Portland Harbor CAG Feasibility Study Sediment Capping and Treatment Concepts

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Quick Review

- June – Dredging and Monitored Natural Recovery
- July – Capping and Treatment
- August – Boat tour
- Fall 2010 – Possible presentations on remediation goals, etc. – per CAG request

CAPPING

Capping Definition

- Capping - placement of an underwater covering or “cap” of clean material over contaminated sediment that remains in place
- Terms you will hear often “in-situ” and “ex-situ” - Latin words meaning “in place” or “not in place”

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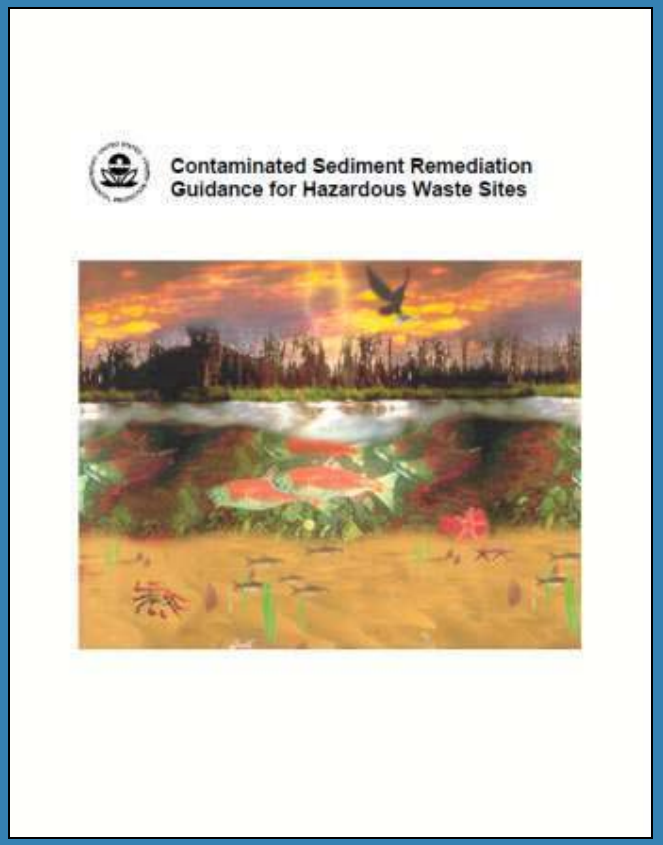
Use of Capping Technology

- As of 2004, Capping a component of the remedy for contaminated sediment at 15 Superfund sites.
- Sometimes the primary approach – sometimes used with other remedies.
- Capping successful at a number of PNW sites – several were constructed over a decade ago.



USEPA. 2005. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*

Sediment Cap Components

- Physical Isolation
- Stabilization/Erosion Protection
- Chemical Isolation

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Sediment Cap Materials

- Caps typically constructed of clean:
  - Sand
  - Gravels or cobbles
  - Can include additional material (e.g., organic carbon) to help adsorb chemicals

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Sediment Cap Materials

Cobbles

Coarse Gravel

Fine Gravel

Coarse Sand

Medium Sand

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Caps Designed to Withstand Physical Forces

- Designs must consider:
  - Erosion from
    - River currents
    - Propeller wash
    - Wind/wake waves
  - Floods
  - Earthquakes
  - Human activities (e.g., anchoring)
  - Biological processes (aquatic organisms digging)

Examples of Site Conditions Conducive for Capping

- Suitable cap materials available
- Infrastructure (e.g., piers, pilings, buried cables) are compatible
- Cap allows site uses such as vessel navigation
- Disruption of cap site unlikely or controllable (e.g., anchoring)
- Long-term risk reduction outweighs habitat impacts, and/or habitat improvements are provided by the cap
- Hydrodynamic forces (e.g., floods) can be withstood
- Rates of groundwater flow in cap area not likely to create unacceptable contaminant releases
- Sediment has sufficient strength to support cap
- Contaminants have lower rates of flux through cap
- Contamination covers contiguous areas

USEPA. 2005. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*

Pro's and Con's of Capping

Pros

- Can quickly reduce exposure to contaminants
- Requires less infrastructure
- Less disruptive to people in local communities
- Can improve habitat
- Less construction water quality impacts than dredging
- Less costly and quicker than dredging

Cons

- Contaminants could be exposed if the cap is significantly disturbed
- Can be difficult to implement in some situations
- May limit some site uses; require institutional controls
- Preferred habitat may not be provided by the surface cap materials which may be needed for erosion control

USEPA. 2005. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*

Cap Placement Methods

- Direct placement
  - Clamshell
  - Barge
  - Hopper
  - Conveyor belt
- Broadcast spreader
- Hydraulic pipeline
- Submerged diffuser

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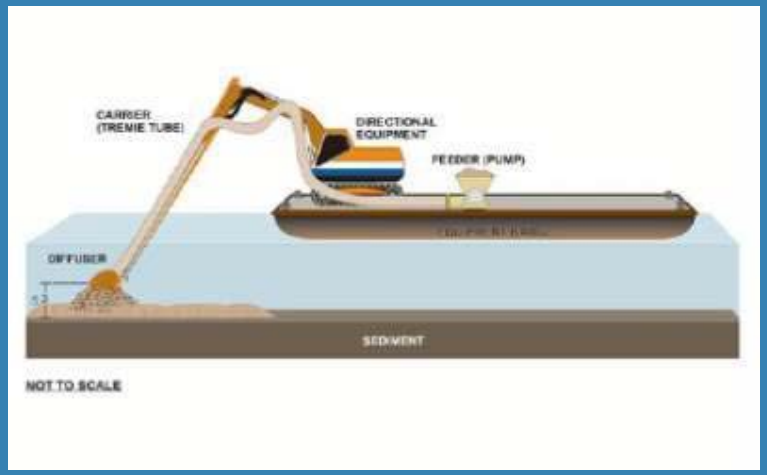
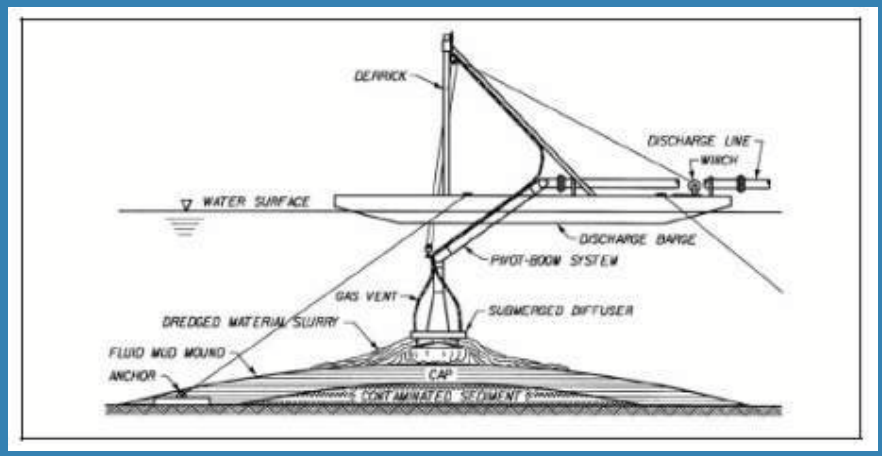
Example Cap Placement Methods





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Thin Layer Capping

- Consider where natural recovery may be an appropriate remedy
- Accelerates rate of sedimentation to reduce risks within an acceptable time frame
- Often achieved by addition of a thin layer of clean sediment or sand
- This approach is sometimes referred to as “enhanced natural recovery”
- Sometimes post dredge applications

USEPA. 2005. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*

Cap Monitoring

- Caps must be monitored over time to ensure effectiveness
- Typically includes several types of observations:
  - Physical - Is the cap still there and thick enough?
  - Chemical - Are chemicals effectively isolated beneath the cap?
  - Biological (sometimes) – Is the cap providing the expected habitat?

TREATMENT

What is Treatment?

- Basically, treatment is any process, manufactured or naturally occurring, which causes the destruction or reduction of contamination in a given media.
- Treatment is not “one size fits all” solution
- Can be a range of options:
  - low tech
  - high tech

What's in the Treatment Toolbox?

- Methods are based on physical, chemical, thermal, and biological processes
- Pre-treatment methods are used to prepare the sediment (e.g., debris removal, dewatering)
- A short-list of examples includes:
  - Particle Separation
  - Reagent Stabilization
  - Land Treatment
  - Sediment Washing
  - Vitrification
  - In Situ Carbon Adsorption
  - Enhanced capping materials

What Can Treatment Achieve?

- Treatment methods can be used to:
  - Destroy contaminants
  - Reduce toxicity of a contaminant
  - Reduce the bioavailability of a contaminant
  - Reduce the leachability of a contaminant
  - Reduce overall waste volumes
- Some methods are contaminant-type specific, while others address a range of contaminants

Potential Beneficial Uses

- Typical products generated include:
  - Clean sand/fill and feedstock for manufactured topsoil
  - Regulated fill for Brownfield/infrastructure sites
  - Cement substitute
  - Concrete aggregate stock
  - Daily landfill cover

Beneficial Use Challenges

- Locally, there may be a market for these materials; specifics may not become apparent until design phases. No established markets at this time.
- Regulations controlling use are evolving
- Potential issues of long-term liability at point of use
- May need to import other contaminated material into Portland Harbor area to make cost-effective
- Regional facility development is often lead by the government not the PRPs.

Treatment Technology Pros/Cons Summary

Pros

- Contaminants are permanently destroyed (for some methods)
- Provides a means to reduce volume of material requiring landfill disposal
- Partial treatment approaches may reduce hazardous wastes to non-hazardous levels
- Remediation time frames are generally short compared to other technologies
- Beneficial use products may be generated (typically for sandy or gravel-like material)

Cons

- Limited success with sediments
- No guarantee that a beneficial use will result from treatment
- Lack of marketability
- Most approaches costly
- Pre-treatment steps are required
- Long-term monitoring is necessary for in-place methods
- Require large staging areas
- Limited in-water work window

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Example: Reduce Contaminant Leachability Reagent Mixing (in-barge)

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Example: Reduce Contaminant Leachability Reagent Mixing (on land)

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Example: In Place Treatment

Grasse River, New York

In Situ Pilot Study with activated carbon to reduce PCB bioavailability

Conclusions

- Pros and Cons for both Capping or Treatment
- No one technology is best for every situation
- Technologies will be used in combination

Questions?