HUDSON RIVER PCBs
SUPERFUND SITE
CAG Meeting

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Environmental Stewardship Concepts
December 8, 2011
Monitoring

- PCBs
  - Water Quality (resuspension)
  - PCB Load
- Air Quality Monitoring
- Odor Monitoring
- Noise Monitoring
- Lighting Monitoring
- Navigation Monitoring
PCBs

- Monitoring May - Nov 2011
- Most data: Thompson, Schuylerville, Waterford
- Control level = 500 ppt PCB
- May 21 = 561 ppt at Waterford
- Load limits
  - 2% of Tri+ PCB mass removed at Thompson
  - 1% of Tri+ PCB mass removed at Waterford
- In-compliance at Thompson Island Dam (TI) and Waterford
PCB Monitoring Data Results

-- Graphs show individual PCB concentrations in water (ppt) on a specific date at each monitoring location.
>500 ppt = exceedance

-- The ‘Air Quality Exceedance’ figure shows the date of air quality exceedance (daily total PCBs above standard) and the river section to which it corresponds. All dates on the far right represent an exceedance in the processing facility area.

--All data were collected from the EPA Hudson River Dredging Data Website: hudsondredgingdata.com.
Data is from Poughkeepsie, further downstream
Air Quality Monitoring

• Monitoring began June 6, 2011
• Locations
  ▪ Stations near active dredging operations
  ▪ Sediment processing facility
  ▪ Unloading area
  ▪ Permanent background station
• Generally - no monitoring at areas undergoing capping activities
Air Quality Monitoring

- Residential
  - Concern = 0.08 µg/m³
  - Standard = 0.11 µg/m³
- Commercial/Industrial
  - Concern = 0.21 µg/m³
  - Standard = 0.26 µg/m³
- Control level = daily total PCBs within 20% of the standard
- Concern level = 80% of their respective standard for 24-hour PCB concentration averages
  - Daily total PCBs under this level indicate typical operations
# Daily Air Quality Monitoring Exceedances

<table>
<thead>
<tr>
<th>Date</th>
<th>River Section A</th>
<th>River Section B</th>
<th>River Section C</th>
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<td>9-Nov</td>
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<td>Control</td>
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Vagueness in reporting on website
- Exceedance of industrial or residential standard?
Odor Monitoring

- Monitoring began June 6, 2011
- No exceedances
- **Control level:** *Presence of uncomfortable odors was noted by the remedial action team or by the public*
Noise Monitoring

• Monitoring began June 6, 2011
• No reported exceedances
• Performance standards
• Short-term
  ▪ Residential (nighttime) = 65 decibels
  ▪ Residential (daytime) = 75 (control), 80 decibels
  ▪ Commercia/industrial = 80 decibels
• Long-term
  ▪ Residential = 65 decibels
  ▪ Commercial/industrial = 72 decibels
Lighting Monitoring

• Monitoring from June 6 through Nov. 8, 2011
• At typical levels; no exceedances
• **Typical Operations:** *Project operations allow for continuous use of the river with minimal impacts*
Daily Oversight Summaries

- Dredging operations
- Process Facility operations
- Rail Yard operations
- Water Quality, Sediment Sampling/Processing and Survey activities
- Quality of Life Performance Standards Monitoring and Weather Conditions
- Miscellaneous Comments/Safety Items
Daily Oversight Summaries

- Reports from August 11, 2011 through present
- Dredging in CU’s 11, 12, 14 - 16, 19 - 25
- Backfill and/or capping in CU’s 9 - 16, 19 - 25
Overall dredging proceeding as planned—some minor setbacks due to extreme weather conditions and/or repairs needed to equipment.

- BMP measures employed as needed.
- Pass dredging, backfilling/capping and trans-loading (as needed) being completed for CUs 13-25.
Phase 2 habitat construction activities will include (but not yet finalized):

- planting riverine fringing wetland vegetation
- planting submerged aquatic and floating vegetation
- repairing and planting on shoreline areas above the 119-foot elevation if they were disturbed during dredging operations
- monitoring plantings
- re-planting the following year
Habitat Construction

- Potential issues with the current plan (NRD 2011)
  1. Unsuitability of backfill material for native plant growth
  2. Destruction of wildlife habitat (e.g. mussels)
  3. Capping may cause river bottom to harden
  4. Increased erosion of river banks
  5. Only about 1/3 of dredged area is to be replanted
  6. Backfilling will not return all areas to original depths
  7. Some riverine fringing wetland areas only seeded with annual seed instead of preferred perennial
  8. Grass or herbaceous planted instead of preferred trees and shrubs
  9. No woody debris will be placed in the river to mimic habitat conditions prior to dredging
Mussels

• Keystone species:
  ▪ Provides habitat, food, and clean water
  ▪ Maintains species-specific relationships with fish
• Destruction:
  ▪ Community disruptions; invasive species
• No plan to reintroduce mussels after dredging is complete, though feasible
• White Sulphur Springs (WV) National Fish Hatchery’s Aquatic Resources Recovery Center
  ▪ Supplies mussels and assists in mussel habitat recovery at a variety of sites
Models: Purpose

• To relate PCB concentrations in sediment and water to concentrations found in fish tissue
• Aid in sediment cleanup decision-making
  ▪ Fish body burden values as a criterion in evaluating remedial alternatives
  ▪ Model output used for human health and ecological risk assessments in Remedial Investigation/Feasibility Study
Models: Types

• Bioaccumulation models:
  ▪ Bivariate BAF Analysis
  ▪ Empirical Probabilistic Food Chain Model
  ▪ FISHRAND

• HUDTOX model provides *fate and transport* of PCB data
Limitations:

- Does not take into account exposure pathways or physiological processes
- Temporal changes annual only
- PCBs in biota are assumed to be in steady-state
- Organic carbon content in suspended solids is not available for the Hudson
- Limited congener-specific measurements for all media
Bivariate BAF Analysis

- **Purpose:** To develop statistical relationships between the PCB concentrations in fish relative to sediment and water
- **Input:** historical data on PCB concentrations in fish, sediment, and water
- **Output:** Regression models describe the relationship
Empirical Probabilistic Food Chain Model

- **Purpose:** describes uptake of environmental contaminants through food chain

- **Input:**
  - PCB water and sediment concentrations (HUDTOX)
  - Food web structure and feeding preferences

- **Output:**
  - PCB load relative to fat content (lipid) and whole fish basis for each species
  - Fish populations that are at or above certain PCB levels
Empirical Probabilistic Food Chain Model

• Limitations:
  ▪ Variable factors affecting the distribution of PCBs are not well known in the Hudson
  ▪ Model is based on limited data
  ▪ Assumes that fish PCB concentrations will be in steady-state with the environment
  ▪ Fish specific data, including trophic level, feeding preferences, lipid content, are lacking for fish species in the Hudson
• **Purpose:** Describes the change in PCB concentrations in biota over time

• **Input:** end product of equations used to describe species-specific uptake factors, including:
  - Gill uptake/elimination rate
  - Metabolic rate
  - Growth rate
  - PCB concentration in fish and water
FISHRAND

- **Output:** estimates of fish PCB concentrations considering sediment and water concentrations
- **Limitations:**
  - No benthic feeding strategies
  - Difference between observed and predicted FISHRAND data, 25-40%
  - Inputs are averages
  - Bioaccumulation models are simplified
Relative percent differences between modeled and observed data for FISHRAND

<table>
<thead>
<tr>
<th></th>
<th>Brown Bullhead</th>
<th>White Perch</th>
<th>Pumpkinseed</th>
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<tr>
<td></td>
<td>Lipid</td>
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<tr>
<td></td>
<td>Normalized</td>
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<td>Range</td>
<td>1 - 184%</td>
<td>1 - 188%</td>
<td>7 - 71%</td>
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<td>Mean</td>
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Summary Limitations

• Fate and transport models, which provide input parameters for bioaccumulation models, do not account for every mechanism contributing to transport processes. Best professional judgment, prior experience and existing models considered

• The Bivariate BAF Analysis and the Food Web Model cannot be reliably used as predictive tools – can only be used to extrapolate
• Between 26 and 310 fish samples were collected yearly (1977-1997) between river miles 142 and 193
• Efforts for some species are more comprehensive than others. Sampling counts as little as two for some species in some years
• Estimates of water and sediment PCB concentrations from HUDTOX output – used in Food Chain and FISHRAND models
The EPA model used to establish the load standard for Phase 1 operations needs to be recalibrated; the loads predicted by the model are much lower than load amounts observed over the last five years.

<table>
<thead>
<tr>
<th>Year</th>
<th>River Section</th>
<th>Fish PCB Concentration (mg/kg-wet weight)</th>
<th>Percent Improvement by Remediation</th>
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References