

Sediment Remediation in the US Superfund Program

Bruce Means

Office of Superfund Remediation and
Technology Innovation



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What is Superfund?

- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). National Oil and Hazardous Substances Contingency Plan.
- Statute charges EPA to clean up sites through responsible parties, or to perform cleanups itself.
- Emergency response, time-critical, or short term actions
- Remedial response (longer term):
 - Identify worst sites (National Priorities List)
 - Remedial investigation (nature & extent, risk assessment)
 - Feasibility study (screen / develop alternatives)
 - Select remedies (document in Records of Decision)

Nine Superfund Decision Criteria

Threshold Criteria

- Overall protection of human health & the environment
- Compliance with applicable or relevant and appropriate requirements

Primary Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume of hazardous wastes through the use of treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

11 Sediment Management Principles

Technical

- Control sources early
- Conceptual site model considers sediment stability.
- Iterative approach in risk-based framework.
- Evaluate assumptions and uncertainties of data and models.
- Select remedies that are expected to achieve risk-based goals.
- Tie sediment cleanup levels to risk management goals.
- Monitor to assess and document remedy effectiveness.
- Design remedies to minimize short-term risks.

Process Oriented

- Involve the community early and often.
- Coordinate with states, local governments, tribes, and Trustees.
- Maximize effectiveness of Institutional Controls; recognize limitations.

In-Situ Remedies

■ Capping



■ Monitored Natural



Ex-Situ Remedies

■ Dredging



■ Excavation



Site Conditions Conducive to Monitored Natural Recovery (MNR)

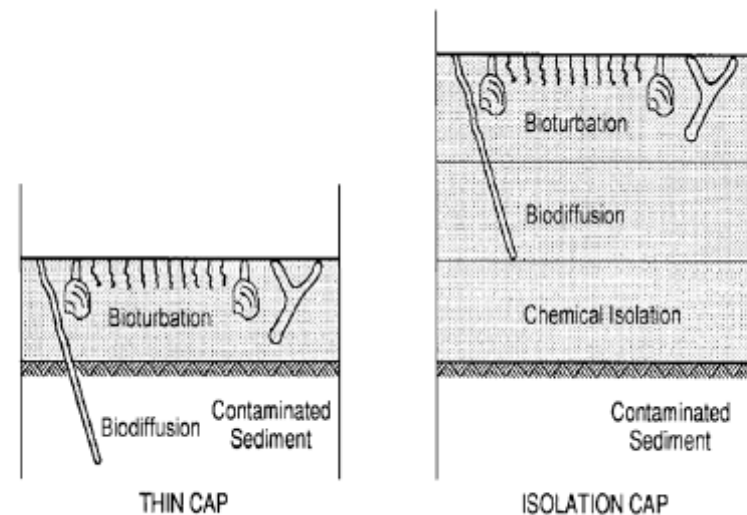
- NR processes are expected to continue at rate that will reduce risks in an acceptable time frame.
- Human exposures are low and/or can be controlled with Institutional Controls (e.g., fish advisories).
- Sediment bed is stable and expected to remain so.
- Contaminants have low ability to bioaccumulate.
- Contaminant levels in biota and sediment are:
 - Decreasing
 - Low and dispersed

Site Conditions Conducive to Capping

- Suitable cap material available
- Infrastructure compatibilities
- Water depth is adequate to accommodate anticipated uses
- No ship anchoring
- Hydrodynamic conditions (floods, ice scour) can be accommodated
- Ground water flow low and/or not likely to create unacceptable releases
- Sediment has sufficient strength to support cap
- Contamination covers contiguous areas

In-Situ Caps Can Reduce Risk Through...

- Physical isolation of the contaminated sediment sufficient to reduce exposure
- Stabilization of contaminated sediment and erosion protection of sediment and cap, sufficient to reduce resuspension and transport
- Chemical isolation of contaminated sediment sufficient to reduce exposure from dissolved and colloidally bound contaminants



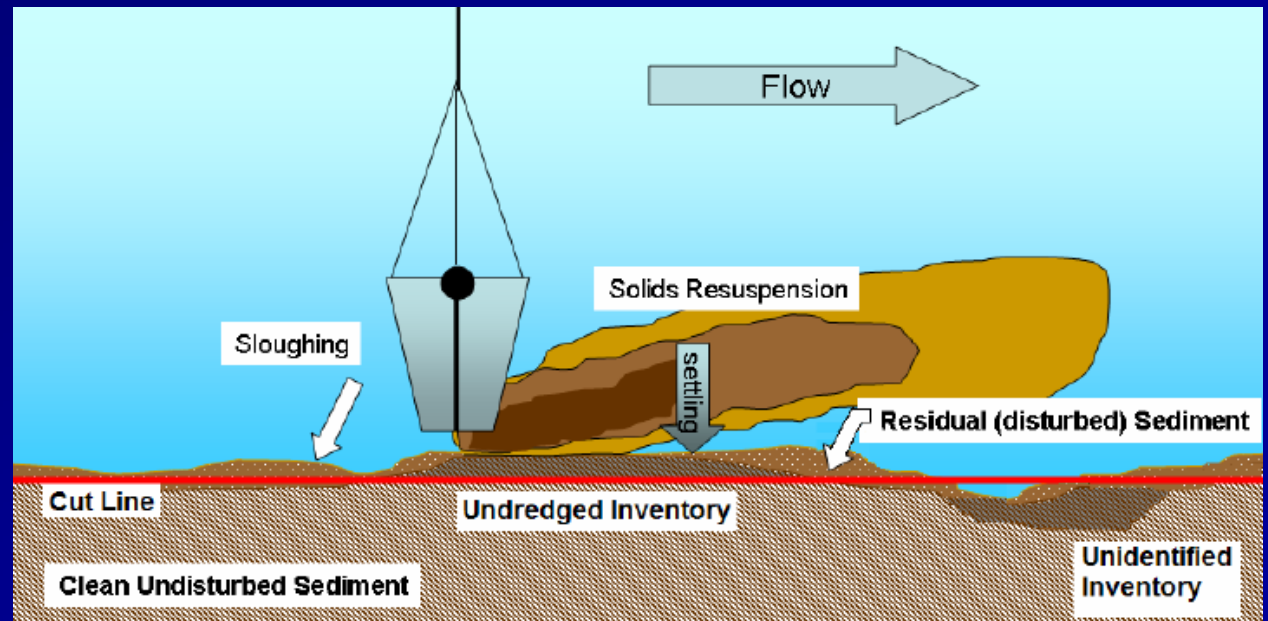
Site Conditions Conducive to Dredging or Excavation

- Suitable disposal site(s) available
- Available staging/handling area
- Navigational dredging is planned
- Water depth is adequate to accommodate dredge but not so great as to be infeasible; or excavation in dry is feasible
- Over-dredging is feasible
- Low incidence of debris
- High contaminant concentrations cover discrete areas



Plan For Dredging Residuals

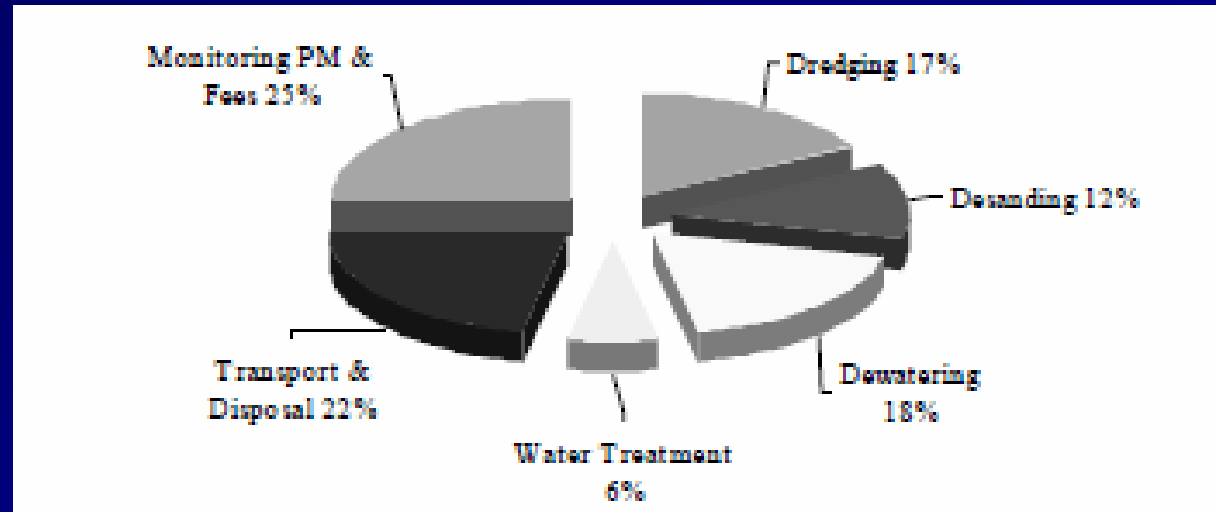
- All dredging operations leave behind some residual contamination, usually both within the dredged area and spread to adjacent areas
- In situations where the final dredging pass contains lower-level contaminated sediment, lower residuals may be attainable
- Plan for backfilling or placement of a thin layer of clean material designed to mix with residual contaminated sediment



Evaluate All Components of the Remedy (E.g., Dredging/Excavation)

NBH Cost Breakdown

- Debris removal
- Sediment removal
- Transport
- Staging
- De-watering
- Treatment
- Disposal



Monitoring Remedy Performance (Technical)

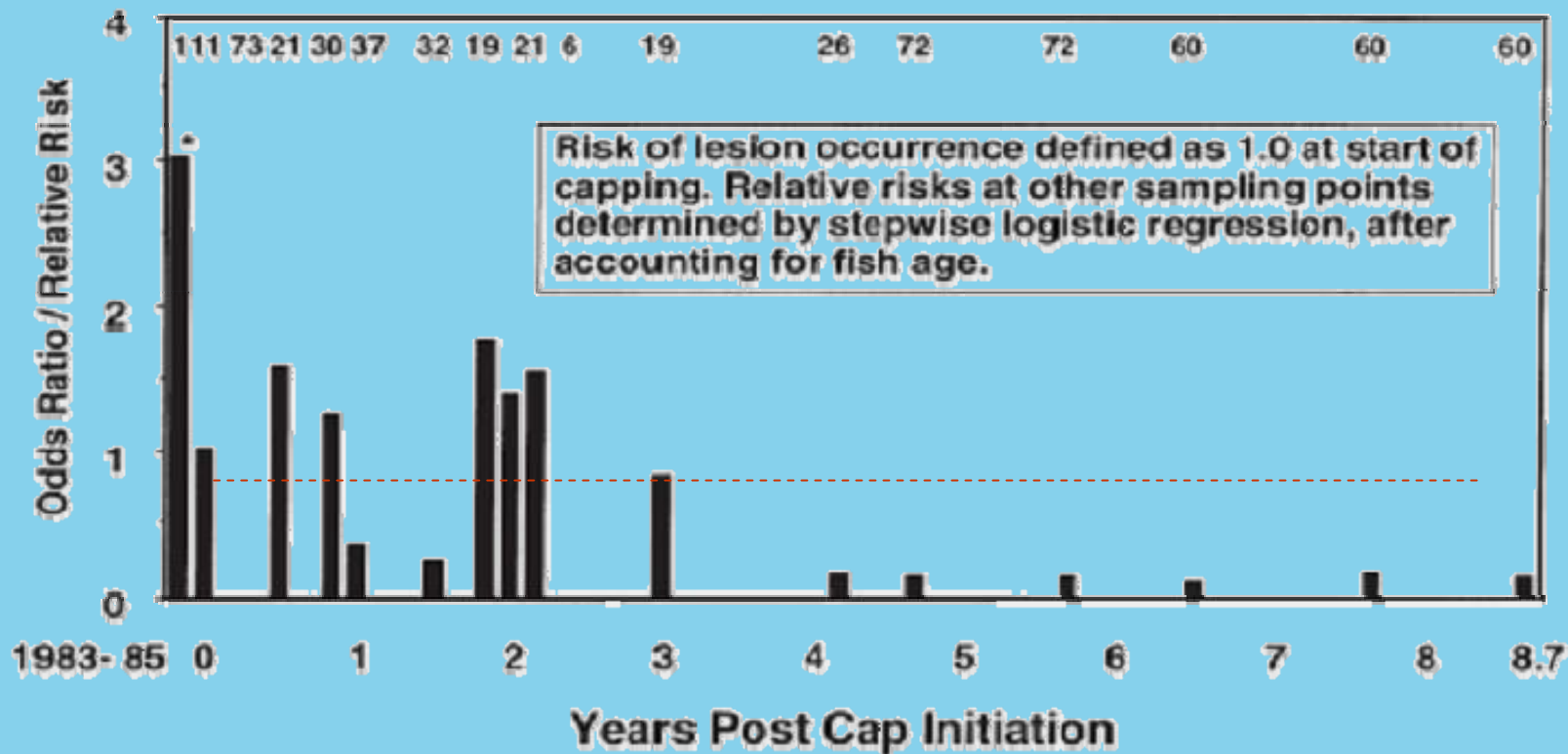
- What is the purpose of the monitoring?
- Are the detection limits adequate?
- Are there non site-related releases that may influence the monitoring results?
- What are the most appropriate monitoring locations, frequency and duration?

Monitoring Performance (cont.) (People)

- Can the monitoring results easily be made available to the project team and others?
- Who is responsible for reviewing the data?
- Is there agreement on what actions will be taken given the results?
- How will the results be communicated to the public, and who is responsible for doing this?

Eagle Harbor Fish Recovery

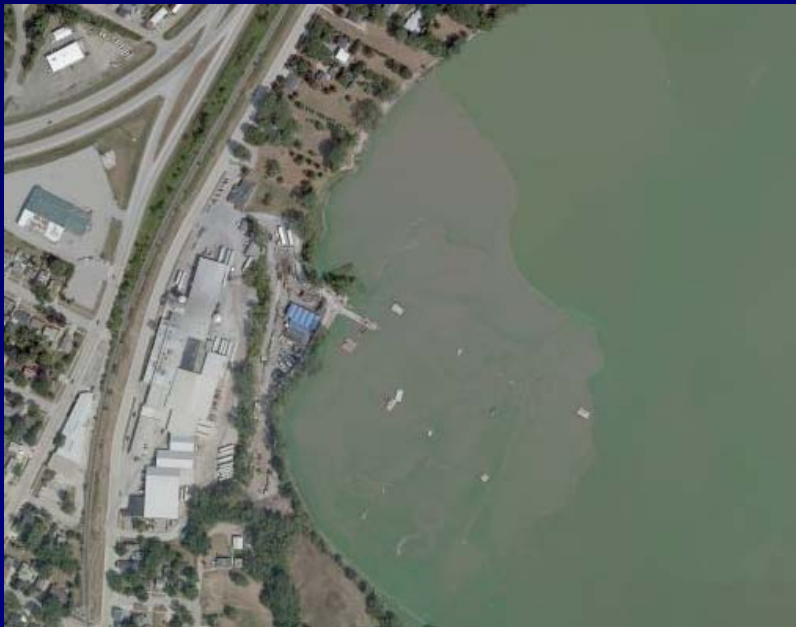
Toxicopathic Liver Lesions in English Sole Eagle Harbor, 1983-May 2002



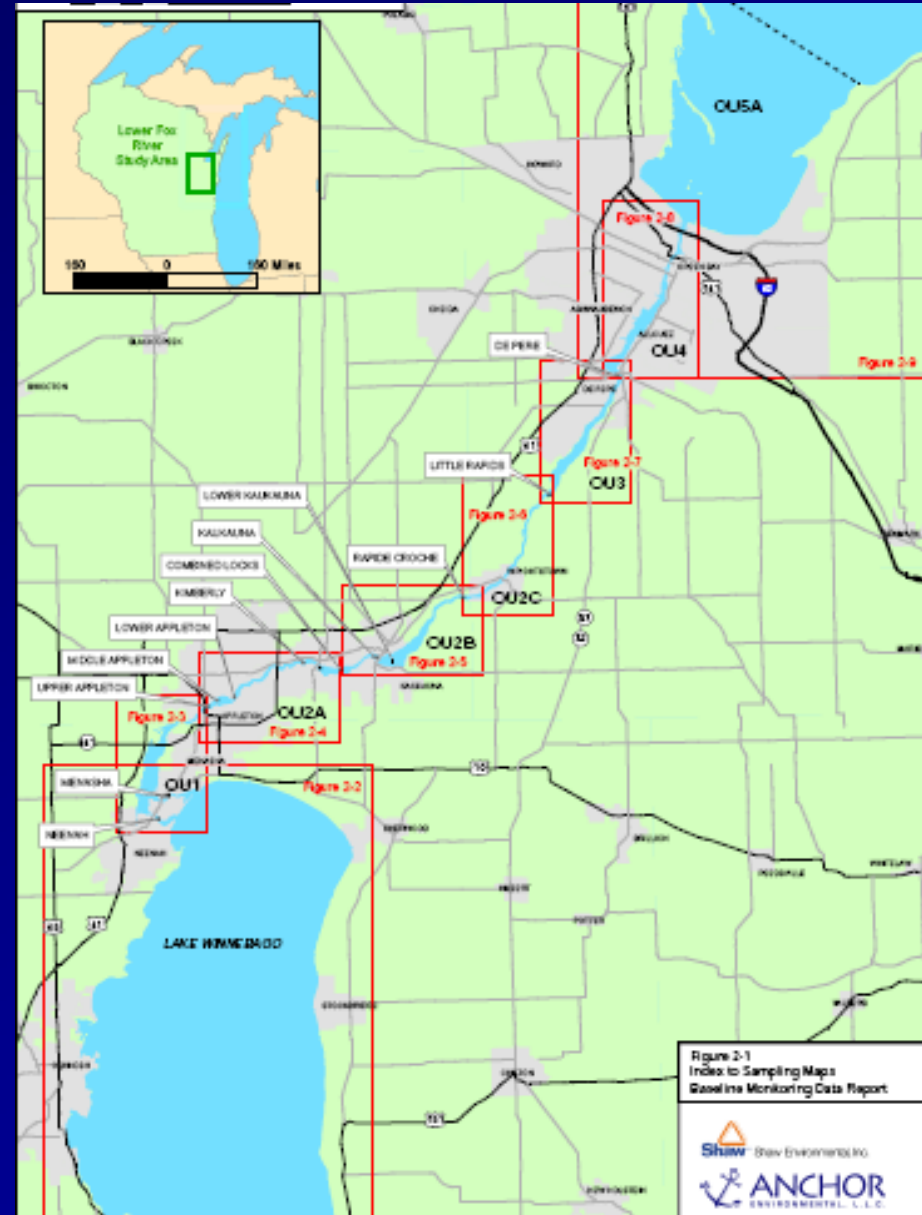
Fox River, WI

- 38 mile study area; 5 OUs- PCBs primary risk driver
 - Proposed NPL (1998)
 - RODs:
 - OU1: 2002, amended 2008
 - OU2: 2002, amended 2007*
 - OUs 3-5: 2003, amended 2007
- *only deposit DD

Remedy implementation Stage



Microsoft Virtual Earth

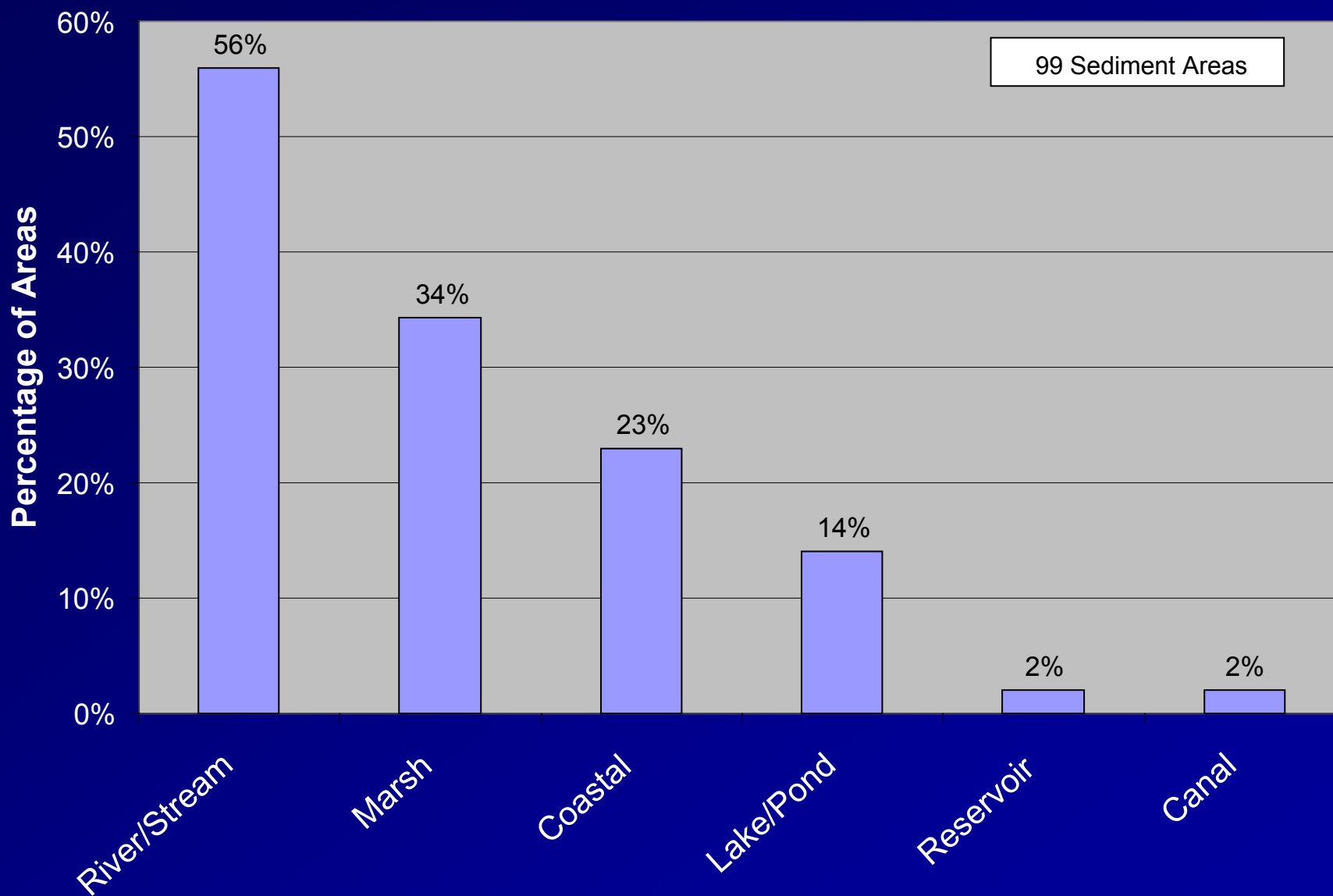


Anchor Environmental 2008

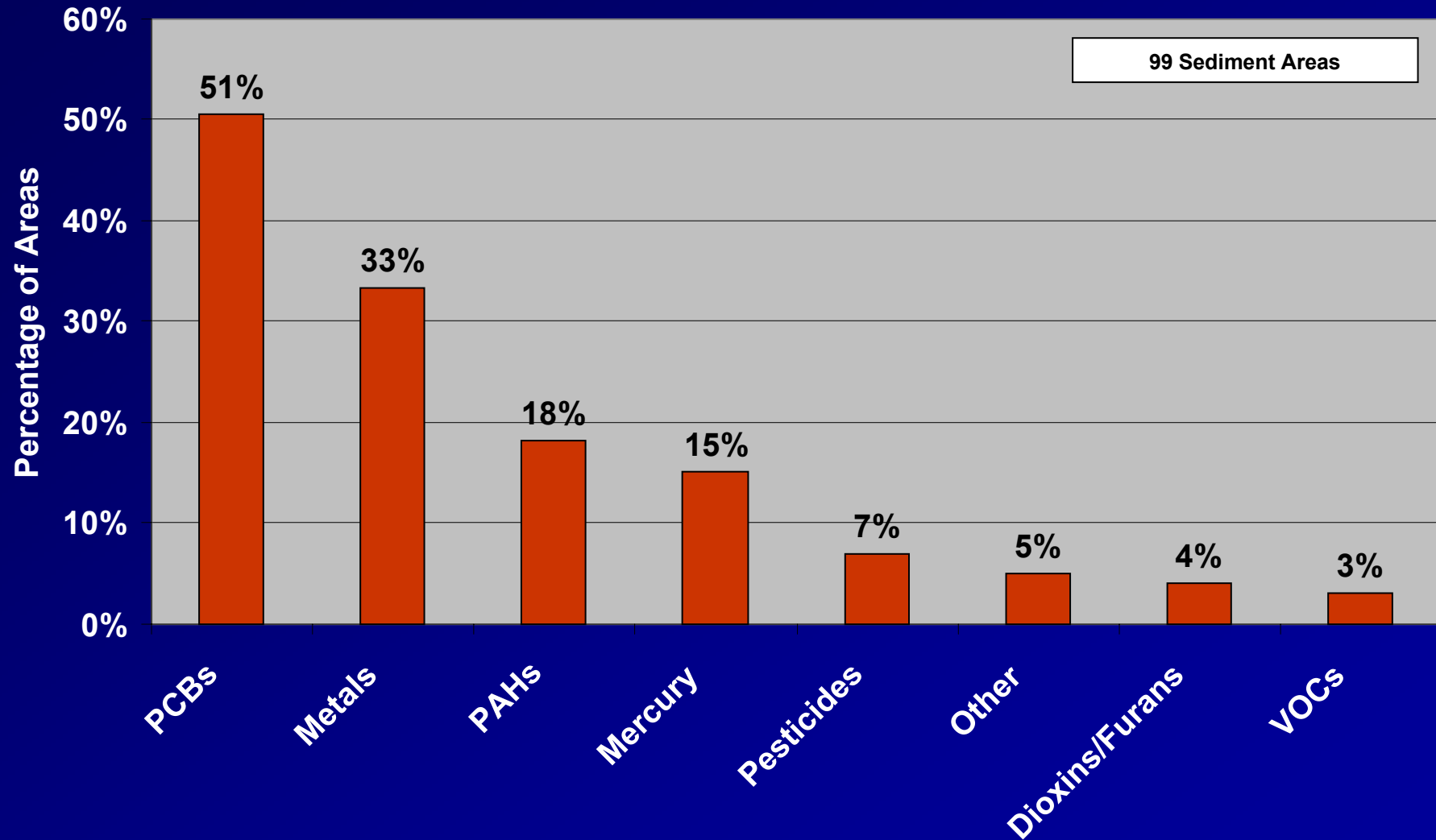
Fox River Results 2005

Sub-area	Measure	Pre-dredging	Post-dredging	% reduction
POG1	PCB mass (kg)	205.5	26.6	87
	Avg. surface PCB concentration (ppm)	13.3	2.8	79
A	PCB mass (kg)	24.1	1.1	95
	Avg. surface PCB concentration (ppm)		1.0	87
C/D2S	PCB mass (kg)		1.3	96
	Avg. surface PCB concentration (ppm)	13.7	1.8	87

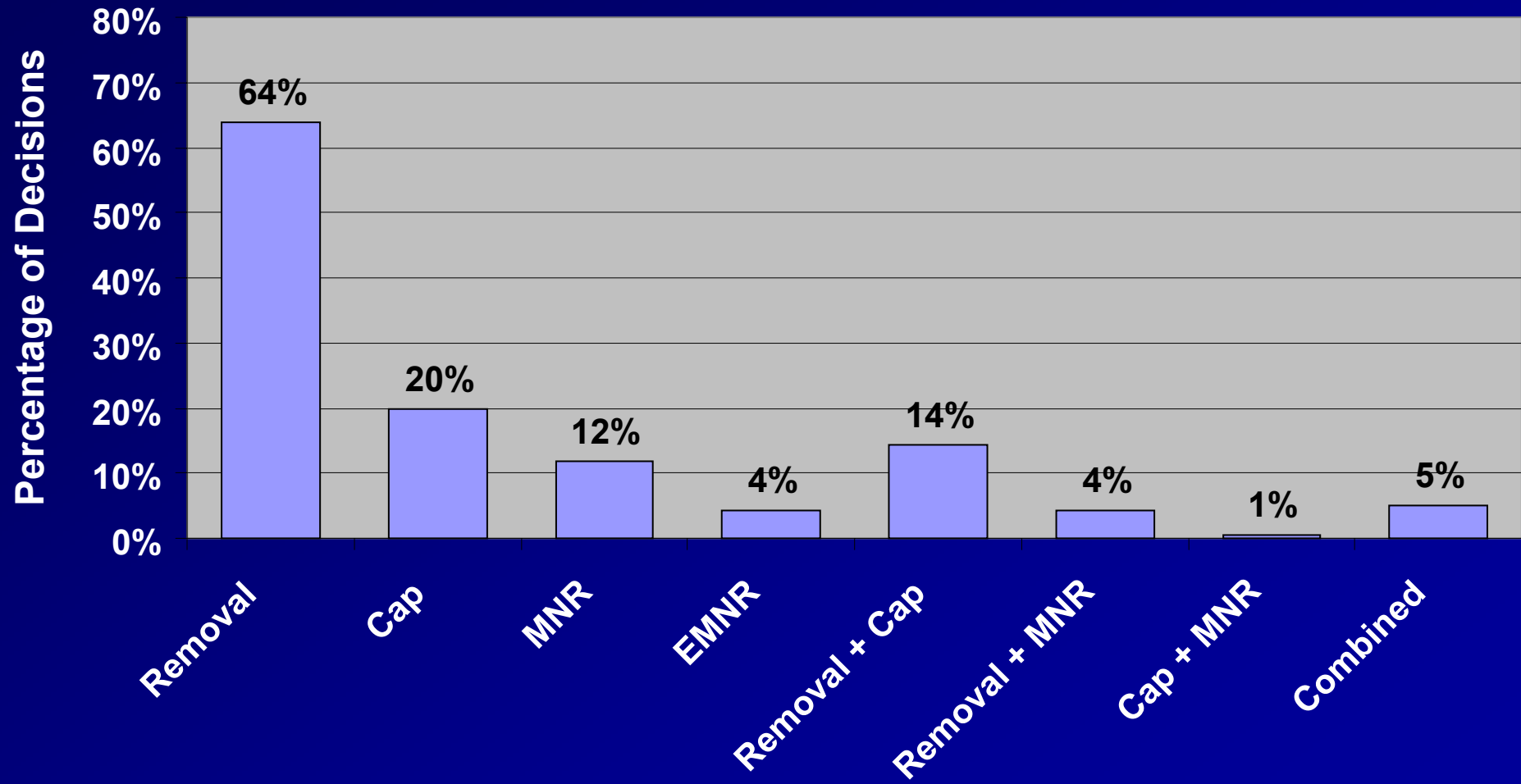
Water Body Types



Contaminants Driving Risk



Remedies Selected



Moving Forward

- Consider combination remedies.
- In remedy selection ask: What risk-based cleanup levels and goals are achievable, and when?
- What protection will this achieve?
- More focus on monitoring remedy effectiveness
 - Sediment, water
 - Fish tissue
- Foster research, development and use of *in situ* sediment amendments to reduce bioavailability.



Sediment Guidance

- Principles for Managing Contaminated Sediment Risks (February 2002)
- Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (December 2005)
- Other Technical Sediment Documents:
 - Using Fish Tissue Data to Monitor Remedy Effectiveness - Sediment Assessment and Monitoring Sheet (2008)
 - The Four Rs of Environmental Dredging: Resuspension, Release, Residual, and Risk (w/USACE; 2008)
 - Dredging Guidelines (w/USACE; 2008)
 - Capping Guidelines (in production)
 - Modeling Primer (anticipated late 2009)
 - Use of In Situ Sediment Amendments and Reactive Caps (anticipated late 2010)
- All found at:
<http://www.epa.gov/superfund/health/conmedia/sediment/documents.htm>

Additional Information

USEPA Superfund

<http://www.epa.gov/swerrims/index.htm>

Contaminated Sediments in Superfund Program

<http://www.epa.gov/superfund/health/conmedia/sediment/index.htm>

Contaminated Sediments in the USEPA Office of Water

<http://www.epa.gov/waterscience/cs/>

Great Lakes Legacy Act and Contaminated Sediments

<http://www.epa.gov/glnpo/sediment/legacy/>

Thank you very much
kiitos paljon!