
Upland Disposal Problem Formulation and Conceptual Model Development

Trudy J. Estes

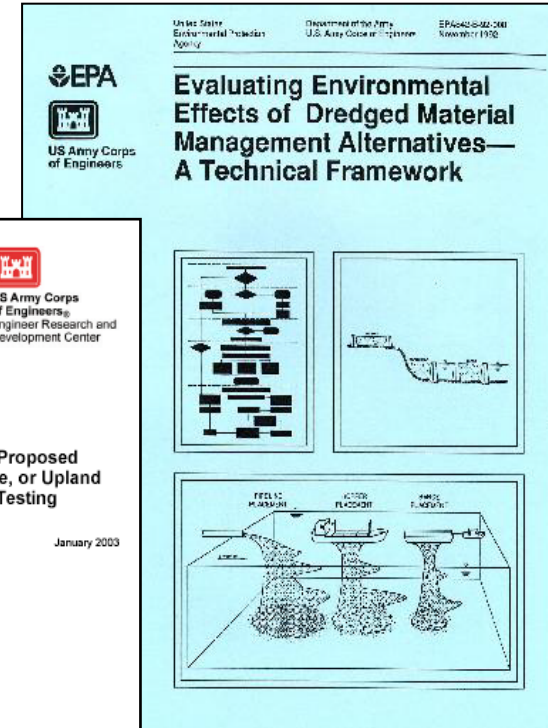
US Army ERDC, Vicksburg, MS

Email: Trudy.J.Estes@usace.army.mil



Governing Framework

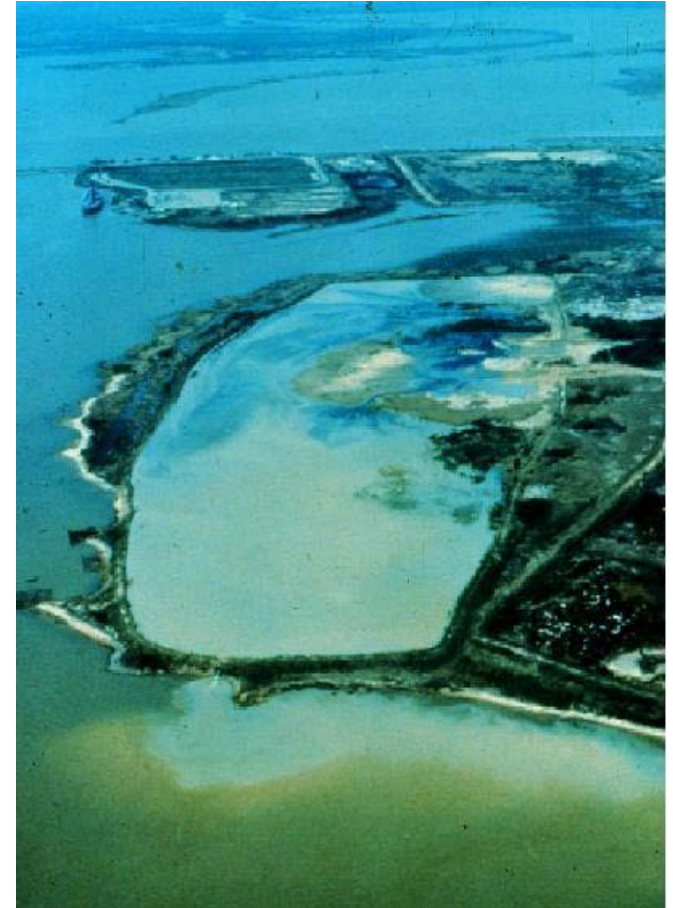
- **Regulatory**
 - **Clean Water Act (CWA)**
- **Technical**
 - **USACE/EPA Technical Framework**
 - **Upland Testing Manual (UTM)**



Clean Water Act

- **Regulatory (Section 404)**
- **Requires return flow**
 - **Trigger for RCRA Subtitle C Exclusion¹**
 - **BUT states can still choose to regulate DM as solid waste**

1 Palermo and Wilson 2000



USEPA/USACE Technical Framework

- **Guidance (not regulatory)**
- **Articulates NEPA, CWA, MPRSA requirements**
- **Alternatives screening**
 - <http://el.erdc.usace.army.mil/dots/pdfs/epa/tech-frame-rev04.pdf>
 - **Open water**
 - **Confined disposal**
 - **Beneficial use**
- **Environmental suitability**

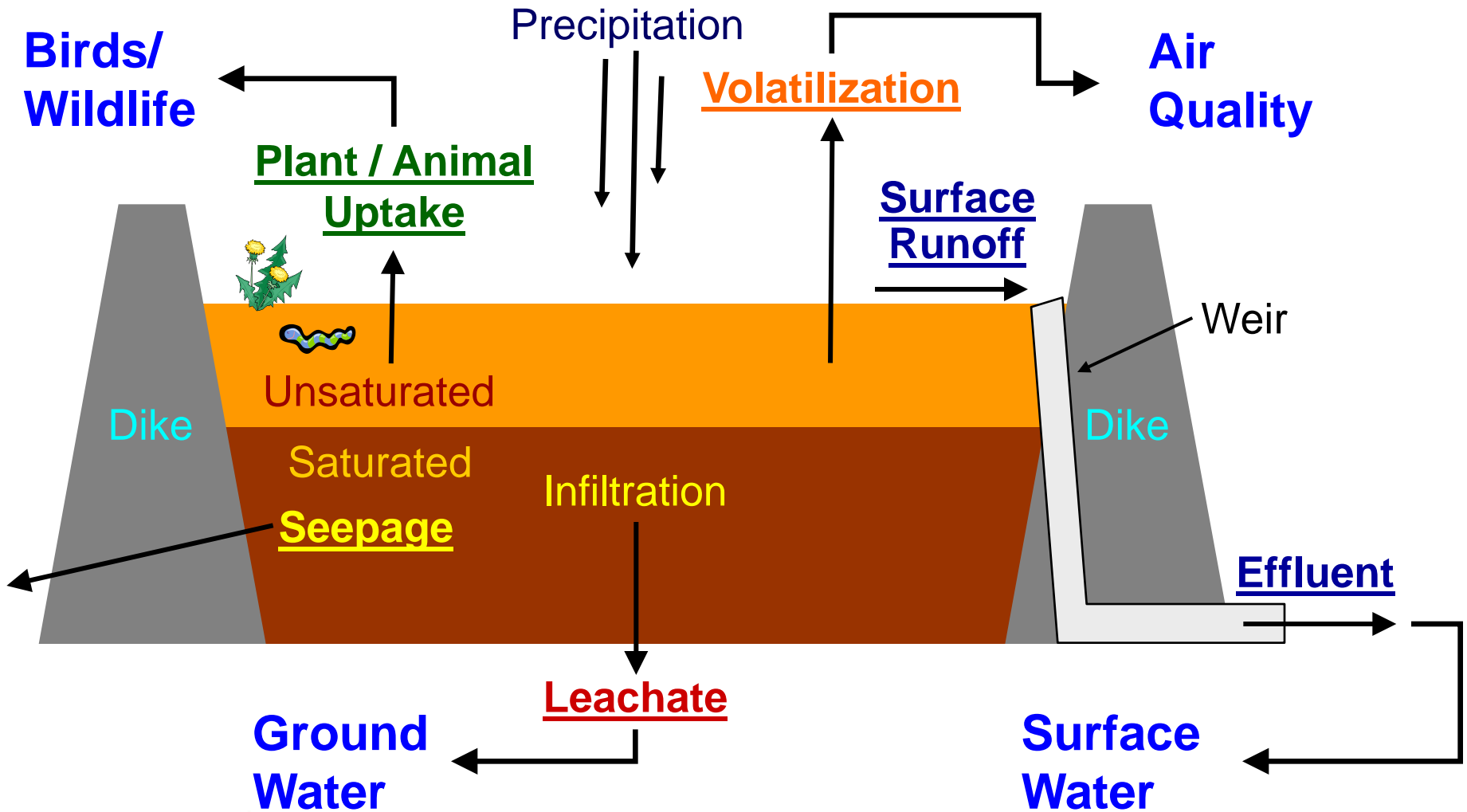


Upland Testing Manual

- **Guidance (not regulatory)**
 - <http://el.erdcl.usace.army.mil/dots/pdfs/trel03-1.pdf>
- **Concerned with contaminant exposures associated with CDFs**
- **Develop lines of evidence to support decision making**
 - **Management requirements**
 - **Need for controls**
 - **Alternatives analysis**
 - **Evaluation of risk, inform risk management**



Conceptual Model - Contaminant Pathways



CDF Pathway End Points

- **Effluent and Runoff**
 - **WQ Standards and/ or WC Toxicity after Mixing**
- **Leachate**
 - **Applicable WQ Standards after Attenuation (groundwater or surface water)**
- **Volatiles**
 - **OSHA Human Exposure Standards after Dispersion**
 - **Health Based Air Concentration for Acceptable Risk**
- **Plant and Animal Uptake**
 - **Comparison of uptake to Reference Soil**
 - **Comparison to EcoSSL's**



UTM – A Tiered Approach for Evaluations

| | |
|----------|---|
| Tier I | Existing Info |
| Tier II | Screening Evaluations |
| Tier III | Effects-Based Testing and Evaluations |
| Tier IV | Case Specific Studies/ Risk Assessment |

Complexity

Data/Effort Required

Cost



Tier I – Existing Information

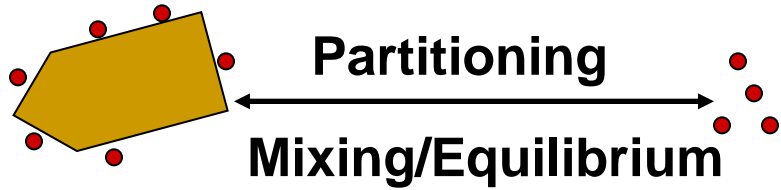
- **“Reason to believe”**
 - **Need for Pathway Evaluations**
- **Compile**
 - **Available sediment and water chemistry**
 - **Sediment physical characterization**
 - **Municipal, industrial, surface water inputs**
 - **Project info (maintenance vs. new work)**
 - **Available data from other agencies – diversity studies, tissue sampling**
- **Establish Relevant Pathways and Contaminants of Concern**



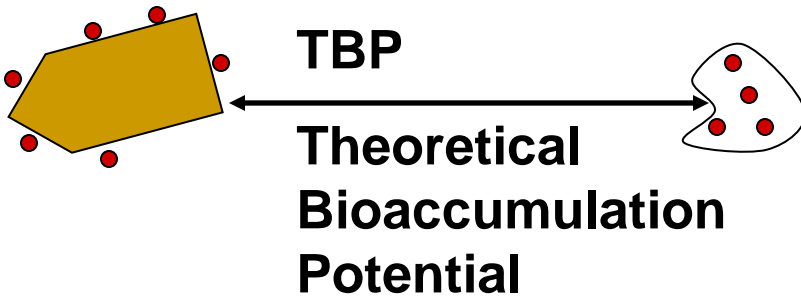
Proceed to Tier II for relevant pathways



Tier II - Screening



**Effluent; Runoff; Leachate;
Volatiles (Henry's Law)**



Animal Uptake

Plant Uptake - PUP

Diethylenetriamine-pentaacetic acid (DTPA) Extract

| Contaminants | Input | | | SCREENING CRITERIA | | | | | | | Molec Wt (g/gene) |
|--------------|---------------------------|--------------------|-----------------------|---|---|---|---|---|--|----|-------------------|
| | Actual Bulk Conc. (mg/kg) | Water Conc. (µg/l) | Back-ground CB (µg/l) | Effluent Marine Chronic Criteria (C _u) (µg/l) | Runoff Marine Chronic Criteria (C _u) (µg/l) | Leachate Marine Chronic Criteria (C _u) (µg/l) | Volatilization Reference Dose (mg/kg/day) | Plant Applicable Screening Criteria (mg/kg) | Animal Applicable Screening Criteria (mg/kg) | | |
| Aluminum | | | | 200.0000 | 200.0000 | 200.0000 | 1.40E-02 | NA | NA | 28 | |
| Antimony | 5.0000 | | | 5.0000 | 5.0000 | 5.0000 | 4.00E-04 | 37 | 21 | 12 | |
| Arsenic | 0.8800 | 36.0000 | 0.0000 | 50.0000 | 50.0000 | 50.0000 | NA | NA | NA | 7 | |
| Barium | 38.4000 | | | 2000.0000 | 2000.0000 | 2000.0000 | NA | NA | NA | 13 | |
| Beryllium | 0.6200 | | | 4.0000 | 4.0000 | 4.0000 | No data | 24 | 110 | 7 | |
| Cadmium | 1.1000 | 9.3000 | 0.0000 | 5.0000 | 5.0000 | 5.0000 | 5.00E-04 | NA | NA | 11 | |
| Chromium | 25.2000 | 50.0000 | 0.0000 | 100.0000 | 100.0000 | 100.0000 | 9.70E-07 | NA | NA | 5 | |
| Cobalt | 5.2000 | | | NA | NA | NA | NA | NA | NA | 9 | |
| Copper | 54.5000 | 3.8000 | 0.0000 | 1300.0000 | 1300.0000 | 1300.0000 | NA | NA | NA | 6 | |
| Lead | 50.8000 | 9.3000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | NA | NA | NA | 20 | |
| Mercury | 0.1500 | 0.0250 | 0.0000 | 0.2000 | 0.2000 | 0.2000 | 0.60E-05 | NA | NA | 20 | |
| Nickel | 14.5000 | 8.3000 | 0.0000 | NA | NA | NA | NA | NA | NA | 9 | |
| Phosphorus | 0.1000 | 0.0000 | 0.0000 | 0.1000 | 0.1000 | 0.1000 | NA | NA | NA | 3 | |
| Selenium | 5.0000 | 71.0000 | 0.0000 | 5.0000 | 5.0000 | 5.0000 | 1.00E-03 | 189 | NA | 7 | |
| Silver | | | | 100.0000 | 100.0000 | 100.0000 | 5.00E-03 | NA | 120 | 10 | |
| Thallium | 0.5000 | 0.5000 | 0.0000 | 5.0000 | 5.0000 | 5.0000 | 8.00E-05 | NA | NA | 20 | |
| Tin | | | | NA | NA | NA | NA | NA | NA | 11 | |
| Vanadium | 37.2000 | | | NA | NA | NA | NA | 5.42264 | NA | 9 | |
| Zinc | 143.0000 | 86.0000 | 0.0000 | 5000.0000 | 5000.0000 | 5000.0000 | NA | 13.81486 | NA | 6 | |



Tier II Outcomes

- **Definitive**
 - **WQC met with attainable dilutions/attenuation**
 - **Volatilization exposures acceptable**
 - **Plant and animal uptake levels acceptable**
- **Not definitive**
 - **Contaminants present have no WQC**
 - **Predicted dilution requirements high**
 - **Predicted exposures potentially unacceptable**
 - **Data or model inconsistency**

Resolve specific issues with Tier III Testing and Evaluations



Tier III Testing

- **Effects Based Testing and Evaluations**
 - **Physical modeling of contaminant exposure effects**
 - **Chemical and Biological Tests**
- **Models for Mixing, Attenuation, Dispersion**

Tier III test results provide data for Tier IV Risk Assessments



Tier IV Case Specific Studies

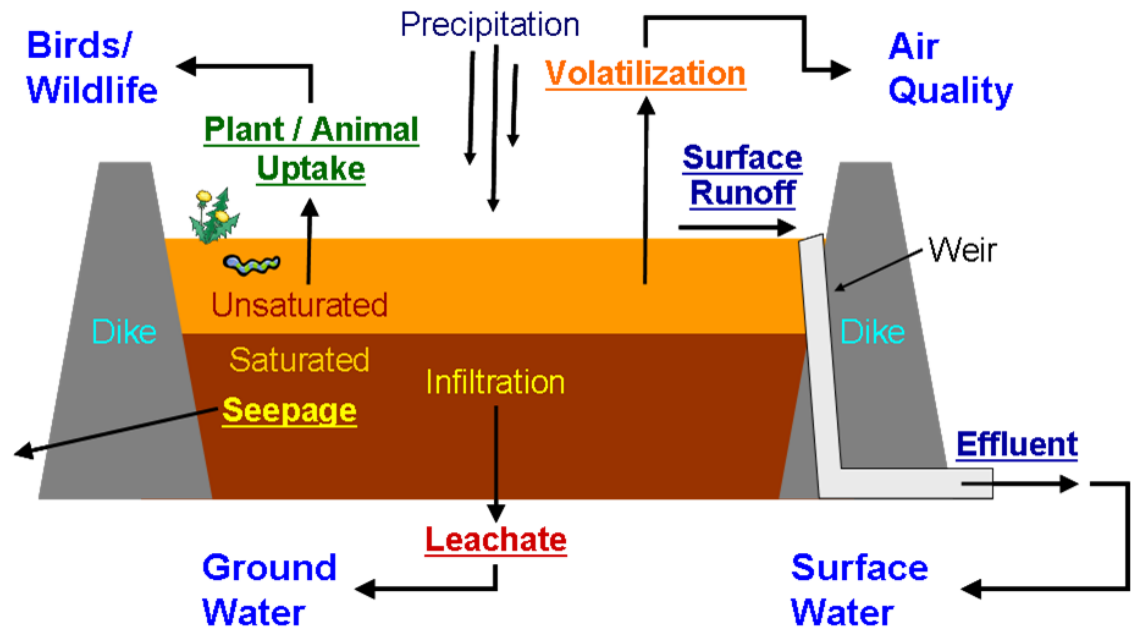
- **Formal quantitative risk assessment**
- **Addresses specific, well-defined questions**
- **Rarely necessary for navigation dredging**
- **Useful if**
 - **Contamination is substantial**
 - **Decision-making information not otherwise available**
 - **The evaluation will provide essential information**
- **Unnecessary use of resources when**
 - **Merely a refinement of Tier III**
 - **Definitive determination unchanged**



Up Next

- **Pathway Evaluations**

- **Effluent**
- **Runoff**
- **Volatilization**
- **Leachate**
- **Biological**



References

- **USEPA/USACE 2004. “Evaluating Environmental Effects of Dredged Material Management Alternatives – A Technical Framework”, EPA842-B-92-008 Revised May 2004, U.S. Environmental Protection Agency, Washington, D.C.**
- **US Army Corps of Engineers 2003. “Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities — Testing Manual”, ERDC/EL TR-03-1, Engineer Research and Development Center, Vicksburg, MS.**
- **Palermo and Wilson 2000. “Corps Of Engineers Role In Contaminated Sediment Management And Remediation”, proceedings of *Contaminated Sediments: Science, Law and Politics*, the 8th Section Fall Meeting, American Bar Associate, Section of Environment, Energy, and Resources, New Orleans, Louisiana, September 20-24, 2000, U.S. Army Engineer Research and Development Center, Waterways Experiment Station, Vicksburg, MS**

