DOER Risk Focus Area

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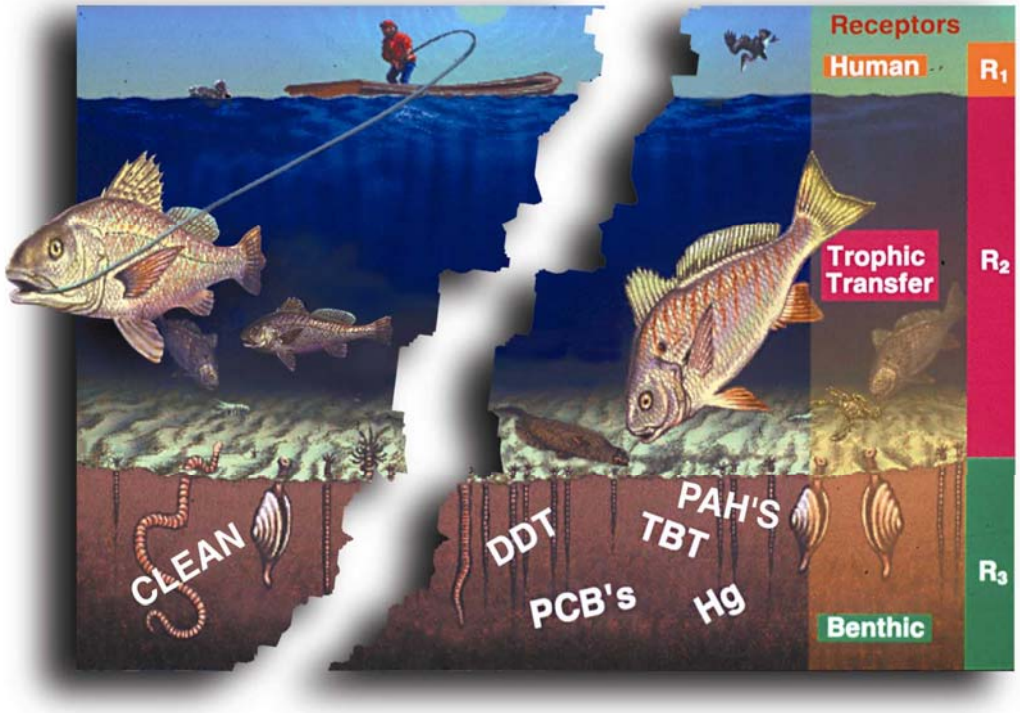


Dredging Operations Environmental Research

- Environmental issues pose constraints and opportunities for dredging operations and the navigation program
- Risk-based assessment and management has become accepted basis for decision-making
- Cost and time pressures on dredging operations present significant challenges
- Maintain and enhance corporate expertise and know-how
- Engineering and science innovation and technology transfer are the keys to success

The Goal of DOER

Support sound environmental management and engineering practice by advancing the science and technology applied to navigation dredging operations

DOER
- Focus Areas -

- Risk
- Environmental Resource Protection
- Operations Technologies
- Dredged Material Management

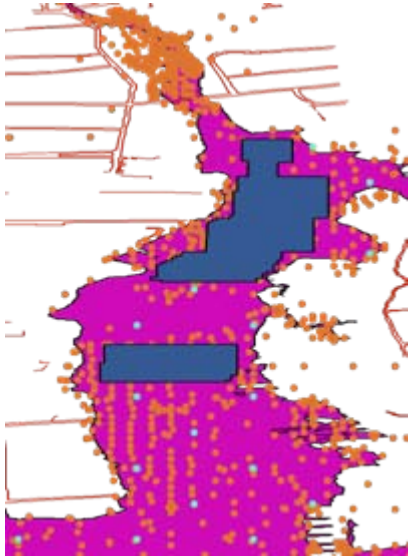
(Finite term projects, e.g. 1-3 years in length, structured to respond to national priorities in the navigation program through interaction with the field and HQ)

Risk Focus Area

- **Situation**: USACE Districts are increasingly challenged to define the environmental risks and uncertainties posed by dredging and managing contaminated sediment
- **Barriers**: Lack of fundamental descriptors for key processes controlling contaminant F&T and limitations on the ability to integrate this information in a timely fashion to make credible, risk-informed decisions that will withstand regulatory scrutiny
- **Solution**: Improve the scientific understanding of the processes contributing to risks associated with navigation dredging operations.
  - Develop a suite of peer-reviewed process models, risk models and decision analysis tools to support decisions based on a more comprehensive understanding of risk and uncertainties.

FY09 RISK Products
High-Fidelity Contaminant Fate/Transport Model

- Problem/Purpose
  - Questions regarding fate and effects of in-place contaminated sediments.
  - Questions regarding fate and effects of contaminated sediments resuspended during dredging



New Bedford Harbor

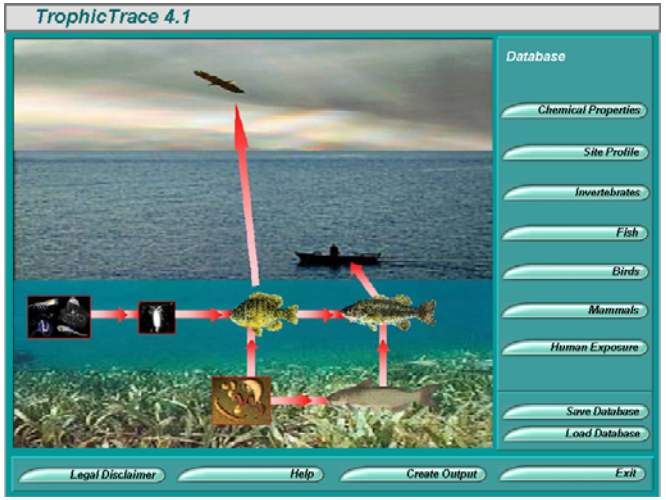
- Solution/Approach
  - Need a predictive model that can act over wide range of spatial and temporal scales
  - Build on existing CE-QUAL-ICM and SEDZLJ models

- Products
  - Computer code in which SEDZLJ interacts with ICM
  - TR “Incorporation of Sediment Transport into ICM”
  - Coordination with FEDSEDS

FY09 RISK Products
Improved Contaminant Bioaccumulation & Exposure Modeling

- Problem/Purpose
  - Bioaccumulation models are widely used for sediment management
  - Bioaccumulation models are very uncertain
  - Comprehensive sensitivity/uncertainty analyses have not been implemented

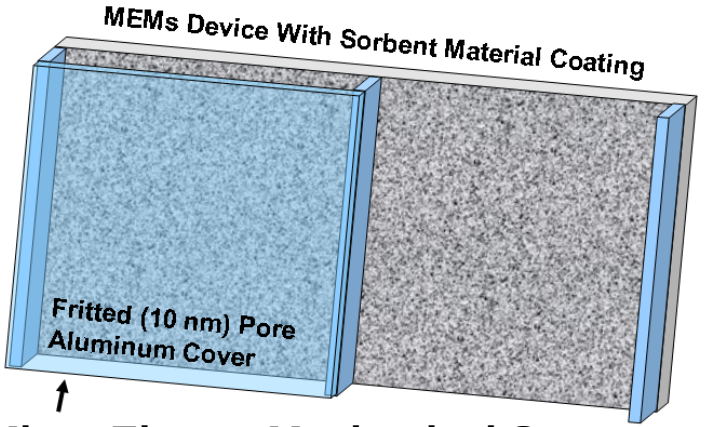
- Comprehensive Uncertainty analysis and Software Development
  - Review of uncertainty associated with bioaccumulation models
    - State of Application
    - Model Assumption
  - Sensitivity analysis of FISHRAND Model
  - Implementation of TrophicTrace model using web-based platform



- Products
  - 3 peer-reviewed publications
    - Uncertainty in application
    - FISHRAND Sensitivity
    - Method and model Uncertainty
  - TrophicTrace Software implemented in web-based platform

FY09 RISK Products
Biotech Methods for Contaminant Analysis

- Problem/Purpose
  - Quantifying the bioavailability of contaminants in sediment is critical for risk assessment of DM
  - Rely on the use of laboratory bioassays and analytical chemistry
  - Advances in material science enable new tool for DM evaluation



Micro Electro Mechanical Structure (MEMS)

- Solution/Approach
  - Examine use of a silicon wafer-based surrogate device designed to assess bioavailable contaminants in sediment
  - Coupling the contaminant sampling using the device to techniques relevant to sediment risk assessment

- Products
  - Prototype device for sediment sampling of hydrophobic organics.
  - Journal article: "MEMs devices to assess bioavailability of hydrophobic compounds"

FY09 RISK Products

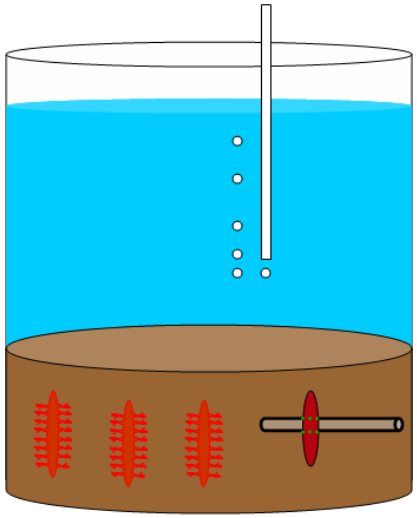
Development of a Sediment Bioaccumulation Test using the Amphipod *Leptocheirus plumulosus*

- Problem/Purpose
  - Standard bioaccumulation tests are expensive and labor intensive
  - Some test species fail to reach steady state requiring the use of multipliers
  - Due to biotransformation, some traditionally utilized species are poor indicators of bioaccumulation of PAHs

- Solution/Approach
  - Evaluate the use of *L. plumulosus* as a sediment bioaccumulation test species
  - Develop a standard sediment bioaccumulation protocol for *L. plumulosus*
  - Compare test responsiveness to standard bioaccumulation test methods
- Products
  - TN/JA-Development of a Bioaccumulation Test Method with the Amphipod *Leptocheirus plumulosus*

FY09 RISK Products
Surrogate Devices for Assessing the Bioavailability of Organic Compounds in DM

- Problem/Purpose
  - Traditional approaches use lengthy and costly kinetics and long-term bioaccumulation laboratory exposures.
  - Confounding factors (e.g., black carbon) and metabolism, availability and health of test organism precludes the derivation of accurate bioaccumulation data.



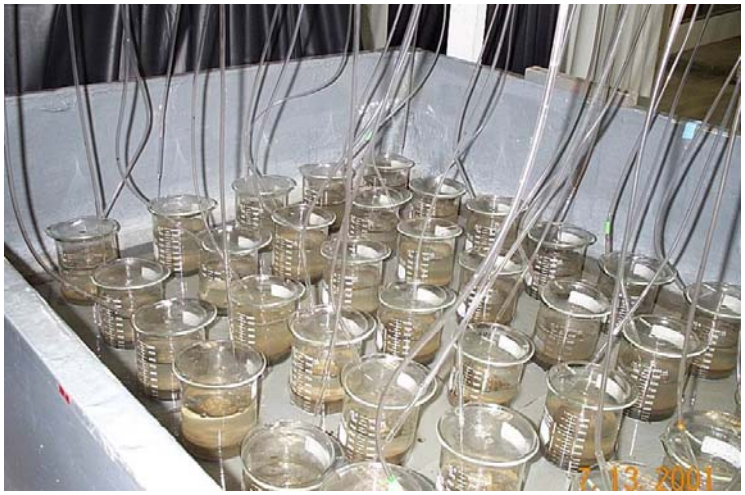
- Solution/Approach
  - Evaluate the use of optimal conditions to use SPMEs in laboratory sediment exposures.
  - Evaluate the correlation between sorption to SPME and steady-state bioaccumulation of hydrophobic organic compounds.
  - Assess the feasibility of using SPME for routine bioaccumulation potential of dredged materials

- Products
  - TN - SPME-based methods to measure bioavailability in laboratory sediment assays.
  - JA/TN - The use of SPME to predict bioaccumulation of PAHs by benthic invertebrates.
  - JA/TN - The use of SPME to predict bioaccumulation of hydrophobic chlorinated compounds by benthic invertebrates.

FY09 RISK Products

Linking Toxicity Identification Evaluation and Tissue-Residue Evaluation to Assess Mixture Effects

- Problem/Purpose
  - Current sediment testing provides a go/no-go binary characterization for management decision making
  - Bioavailability, toxicity and bioaccumulation are not adequately linked to establish cause-effect relationships
  - Understanding the relationship between bioavailability, toxicity and bioaccumulation would provide a significant linkage for lines of evidence in a dredged material evaluation



- Solution/Approach
  - Use the TIE approach to determine bioavailability and toxicity of chemical mixtures
  - Establish critical body residue levels for chemical mixtures using amendment gradients
  - Determine the relationship between bioavailability/toxicity and bioaccumulation

- Products
  - TN/JA- Use of TIEs in a weight of evidence approach for dredge material evaluations

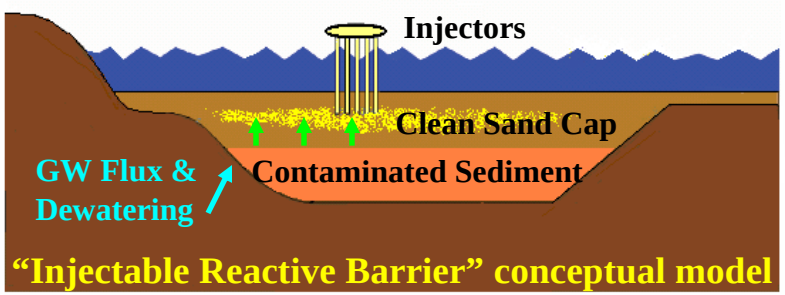
FY09 Risk Products
Sediment Treatment Technologies

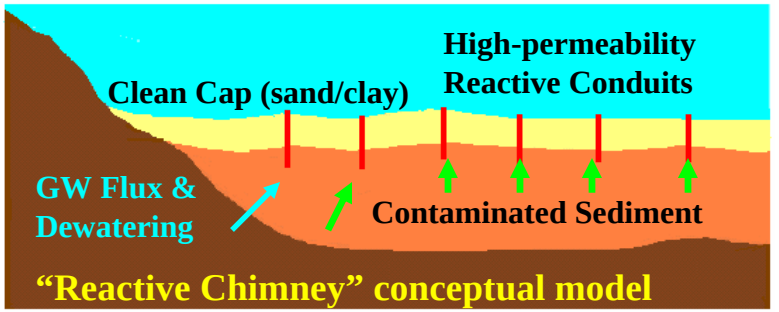
- Problem/Purpose
  - Contaminant impediments to DM as “resource”
  - Slow commercialization of effective and economic sediment treatments
  - Evaluate state of the art treatments, effectiveness, cost & obstacles to use

- Solution/Approach
  - Review technology development literature & documentation
  - In depth evaluation and technical verification of “near-commercial” technologies
  - Establish uniform technology and cost evaluation basis for PMs
- Products
  - TR – Overview of …Sediment Remediation Technologies
  - JA – State of the Art of Sediment Remediation Technologies
  - JA – Template for Evaluation of Sediment Treatment Technologies

FY09 RISK Products
Reactive Barrier & Cap Design

- Problem/Purpose
  - Unamended permeable caps may be ineffective over mobile contaminants and porewater flux
  - Impermeable caps are vulnerable to bypass or gas rupture
- Solution/Approach
  - Develop alternative cap designs
  - Permeable reactive chimneys/caissons
  - Additive within permeable cap (dispersed or layer)
  - Achieve *via* experimental & numerical assessments

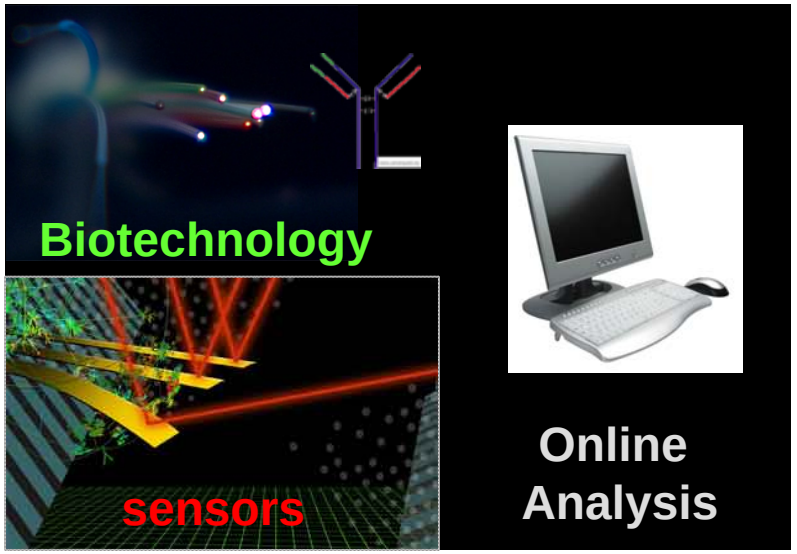




- Products
  - FY09: TN review of reactive cap applications
  - FY10: JA/TN on alternative additive placements
  - FY11: JA/TN on stability of contaminant retention

FY10 RISK Projects
Contaminant Risk Characterization Tools

- Problem/Purpose
  - Current tools are low resolution/expensive for contaminant assessment
  - Project converges advances in material sciences and technology to enhance contaminant assessment
- Solution/Approach
  - Technology based approaches (POM, DGT, SPME) for bioavailability
  - Biotechnology approaches for toxicity assessment
  - Integrated online sediment evaluation tools



- Planned Products FY10
  - Demo of bioavailability SPME fibers
  - Cantilever sensors for contaminant analysis
  - Online integration and centralization of statistical analysis tools

FY10 RISK Projects
Risk-Based Guidance for CDF Reclamation

- Problem/Purpose
  - Diminishing CDF Capacity
  - Need CDF sampling protocols tailored for recovery & BU application
  - Require risk-based criteria and appropriate testing and assessment protocols for BU application

- Solution/Approach
  - Tools to develop sampling plans for characterization
  - Risk-based criteria for beneficial use applications
  - Testing as assessment protocols for beneficial use applications

- Products
  - TN: Issues in Implementation of CDF Characterization Protocol
  - JA: Development of Contaminant Criteria for Beneficial Use of Dredged Material
  - TR: CDF Characterization – Preliminary Strategy, Sampling and Compositing Protocol

FY10 RISK Projects
Risk-Informed Decision Making for the Navigation Program

- Problem/Purpose
  - PMs must justify actions in terms of risk reduction benefits
  - Requires risk mgmt while balancing multiple objectives
  - Develop RIDM approach to address this need
- Solution/Approach
  - Analyze uncertainty used to estimate dredging requirements in navigation channels
  - Develop methods assessing the reliability of current infrastructure
  - Develop risk assessments and a risk-informed framework for navigation decisions

- Planned Products
  - FY10:Schedule workshops; ID infrastructure failure modes
  - FY11:TN; uncertainty and risk analysis; develop framework
  - FY12: finalize models and framework; write JAs

Your Input

- What needs do you see in these areas:
  - Exposure assessment and modeling
  - Assessing effects of exposure
  - Characterizing risks
  - Managing risks