Dredged Material Assessment in the U.S.
Moving toward risk-informed decision making

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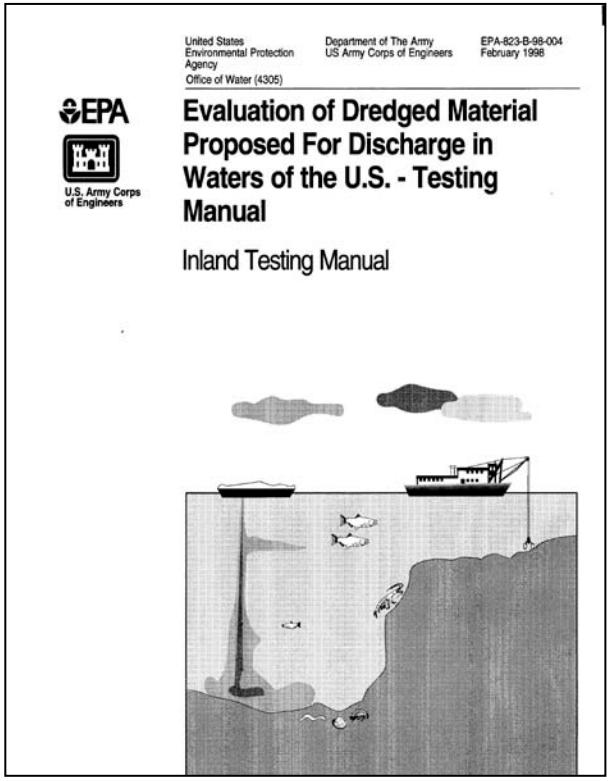
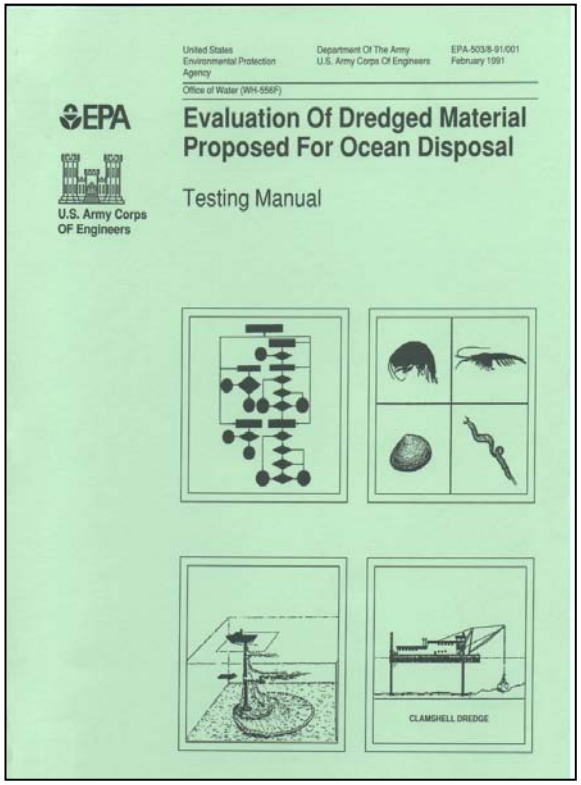
U.S. Navigation Dredging Program

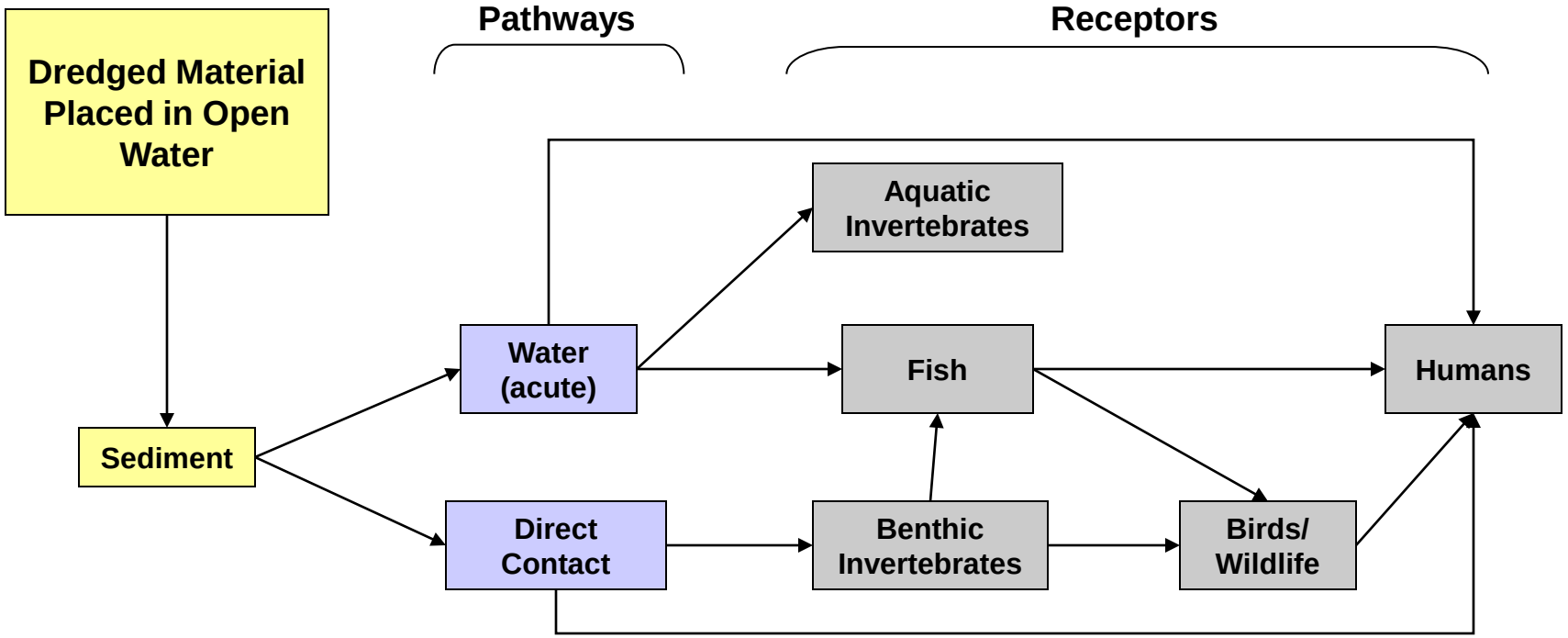
- **400 U.S. Ports**
- **25,000 miles of navigation channel**
- **200-250 million cubic meters of sediment dredged annually**
- **Federal dredging costs increased from $500M to $900M from 1991 to 2002**

Dredged Material Management



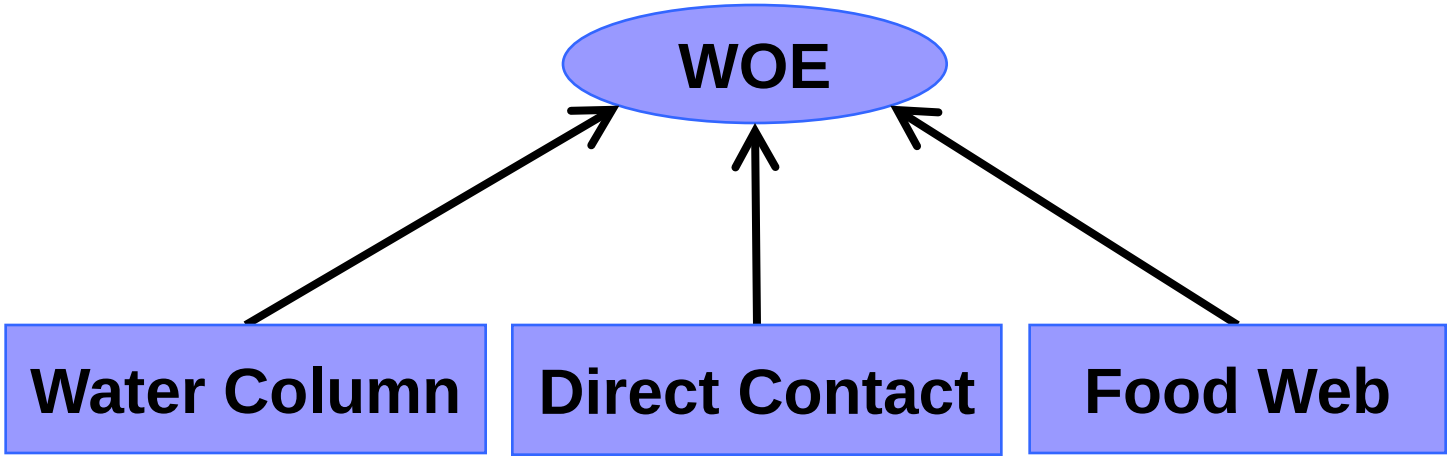


Conceptual Model: Open Water Placement of DM



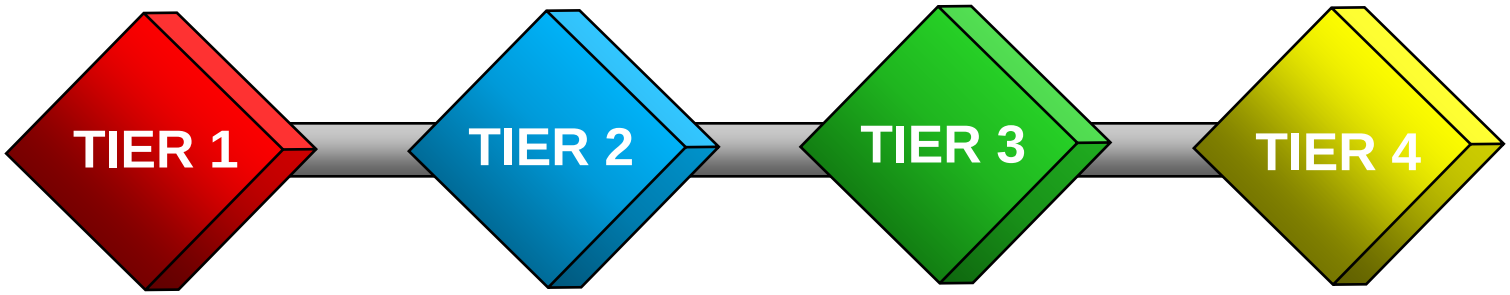
Weight of Evidence

- Relies on multiple lines-of-evidence (LOE)
- Reach conclusions regarding the potential risks to receptors identified within the CM
- Three main lines-of-evidence

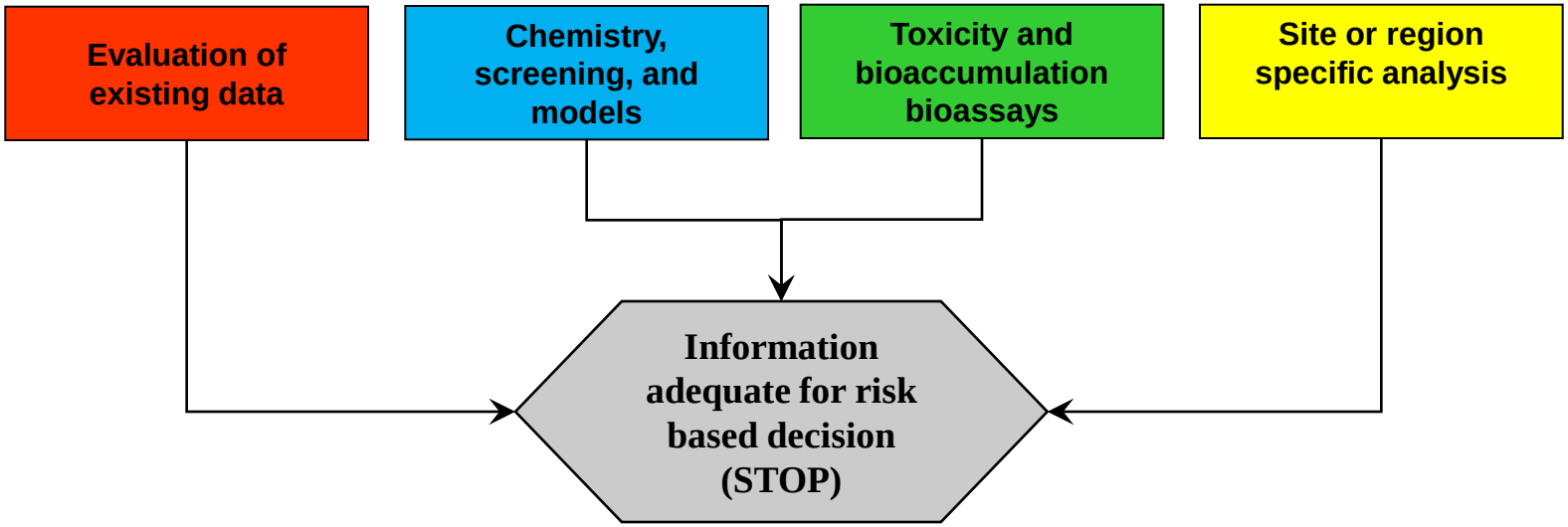


Lines of Evidence

Guidance Manuals: 4 Tiered Procedure



Tiered process → follow as far as necessary to make decision



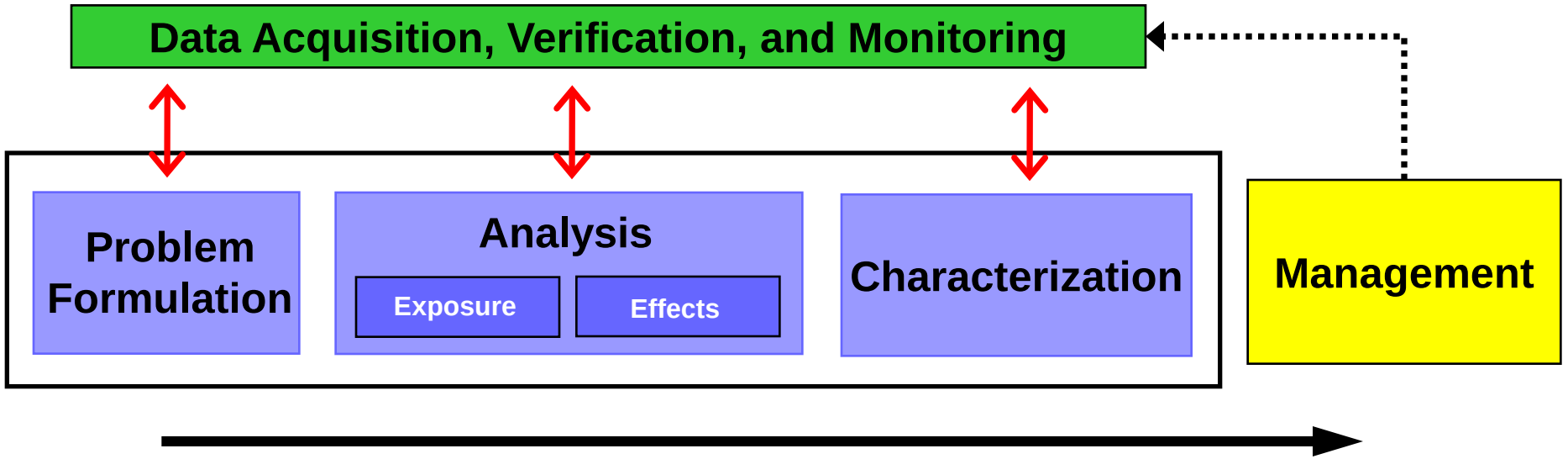
Tier III: Test Design





- **Short-term exposure (typically 10 days)**
- **Measure survival**
- **Recommend testing with at least two species**
- **Feeding is test dependent**
- **Minimum 5 replicates/ treatment**
- **Test validity based on survival in control sediment**

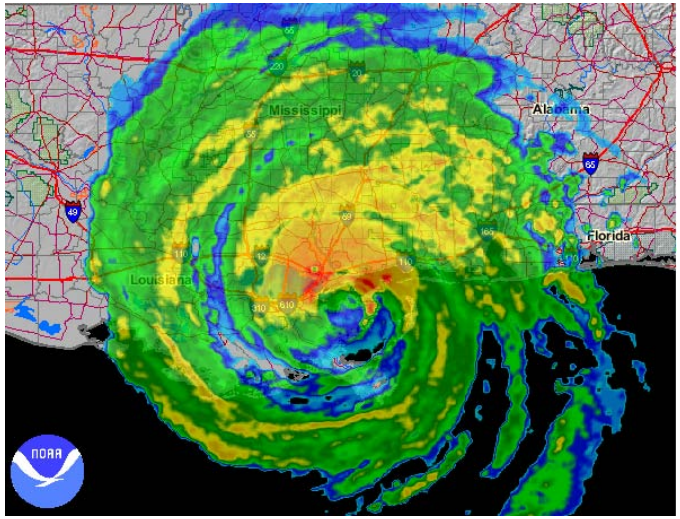
Risk Assessment and Management Process



- **Process that evaluates the likelihood that adverse effects may occur or are occurring as a result of exposure to one or more stressors (USEPA 1997).**
- **Risk management considers, selects and implements actions to reduce risks.**

What is a risk-informed decision?

- **A risk management decision that can be justified in terms of quantitative evidence about risk reduction, where**
  - ***risk* is the likelihood for all relevant adverse impacts**
  - **uncertainties are explicitly considered and processes are implemented to manage them**
  - **the investment is commensurate with the magnitude of the risks and benefits**



"Transforming Practice to Apply Risk-Informed Decision Making." T.S. Bridges 2007
"Transforming the Corps into a Risk Managing Organization." D. Moser, T. Bridges, S. Cone, Y. Haimes, B. Harper, L. Shabman, C. Yoe. 2007

The USACE Navigation Mission

"To provide safe, reliable, efficient, effective and environmentally sustainable waterborne transportation systems for movement of commerce, national security needs, and recreation"

Observations

- **The USACE navigation mission involves multiple objectives**
- **Managing the risks and benefits relevant to these objectives requires making tradeoffs**

What risks are we concerned about?

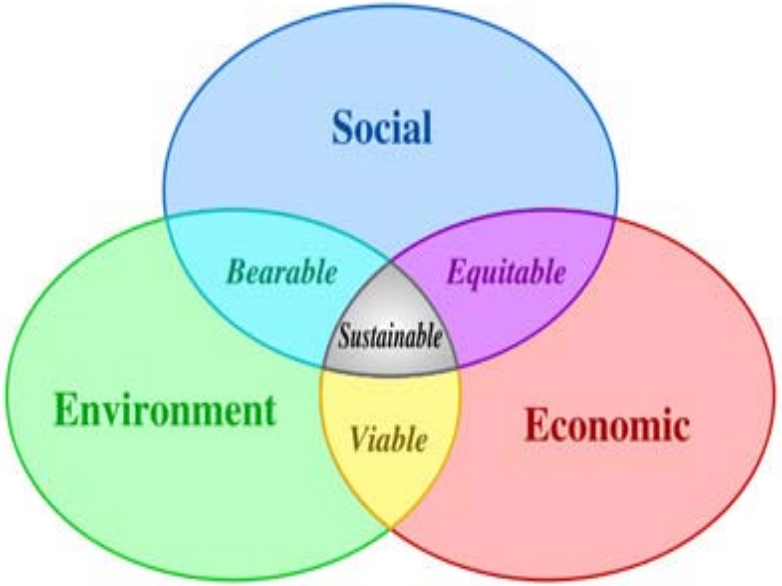
- Economic losses associated with reduced performance of a channel
- Environmental impacts associated with dredging
- Environmental impacts associated with DM placement, disposal, or beneficial use
- Navigation accidents
- Unnecessary costs for the dredging program
- Environmental impacts associated with contaminated sediments when dredging must be deferred

Sustainability: Past and Present

- Ruling paradigm: economic development occurs at the cost of damage to the environment
  - The basis of relevant environmental laws and regulations
    - National Environmental Policy Act
    - Clean Water Act
    - Marine Protection, Research, and Sanctuaries Act
    - Endangered Species Act
    - Etc.
  - Federal Standard: least costly environmentally acceptable alternative

Sustainability: The Future

- Past: maximize economic benefits while minimizing environmental damage
- Future: expand and optimize benefits across all three sustainability domains



Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Brundtland Commission

Sustainability: Looking Forward

- Applying the principles of sustainability to navigation dredging
  - For example:
    - Extending the life of CDFs by keeping material out of CDFs
      - E.g., Use of DM to restore aquatic habitat provides a tangible economic benefit (e.g., conserved CDF capacity
    - Constructing habitat and other features that reduce sedimentation in channels, thereby reducing future dredging costs
    - Reducing energy usage and carbon footprint associated with operations
    - Life-cycle analysis applied to navigation dredging to optimize the allocation of resources

Sustainability: Benefits

- Reduced costs and delays
  - Environmental agencies retain considerable flexibility in pursuing their mandates
    - Sustainability model (expanding benefits) will incentive cooperative behavior (WIIFE)
  - Beneficial alignment of physical processes serving navigation by “Working with Nature” (PIANC)
    - E.g., using environmental features to reduce channel in-filling
- Expanded benefits leading to broadened support for the program
  - E.g., navigation viewed as supporting environmental benefits and services
- Sustained benefits
  - Developed through a strategic approach that maximizes benefits across all the domains

Why We Need a Better Way