PCB Source Tracing
Lower Duwamish Waterway

Beth Schmoyer
Seattle Public Utilities
June 6, 2012

SPU source control website:
http://www.seattle.gov/util/Services/Drainage___Sewer/PollutionControl/index.htm
Lower Duwamish Waterway

- 5 mile reach
- Tidally influenced

215 outfalls
- 151 storm drains
- 8 CSOs
- 4 emergency overflows
- 5 ditches/swales
- 7 major seeps
- 40 unknown outfalls
Lower Duwamish Waterway

- Contaminants of concern:
  - PCBs
  - Arsenic
  - Dioxins/furans
  - Phthalates
  - PAHs
  - Other metals
- ~450 sq mile upper basin
- Study area:
  - 8,400 acre separated storm drain
  - 20,000 acre combined sewer system
SPU Source Control Program

Duwamish-specific programs
- Business inspections
- Source tracing/characterization
- Line cleaning
- Treatment

Citywide programs
- Stormwater code
- Spill response
- IDDE
- Water quality complaint
- Public education/outreach
- Line cleaning
Washington Sediment Management Standards

- Based on impacts to benthic organisms
- 2 levels:
  - Sediment quality standard (SQS): 130 ug/kg dw total PCBs
  - Cleanup screening level (CSL): 1,000 ug/kg dw total PCBs
- Duwamish remedial action level: 240 ug/kg dw
- Goal: 2 ug/kg dw
- Use as benchmarks to aid in source tracing
- State revising standards to account for higher fish/seafood consumption rates by local tribal populations
Source Samples

- Inline traps
- Inline grabs
- Onsite catch basins
- Right-of-way catch basins
- Street dirt and soil
Source Tracing: PCBs

Samples through June 2011

Total Aroclors

Hotspots

- T117
- GTSP/NBF
- Rainier Commons
- KC-Jorgensen SD
- Others
Metal Shredding Facility

- Elevated PCBs, Hg found:
  - Right-of-way and onsite catch basins
  - Inline grabs
  - Roof drains/gutters
  - Windshield wipe sample

- Transport pathways:
  - Fugitive dust
  - Track out
  - Stormwater runoff
Metal Shredding Facility

- Elevated PCBs, Hg found:
  - Right-of-way and onsite catch basins
  - Inline grabs
  - Roof drains/gutters
  - Windshield wipe sample

- Transport pathways:
  - Fugitive dust
  - Track out
  - Stormwater runoff
Metal Shredding Facility

- SPU jetted and cleaned City storm drain/structures
- Owner cleaned problem catch basin
- Contamination returned
- SPU issued NOV (2009), negotiated voluntary compliance agreement (2010-2011)
  - Route roof runoff through onsite treatment system
  - Sweep streets
  - Install Filterra™ unit in problem catch basin
- State revising NPDES permit (2012)
Old Brewery
PCBs in building paint

- 2004: Found 10 mg/kg PCBs in ROW catch basin
- 20,000 mg/kg in exterior building paint
- EPA TSCA site
- SPU jetted and cleaned lines
- Owner installed filter fabric in CBs
- Owner pilot testing paint removal techniques
Old Brewery
PCBs in building paint

- 2004: Found 10 mg/kg PCBs in ROW catch basin
- 20,000 mg/kg in exterior building paint
- EPA TSCA site
- SPU jetted and cleaned lines
- Owner installed filter fabric in CBs
- Owner pilot testing paint removal techniques
Ecology Building Survey

- Composite samples from buildings constructed 1950-1977
- 2 or more buildings per composite
- 38 Paint and 17 caulk samples

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Median</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caulk</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

39% detect for Paint, 47% detect for Caulk.
PCBs: Residential

PCBs detected in 32% of samples

Total PCBs (ug/kg dw)

- <40
- 40 - 60
- 60 - 80
- 80 - 100
- 100 - 130
- >130

n = 84
Best Management Practices

- Line cleaning
- Test/remove building materials?
- Treatment?
  - Conventional passive (wet ponds, vaults, swales, bioretention)
  - Active treatment (chemical coagulation/flocculation)
Active Treatment

- Electrocoagulation
- Chitosan-enhanced sand filtration
- Chemically-enhanced primary treatment
- Ballasted sedimentation

- All use some form of chemical addition
  - $\text{Al}^{+++}$ or $\text{Fe}^{+++}$
  - Polymer as flocculant aid
Electrocoagulation

- Electrochemical process using sacrificial plates.
- Approved in Washington for construction applications.
- Up to 100 gpm per cell.
- Effective in removing turbidity, TSS, total and dissolved metals, PCBs, fecal coliform.
- Fully automated, remote operations, vendor service available.
Runoff from 230-acre drainage basin.
7 storms monitored, January to February 2012.
EC system installed/operated by Watertectonics.
Run at 100-200 gpm.
Tested with standard clarifier, sand filter, GAC filter.
PCB source identified in basin.
63-88% removal when influent >0.01 ug/L
PCBs non-detect at 0.01 ug/L in 5/7 effluent samples
Chitosan-enhanced sand filtration

- Uses chitosan acetate, a natural biopolymer, with pressurized sand filtration.
- Approved in Washington for construction applications.
- Effective in removing TSS, turbidity, total metals, PCBs, and dissolved metals if used in conjunction with another coagulant.
- Fully automated, remote operations, vendor service available.
- Full scale system installed at PCB-contaminated site to treat stormwater.
  - 1,500 gpm capacity
  - Discharge limit: 0.03 ug/L total PCBs.
Chemically-enhanced primary treatment

- Advanced wastewater treatment system that uses variety of coagulants and polymers (alum, ferric chloride).
- Industrial and wastewater applications, not typically remotely operated.
- Data provided by King County pilot test: Effective removal of TSS and particulate-bound pollutants, but less effective than EC and CESF in removing dissolved metals.
Ballasted Sedimentation

- CEPT + ballast (sand or re-circulated solids)
- Industrial and wastewater applications, not typically remotely operated.
- Data provided by King County pilot test and vendor jar tests: Effective removal of TSS and particulate-bound pollutants, but less effective than EC and CESF in removing dissolved metals.
- ~30 minute startup
# Technology Comparison

<table>
<thead>
<tr>
<th>Vendor Services</th>
<th>Relative cost</th>
<th>TSS removal %</th>
<th>D. metals removal %</th>
<th>PCB removal %</th>
<th>Pathogen removal</th>
<th>Monitoring req’d</th>
<th>Treatment adjustable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive/conventional</td>
<td>$</td>
<td>52-79</td>
<td>0-20</td>
<td>0-81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrocoagulation</td>
<td>$$$</td>
<td>69-95</td>
<td>19-95</td>
<td>80-94</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CESF</td>
<td>$$</td>
<td>85-99</td>
<td>96-100</td>
<td>42-89</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CEPT</td>
<td>$$</td>
<td>70-90</td>
<td>23-28</td>
<td>31-35</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Ballasted sed.</td>
<td>$$$</td>
<td>55-93</td>
<td>0-36</td>
<td>ND</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>