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The Lake Washington PCB/PBDE Study: Estimates of loading from major pathways

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Lake Washington PCB/PBDE Study
Estimates of loading from major pathways

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Conceptual Model for PCBs

**PCB SOURCES**
- Global Atmospheric Sources
- Local Atmospheric Sources
- Domestic and Industrial Waste Sources
- Watershed Sources: industrial facilities, military facilities, electrical facilities, building caulks, paints, and sealants

**PCB PATHWAYS**
- Direct Atmospheric Deposition
- Combined Sewer Overflows
- Watershed Drainage: Rivers, Creeks, Stormdrains

**LAKE WASHINGTON FATE PROCESSES**
- Water: Volatilization, Wash out, Degradation, Deposition, Resuspension
  - Air-Water Interface
  - Water-Sediment Interface
- Active Sediment: Biofouling and mixing, Deposition, Resuspension, Burial, Degradation

**BIOACCUMULATION LINKAGES**
- Sport Fish (eat prey fish and/or benthos)
- Prey Fish (eat benthos and plankton)
- Benthos (live in sediment)
  - Fish Eating Animals
  - Mammals
  - Birds
  - Humans
Major Pathways

- Rivers (Cedar and Sammamish)
- Local Drainages
  - Monitored tributaries
    - Thornton Creek
    - Juanita Creek
    - May Creek
  - Remaining unmonitored lake drainage
- CSOs
- Floating bridges (stormwater runoff)
- Direct atmospheric deposition
Loadings Estimates

Concentration $\times$ Flow = Loading

Field study mean concentration used, except

- Extrapolation approach for unmonitored tributaries
- Enhanced CSO data with historical data

Flow

- Gauged flow data OR
- Estimated
Correlations with Land Use/Population

- %Total Impervious Cover
- %Developed pre-1979
- Population Density (#/ac)
- %Commercial/Industrial Dev pre-1979
Relationship with Historical Land Use?

![Map showing relationship between historical land use and PCB yield](image)

- PCB Yield (g km\(^{-2}\) yr\(^{-1}\)):
  - 0.0
  - 0.5
  - 1.0
  - 1.5
  - 2.0
  - 2.5
  - 3.0

- % Commercial/Industrial Development:
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12

Legend:
- Percent Commercial Pre-1979
  - < 4
  - 4 - 8
  - 8 - 16

Insert graph showing:
- % Commercial/Industrial Development vs. PCB Yield
- Highlighted areas with different colors indicating percent commercial/industrial development
- Bars for: Thornton, Juanita, May
Current PCB Loading Estimates

- 672 g yr⁻¹ to Lake Washington
- 140 g yr⁻¹ exits Lake Washington
- 360 g yr⁻¹ to Puget Sound
PCB Loading Summary

Lake Washington

- Bridges: 3 g
- CSOs: 12 g
- Rivers: 97 g
- Local Dr.: 450 g

Lake Union/Ship Canal

- Bridges: 1 g
- CSOs: 58 g
- Local Dr.: 40 g

Puget Sound

- Total: 360 g
Current PBDE Loading Estimates

- 2,023 g yr\(^{-1}\) to Lake Washington
- 968 g yr\(^{-1}\) exits Lake Washington
- 990 g yr\(^{-1}\) to Puget Sound

**tPBDE load (g yr\(^{-1}\))**

- **Atmospheric Deposition**: 590 (29.2%)
- **Highway Bridges**: 19 (0.9%)
- **CSOs**: 14 (0.7%)
- **Local Drainage**: 820 (40.5%)
- **Rivers**: 580 (28.7%)
Load from Local Drainage Driven by Stormwater

- Stormwater is <30% of annual flow in streams BUT
- Accounts for 80-90% of annual PCB load from local drainage
Loadings Conclusions

- Appears to be relationship between local tributary PCB areal loading and age and/or type of development
- As much as 70% of lake PCB load comes from local tributaries
- As much as 80% of local tributary PCB load delivered in stormwater
- Lake Washington is a sink for PCB and PBDE
Search: lake washington pcb study