Monitoring

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Training Objectives

- Learn general monitoring principles and considerations and monitoring components for environmental dredging,
- Become familiar with monitoring tools and techniques commonly used,
- Identify components of a monitoring and management plan

ED Monitoring Outline

- Monitoring Principles /General Considerations
- Monitoring Objectives for ED
- Tools and Techniques
- Monitoring and Management Plans

Why Monitor?

- To measure success
  - Remedy Effectiveness (cleanup levels)
  - Risk Reduction
- To determine compliance with ARARs
  - Water quality standards (resuspension, release)
  - Air quality concerns (release)
- To learn something (as with a pilot)

What do we monitor?

- Removal
- Resuspension
- Release
- Residual

General Monitoring Considerations

- Compatibility with Guidance
  - EPA Monitoring Guidance (OSWER) Directive 9355.4-28
  - EPA Monitoring Fact Sheets (underway)
  - Six-Step Process
- QA/QC via approved SOW/ Quality Assurance Plan process

ED Monitoring Objectives

- Confirm that contaminated material is removed
- Determine compliance with CULs
- Determine compliance with ARARs regarding resuspension/ releases

ED Monitoring Tools/ Techniques

- Bathymetry/ Volume Measurements
- Plume dimensions via ADCP and similar tools
- Turbidity/TSS and WC Chemistry sampling
- Sediment chemistry in post-dredging samples for undredged inventory and residuals

(Note that these partially overlap with site and sediment characterization)

Monitoring Plans - Six-Step Process

1. Identify monitoring plan objectives;
2. Develop monitoring plan hypotheses;
3. Formulate monitoring decision rules;
4. Design the monitoring plan;
5. Conduct monitoring analyses and characterize results; and,
6. Establish the management decision.

Success = Meeting Goals

- All cleanup decisions should be RISK-BASED
- There is a hierarchy of goals: RAOs>RGs>CULs
- Remedial Action Objectives (RAOs)
  - e.g., reduction in cancer risk to fish consumers
- Remediation Goals (RGs)
  - e.g, achieve a specified fish tissue level
- Cleanup Levels (CULs)
  - Chemical specific cleanup levels
  - Consider uncertainty, exposure, remedy feasibility
  - Should be tied to risk reduction and are considered a surrogate for RGs and RAOs.

Success = Meeting Goals

More on the hierarchy of RAOs/RGs/CULs:

- Depend on one another
- Represent a continuum from scoping to remedy selection
- CULs should be tied to risk management goals
- Meeting CULs is more direct (easier) than meeting RGs and RAOs
- CULs are met short term; RGs and RAOs are met in the long term
- If properly structured, meeting CULs will result in meeting RGs and RAOs

Levels of Remediation Success

- Remedy Effectiveness Success
  - If CULs are met and maintained, the remedy is effective
  - Depends on viability of design, operations, and construction (engineering)
- Risk Reduction Success
  - If RGs and RAOs are met, the desired risk reduction is achieved
  - Depends on validity of food chain modeling, toxicity data, species diversity data, etc. (biological/ toxicological)
- Monitoring can be categorized in a similar fashion
  - Remedy Effectiveness Monitoring (specific to the remedy approach, e.g., dredging vs. capping)
  - Risk Reduction Monitoring (this is similar for all remedy approaches)

ED Monitoring Categories

- Production and Project Duration
- Resuspension, Transport, and Release
- Dredging Effectiveness (Residuals)

Production (Removal) Monitoring Approaches

- Determine if intended sediment volume is removed
- Determine if goals for production rates and duration of project are met

Production (Removal) Monitoring Tools/ Techniques

- Bathymetric surveys
  - Compare pre and post dredging surveys
  - Determine progress over time

Production (Removal) - Management Actions

- Multiple dredges
- Larger dredges

(Note that this may conflict with other objectives)

Resuspension/ Release Monitoring Approaches

- Water Column
  - Near Field vs. Far Field (differing points of compliance)
  - Impact of dredging alone and effectiveness of controls
  - Stationary or towed instruments for real time feedback
  - Water Column sampling for compliance
  - "Upstream" and "downstream" stations for comparison to background and WC standards

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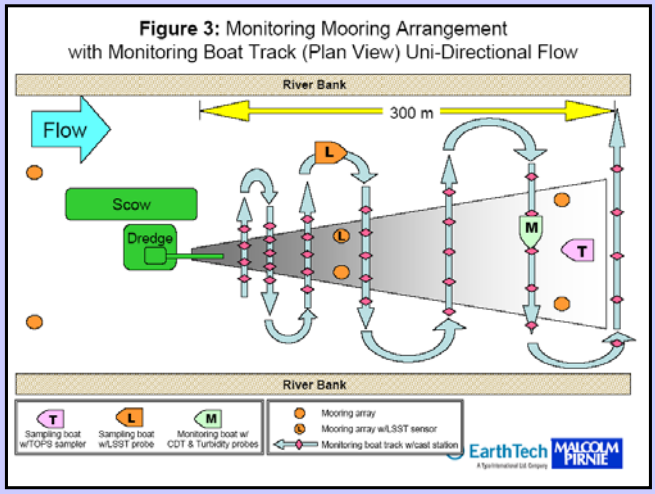
Resuspension/ Release Monitoring Approaches

- Air
  - Focus on near field exposures
  - Comparison with air-quality limits
  - Stationary instruments for real time feedback

Resuspension/ Release - Monitoring Tools/ Techniques

- Measure turbidity (real time feedback)
- Turbidity a surrogate for TSS (site specific)
- Measure WC TSS and chemistry (analytical requires time)
- Dissolved and Total concentrations of COCs
- Direct measurements of air quality

Resuspension/ Release - Monitoring Tools/ Techniques



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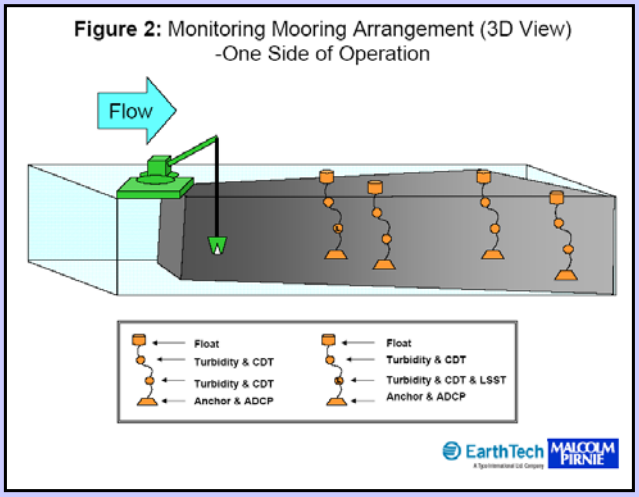
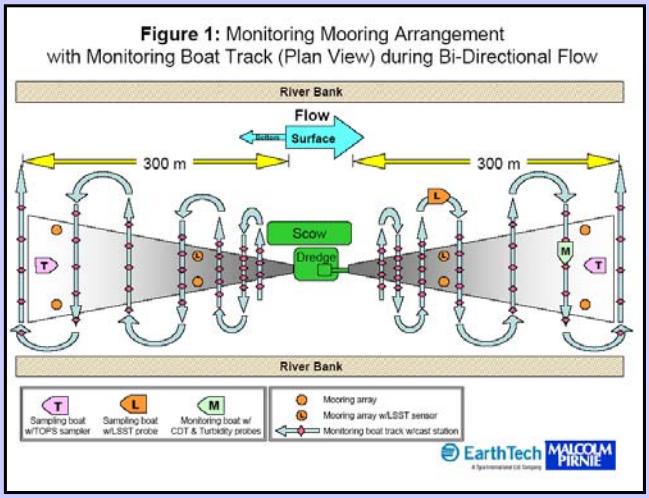
Resuspension/ Release - Monitoring Tools/ Techniques



Resuspension/ Release - Monitoring Tools/ Techniques



Resuspension/ Release - Management Actions

- Increase monitoring
- Implement operational controls
  - Temporary work stoppage
  - Slow down the operation
  - Use smaller dredge
- Implement engineered controls
  - Containment (curtains, etc)
  - Volatile controls (foams, etc.)

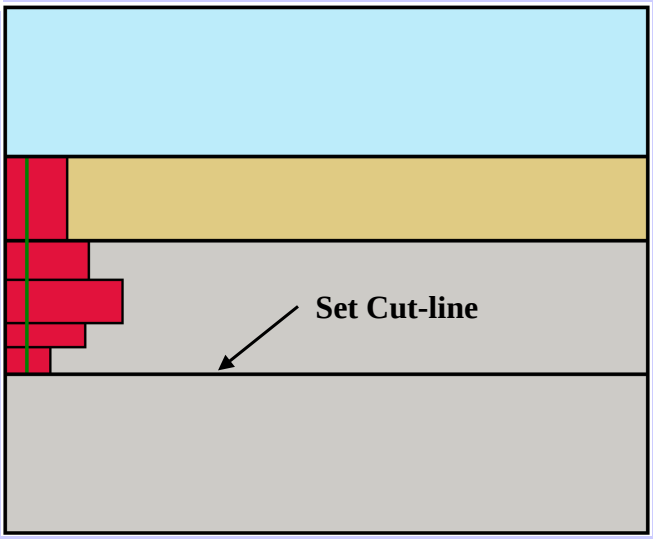
Dredging Effectiveness Monitoring Approaches

- Sampling of post-dredging surficial sediments for comparison to CULs
  - Undredged inventory
  - Residual sediments
- Sampling of surficial sediments in non-dredged areas
  - Residuals due to resettlement of resuspended sediments

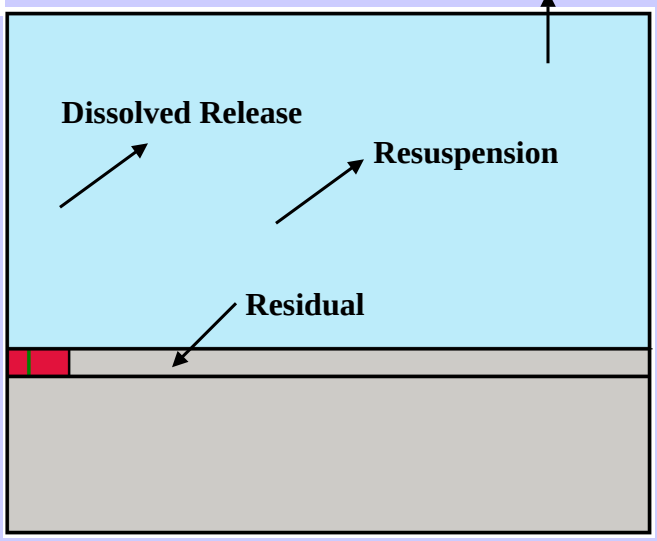
More on Cleanup Levels

- Most likely form of CUL is limiting concentration of COC in surficial sediment
- CUL should be tied to a surficial thickness and method for confirmation
- CUL may be tied to Surface Area, e.g. SWAC approaches
- Design Standards based on CULs should therefore consider processes affecting surficial sediment concentrations with depth and time, considering mechanics of the remedy.

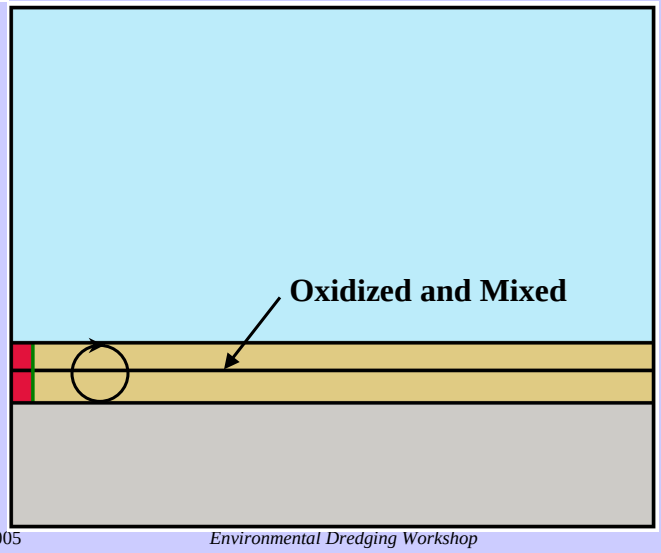
Pre-Dredging



Post-Dredging – Short Term



Post-Dredging – Long Term



Compliance for Dredging Effectiveness

- Point of Compliance should be in the surficial sediments (considering residual), i.e., the biologically active zone.
- Time of Compliance – what is appropriate?

Dredging Effectiveness - Monitoring Tools/ Techniques

- Sediment cores
  - Upper sediment layers (~ 2 foot cores)
  - Analysis from top down
  - Separate analysis of surface “fluff” vs stiffer material
- Grab samples
- Sediment Profile Camera

Dredging Effectiveness - Monitoring Tools/ Techniques

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Dredging Effectiveness - Management Actions

- If residuals exceed CUL,
  - Additional cleanup passes,
  - Consider time period of mixing, or
  - Add residual cap
- If inventory remains,
  - Additional production passes,
  - Consider partial dredging with isolation cap
  - Same considerations as for capping remedy

ED Monitoring and Management Plans

Should be:

- A written plan agreed to by all parties
- Include detailed SOPs, etc. for all components
- Results tied to testable hypotheses
- Include pre-determined management actions

Environmental Dredging
General Conclusions

- Evaluate risks – Balance capabilities and limitations with environmental controls
- Suitable equipment is available
- Mass removal with acceptable precision is attainable
- Resuspension is minimal and can be controlled
- Release is a far field issue – evaluate risks accordingly
- Residual is a major issue for effectiveness and cost – limit cleanup passes and allow for residual cap
- Dredging/transport must be compatible with treatment/disposal
- Detailed/comprehensive guidance on environmental dredging is lacking but under development