Emerging Problems?
Progress on Identifying Contaminants of Concern in San Francisco Estuary

Susan Klosterhaus
San Francisco Estuary Institute
RMP Annual Meeting
October 2, 2007
Emerging Contaminant Workgroup Approach

Chemical Screening

↓

RMP Pilot Study/SFEI Project

↓

Status and Trends Monitoring
Polybrominated Diphenyl Ethers (PBDEs)

BDE 47 in Human Tissues

- U.S. (San Francisco, adipose)
- Sweden (adipose)
- Germany (whole blood)
- Canada (milk)
- Finland (milk)
- Japan (milk)
- Sweden (milk)

Petreas et al. 2001

- Sources in most segments
- No trend
- Similar or higher than other locations worldwide
PBDEs in the Bay Area

Detected in:

- Water, WW effluent, sediment
- Bivalves
- Sport fish
- Harbor seals
- Bird eggs
- People

Penta- and Octa-BDE mixtures banned in 2006
Potential Emerging Contaminants

- Pyrethroid pesticides
- Pharmaceuticals and Personal Care Products
- Perfluorinated chemicals
- Non-PBDE, alternative flame retardants
- Nanoparticles
Pyrethroid Pesticides

Data from the Pesticide Use Reporting database of the CA Dept. of Pesticide Regulation
Aquatic Toxicity Due to Residential Use of Pyrethroid Insecticides
(Weston et al. 2005)
Investigations of Sources and Effects of Pyrethroid Pesticides in Watersheds of the San Francisco Bay Estuary

- Detected in urban tributaries
- Source of toxicity?

Map showing the locations of Napa R., Suisun Cr., Petaluma R., San Mateo Cr., San Lorenzo Cr., and Coyote Cr., with the sum of pyrethroids (2004-2005) in urban tributaries.
Pharmaceuticals and Personal Care Products

- Previously identified in Bay water

RMP Pilot Study (2007)

Determine concentrations in:
- Influent, effluent from 2 WWTP
- Surface water, 10 South Bay sites

In-kind Contributions
- City of Palo Alto, City of San Jose, AXYS Analytical
# Pharmaceuticals and Personal Care Products in the South Bay

## Average concentration (ng/L)

<table>
<thead>
<tr>
<th>compound</th>
<th>influent</th>
<th>effluent</th>
<th>Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen</td>
<td>60,000</td>
<td>&lt;500</td>
<td>&lt;300</td>
</tr>
<tr>
<td>Albuterol</td>
<td>20</td>
<td>2</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Caffeine</td>
<td>60,000</td>
<td>40</td>
<td>70</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>500</td>
<td>&lt;300</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Codiene</td>
<td>200</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
<tr>
<td>Cotinine</td>
<td>1,000</td>
<td>30</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Diltiazem</td>
<td>200</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>Erythromycin Hydrate</td>
<td>200</td>
<td>200</td>
<td>10</td>
</tr>
<tr>
<td>Fluoxetine</td>
<td>20</td>
<td>30</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Gemfibrozil</td>
<td>1,000</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>10,000</td>
<td>&lt;100</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Lincomycin</td>
<td>20</td>
<td>2</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Roxithromycin</td>
<td>3</td>
<td>&lt;4</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Sulfadimethoxine</td>
<td>2</td>
<td>1</td>
<td>&lt;200</td>
</tr>
<tr>
<td>Sulfamethoxazole</td>
<td>1,000</td>
<td>70</td>
<td>200</td>
</tr>
<tr>
<td>Sulfathiazole</td>
<td>4</td>
<td>&lt;4</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>300</td>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>Warfarin</td>
<td>5</td>
<td>&lt;1</td>
<td>&lt;1</td>
</tr>
</tbody>
</table>

- Influent > Effluent > Bay Water
- Concentrations in Bay << toxicity thresholds
- Potential Studies for 2009
  - Triclosan
  - Degradation products

*Water body: Lake Mead, NV

- Gomez et al., 2007.
- Vanderford and Snyder, 2006.
Perfluorinated Chemicals (PFCs)

Applications:
Stain repellants, packaging materials, industrial surfactants, fire-fighting foams

Persistent, bioaccumulative, toxic
Perfluorinated Chemicals (PFCs)

RMP Pilot Study:

- Collaboration with Marine Mammal Center
- Health of seal population
- PFCs, PBDEs in harbor seal blood
- Exposure to apex predators
Perfluorinated Chemicals (PFCs)

Perfluorooctanesulfonate (PFOS) in Seal Blood: SF Bay vs. Other Locations

Source: Giesy and Kannan 2001
Alternative Flame Retardants: Flammability Standards

1. Consumer product-specific standards

2. CA Furniture Flammability Standard (TB 117, 1975)
   - Polyurethane foam
   - CA first, only state to have standard
   - Penta-BDE

3. National Mattress Flammability Standard (July 1, 2007)

4. National Furniture Flammability Standard (in development)
<table>
<thead>
<tr>
<th>Chemical</th>
<th>2002 Prod. Vol. (lbs)</th>
<th>Accumulates</th>
<th>Persists</th>
<th>Eco Tox</th>
<th>Mam Tox</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tris(1,3-dichloro-2-propyl)phosphate (TDCPP)</td>
<td>10-50M</td>
<td>?</td>
<td>M?</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Triphenylphosphate (TPP)</td>
<td>10-50M</td>
<td>H?</td>
<td>L?</td>
<td>H</td>
<td>?</td>
</tr>
<tr>
<td>Octyl tetrabromobenzoate (OTB)</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>H?</td>
<td>?</td>
</tr>
<tr>
<td>Tetrabromobisphenol A (TBBPA)</td>
<td>100-500M</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Hexabromocyclododecane (HBCD)</td>
<td>10-500K</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Decabromodiphenylethane (DBDPE)</td>
<td>?</td>
<td>L</td>
<td>H?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>1,2-Bis(2,4,6-tribromophenoxy)ethane (BTBPE)</td>
<td>1-10M</td>
<td>H?</td>
<td>M?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Pentabromoethylbenzene (PBE)</td>
<td>0</td>
<td>M?</td>
<td>M?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Dechlorane Plus (DP)</td>
<td>1-10M</td>
<td>L</td>
<td>H</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
2008 Pilot Study: Alternative Flame Retardants in San Francisco Bay
with the Marine Mammal Center
EBMUD, Duke University, Skidaway Institute of Oceanography

Analyze bioaccumulative compounds in:
- harbor seal blubber
- sport fish
- cormorant eggs

Analyze non-bioaccumulative compounds in:
- Bay surface water
- WWTP influent, effluent (if feasible)
Nanoparticles

Applications:
electronics, biomedical, pharmaceutical, cosmetic, environmental

Production: 2000 tons in 2004, 30-fold increase by 2011-2020

A Concern in the Bay?
- Bioavailable, toxic to aquatic organisms
- Urban sources
- Colloidal fraction or form aggregates
- Adsorbent for metals and organic contaminants

(www.nsti.org)
Emerging Contaminant Workgroup

• Approach works
• Making progress on new issues
• 5 Year Work Plan in development
• Surveillance monitoring continues

How balance priorities?
‘New’ vs. Legacy chemicals