The Lake Washington PCB/PBDE Study: Concentrations Measured in Stormwater and Other Major Pathways to the Lake Washington Watershed

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King County Water and Land Resources Division
Department of Natural Resources and Parks
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Problem: Lake Washington Fish are Contaminated

Lake Washington Fish Tissue Results

PCB Concentrations in Freshwater Fish Across Washington State

Modified from Ecology (2010)
Lake Washington PCB/PBDE Loadings Study

- Objectives
  - Estimate PCB and PBDE loadings to Lakes WA and Union, to Puget Sound
  - Determine key pathways (CSO, stormwater, streams, air, rivers, bridge runoff) to Lakes
  - Model response time from any total PCB load reduction
  - What total PCB load reduction is needed to reach safe levels in Lake WA fish?
Lake WA Project Components

- Field study (Pathway sampling of PCB and PBDE congeners)
- Loadings estimates (PCBs & PBDEs)
- PCB modeling
- PCB load scenarios for Lake WA
- Findings and recommendations
Lake WA Advisory Panel

- Fred Bergdolt, WA Dept. of Transportation
- Betsy Cooper, King County Wastewater Treatment Division
- Jonathan Frodge, Seattle Public Utilities
- Jenny Gaus, City of Kirkland
- Joan Hardy, WA Dept. of Health
- Rachel McCrea, WA Dept. of Ecology
- Doug Navetski, King County Stormwater Management
- Andy Rheaume, City of Redmond
- Ronald Straka, City of Renton
- Heather Trim, People for Puget Sound/FutureWise
- Bruce Tiffany, King County Industrial Waste
- Patrick Yamashita, City of Mercer Island
FIELD STUDY

Air deposition sampler
Field Study

- Sampled one year (2011/2012)
- 209 PCB and 9 PBDE congeners in:
  - CSOs (1 King County, 2 Seattle)
  - Stormwater (storm and baseflow, 6 stns)
  - Streams (storm and baseflow, 3 stns)
  - Sammamish and Cedar Rivers (3 stns)
  - I-90 Bridge runoff
  - Atmospheric deposition (wet and dry, 2 stns)
  - Lake Washington and Ship Canal inlet and outlet
Sampling Stations

Station Type
- At
- Ambient
- CSO
- Stormwater
- Streams
- Highways

King County

Department of Natural Resources and Parks
Water and Land Resources Division
Concentrations in Rivers

Base and storm flows not specifically targeted

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**Total PCBs pg/L**

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<th>Collection Date</th>
<th>Total PCBs pg/L</th>
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**Cedar upstream**

**Sammamish**

**Cedar downstream**

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**Total PBDEs pg/L**

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</table>

**Cedar upstream**

**Sammamish**

**Cedar downstream**

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*Base and storm flows not specifically targeted*
Concentrations in Tributaries

**Total PCBs pg/L**

- **Thornton**
- **May**
- **Juanita**

**Total PBDEs pg/L**

- **Thornton**
- **May**
- **Juanita**

Collection Date:

- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec
- Jan
- Feb
Concentrations in Stormwater

![Graph showing concentrations of Total PCBs and PBDEs over time for different locations.](image)

- **Total PCBs pg/L**
  - **Baseflow**
  - Locations: Fremont, I-90, Kirkland, Madrona, Mercer Island, Renton, Seward Park

- **PBDEs pg/L**
  - **Baseflow**
  - Locations: Fremont, I-90, Kirkland, Madrona, Mercer Island, Renton, Seward Park
Concentrations in CSOs

**Total PCBs pg/L**

- **Dexter**
- **Seward Park**
- **Ballard 150/151**

**Collection Date**

- Nov
- Dec
- Jan
- Feb
- Mar
- Apr

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**Total PBDEs pg/L**

- **Dexter**
- **Seward Park**
- **Ballard 150/151**

**Collection Date**

- Nov
- Dec
- Jan
- Feb
- Mar
- Apr
Atmospheric Deposition Rates

Units are ng/m²/day

![Graph showing Atmospheric Deposition Rates for PCBs and PBDEs at Beacon Hill and Sand Point. The graphs display data for each month from May to March, with a legend indicating 'Beacon Hill' and 'Sand Point.' The x-axis is labeled 'Collection Date' and the y-axis is labeled 'Total Deposition Rate ng/m²-day.']
Measured Water Concentrations

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<th>PCBS pg/L</th>
<th>Ambient</th>
<th>Stormwater Bridges</th>
<th>Stormwater Seattle</th>
<th>Stormwater All</th>
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<th>Stormwater Small Cities</th>
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</table>

PCBs pg/L

- Ambient
- Stormwater
- CSOs

Legend:
- Orange: Ambient
- Teal: Stormwater
- Blue: CSOs
Conclusions

- CSO concentrations highest, up to order of magnitude
- River concentrations lowest
- Seattle stormwater concentrations higher than smaller cities
- Use these data to estimate loadings to Lakes Washington and Union