Learning For the Future:
The Role of Pretreatment and Pollution Prevention in Sustainable Municipal Wastewater Treatment

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General Manager
East Bay Discharger’s Authority

Chair, BACWA
Today’s Santa Clara Basin, Looking Southeast
Palo Alto Baylands/Dump 1953
Dramatic Reduction in Conventionals

Total BOD and TSS Loading to the Bay

- Flow from all POTWs
- Suspended Solids
- BOD Loading

Flow (MGD)

Total BOD & TSS Loading (1000 kg/day)


1972
Dramatic Reduction of Heavy Metals

Copper and Nickel Loading from Large Dischargers

Annual Flow (MGD) vs. Metal Loading (kg/year)

BACWA - Leading the way to protect our Bay
Copper Loadings from San Jose/Santa Clara

Annual Flow (MGD) vs Copper Loading (kg/year) from 1980 to 2005.
Most contentious SF Bay TMDLs driven by Fish Advisories
Mercury & PCB TMDLs Set Ambitious Goals

**Municipal Wastewater**

- **2000-2003** – 17 kg/yr
- **2008 TMDL** – 2.3 kg/yr

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SF Bay Striped Bass Mercury Flat

Mercury ppm wet weight

PCBs Declined in Mussels When First Banned

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PCBs Last 20 Years Unresponsive

- White Croaker
- Surfperch
- PCB Goal

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Changing Policies
“...little difference in the assessment of ambient toxicity regardless of which statistical method is applied”

Table 3
Comparison of results of chronic *C. dubia* ambient toxicity tests using the TST approach and the traditional (t-test) analysis. For the TST approach $\alpha = 0.20$ and $b$ value = 0.75. For the t-test approach $\alpha = 0.05$.

<table>
<thead>
<tr>
<th>Traditional (t-test)</th>
<th>EPA Test of Significant Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Toxic</td>
</tr>
<tr>
<td>Toxic</td>
<td>20%</td>
</tr>
<tr>
<td>Non-Toxic</td>
<td>6%</td>
</tr>
</tbody>
</table>

(The two approaches agree 92% of the time.)

Figure 7: Magnitude of toxicity in wettest toxic sites. Only 100% of sites assessed are shown.
### Table 2

Classes of chemicals and specific compounds shown to have caused toxicity in California. Numbers represent the numbers of water and sediment samples on which TIEs were conducted by the various studies.

<table>
<thead>
<tr>
<th>Class</th>
<th>Compound</th>
<th>Water</th>
<th>Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>Ammonia</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Carbamate Pesticide</td>
<td>Carbofuran</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Chlorpyrifos</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Diazinon</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Ethyl Parathion</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Malathion</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Methyl Parathion</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Organophosphate Pesticide</td>
<td>Bifenthrin</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Cyfluthrin</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Cyhalothrin</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Cypermethrin</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Esfenvalerate</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Pyrethroid Pesticide</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Here's a handy hint from Mister Natch:

At home or at work....

Get the right tool for the job!
From Factories to Cubicles

An American economy that used to be built on making stuff is now built on shuffling paper instead. From 1947 to 2009, manufacturing shrank from more than a quarter of the gross domestic product to just a ninth of it. Meanwhile, white-collar work grew from less than a fifth of GDP to nearly half of it (counting finance, insurance, real estate, professional and business services, information, education, and health care).

Government’s hand has barely grown heavier. The share of GDP accounted for by government at all levels peaked at 15.3 percent in 1971, though it’s been growing slowly again since 2006.

Manufacturing’s role in the economy crested in 1953, when factories contributed 28.3 percent of GDP. Since 1977, its share has declined every year except 1983 and 2004.

Education’s share of the economy has nearly quadrupled (to 1.1 percent). Health care and social services’ share has nearly quintupled (to 7.3 percent) as a proportion of GDP.

Arts, entertainment, and recreation began a slow though steady rise during a former Screen Actors Guild president’s presidency, but have stagnated at about 1 percent of GDP since the mid-1990s.
SF Water Board Tiering

Prioritization Scheme for CECs in San Francisco Bay

**TIER 4**
HIGH CONCERN
HIGH PROBABILITY OF A MODERATE OR HIGH IMPACT ON WATER QUALITY
No CECs currently in this tier

**TIER 3**
MODERATE CONCERN
HIGH PROBABILITY OF A LOW IMPACT ON WATER QUALITY
- PFOS
- Fipronil
- Nonylphenol and nonylphenol ethoxylates
- PBDEs

**TIER 2**
LOW CONCERN
HIGH PROBABILITY OF NO IMPACT ON WATER QUALITY
- HBCD
- Pyrethroids (14 chemicals)
- Pharmaceuticals (100+ chemicals)
- Personal care product ingredients (10 chemicals)
- PBDDs and PBDFs

**TIER 1**
POSSIBLE CONCERN
IMPACT ON WATER QUALITY UNCLEAR
- Alternative flame retardants
  (BDE-TEBP, EH-TBB, DBDPE, PBEB, BTBPE, HBB, Decchlordan Plus, TPHP, TDCPP, TCP, CEEP, TBP, TBPP, V6, EBTBBP, TBECH)
- Fluorinated chemicals (17 chemicals)
- Pesticides (dozens of chemicals)
- Plasticizers (bisphenol A, phthalates)
- Nanomaterials
- Short-chain chlorinated paraffins
- Many, many others
Residential Pesticide Use Increasing (Weston, 2003)

Chart showing residential pyrethroid use in California (lb/yr) from 1993 to 2003, with a significant increase over the years. The chart distinguishes between non-permethrin and permethrin use.
Pyrethroid profile in POTW effluent
Reduction Factors

Reduction Factor - Total Pyrethroids, Lab A

Site Name

Primary - Red; Secondary - Blue; Tertiary - Green
Results - Treatment Effects

### Permethrin-Effluent

- **Sites**
  - Primary
  - Secondary
  - Tertiary

### Cypermethrin-Effluent

- **Sites**
  - Primary
  - Secondary
  - Tertiary
Wastewater Resource Recovery Plants

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Water Recycling Spreading throughout Bay Area
Bay Area Recycled Water Production by Year and Use in Acre-Feet per Year (AFY)
EBMUD - First WWTP in U.S. to Become a Net Electricity Provider

Net Electricity Provider

2012
Generation: 7MW
Demand: 5MW
Net Sales = 2MW

Electrical Grid

Wastewater Treatment Plant
Siloxanes in Biogas Require Expensive Treatment for Removal

BACWA - Leading the way to protect our Bay
Phosphorus Reuse as Fertilizer

Reduction of return nutrient load:
- Return to plant through clean pipes.
- Normally, pipes require maintenance due to struvite scale formation.

Third exit for nutrients:
- Collect Crystal Green® Product
- DEWATERING
- BIOSOLIDS
- ANAEROBIC DIGESTION
- PRIMARY SLUDGE
- SECONDARY SLUDGE
- SLUDGE RECYCLE
- PRIMARY SEDIMENTATION
- MUNICIPAL WASTEWATER
- TREATED EFFLUENT

SECONDARY TREATMENT WITH Bio-P
Re-envisioning Wastewater Treatment

1. Technological Opportunities
2. Institutional Constraints
3. Integration Needs
4. Financial Strategies
# Wastewater as a Resource - Constraints

<table>
<thead>
<tr>
<th>Category</th>
<th>Constraints</th>
</tr>
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</table>
| **Water**  | 1. Cost competitive markets  
                2. Concern About Contaminants  
                3. Integration across systems |
| **Energy** | 1. Integration into Power System  
                2. Contaminants (process & emissions)  
                3. Capital Funding  
                4. Business strategy |
| **Nutrients** | 1. Technology  
                2. Markets  
                3. Linkage to Effluent Goals |
| **Biosolids** | 1. Concern About Contaminants  
                2. Business/Application Strategy  
                3. Integration w/ climate change/restoration plans. |
Learning for the Future

- FOG Reduction
  - Crucial role in biogas energy
- Pollution Prevention Session - North
  - SF Pharmaceuticals
  - SFEI Emerging Contaminants
  - Product Stewardship Council
- Community Engagement
- Leadership
Seize the Initiative!

- Develop New Paradigm Pre-treatment Permitting Effectiveness
  - Primary community contact - changing industrial base
  - Reduce Institutional Barriers
  - Partnerships with Oversight Agencies

- Build Partnerships
  - Oversight Agencies
  - NGOs (Save the Bay, Pesticide Action Network, Clean Water Action)

- Consider a New Driver - Wastewater Resource Recovery
  - Water reuse
  - Energy markets

- Develop New Tools for the Job
  - Social Media
  - Cellphone reporting

- Improve Regional Integration
  - Water, Wastewater, Stormwater, Flood control
  - Ecosystem Management (Bird goop)