# Hudson River PCBs CAG Meeting

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# Cleanup Background

### Phase 1

- May November 2009
- ~300,000 cy contaminated sediment and debris removed
- 10 Certification Units
  - CUs 1-8, 17, 18
- ~36% capped
- Excluding CU1, ~10,400 kg of PCB mass removed
  - 25% less PCB mass removed than planned



http://www.epa.gov/hudson/pdf/phase1\_factsheet\_nov2009.pdf

# **Cleanup Background**

- Phase 2, Year 1
  - June November 2011
  - CU09 CU25
  - ~363,000 cy of contaminated sediment removed
  - ~3% capped
  - PCB removal targets (CU09 – CU30)
    - 21,647 kg total PCBs
    - 7,475kg Tri+ PCBs



## **Remediation Goals**

- Fish tissue target PCB concentrations
  - Human exposure
    - 0.05 mg/kg in fish fillet → one half-pound meal per WEEK (cancer and non-cancer)
    - 0.2 mg/kg in fish fillet  $\rightarrow$  one half-pound meal per MONTH
    - 0.4mg/kg in fish fillet → one-half pound meal every TWO months (average angler)
    - Fish advisories might be less restrictive if these goals are met

## **Remediation Goals**

- Ecological exposure
  - 0.3 to 0.03 mg/kg in fish (whole body)
    - River otter consumption of fish
  - 0.7 to 0.07 mg/kg in spottail shiner (whole body)
    - Mink consumption of spottail shiner

## **Remediation Goals**

- Sediment PCB concentrations
  - No specific Preliminary Remediation Goal for sediment
  - Sediment cleanup standards derived from modeling results based on fish tissue targets



http://www.dhs.wisconsin.gov/eh/fish/PCBimage/cy cle.jpg

## **Target Cleanup Levels**



• River Section 1

- 3 grams/meter<sup>2</sup> Tri+
   PCBs per mass unit
   area
- River Sections 2 and 3
  - 10 g/m<sup>2</sup> Tri+ PCBs
     MPA

Figure 1. The Upper Hudson River (UHR) section, subsection and reach designations.

## **Target Cleanup Levels**

- River Section 1 surface sediment
  - 10 mg/kg Tri+ PCBs
  - ~25 30 mg/kg total PCBs
- River Sections 2 and 3 surface sediment
  - 30 mg/kg Tri+ PCBs
  - ~60 90 mg/kg total PCBs
- EPA → these results will bring fish tissue concentrations down to cleanup goals

## **Dredge Areas**

- Based on:
  - Surface sediment PCB concentrations
  - PCB (kg per m<sup>2</sup>) in sediment
  - Sediment texture
  - Bathymetry
  - Depth of contamination
  - Practicality
    - No areas under 50,000 ft<sup>2</sup>
  - Sensitive habitats and cultural significance
  - Potential for erosion

# **Depth of Contamination**

- Based on sediment cores from 2002 current
- PCB concentrations at depths
- Challenges
  - Incomplete cores-
  - Clay layer determined by bathymetry
  - Estimation for incomplete data
  - Factors in previous slide

## **Dredging Goals**

- 2.65 million cy of PCB contaminated sediment
- 40 mile stretch of Upper Hudson River
- Dredge ~493 acres
- Eventually reach fish PCB concentration goals in fish through remediation efforts

### **Trustees Analyses**

- Evaluation of Natural Recovery Models for Sediment in the Upper Hudson River
- Hudson River Remedy Part I: Unremediated

PCBs and the Implications for Restoration

### **Evaluation of Natural Recovery Models for Sediment in the Upper Hudson River (2009)**

- Predicted PCB concentrations (2002 ROD) compared to observed concentrations
  - 9000 core samples (2002 2007)
  - Concentrations exceeded upper bound EPA model predictions for 2003
  - Estimations of post-dredging concentrations are approximately 5x higher than EPA model estimate in RS2 and RS3

### **Evaluation of Natural Recovery Models for Sediment in the Upper Hudson River (2009)**

- Methods
  - Systematic grid sampling
  - Calculated average surface sediment Tri+ PCB concentrations for each RS
  - Post-dredging Tri+ PCB concentrations in DAD estimated
    - Tri+ PCB concentration of 0.25 ppm used to calculate post-dredge estimates
  - Compared to EPA and GE model predictions

#### EPA's model predictions (2002)

Modeling Assumptions and Interpretation: Mid Hudson Species-Weighted Fish Fillet Average PCB Concentrations (in mg/kg)

		Fish PCB Concentration (mg/kg - wet weight)		Percent Improvement by
Year	<b>River Section</b>	MNA	ROD Remedy	Remediation
2020	1	0.289	0.179	38
	2	0.124	0.083	33
	3	0.109	0.079	28
2046	1	0.143	0.120	16
	2	0.073	0.062	15
	3	0.064	0.057	11

Data from EPA's Responsiveness Summary, Hudson River PCBs Site Record of Decision, Table 799-1

### **Three Assumptions about Recovery Over Time**







	-	-	_
Rate of	Natural	10 ppm	3 ppm
Decline	Recovery	Alternative	Alternative
9%	29	25	12
6%	55	38	18
3%	>100	76	37





- Relies on data from previous model evaluation study
- Surface sediment PCB concentrations above RS1 target levels remaining outside of dredge footprint, ~ 136 acres
  - In RS2 and RS3
  - Potential impact on current remedy

- RS1 cleanup levels more stringent than RS2 and RS3
  - Pre-dredging surface sediment PCB concentrations in RS1 are comparable to RS2 concentrations (>100 ppm total PCBs)
  - Post-dredging PCB concentrations will be less reduced in RS2 and RS3 than in RS1
  - Many of RS2 and RS3 cores with surface sediment concentrations > RS1 levels are within ~200 ft of Phase 2 dredge areas

- Applying RS1 surface sediment standards to RS2 and RS3 would
  - Produce a more protective cleanup
  - Require dredging ~136 acres



Figure 3. Post-dredging estimated average Tri+ and Total PCB concentrations (mg/kg) in surface sediment by river section under three scenarios: 1) current remedial design; 2) additional removal of cores with surface Tri+ concentration exceeding 10 ppm that are within 200 feet of existing dredge areas; 3) additional removal of all cores with surface Tri+ CB concentration exceeding 10 ppm.

### **River Section 2**



Figure 4. Map of the Upper Fort Miller Pool (River Section 2, river mile 187-8) showing cores outside of Phase 2 dredge prisms that exceed 10 ppm Tri+ PCB (red circles) and are within 200 feet of dredge prism boundary (red circles with white halo).

Figure 5. Map of the Northumberland Pool (River Section 2, river mile 184) showing cores outside of Phase 2 dredge prisms that exceed 10 ppm Tri+ PCB (red circles) and are within 200 feet of dredge prism boundary (red circles with white halo).

**River Section 3** 



Figure 6. Map of area in the vicinity of Hot Spot 36 (River Section 3, river mile 170) showing cores outside of Phase 2 dredge prisms that exceed 10 ppm Tri+ PCB (red circles) and are within 200 feet of dredge prism boundary (red circles with white halo).

Figure 7. Map of area in the vicinity of Hot Spot 37 (River Section 3, river mile 166) showing cores outside of Phase 2 dredge prisms that exceed 10 ppm Tri+ PCB (red circles) and are within 200 feet of dredge prism boundary (red circles with white halo).

### Scenic Hudson Maps



- This analysis considers surface sediment sampling results
- Additional analysis needed to determine
  - Depth of contamination
    - Inverse Distance Weighting to delineate vertical extent of contamination in DAD
  - Specific additional sediment amounts to be removed

## Discrepancies

- Models
  - Bioaccumulation/Fate and transport
  - Imperfect, rely on assumptions
  - "Outdated and inadequate" models used by EPA
    - Peer Review Report of Phase 1 dredging (2010)

## **Dredging Concerns**

- Protect bridges, other structures
- Restoration of sensitive habitat areas
- Resuspension
  - Disagreement over the resuspension figures
    - GE's Phase 1 Evaluation Report states ~ 5 fold increase in PCB concentrations within and near dredged areas
    - NY Dept. of Environmental Conservation analysis does not support GE's claim

# **Dredging Concerns**

- Resuspension
  - Potential natural resuspension from storm events and snowmelt
  - Spring 2011 snow melt event
    - Mass transport of PCBs within one week after event was approximate to the total mass transport during the entire Phase 1 dredging event
    - Study by Kevin Farrar New York Division of Environmental Remediation

### Hudson Sediment Pile



National Institute for Occupational Safety and Health Photostream (June 10, 2010).

### **Covered Salt Pile**



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## References

- Anchor QEA, LLC. 2010. Phase 1 Evaluation Report. Hudson River PCBs Superfund Site. <u>http://www.hudsondredging.com/wp-content/uploads/2011/pdf/20100308P1ER\_full.pdf</u>
- Arcadis. 2011. Phase 2 Final Design Report for 2011. Hudson River PCBs Superfund Site. <u>http://www.hudsondredgingdata.com/content/pdf/2011 Final%20Design%20Report%20%28FDR%20for%</u> <u>202011%29 text tables figures.pdf</u>
- Bridges, T et al. 2010. Hudson River PCBs Site Peer Review of Phase 1 Dredging Final Report. <u>http://www.epa.gov/hudson/pdf/hudsonriverphase1dredgingreport\_final.pdf</u>
- Farrar, K. Division of Environmental Remediation. 2012. Relative Impact of 2011 Tropical Storms on PCB Transport in the Upper Hudson.
- Field, J, Kern, J, and L Rosman. 2011. Evaluation of Natural Recovery Models for Sediment in the Upper Hudson River. Poster. http://www.darrp.noaa.gov/northeast/hudson/pdf/Battelle09 Field NatRecovery 508.pdf
- Quantitative Environmental Analysis, LLC (QEA). 2007. Hudson River PCBs Site Phase 2 Area Delineation Report. <u>http://www.epa.gov/hudson/pdf/phase2\_dad\_report.pdf</u>
- US Environmental Protection Agency (US EPA). 2002. Hudson River PCBs Site New York Record of Decision. http://www.epa.gov/hudson/RecordofDecision-text.pdf
- US EPA. 2002. Responsiveness Summary. Hudson River PCBs Superfund Site Record of Decision. <u>http://www.epa.gov/hudson/ResponsivenessSummary.pdf</u>
- US EPA. 2009. Phase 1 Dredging factsheet. Hudson River PCBs Superfund Site. <u>http://www.epa.gov/hudson/pdf/phase1\_factsheet\_nov2009.pdf</u>
- US EPA . 2011. Phase 2 Overview Factsheet. Hudson River PCBs Superfund Site. <u>http://www.hudsondredgingdata.com/content/pdf/Phase2-Overview-May25-2011 no CU.pdf</u>
- US EPA. 2012. Phase 2, Year 1 (2011) Factsheet. Hudson River PCBs Superfund Site. <u>http://www.epa.gov/hudson/Phase2\_Dredging.pdf</u>