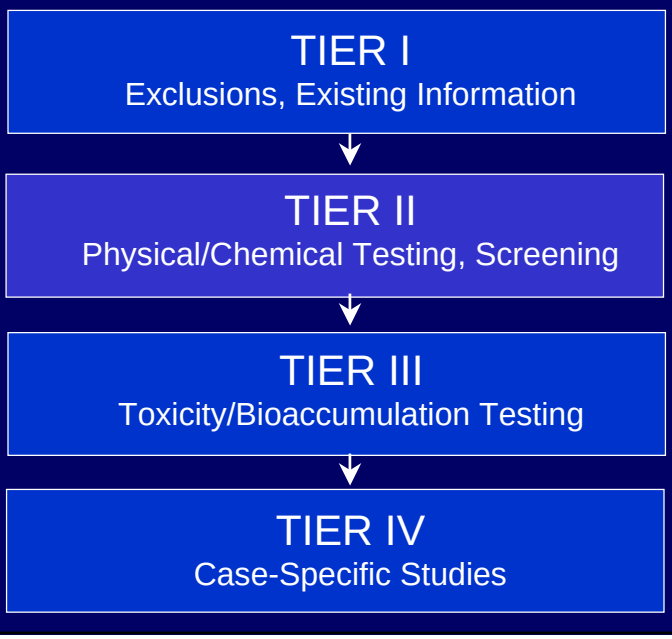
Initial Evaluation

Jeffery A Steevens

Email: steevej@wes.army.mil

KEY WORDS: Open Water Disposal, Confined Disposal, Tier I Evaluation

Tiered Evaluation Process



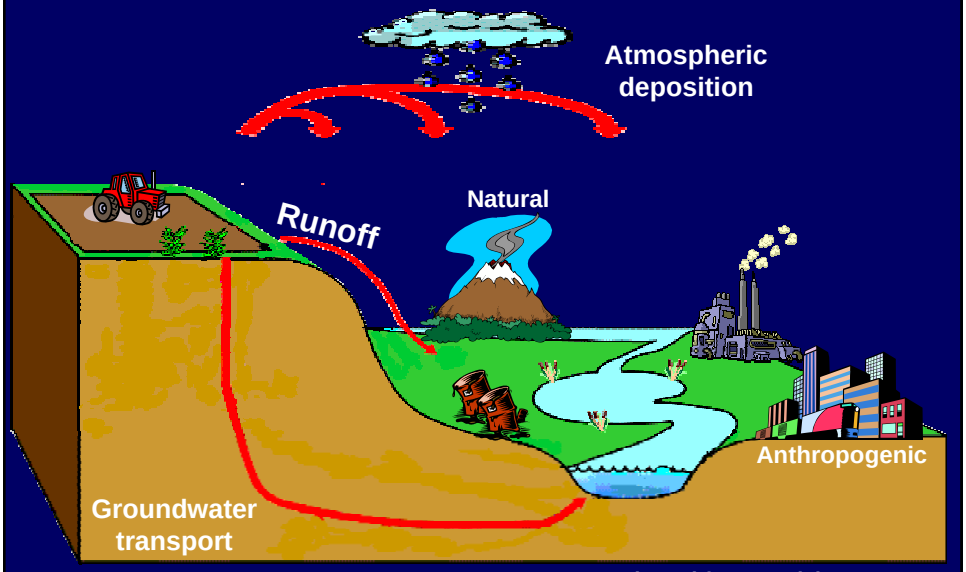
Tier I

- Purpose: determine if conclusion can be reached based on existing data
  1. Compile existing Information
  2. Exclusions
  3. Identify contaminants of concern
- Conclusions
  - Information adequate for decision
  - Information inadequate for decision

Tier I. Existing Information

- Contaminant Sources
- Pathways from Sources to Sediments
- Information Sources

Contaminant Pathways



Adapted from Danish EPA, 1998

Contaminant Sources

- Urban and agricultural runoff
- Sewer outfalls
- Industrial Effluent
- Previous dredging
- Landfill leachate
- Spills of oil or chemicals

- Superfund sites
- Air deposition
- Biological material
- Mineral deposits

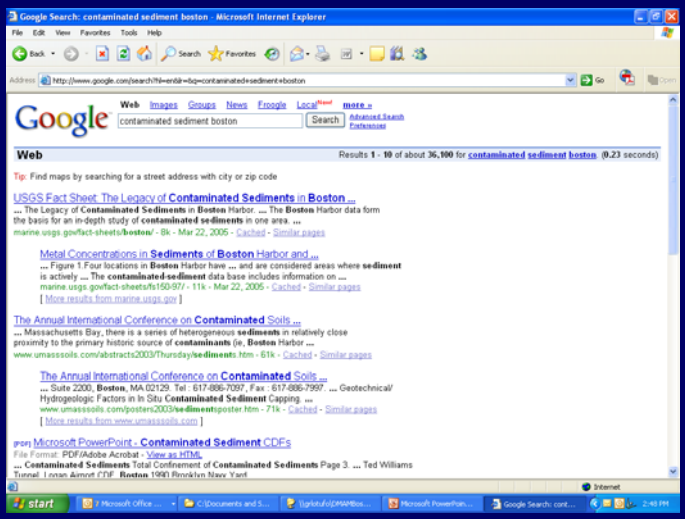
Factors Influencing Transport from Sources to Sediments

- Bathymetry
- Water current
- Tributary flows
- Sediment/soil types
- Sediment deposition
- Watershed hydrology and land uses

Information Sources

- Prior physical, chemical, and biological tests and monitoring
  - Previous permits (CWA, MPRSA evaluations)
- Files from agencies such as EPA, USACE, or State Environmental Quality Office
- Data available from public or private sources
  - University research
  - Industry monitoring

Another Information Source:



Information Sources

- **NOAA Office of Response and Restoration.** Contains information on chemical and oil spills.
  response.restoration.noaa.gov
- **EPA Envirofacts**. Provides information on air, facility information, hazardous waste, Superfund, toxic releases, water permits, drinking water contamination, microbial contamination.
  www.epa.gov/enviro
- **EPA Enviromapper**. Maps environmental information, including drinking water, toxic and air releases, hazardous waste, water discharge permits, and Superfund sites.
  www.epa.gov/enviro/html/em
- **EPA Surf Your Watershed**. Contains watershed information including chemistry data, watershed information, and toxic release information.
  www.epa.gov/surf
- **USGS Databases.** Several databases for sediment data, watershed information, and contaminant monitoring.
  www.usgs.gov

Tier I. Exclusions

- Exclusions from further testing
- Specific exclusions listed in regulations for MPRSA and CWA
- Decision made based on existing data
- Use common sense

MRRSA Exclusions
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

CWA Exclusions from Testing
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

CWA Exclusions from Testing
40 CFR 230.60

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

CWA Exclusions from Testing
40 CFR 230.60

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.

CWA Exclusions
Sections 230.60 (a), (b), (c), and (d)

230.60 (c) “adjacent to ... “ :

-Applies even if the dredged material is a carrier of contaminants

-Technologies such as capping or underwater containment are potentially applicable (40 CFR 230.72)

-Design and monitoring required

CWA Exclusions from Testing

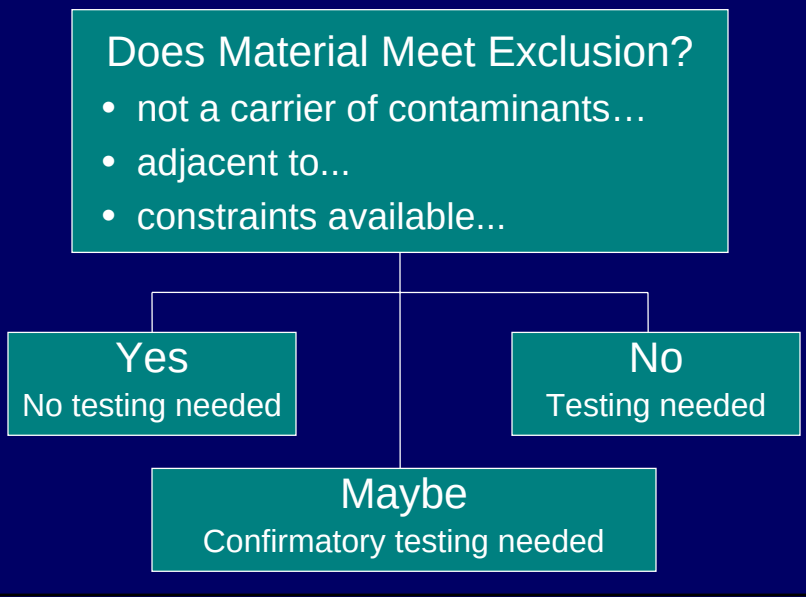
40 CFR 230.60

230.60 (d) “if constraints are available…” :

“ even a high probability that material is carrier of contaminants…“

“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…”

Tier I. Exclusions



Contaminants of Concern (COCs)

- Determine list of COCs for project
  - Identify from existing information
  - Chemical properties of contaminants
  - Regional guidance may be available
- Direct Tier II and Tier III evaluations
  - Tier II: TBP and Elutriate analysis
  - Tier III: Bioaccumulation testing

Identification of Chemical Contaminants

- Presence in sediment
- Comparison to reference material
- Chemical properties
  - Water solubility
  - Persistence
- Toxicological significance
- Propensity to bioaccumulate

Chemical Properties to Consider

- Water solubility
  - Compounds with low solubility (< 1 mg/L) are likely to be found in sediment

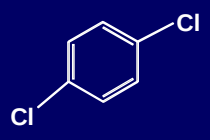
Solubility of Contaminants

PAH	0.003 ppm
DDT	0.025 ppm
Dieldrin	0.110 ppm
Cadmium	insoluble
Diazinon	68 ppm

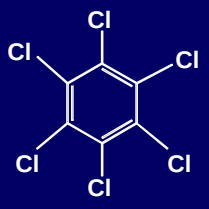
Chemical Properties to Consider

- Persistence
  - Controlled by structure of chemical stability and ability for organisms to degrade
  - Stabile compounds include:

    Metals, PCBs, Pesticides



Dichlorobenzene
Half life = 10 days



Hexachlorobenzene
Half life = 6 years

Toxicological Significance

- Toxicity is controlled by bioavailability and mechanism of chemical to cause effect
- Mechanisms of highly toxic chemicals
  - Carcinogens (PAHs)
  - Disrupt cellular function (metals, pesticides)
- Species of metal or form of chemical
  - Example, Cr^{+6} is highly toxic
    Cr^{+3} is non-toxic

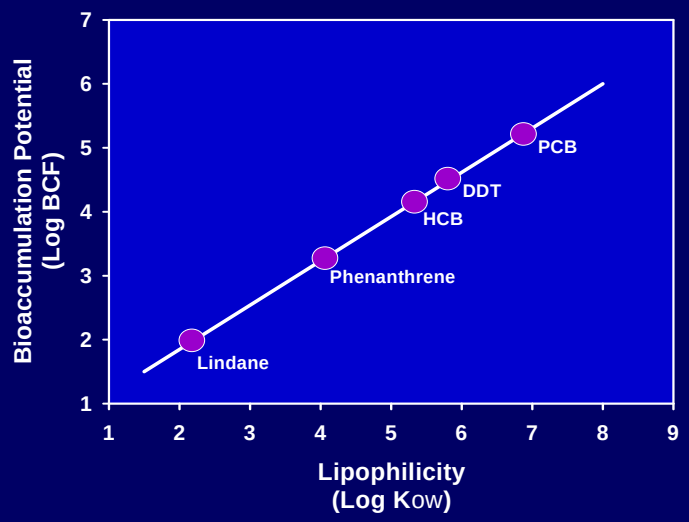
Toxicity of Chemicals to Humans

Chemical	LD_{50}
Inorganic arsenic	2 mg/kg
Organic arsenic	800 mg/kg
Dioxin	0.001 mg/kg
DDT	300 mg/kg
Benzo(a)pyrene	120 mg/kg
Aluminum	770 mg/kg

Propensity to Bioaccumulate

- Lipophillic (fat-loving) organic chemicals accumulate more than water soluble chemicals
- Non-essential metals can bioaccumulate (Cd, Methyl mercury, Lead)
- Essential metals are regulated (Zinc, Copper, Iron)

Bioaccumulation and Lipophillic Chemicals



Other Contaminants to Consider

- Microbial Contamination
  - Analysis may be required if:
    A. High levels of pathogens suspected, and
    B. Disposal is near shellfish beds, beaches, or drinking water intakes
- Radioactive Contamination
  - Analysis may be necessary if:
    A. Higher than background levels are expected
    B. Previous studies indicate concern

Tier I. Conclusions

- Possible Conclusions
  - Information Adequate for Decision
    - Material meets exclusions - no testing
    - Existing data indicates material suitable - no testing
    - Material is unsuitable without controls
    - Physical/chemical analysis may be necessary
  - Information Inadequate for Decision
    -- Proceed to Tiers II and III
- Separate conclusions can be reached for water column and benthic pathways

Tier I. Summary

- Compilation of existing information
- Exclusions from testing
- ID of Contaminants of Concern
- Decision based on existing information
- Decision to evaluate material in higher tiers (II, III, IV)