Adaptive Management at Contaminated Sediment Sites

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THE FOLLOWING PRESENTATION HAS BEEN APPROVED FOR APPROPRIATE AUDIENCES

INFORMATION IN THIS PRESENTATION IS BASED ON REAL SITES AND EVENTS, BUT IDENTITIES HAVE BEEN ALTERED OR CONCEALED FOR THEIR/MY/OUR PROTECTION

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<th>PROFESSIONALS STRONGLY ENCOURAGED</th>
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<td>SOME MATERIAL MAY BE EXCEEDingly Boring to CHILDREN UNDER (OR OVER) 13</td>
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<td>CONTAINS SCENES OF INTENSE ADAPTIVE MANAGEMENT</td>
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Adaptive Management – General Concept

“Acting where you have sufficient certainty to make decisions, and where you do not have sufficient certainty, collecting more information to reduce uncertainty and support making appropriate decisions later”

- a great mind at EPA circa March 2019
Adaptive Management – Recent Developments

• May 2017 Prioritizing the Superfund Program
• July 2017 Superfund Task Force Recommendations
• July 2018 Superfund Task Force Recommendation #3: Broaden the Use of Adaptive Management [OLEM 9200.3-120]
  • Formal and systematic management approach centered on rigorous planning and a firm understanding of site conditions
  • Continuous re-evaluation and prioritization of activities to account for new information and changing conditions
  • Structured and continuous planning, implementation, and assessment process
  • Management and resource decisions directed towards incrementally reducing uncertainty while supporting site progress
• October 2018 Adaptive Management Task Force presentation
• December 2018 Pilot Study site selection
  • [https://www.epa.gov/superfund/superfund-task-force-accomplishments#six](https://www.epa.gov/superfund/superfund-task-force-accomplishments#six)
Adaptive Management – What it IS NOT

RI → FS → RD → RA → O&M

Managing Unforeseen Field Conditions

Kicking the Can Down the Road
A Story of Adaptive Management Success

- Urban industrialized riverine setting
- Contaminated with organic and inorganic chemicals from historical manufacturing operations
- Complex geomorphological and hydrodynamic system with large catchment area
- Extensively investigated since the 1980s
  - Sediment, surface water, tissue, hydrodynamics
Adaptive Management Success at the Site Level

**Investigation**
- RI
- HHRA/ERA
- Models

**Source Control IR**
- IR FS
- IR PP/ROD
- IR PDI
- IR RD

**Monitoring**
- Baseline
- Post-IR Confirmation
- LTM
- Model Refinement and Projections

**Final Remedy**
- FS
- PP/ROD
- RD

**PLAN**
- ADJUST
- DO
- LEARN
- EVALUATE

**DO**
- ADJUST
- LEARN
- EVALUATE

**EVALUATE**
- ADJUST
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Adaptive Management Success at the Site Level

• Derivation of Remedy Footprint
  • Use current information for IR FS, recognizing and assessing uncertainties
  • Develop decision framework to determine needs for PDI
    • Reduce uncertainties in SWACs
    • Reduce footprint targeting errors
  • Develop decision framework for establishing RD footprint to attain RAOs, incorporating new information (including PDI)
    • Application of RAOs
    • Selection of RALs
    • Identification of erosional areas
    • Treatment of residuals

Source Control IR

• IR FS
• IR PP/ROD
• PDI
• IR RD
Adaptive Management Success at the Site Level

• Use of Monitoring Data
  • Implement baseline monitoring and LTM to facilitate evaluation of the IR and any final action
    • Reduce overall uncertainties
  • Develop decision framework to determine compliance with IR RAOs
    • Statistical assessment of post-IR data
    • Potential additional source removal action
  • Refine project models and develop new model projections of system recovery

Monitoring
  • Baseline
  • Post-IR Confirmation
  • LTM
  • Model Refinements and Projections
Adaptive Management Success at the Site Level

• Application of Final Cleanup
  • Comprehensively evaluate new information
    • Further characterize site
    • Update CSM, if necessary
    • Recharacterize, and possibly reassess, risks
  • Derive final RGs
    • Assess post-IR data to confirm COCs
  • Evaluate projections of recovery from refined models
  • Select and implement final remedy to achieve final RAOs in an appropriate timeframe

Final Remedy

• FS
• PP/ROD
• RD
Sources of Success

• Selling the Benefits
  • Reduction of source concentrations followed by final remedy

• Stakeholder Engagement
  • Coordinated, team-based project approach
  • EPA, partner agencies, responsible parties, and contractors working together
  • Community involvement

• Face Time
  • Regular project team and community meetings

• Structuring Decisions
  • Seeking consensus
  • Identifying critical decision points and interim milestones
  • Memorializing decisions and decision frameworks in a formalized manner
A Story of Lost Adaptive Management Opportunity

- Sheltered embayment with direct connection to marine environment
- Contaminated with organic and inorganic chemicals from historical discharges
- Investigated beginning in early 1990s
- Remediated in mid 2000s
Lost Adaptive Management Opportunity at the Site Level

• Firewalled implementation of project phases
Lost Adaptive Management Opportunity at the Project Level

• RD
  • Uncertainties acknowledged...
    • Relatively sparse characterization data = relatively uncertain remedy footprint
    • Ongoing adjacent projects = uncertain project footprint and sequencing
    • Loose definition of remedy completion = uncertain exit strategy
  • ...but mechanisms and strategies to reduce uncertainties largely absent
    • Generally performance endpoint basis
Lost Adaptive Management Opportunity at the Project Level

• RAWP-RA
  • Numerous tasks complicated and delayed due to...*gathering new information*
    • Site setup
    • Initial dredging activities
    • Debris
    • Ecology
    • Dewatering and water treatment
    • Sediment screening and characterization
    • Post-dredge confirmatory sampling
    • Site restoration
Sources of Lost Opportunity

• Multiple site authorities
  • Including contractor over contractor

• Highly disaggregated stakeholder engagement
  • Client, regulators, contractor, community
  • Major stakeholder left out until RA stage

• Rigid contracting mechanism

• Fundamentally, no allowance for adaptive management processes
Takeaways

• Adaptive management can be highly effective for complex sites

• Success of adaptive management is predicated on the ability and willingness to incorporate key principles
  • Give appropriate weight to certainty and uncertainty
  • Allocate decisions and resources around current certainty and gather information to improve future certainty
  • Formalize the processes for utilizing existing and new information

• Ability to effectively apply adaptive management relies on
  • Stakeholder participation
  • Contracting mechanisms
THANK YOU!

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