
Upland Disposal Problem Formulation and Conceptual Model Development

Trudy J. Estes

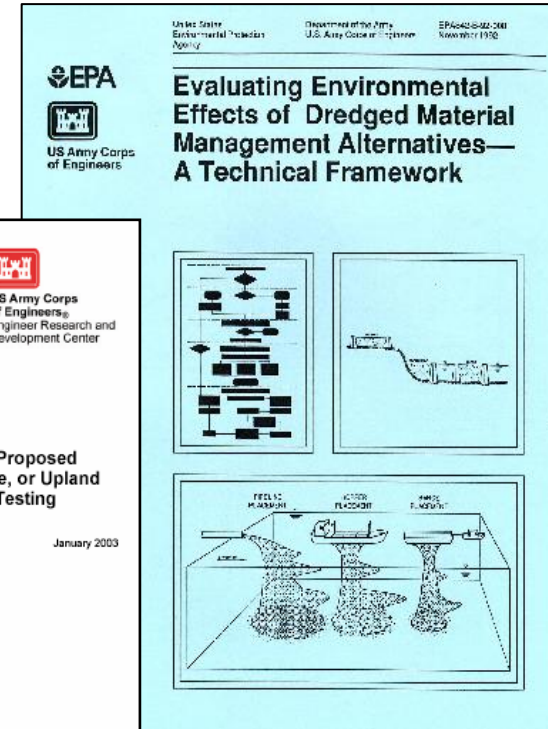
US Army ERDC, Vicksburg, MS

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



Governing Framework

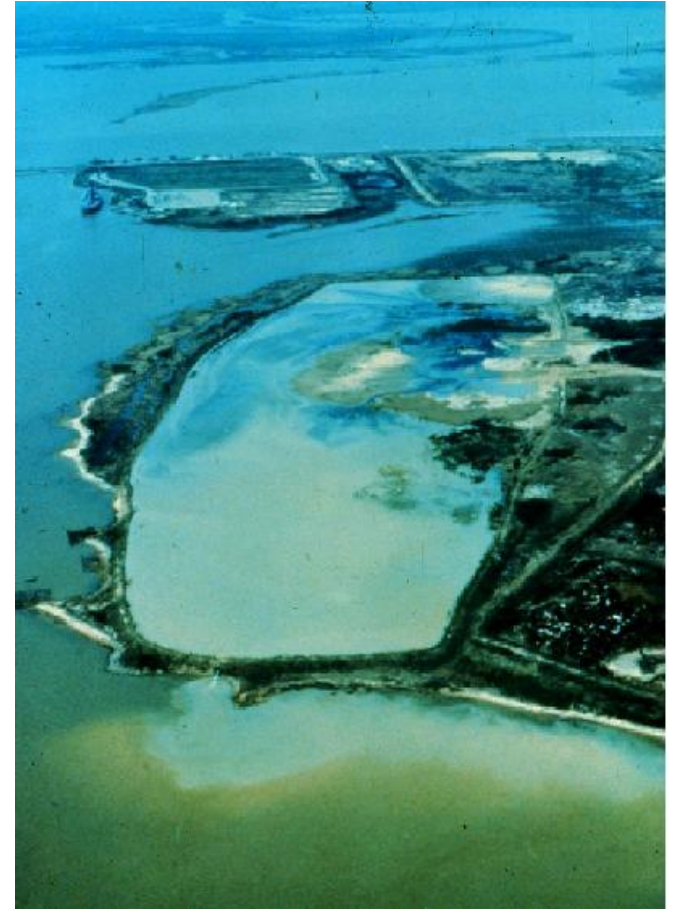
- **Regulatory**
 - **Clean Water Act (CWA)**
- **Technical**
 - **USACE/EPA Technical Framework**
 - **Upland Testing Manual (UTM)**



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**

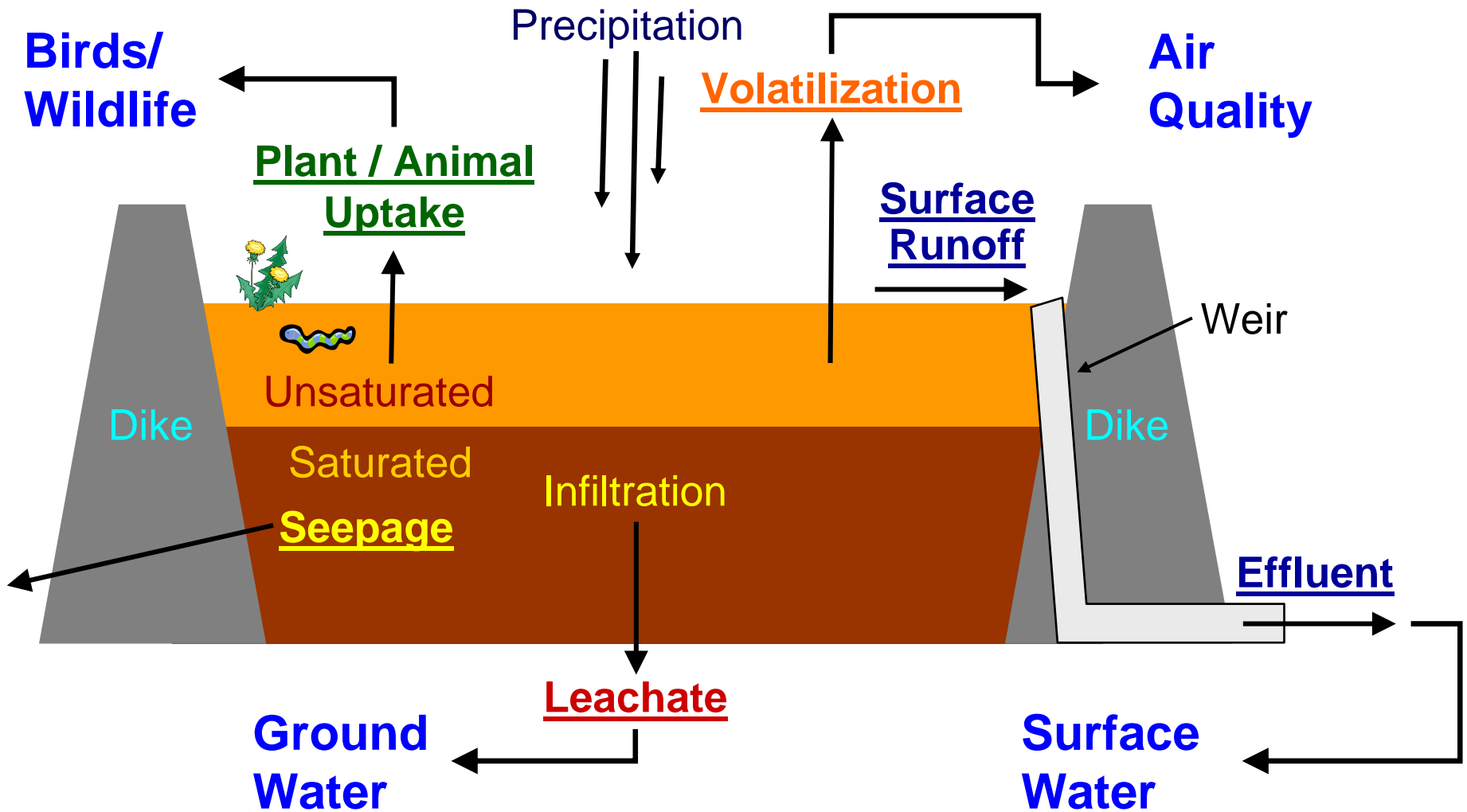


Upland Testing Manual

- **Guidance (not regulatory)**
 - <http://el.erdc.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**



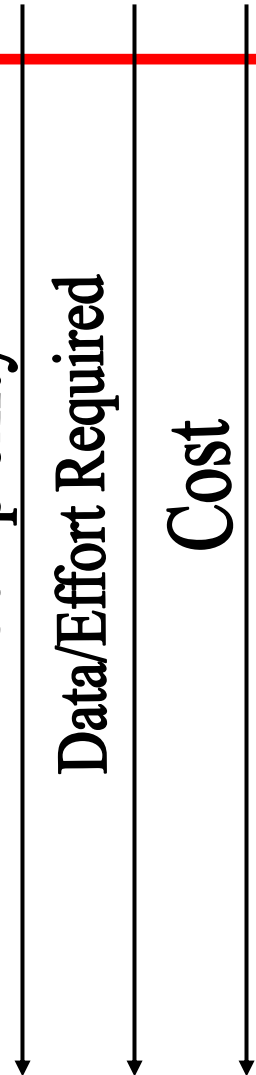
UTM – A Tiered Approach for Evaluations

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

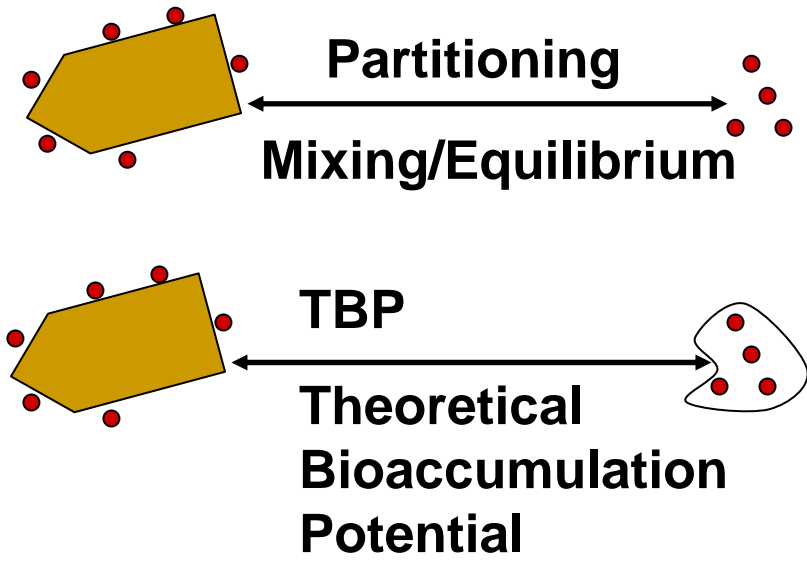
- **“Reason to believe”**
 - **Need for Pathway Evaluations**
- **Compile**
 - **Available sediment and water chemistry**
 - **Sediment physical characterization**
 - **Municipal, industrial, surface water inputs**
 - **Project info (maintenance vs. new work)**
 - **Available data from other agencies – 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

Input			SCREENING CRITERIA							
Actual Bulk Conc. (mg/kg)	Carrier Water Conc. (µg/l)	Back-ground Conc. (µg/l)	Effluent Marine Chronic Criteria (C _{em} (µg/l))	Runoff Marine Chronic Criteria (C _{rw} (µg/l))	Leachate Marine Chronic Criteria (C _{lc} (µg/l))	Volatilization Reference Dose (mg/kg-d)	Plant Applicable Screening Criteria (mg/kg)	Animal Applicable Screening Criteria (mg/kg)	Molec Weigh (µg/gene)	
Metals										
Aluminum			200.0000	200.0000	200.0000	1.40E-02	NA	NA	29	
Antimony	5.0000		5.0000	5.0000	5.0000	4.00E-04	37	21	12	
Arsenic	0.8000	36.0000	0.0000	50.0000	50.0000	NA	NA	NA	7	
Barium	39.4000			2000.0000	2000.0000	NA	NA	NA	13	
Beryllium	0.6200			4.0000	4.0000	4.0000	NA	24	110	
Cadmium	1.1000	9.3000	0.0000	5.0000	5.0000	5.0000	NA	21	11	
Chromium	25.2000	50.0000	0.0000	100.0000	100.0000	9.70E-07	NA	NA	5	
Cobalt	5.2000			NA	NA	NA	NA	NA	9	
Copper	54.5000	3.0000	0.0000	1300.0000	1300.0000	1300.0000	NA	NA	6	
Lead	50.6000	9.2000	0.0000	0.0000	0.0000	0.0000	NA	NA	20	
Mercury	0.1500	0.0250	0.0000	0.2000	0.2000	0.2000	0.60E-05	NA	20	
Nickel	14.5000	8.3000	0.0000	NA	NA	NA	NA	NA	9	
Phosphorus	0.1000	0.0000	0.0000	0.1000	0.1000	NA	NA	NA	3	
Selenium	5.0000	71.0000	0.0000	5.0000	5.0000	1.00E-03	109	NA	7	
Silver				100.0000	100.0000	100.0000	5.00E-03	NA	120	
Thallium	0.5000	0.5000	0.0000	0.5000	0.5000	0.5000	NA	NA	20	
Tin				NA	NA	NA	NA	NA	11	
Vanadium	37.2000			NA	NA	NA	5.42264	NA	9	
Zinc	143.0000	86.0000	0.0000	5000.0000	5000.0000	5000.0000	NA	13.81486	NA	
PAHs										
	15000	0.0000	0.0000	NA	NA	NA	NA	NA	15	



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

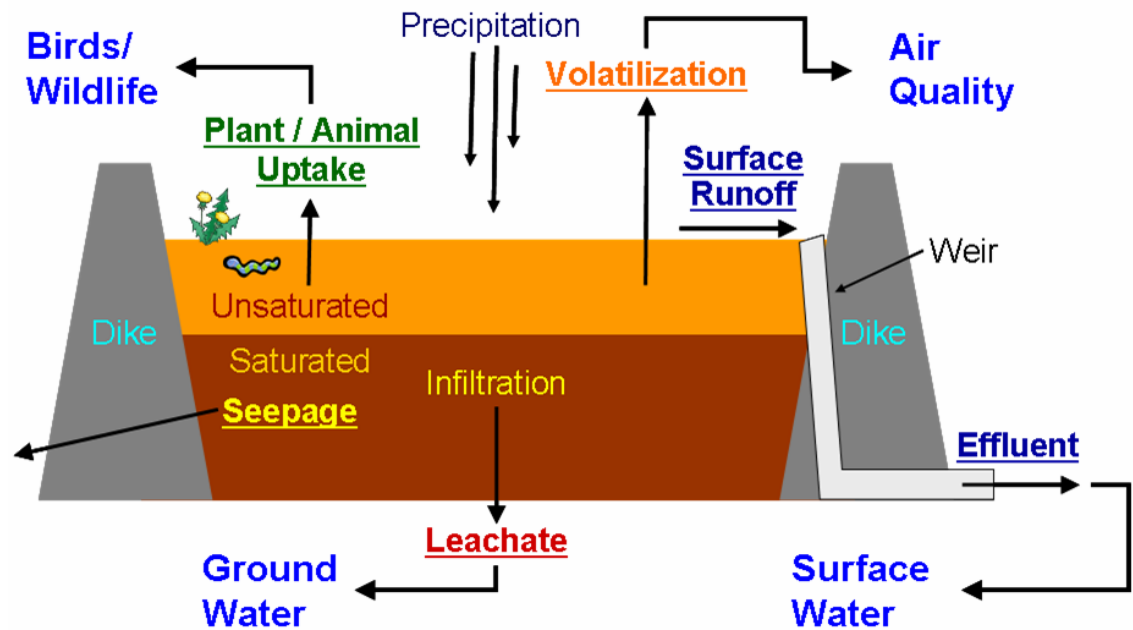
- **Formal quantitative risk assessment**
- **Addresses specific, well-defined questions**
- **Rarely necessary for navigation dredging**
- **Useful if**
 - **Contamination is substantial**
 - **Decision-making information not otherwise available**
 - **The evaluation will provide essential information**
- **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**

