Connecting the Upper Hudson and the Western Harbor

A multi-contaminant geochemical perspective

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Superfund Sites in the Hudson Basin
“Near ideal” dated sediment cores

Core 188.5
Collected July 1983

Core 188.6
Collected May 1991
### Sampling Site Information

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<th>Core Designation</th>
<th>Location/Significance</th>
<th>Site Activities</th>
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| Site 1 | Downstream of the largest single discharger of pulp and paper waste in the Hudson basin | - PCB Chronology  
- Metals Chronology  
- Paired-Core PCB degradation studies  
- Dioxin time horizon samples  
- Characterization of Pulp & Paper APEOs  
- Paired-Core APEO transformation studies |
| Site 7 | Discharge of Major Sewage | - PCB time horizon samples  
- Down time horizon samples  
- Characterization of Sewage-Related APEOs  
- Paired-Core APEO transformation studies |
| Site 8 | Mohawk River, near Kingston | - PCB-Chlorinated |  
| Site 9 | Lower Hudson Estuary, near Newburgh | - PCB-Chlorinated  
- geographic and temporal distribution of APEOs |
| Site 10 | Lower Hudson Estuary, near Pelham | - PCB-Chlorinated  
- geographic and temporal distribution of APEOs |
| Site 11 | Lower Hudson Estuary, near Pelham | - Currently being analyzed for PCB congeners in collaboration with NYDEC (Through CAPP)  
- Monitoring Hudson impacts in NY Harbor |
| Site 12 | NY Harbor, mainstem Hudson | - PCB time horizon samples  
- DDT and chlorinated time horizon samples  
- Metals time horizon samples  
- geographic and temporal distribution of APEOs |
| Site 13 | NY Harbor, mainstem Hudson | - PCB-Chlorinated  
- DDT and chlorinated chronologies  
- Metals chronologies  
- geographic and temporal distribution of APEOs |

### Map
- **Site 1**
  - Location: Downstream of the largest single discharger of pulp and paper waste in the Hudson basin
  - Sampling dates: 188.5 (1983), 188.6 (1991)

- **Site 7**
  - Location: Discharge of Major Sewage
  - Sampling dates: 1982, 97, 90, 94, 98

- **Site 8**
  - Location: Mohawk River, near Kingston

- **Site 9**
  - Location: Lower Hudson Estuary, near Newburgh

- **Site 10**
  - Location: Lower Hudson Estuary, near Pelham

- **Site 11**
  - Location: Lower Hudson Estuary, near Pelham

- **Site 12**
  - Location: NY Harbor, mainstem Hudson

- **Site 13**
  - Location: NY Harbor, mainstem Hudson
  - Sampling dates: -1.7V (1979), -1.68 (1984)

- **Bej-T Bearing Corerops**
  - Sampling dates: 1989, 94, 96, 96
PCB Purchases (pounds) Main Stem Tidal Hudson 1958-1977

- Albany to the NY/NJ Harbor: 2,487,560
- NY/NJ Harbor: 6,368,319

Legend:
- Light Blue: Albany to the NY/NJ Harbor
- Maroon: NY/NJ Harbor
Adding in GE.......
“Average” PCB levels in “recent, fine-grained” Hudson Sediments

- > mp 200 and all tributaries*                        <1 ppm
- mp 180 to 193                                        a few hundred ppm
- mp 157 to 166                                        several tens of ppm
- mp 140 to 150                                        a few tens of ppm
- mp 80 to 110                                         about 10 ppm
- mp 40 to 60                                          about 5 ppm
- mp 10 to -2                                          about 2 ppm
Cs-137 and PCB profile of a core from mile point 163.6.
Tracing the Upper Hudson PCB influence

- Upper Hudson has dominated downstream historical PCB loadings
Other Particle Tracers - Metals

- Upper Hudson sources dominate Cd to Kingston (mp 90)
- Other metals:
  - Pb (& stable isotopes)
  - Cr
  - Hg
  - Zn
PCB SOURCES TO MAINSTEM NY HARBOR SEDIMENTS

Overall ~2/3 from "Upstream" sources

"Upstream" PCBs

"Urban" PCBs

ppm PCB's

YEAR

The “other” Superfund site – dioxins from 80 Lister Avenue

Tracing Harbor Sources Upstream: 2,3,7,8-TCDD Ratio
Same Source; Another Contaminant - DDT
Hexachlorobenzene?

- Although produced at 80 Lister Avenue, a source near the Arthur Kill apparently dominates HCB loadings to the Harbor.
Other Sources; Other Contaminants
Other “distribution” of Western Harbor Contaminants

- Dredge spoil (upland)
- Offshore disposal
Other contaminant sources

- Newtown Creek, Jamaica Bay WWTP
  - Sediment monitoring near discharge points
- Atmospheric deposition
  - Sediment cores from Central Park Lake, Prospect Park
- Local road runoff
  - Van Cortlandt Park
“Re-emerging” and Emerging Contaminants

- Mercury
- APEOs
- PBDEs
Mercury deposition in Central Park Lake
Regional Atmospheric Hg Flux
Hg flux to Harbor Sediments

1960s total Hg (ppm)

1990s total Hg (ppm)
APEOs

POTENTIAL APEO SOURCES
Comparison Between Concentrations of PBDEs in Breast Milk from North America and Europe

PBDEs in Hudson Sediments - Long term trends

PBDEs in Sediments from mp 21.6 (Hastings)

- BDE 209
- BDE 47 (x20)
- BDE 99 (x20)

ppb

approximate year of deposition

The WTC influence

BDE 99 in Dated NY Harbor Sediments

Sampling location (milepoint)

ppb

2001
1998

World Trade Center

Hastings (mp 21.6)