Post-ROD Monitoring at Superfund Sites (Before, During and After Cleanup)

Presentation to the
Portland Harbor Community Advisory Group
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Presentation Objectives

Provide overview of EPA monitoring procedures and techniques

* Monitoring plans
* Monitoring short-term
* Monitoring long-term
* Monitoring techniques

Monitoring Plans

* Establish baseline for monitoring program
  - All media
  - Site-wide
  - Background
* Remedial design
* Short-term performance & effectiveness
  - Assess compliance with design
  - Risk reduction
  - Releases and Residuals
* Long-term performance & effectiveness
  - 5-year review
  - Achieving RAOs & Cleanup levels

Monitoring Plan Considerations

* Protocols and procedures
* Sample types
* Analytical methods & detection limits
* Spatial and temporal
* Duration
* Media and Species
* Triggers for identifying important trends (positive or negative)

Remedial Design Sampling

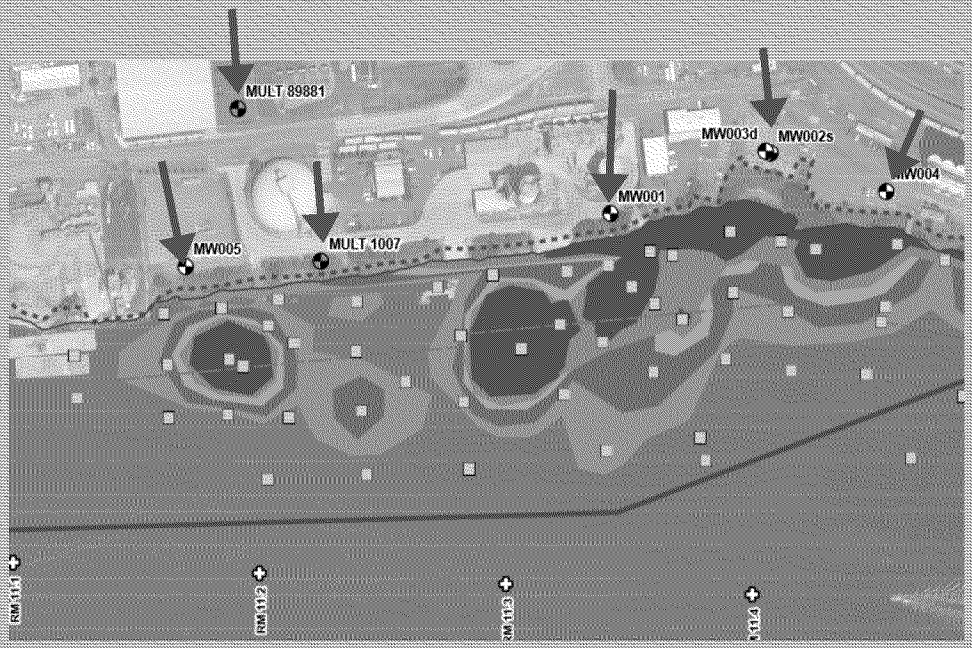
- Delineate areas for capping, dredging, in-situ treatment and EMNR based on Action Levels
  - Surface sediment samples
  - Bioassay tests
- Determine dredge depths
  - Sediment cores
- Determine cap structure
  - Pore water
  - Seepage meters

Short-term Monitoring

* Source Control
* MNR
* EMNR
* In-situ treatment
* In-situ capping
* Dredging
* On-site disposal

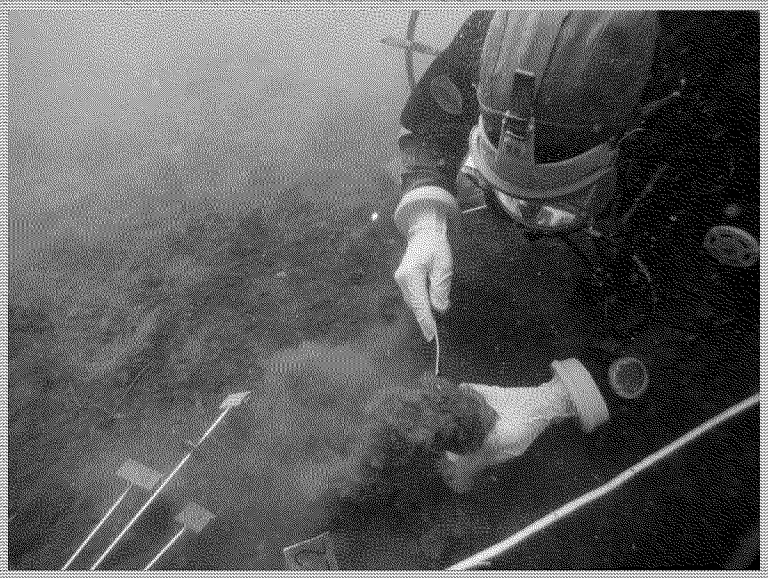
Source Control

* Groundwater monitoring wells along riverbank
* Monitor storm water and industrial releases
* Monitor riverbank controls



Monitor Natural Recovery (MNR)

* Monitor natural processes
  * Sediment accumulation rates
  * Degradation products
  * Sediment and contaminant transport
* Monitor contaminant levels
  * Surface sediment
  * Surface water
  * Biota
  * Pore water
* Monitor biota recovery
  * Sediment toxicity
  * Benthic community size
  * Benthic community diversity



EMNR and In-situ Capping

* Proper cap materials
  - Chemistry
* Turbidity/TSS
  - Water column samples
  - Acoustic doppler current profile
* Material placement surveys
  - Bathymetry
  - Sediment profile camera
  - Sediment cores

In-situ Treatment

* Turbidity/TSS
  - Water column samples
  - Acoustic doppler current profile
* Material placement surveys
  - Bathymetry
  - Sediment profile camera
  - Sediment cores

Monitoring Dredging

* Turbidity (cloudiness of water) and sediment re-suspension
* Water quality
* Air quality
* Proper depth and area dredged/ proper handling of dredged material
* Caged fish/shellfish
* Dewatering effluent quality

Solar-powered water monitoring buoy near dredging operation (EPA)

On-site Disposal

- Structural integrity
- Groundwater monitoring
- Air monitoring
- Surface water run-off

Long-term Monitoring

* Source Control
* MNR
* EMNR
* In-situ treatment
* In-situ capping
* Risk reduction
* Remedy effectiveness

MNR and EMNR

* Monitor natural processes
  * Sediment accumulation rates
  * Degradation products
  * Sediment and contaminant transport
* Monitor contaminant levels
  * Surface sediment
  * Surface water
  * Biota
  * Pore water
* Monitor biota recovery
  * Sediment toxicity
  * Benthic community size
  * Benthic community diversity

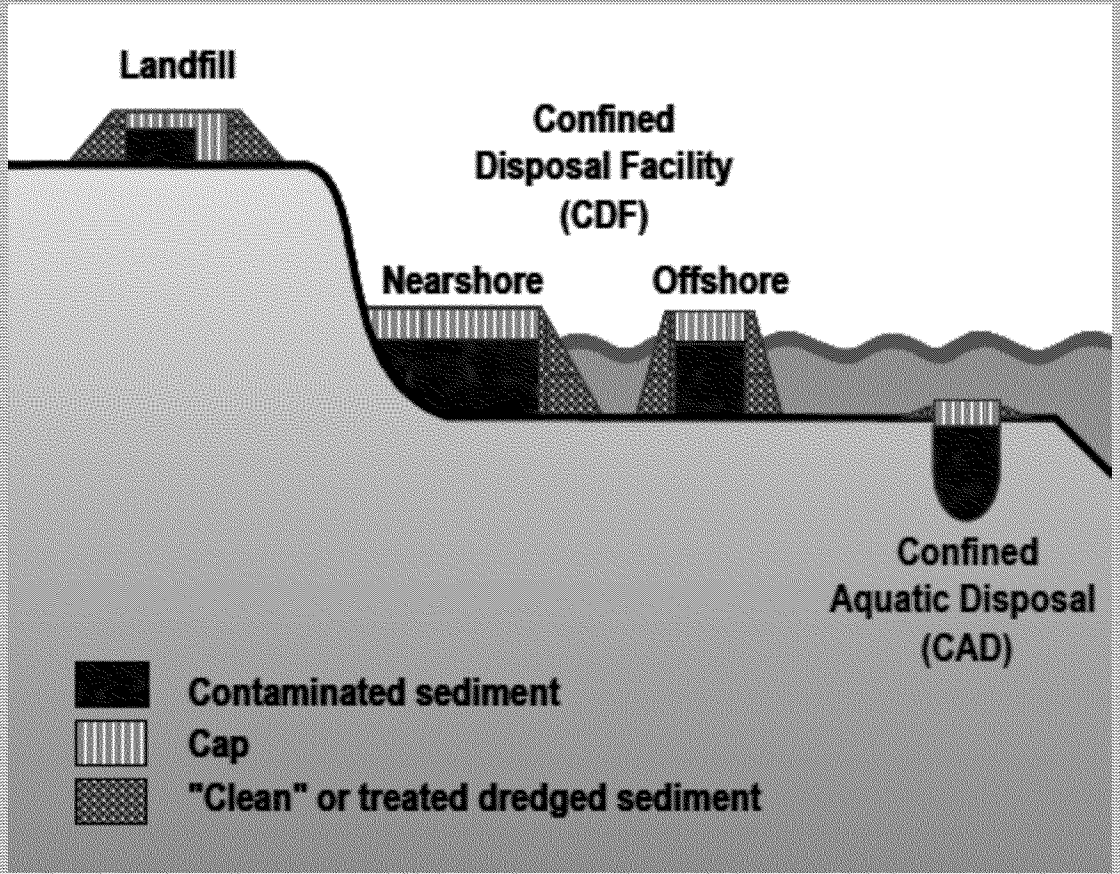
In-situ Capping

* Cap structure
  - Thickness & stability
* Confirm physical and chemical isolation
* Evaluate recontamination
* Measure contaminant levels
  - Surface water
  - Sediment
  - Pore water
  - Fish tissue

Inspection Report: Visible section of an organoclay mat (EPA)

Are Sediment Disposal Facilities Keeping Waste Contained?

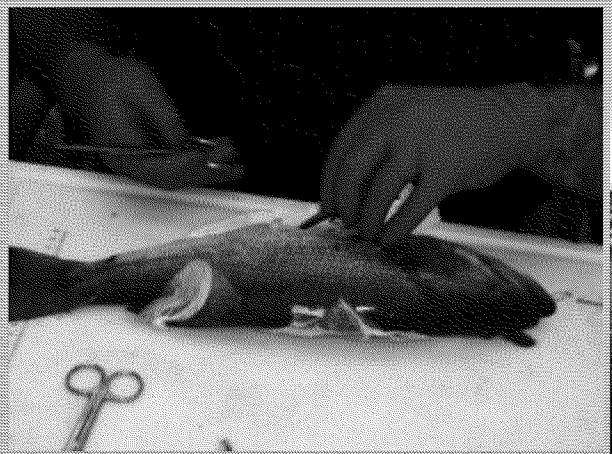
- Structural integrity
- Groundwater monitoring
- Cap integrity



Source: TechData Sheet. Naval Facilities Engineering Command. Dec. 2002.

Are concentrations decreasing?

Surface water samples (USGS)



Fish tissue samples (USGS)

Sediment pore water samples (USGS)

Sediment samples (USGS)

Five-year reviews

* Required to review remedial action
* Answer three basic questions:

1. Is the remedy functioning as intended?
2. Are the remedy assumptions still valid?
3. Has other information come to light that would call the remedy into question?

Evaluate Remedy Effectiveness

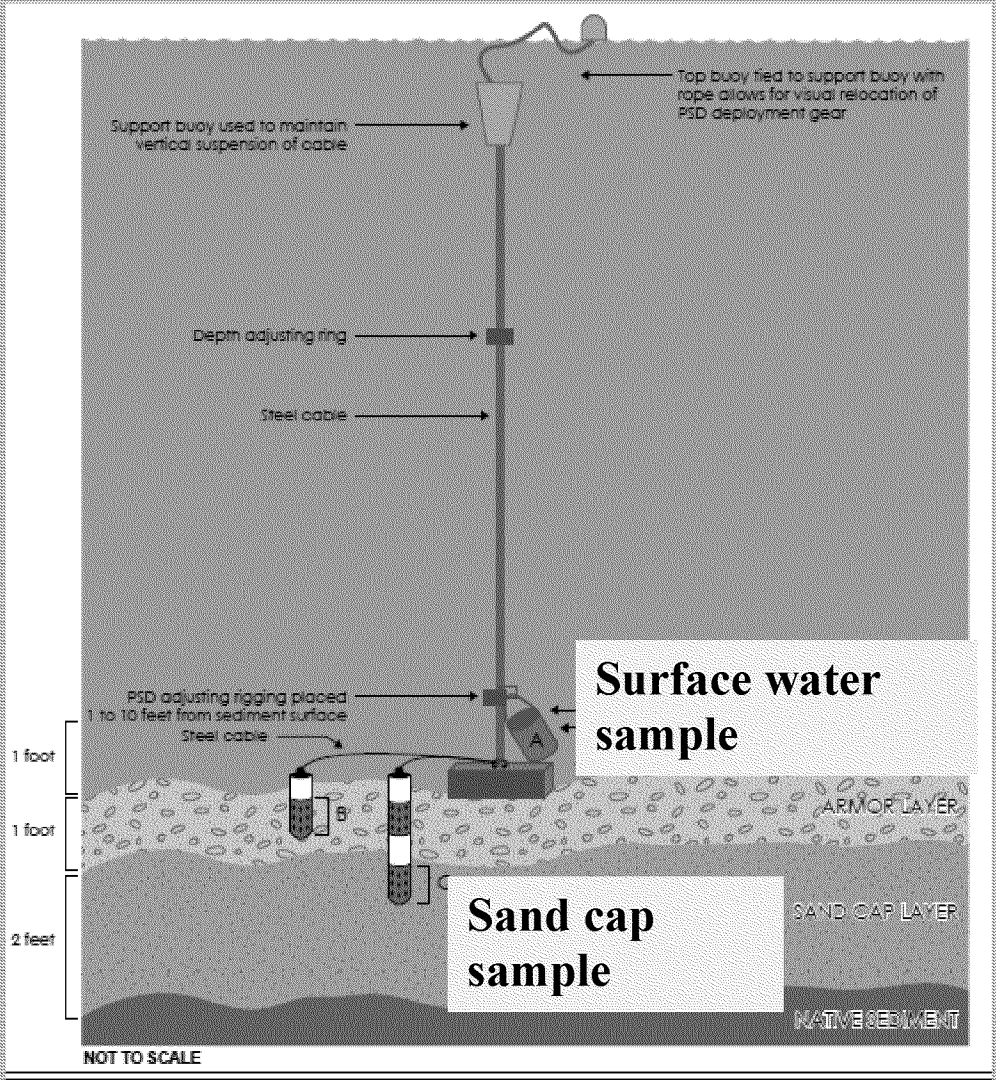
* Consumption of fish and shellfish
  - Fish and shellfish tissue
* Exposure to contaminants in river
  - Sediment and surface water
* Reduce contaminated groundwater migration
  - Groundwater monitoring wells/pore water
* Sediment cap effectiveness
  - Sample cap materials for contaminant seepage
* Source control - recontamination
  - Surface water, groundwater and sediment

Inspections to Evaluate Remedy

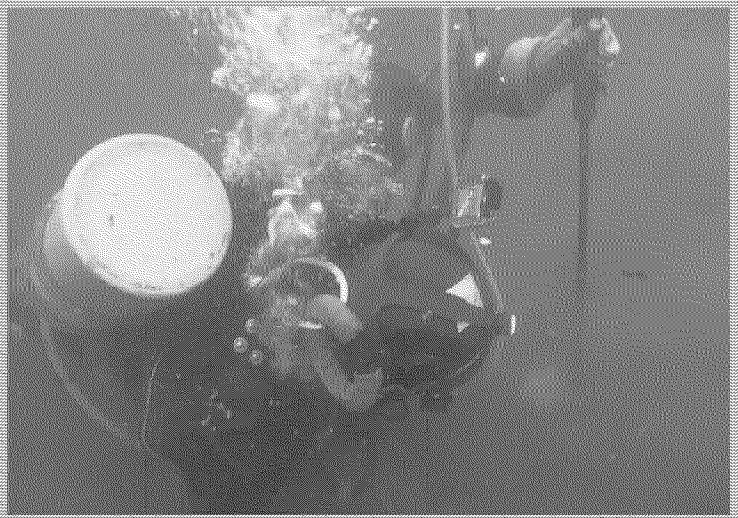
* For integrity of sediment cap
  - Inspect the cap (thickness, barrier layer is intact)
* For recovery of native fish
  - Count fish populations
* For restoration of vegetation
  - Inspect vegetated areas

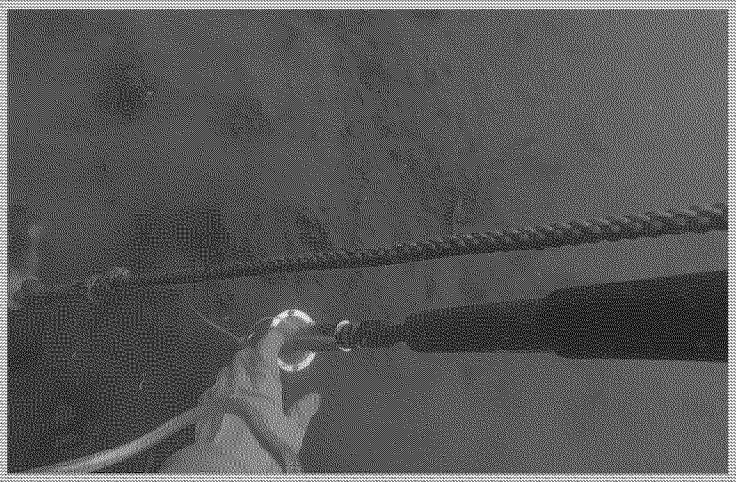
McCormick & Baxter Sampling this Fall

* Inspect cap
* Collect surface water sample
* Collect sand cap sample
  - Remove armoring
  - Install passive sampling device in the sand cap in September
  - Retrieve sampling device in October
  - Replace armoring
* Next 5 Year Review is due in 2016



EPA Dive Team





Physical Measurements

- Sediment Geophysical Properties
  - Contaminant bioavailability
  - Habitat characteristics
- Water Column Physical Measurements
  - Dredging and capping releases
- Bathymetry Data
  - Post-capping or -dredging bottom elevations
  - Sediment stability for MNR
- Side Scan Sonar Data
  - Distribution of sediment types and bedforms

Physical Measurements (cont.)

* Settlement Plate Data
  - changes in cap thickness and consolidation
* Sediment Profile Camera Data
  - Changes in thin layering within sediment profiles
  - Sediment grain sizes
  - Bioturbation and oxidation depths
  - Presence of gas bubbles
* Subbottom Profiler Data
  - Changes in sediment surface and subsurface layers
  - Bioturbation and oxidation depths
  - Presence of gas bubbles

Chemical Measurements

- Sediment Grab Samplers
- Coring Devices
  - vibracore, gravity piston, or drop tube
  - vertical profile of sediment chemistry
  - detect contaminant movement through cap
- Direct Water Column Measurements (probes)
  - pH and dissolved oxygen
- Surface Water Samplers
  - Dissolved & particulate releases
- Seepage meters
  - Contaminant flux

Biological Measurements

- Benthic Community Analysis
  - population size and diversity
- Toxicity Testing
  - acute and long-term lethal or sublethal effects
- Tissue Sampling
  - Bioaccumulation
- Caged Fish/Invertebrate Studies
  - Change in uptake of contaminants
  - Bioaccumulation rates
- Sediment Profile Camera Studies
  - Indirect measurement of macroinvertebrate recolonization

EPA Contacts

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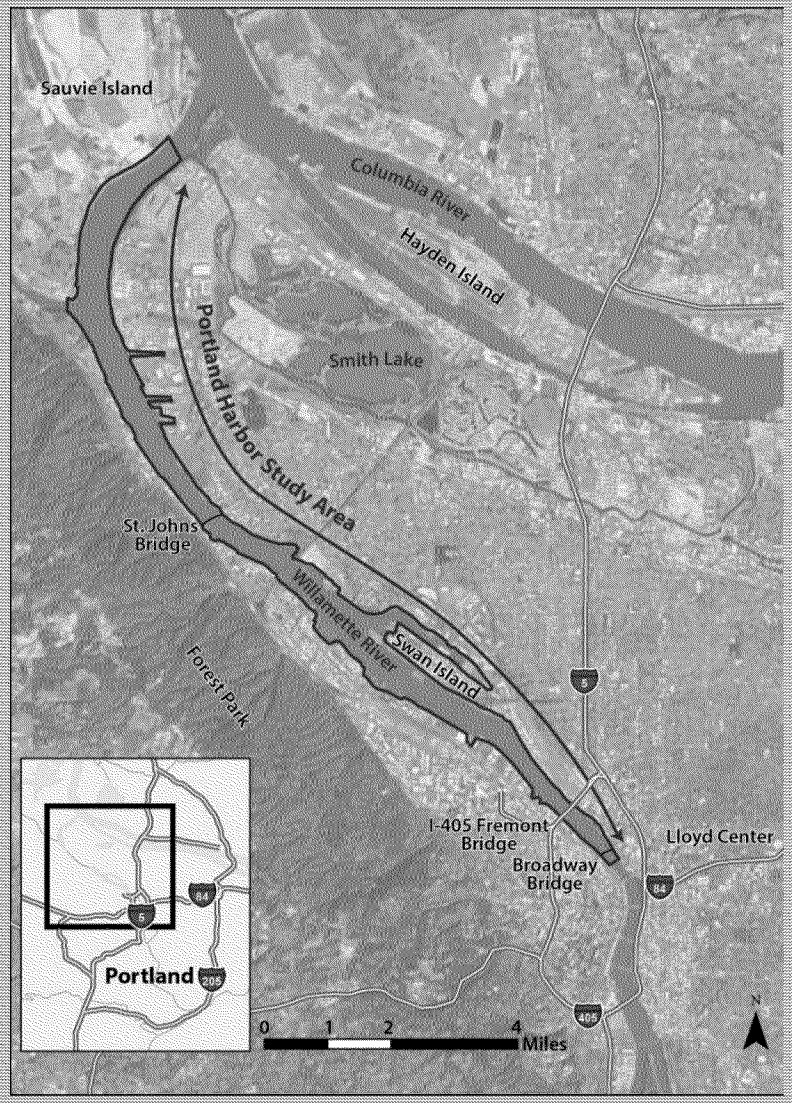
Additional Information:
http://www.epa.gov/region10/portlandharbor

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