Dredged Material Evaluation under the MPRSA and CWA

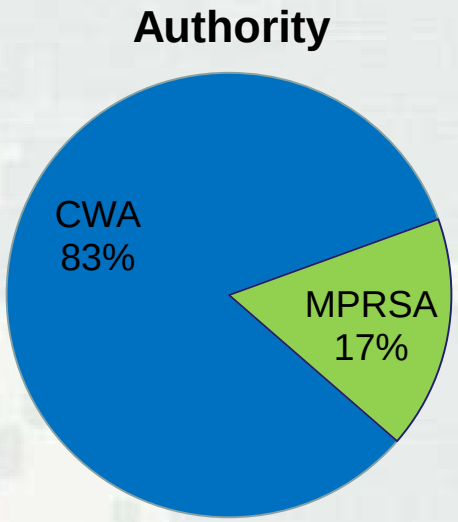
Jeffery Steevens
Senior Scientist

ERDC
Engineer Research and Development Center

US Army Corps of Engineers
BUILDING STRONG®

Corps' Mission

- Maintain navigation of nearly 25,000 miles of channel (1824 Survey Act)
- Requires dredging of over 325 million cubic yards of sediment annually
- Properly manage contaminated sediments; 12 to 20 million yd^3 require special handling and management



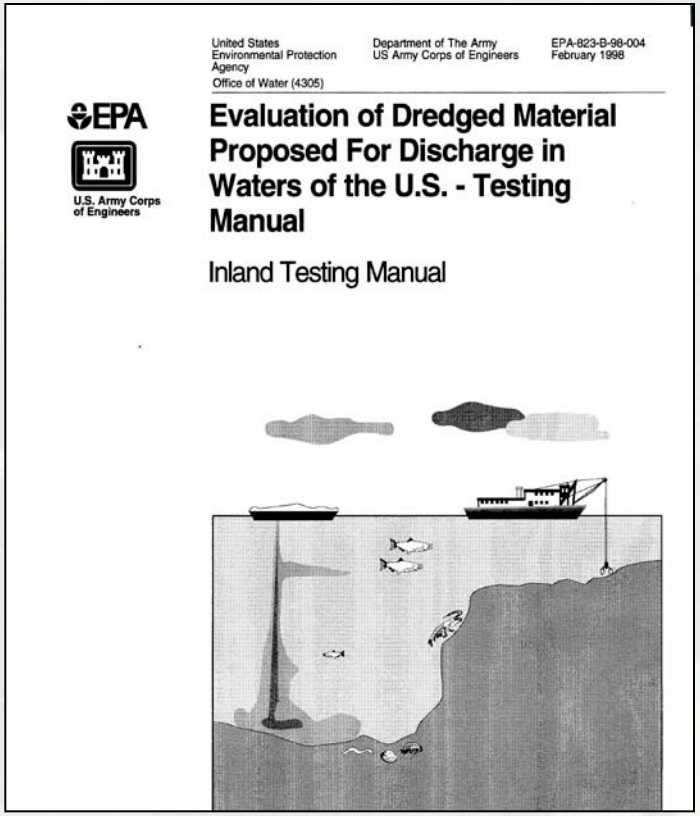
Guidance Documents for Management of Dredged Material

National Technical Guidance

- Technical Framework
- Inland Testing Manual
- Ocean Testing Manual
- Upland Testing Manual
- Ocean Site Designation Manual
- Site Management & Monitoring

Found at: el.erdc.usace.army.mil/dots/guidance.html

Inland Testing Manual


United States Environmental Protection Agency
Office of Water (4305)

Department of The Army
US Army Corps of Engineers

EPA-823-B-98-004
February 1998

EPA

U.S. Army Corps of Engineers

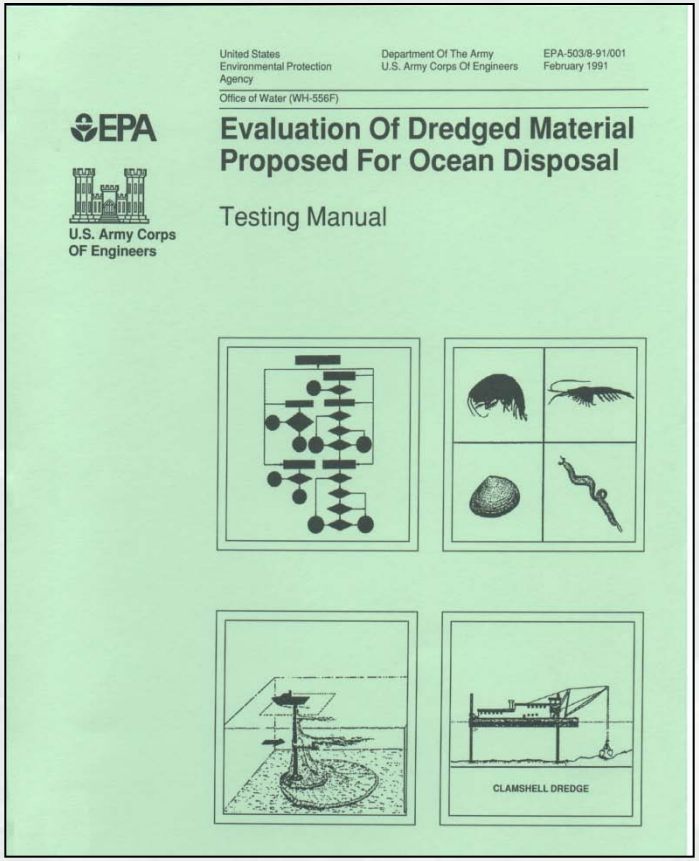
Evaluation of Dredged Material Proposed For Discharge in Waters of the U.S. - Testing Manual

Inland Testing Manual

- Addresses CWA
- Interim guidance in 1976, updated in 1998
- Included:
  - Effects-based testing
  - Sequenced > Tiered

DM placement *"will not cause "an unacceptable adverse impact"*

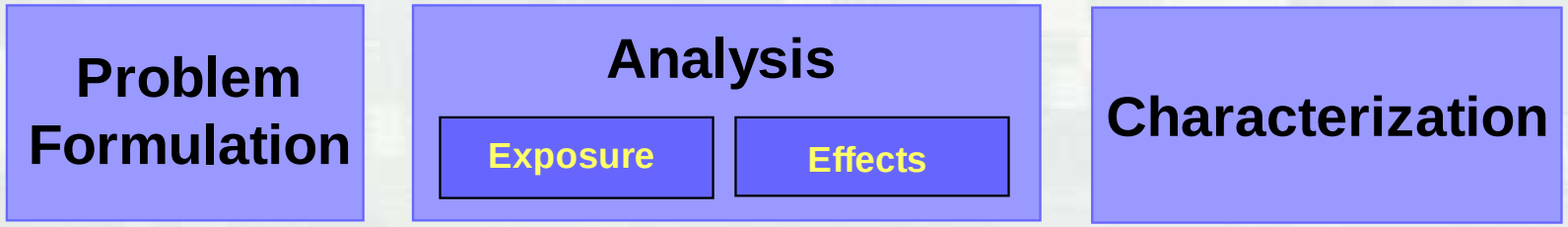
Ocean Testing Manual



- Addresses MPRSA
- Originally developed in 1977, updated in 1991
- Included:
  - Effects-based testing
  - Bioaccumulation
  - Sequenced >Tiered

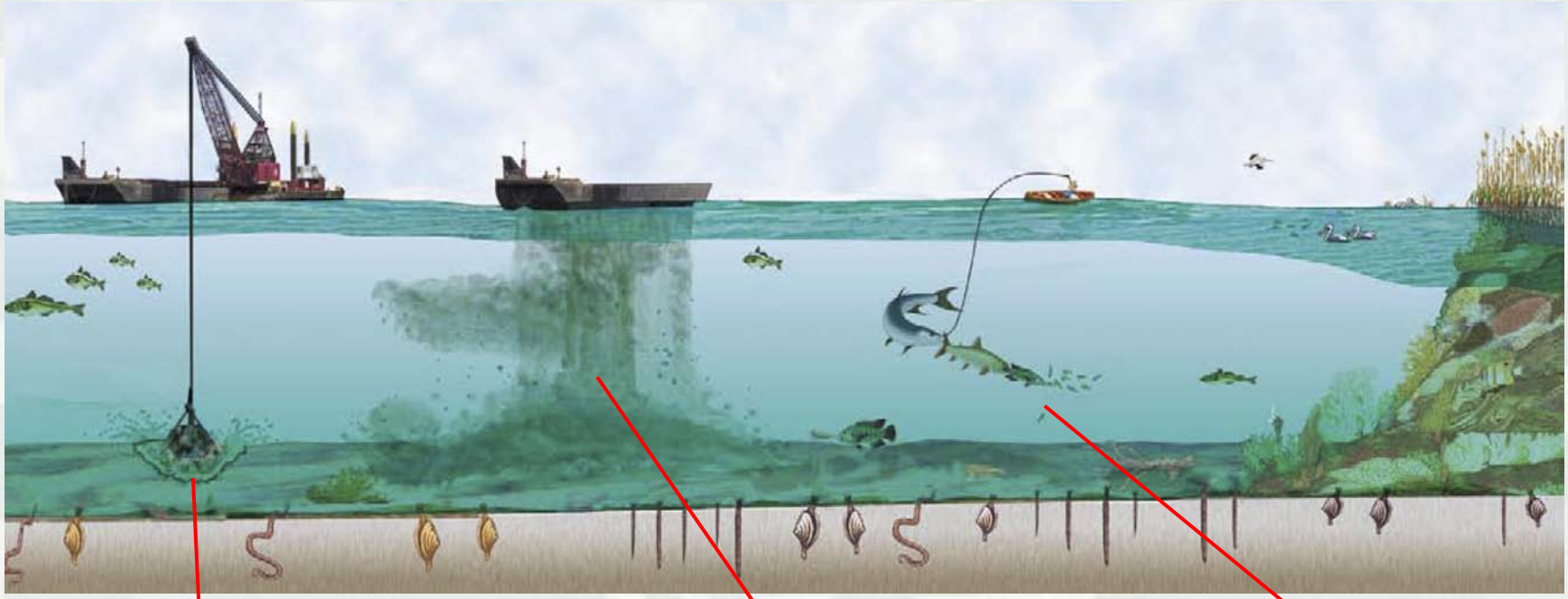
DM placement in ocean will not *"unreasonably degrade or endanger: human health, welfare, or amenities, marine environment, ecological systems, or economic potentialities"*

Risk Assessment and Management



Risk Assessment - 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).

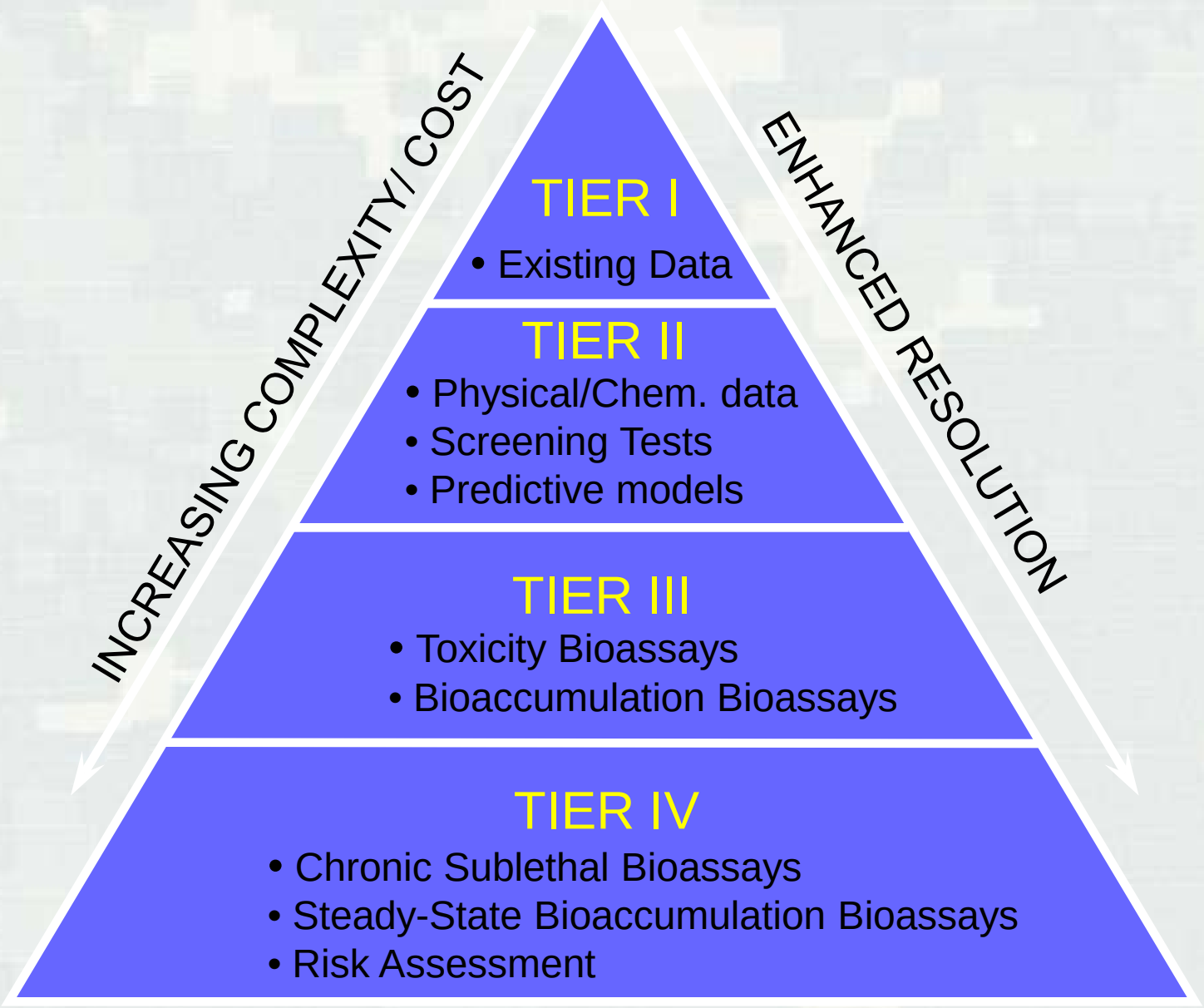
Potential Exposure/Effect Pathways



1. Releases during dredging

2. Biological effects during placement

3. Long term biological effects


INCREASING COMPLEXITY/ COST
ENHANCED RESOLUTION
TIER I
• Existing Data
TIER II
• Physical/Chem. data
• Screening Tests
• Predictive models
TIER III
• Toxicity Bioassays
• Bioaccumulation Bioassays
TIER IV
• Chronic Sublethal Bioassays
• Steady-State Bioaccumulation Bioassays
• Risk Assessment

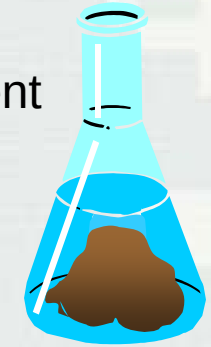
Tier I

- Examine existing information
  - Contaminant sources
  - Physical characteristics of site
    - Bathymetry, currents, deposition, time since last dredging was required
  - Exclusions from requirement for testing
    - Far removed from sources of contamination
    - Sand, gravel, etc

Tier II: Screening Level Analysis

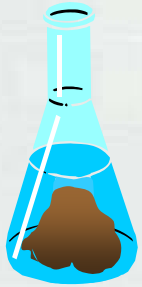
- Predictive models using physical and chemical data (e.g., chemical analysis of sediments)
- Approaches
  - ► Water column effects?
    - Use sediment and elutriate chemistry to determine compliance with relevant water quality criteria/standards
  - ► Benthic effects?
    - Use sediment chemistry to determine potential for accumulation of contaminants in biota

4 parts water
1 part sediment



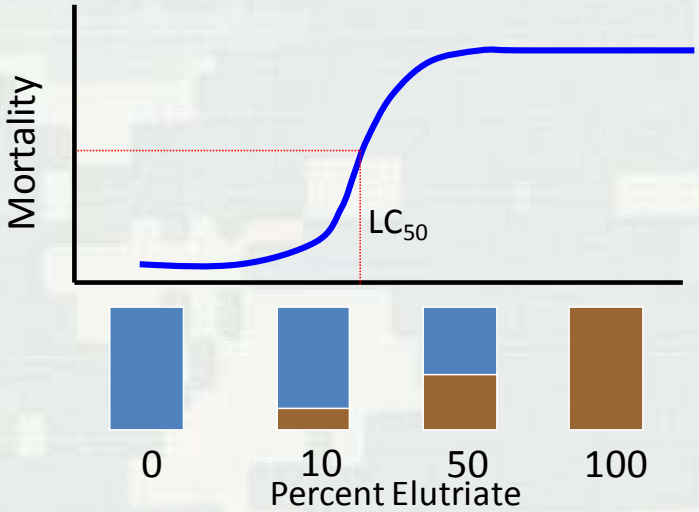
Tier III: Elutriate Bioassay

4 parts water
1 part DM
(volume)



Americamysis bahia

Menidia beryllina



Are levels of contaminants in water column during placement toxic?

Tier III: Sediment Toxicity Bioassay

Compare DM to reference and control sediments

Toxicity

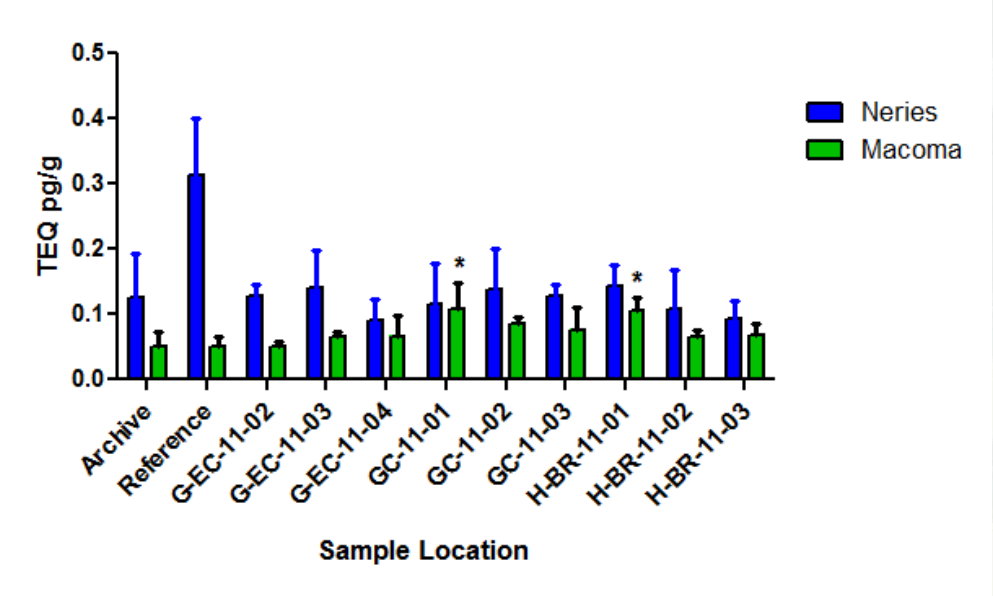
Is sediment toxic to organisms that would colonize at the placement site?

Bioaccumulation

Are contaminants accumulated in organisms to levels that might adversely affect food web?

Drawing Conclusions

- Are there contaminants that are present at levels that can cause toxicity? Accumulate in food web?

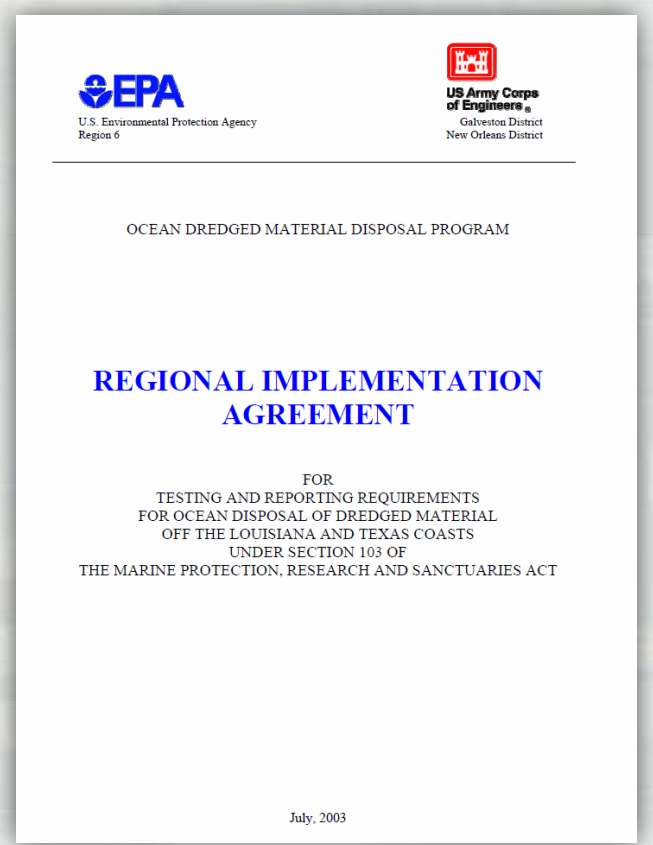


Example data from Houston Ship Channel and Galveston Channel

- If no, options for placement are open
- If yes, consider management controls

Regional Implementation Agreement

- Completed in 2003
- Region specific guidance
  - Process
  - Reference locations
  - Acceptable bioassays
  - Contaminants of concern
  - Target detection levels



EPA
U.S. Environmental Protection Agency
Region 6

US Army Corps of Engineers
Galveston District
New Orleans District

OCEAN DREDGED MATERIAL DISPOSAL PROGRAM

REGIONAL IMPLEMENTATION AGREEMENT

FOR
TESTING AND REPORTING REQUIREMENTS
FOR OCEAN DISPOSAL OF DREDGED MATERIAL
OFF THE LOUISIANA AND TEXAS COASTS
UNDER SECTION 103 OF
THE MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

July, 2003

http://www.epa.gov/region6/water/ecopro/em/ocean/odmd_sites.html

Tier I: Exclusions

MPRSA, 40 CFR 227.13

- (b)(1) dredged material is composed primarily of sand, gravel, rock, AND is found in areas of high current or wave energy, OR
- (b)(2) material is for beach nourishment and composed predominantly of sand, gravel, or shell, with particle sizes compatible with the receiving beach, OR
- (b)(3)(i) material is substantially the same as disposal substrate, AND (ii) sediments are far removed from known historical sources of pollution

Tier I: Exclusions

CWA, 40 CFR 230.60

- 230.60 (a) “material not a carrier of contaminants” Composed primarily of sand, gravel or other naturally occurring inert materials, Generally found in areas of high current or wave energy
- 230.60 (b) “sufficiently far removed ... “ If sediments are from depths deposited in preindustrial times and not exposed to modern sources of pollution, mineral deposits are considered contaminant sources
- 230.60 (c) “adjacent to ... “ the discharge and excavation sites are adjacent, concentrations of contaminants are not substantially different, the geochemical environments are similar, then, the bioavailability of contaminants at the two sites are likely to be similar. Technologies such as capping or underwater containment are potentially applicable.
- 230.60 (d) “if constraints are available…” “if constraints are available to reduce contamination to acceptable levels within the disposal site and to prevent contaminants from being transported beyond the boundaries of the disposal site…”

Terminology

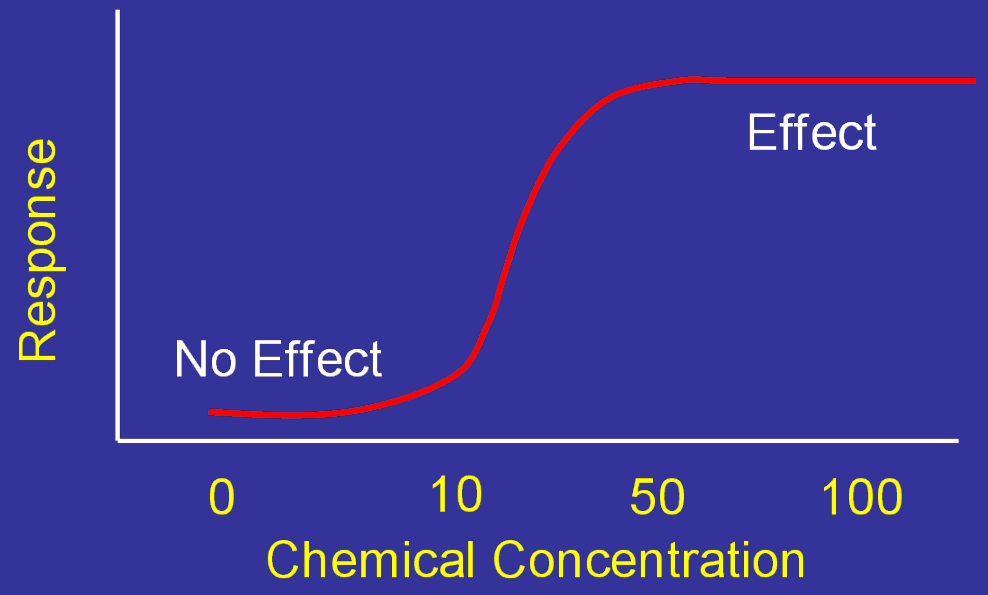
Effects based approach
Use organism to indicate the bioavailability and effects of contaminants; contaminant effects are used to make a determination

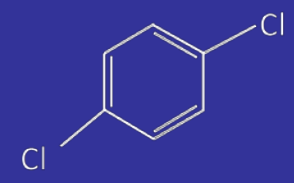
Reference Sediment
A sediment which reflects disposal site conditions except previous dredged material disposal. It is the point of comparison for interpreting test/bioassay results.

Control Sediment/Water
A sediment from the area where the organisms were collected or cultured. For water-column bioassays, water in which the organisms were held or cultured is used. The control serves as a check on the health of the organism and validates the bioassay results.

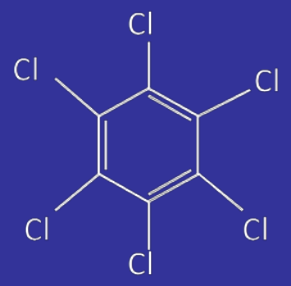
Identify Contaminants of Concern

At what concentration will an adverse effect will occur?





Dichlorobenzene
Half life = 10 days



Hexachlorobenzene
Half life = 6 years

Important Factors

- Chemical properties: mobility, bioavailability, persistence
- Toxicological significance (Cr^{6+} vs Cr^{3+})
- Potential to bioaccumulate

Upland Testing Manual

ERDC/EL TR-03-1

Environmental Laboratory

US Army Corps of Engineers®
Engineer Research and Development Center

Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities — Testing Manual

U.S. Army Corps of Engineers

January 2003

Approved for public release; distribution is unlimited.

- Addresses evaluation of DM for upland placement
- Published in 2003
- Included:
  - Tiered approach to assess contaminant releases
  - Focused on contaminant pathways and use of a conceptual model
  - Goal is to determine need/extent of contaminant controls