Dollars and Sense in Risk Management Decision Making

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Disclaimer

This presentation is an effort to explore issues of mutual interest to its three authors, but its content does not necessarily represent the individual viewpoint or policy of the organizations with which they are affiliated.

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The Dollars & Sense Questions:

- Site-specific cost-effectiveness questions:
  - How much will the remedy cost and how effective will it be?
  - How certain are we?
  - Considering uncertainties, is the cost reasonable compared to other available remedies?
- Broader cost-benefit question:
  - How should sediment cleanup be prioritized nationally?

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Types of Costs for Dredging/Excavation

- Mobilization, site prep, management, engineering
- Sediment removal
  - Equipment & labor
  - Engineering controls
  - Debris or structure removal & disposal
  - Backfilling or thin layer placement, if needed
  - Monitoring
- Staging/transport
- Dewatering/Pre-treatment/Treatment
  - Land acquisition
  - Engineering, construction
  - Treatment
- Disposal
  - Siting/finding capacity
  - Land acquisition, construction OR
  - Disposal fees
  - Mitigation, if required
- Long-term monitoring of residuals & biota

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Total Dredging/Excavation Project Costs

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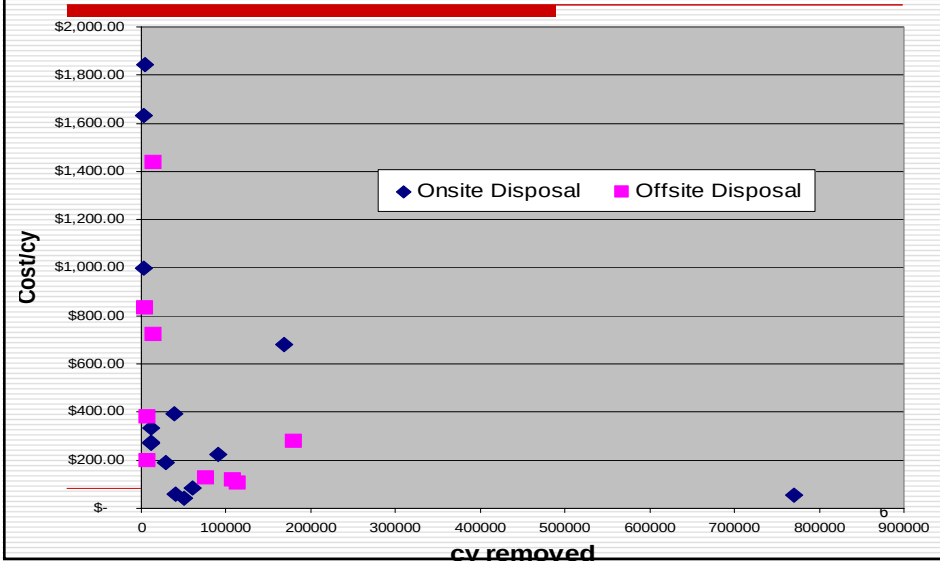
Cost vs. Volume Removed



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Types of Costs for In-Situ Remedies

- In-Situ Capping
  - Mobilization, site prep, management, engineering
  - Cap materials, equipment & labor
  - Transport, stockpiling, staging
  - Cap placement, equipment & labor
  - Construction & long-term monitoring
- Monitored Natural Recovery
  - Long-term monitoring
  - Potential enhancements (e.g., thin layer placement)
- Mitigation, if required
- Implementation of Institutional Controls

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Total Capping Project Costs

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"Costs" of No Risk Reduction

- Human health impacts from eating fish, swimming, wading
- Ecological impacts
- Recreational losses – fishing, swimming
- Economic losses
  - Fisheries
  - Commercial navigation
  - Property values & transferability
  - Tourism
  - Drinking water treatment

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Uncertainties Affecting Cost

- Characterization issues
  - Contamination levels
  - Volumes to be dredged
  - Areas to be capped
  - Debris
- Equipment and operator efficiencies
- Pre-treatment/treatment effectiveness
- Disposal issues
  - Siting
  - Engineering
  - Transport
- Schedule changes
- Weather
- Regulatory agency decisions

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Ways to Present Uncertainty

- Statistical methods
  - Monte Carlo Simulations
  - Distributional data for parameters
- Simple ranges/fuzzy set analysis

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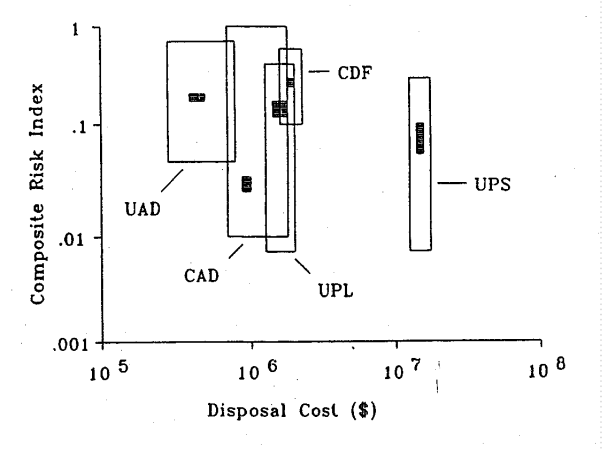
Risk-Cost Trade-Off Example



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Cost-Effectiveness Questions

- How much will the remedy cost and how effective will it be? ("risk reduction vs. cost")
- How certain are we?
- Considering uncertainties, is the cost reasonable when compared to other available remedies? ("risk-cost tradeoffs")

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EPA's Evaluation of Cost-Effectiveness Compares COST to:

- Short-term effectiveness
  - Implementation risks
  - Time to reach objectives
- Reduction in toxicity, mobility or volume through treatment
  - Only applies if treatment is involved
- Long-term effectiveness & permanence
  - Risk reduction
  - Magnitude of residual risk (contaminants left in place, dredging residuals, on-site disposal)
  - Adequacy of controls for residual risk

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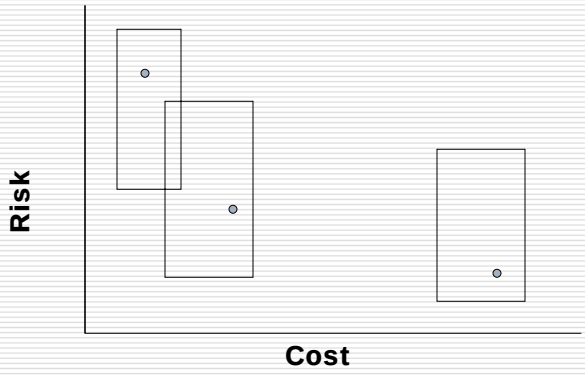
Risk-Cost Trade-Off With Uncertainty



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Decisions - Integrating Risk and Cost

Decision-makers: determine the adequate level of protection and the strategy that best delivers that level of protection

Risk Assessors: provide decision-makers with information on risks associated with current and possible future conditions

Economists/Cost Experts: provide decision-makers with information on costs associated with current risk and risk reduction measures

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Risk Assessors and Economists: Different Perspectives

- Traditional human health risk assessments focus on **risk to individuals** while economic evaluations estimate the benefits for the **population at large**
- Traditional risk assessments often provide **one point** on the upper end of the risk distribution while economists use methods that require risks be expressed as a **probability distribution**
- Traditional risk assessments rely on **conservative assumptions to account for uncertainty** about exposure, but don't always **explicitly characterize and communicate the primary sources of uncertainty**, as is usually associated with economic analysis.

Adapted from: Framework for Environmental Health Risk Management (1997)

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Cost - Benefit Questions

- How should sediment cleanup be prioritized nationally?
- What risk management goals maximize net benefits nationally?
- What are we willing to pay for those benefits?
- How do we compensate for losses which are not addressed?
- "Benefits" vs. "risk reduction"

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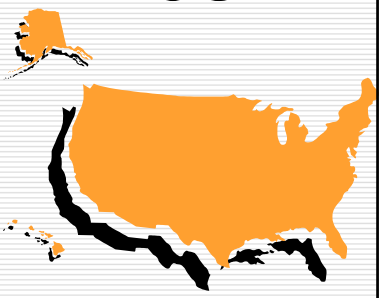
Should we be prioritizing and evaluating sediment cleanup on a national level for smart allocation of resources?

US

Watershed

Site



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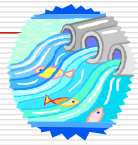
Estimated National Costs to Improve Water Quality and Sediment Quality



- Control of CSOs and SSOs*
  - $10 billion expended to date
  - At least $140 billion for future controls
- Managing Contaminated Sediments**
  - Dredging: $...billion to $...trillion (est. unit cost $..../cy)
  - Capping: $....billion to $....billion (est. unit cost $...../sy to $..../sy)

*_**EPA report to Congress on CSOs and SSOs (2004)**_ 9,340 CSOs; 75,000 SSOs annually

EPA Contaminated Sediment Management Strategy (1998)** assumes 4.5 million acres and 5 to 35 cm depth of 10% of sediments or 1.2 to 8.4 billion cy

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Discussion Items

1. *What do we need to generate accurate cost estimates for dredging and capping (key learnings from completed projects)?*

2. *What are some of the main cost drivers for dredging?*

3. *Could better cost-effectiveness or cost-benefit techniques help the remedy selection process?*
   a. *site level?*
   b. *watershed level?*
   c. *national level?*

4. *Are there sites where an economic cost analysis (advantages and tradeoffs) has been applied and that was acceptable to most of the stakeholders?*

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