 1,4-Dichlorobenzene – 0.88
- Galaxolide (HHCB) – 2.5
- Cholesterol – E 6.3
- 3-beta-Coprostanol – E 5.8
- beta-Sitosterol – E 3.2
- PBDE congeners (47, 66, 85, 99, 100, 153, 154)
- trans-Chlordane – 0.00019

E = estimated
Pharmaceuticals found at all WWTPs

maximum concentrations shown in micrograms per liter (ppb)

- Iminostilbene – 0.4
- Citalopram (Celexa, Cipramil) – 0.5
- Diltiazem – 0.4
- Lidocaine – 0.4
- Methocarbamol (Robaxin) – 13
- Phenobarbital – 0.2
- Tramadol (Ultram) – 0.4
- Carbamazepine – 0.12
- Phenytoin (Dilantin) – 0.6
- Diphenhydramine (Benadryl, Motrin PM, …) – 0.11

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.
Diphenhydramine

- Antihistamine

- Uses
  - Relieves allergy and cold symptoms
  - Prevents and treats motion sickness
  - Treats insomnia
  - Controls abnormal movements (Parkinson’s syndrome)

- Products
  - 89 different brand names
  - 112 brand names for combination medications
Loadings to the Columbia

- Diphenhydramine in Portland
  - 49 mgd from WWTP
  - Average concentration of 0.064 µg/L
  - 10 g/day of diphenhydramine
  - 1 tablet = 25 mg
  - 400 tablets/day (16 boxes)

- Could lead to Columbia concentration of 0.001 µg/L

Idea of “pseudo-persistence”
Lessons learned

- The actions of society have an effect on the ecosystem.
- What goes down the drain reaches the river and the biota that rely on it. Not everything is cleaned up by the WWTP.
- Most stormwater is not treated.
Reconnaissance of Contaminants in Selected Wastewater-Treatment-Plant Effluent and Stormwater Runoff Entering the Columbia River, Columbia River Basin, Washington and Oregon, 2008–10


U.S. Department of the Interior
U.S. Geological Survey

Report available at
http://pubs.usgs.gov/sir/2012/5068
Columbia River Contaminants and Habitat Characterization

EDCs and PBDEs

http://www.youtube.com/watch?v=S2RlIbPLIGHg
Foodweb Sampling Design

Passive samplers
- contaminant analyses
- estrogen screen

Sediments
- contaminant analyses
- sediment transport modeling

Invertebrates
- contaminant analyses
- community assessment

Largescaler Suckers
- contaminant analyses
- biomarkers

(Organs and whole bodies)

Osprey
- contaminant analyses
- productivity assessment
- well bird blood analyses
Biomagnification in the food web

Science of the Total Environment, v. 484, pp. 319-389

Special Section: Foodweb Transfer, Sediment Transport, and Biological Effects of Emerging and Legacy Organic Contaminants in the Lower Columbia River, Oregon and Washington, USA

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THE VIAGRA IN THE WATER MAKES ME WANT TO SWIM UPSTREAM, BUT THE PROZAC IS MAKING ME TOO TIRED...

Questions?

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