

GENERAL SITE INFORMATION, CHARACTERISTICS, AND STATUS

Project Name	<u>WYCKOFF CO./EAGLE HARBOR - PROJECT 1</u> <u>(East Harbor)</u>	ProjectID: 10-02
Last Updated:	01/19/04	
City:	Bainbridge Island	
County:	Kitsap	
State:	WA	
Country:	USA	
Bodies of Water:	Eagle Harbor; Puget Sound	
US EPA Region:	X	
Status (Active, Complete, or Monitoring Only):	Complete	
Date On NPL:	1987	
ROD/ESD Date:	1994 (OU-1)	
Operable Unit:	OU-1	
Areas of Concern (length or acres):	Eagle Harbor (a Puget Sound embayment): 500 acres, comprising about 200 acres of West Harbor and 300 acres of East Harbor.	
Other Characteristics of Water Body:	The Upper Harbor is relatively shallow (0-18 ft); the central channel is 20-50 feet deep. Several small creeks feed the harbor. The harbor was divided into East and West operable units because the sediments in the East Harbor have mostly PAHs, while mercury is the primary contaminant of concern in the West Harbor.	
Contaminants of Concern:	PAHs; mercury	
Source of Contamination:	Wood treating operations, including pressure treatment with creosote, at the Wyckoff Facility. Spills, leaks, drippage, wastewater discharges, and storing treated timbers in the water.	
Contaminated Area Physical Characteristics:	Hot spots; Harbor sediments. The 54-acre area targeted for capping was divided into two target areas based on the nature of the bottom sediments and proposed capping approach. Area 1 was 24.5 acres with predominantly fine to medium sands; Area 2 was 29.5 acres with predominantly silt.	
Type of Regulatory Action:	Final. Superfund. Preceded by enforcement actions in 1988 (AOC), 1991 (UAO), 1993 (AOC), and 1994 (Consent Decree)	
Overall Status Summary:	<p>The first phase of the East Harbor capping remedy was completed in 1993-1994 and included capping of two hot spots of 54 acres total to a nominal depth of 3' by distribution of 280,000 cy of clean sediments obtained from a navigational dredging project 31 miles away; monitoring of the cap's effectiveness is in progress; other phases (of capping) were to follow after completion of additional source control, including facility demolition and control of a ground water source.</p> <p>EPA delayed capping other areas of the East Harbor until a groundwater barrier wall was installed to eliminate creosote seeps from the site. Construction of the sheetpile barrier wall was performed from November 2000 to February 2001. Following this, an additional 15-acre cap was installed which extended from the southern boundary of the earlier 54-acre cap to the Wyckoff property. This additional cap is also about 3' thick.</p> <p>From March to September 2002, an EPA team with support from the Corps of Engineers performed a "Five-Year Review" for both the East Harbor and West Harbor (Project ID 10-06). The Five-Year Review report concluded that (a) contamination still existed in the East Beach area and (b) localized disturbances of the subtidal sediment cap may be occurring.</p>	

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Remedial Action Planned:	<input checked="" type="checkbox"/>
Risk Assessment:	<input checked="" type="checkbox"/>
Remedial Action Implemented:	<input checked="" type="checkbox"/>
Status of Dredging	<input type="checkbox"/>
PRPs:	<input checked="" type="checkbox"/>
Contacts:	<input checked="" type="checkbox"/>
References:	<input checked="" type="checkbox"/>
Modeling:	<input type="checkbox"/>
Fishing Advisory:	<input checked="" type="checkbox"/>
Key Conditions:	capping, fish spawning limitations, navigational dredging component, post monitoring, tidal fluctuations

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Target Sediment Cleanup Standards (TSCS):	Below (How TSCS Established:)	
How TSCS Established:	<p>Source: ROD, September 1994.</p> <p>"Cleanup in the East Harbor and West Harbor is intended to ensure that within a reasonable time frame, sediment contamination is within the range of "minor biological effects" or below, and at levels protective of human health."</p> <p>"The absence of adverse effects is predicted by attainment of the more stringent chemical criteria, the "marine sediment quality standards" (SQS) chemical criteria while minor adverse effects are predicted by chemical concentrations ranging from the SQS to the less stringent "minimum cleanup level" (MCUL) chemical criteria. At contaminant levels above the MCUL, more significant effects are predicted, and sediment cleanup must be considered."</p> <p>"The intent of the Sediment Standards is for sediments within a cleanup area to ultimately meet the sediment quality standards (SQS), the level of no adverse effects. Once a cleanup area has been defined as described above, a cleanup objective for the area is developed. The objective must be within the minor adverse effects range defined by the no adverse effects level (the SQS) and the minor adverse effects level (the MCUL). In all cases, if both biological and chemical data are obtained, the biological information determines compliance with the cleanup objective developed under the Sediment Standards."</p> <p>"Net environmental benefits, cost, and technical feasibility of cleanup must be considered in selecting a cleanup objective, including one which may incorporate a recovery period. At a minimum, all sediments in a defined cleanup area must meet the MCUL within ten years after any active remediation is completed in the area."</p> <p>"Within the framework described above, cleanup goals and objectives were developed for intertidal and subtidal sediments in the East Harbor."</p> <p>"Consistent with the intent of the Sediment Standards and the West Harbor ROD, achievement of the SQS and reduction of contaminants in fish and shellfish to levels protective of human health and the environment are long-term goals of sediment remedial action in the East Harbor. These goals represent a conceptual target condition for all Eagle Harbor sediments."</p> <p>"The primary measurable objective for East Harbor sediments, however, is the MCUL. As in the West Harbor, the main focus of remedial action in the East Harbor is achievement of the MCUL, below which minor biological effects are predicted." The MCUL for mercury is 0.99 ppm. The MCUL for low molecular weight PAHs is 780 ppm normalized to TOC. The MCUL for high molecular weight PAHs is 5,300 ppm normalized to TOC. Individual PAH MCULs also apply (33 ppm dibenzo(a,h)anthracene, normalized is the most stringent).</p>	
Target Bank and Floodplain Cleanup Levels (if applicable):	N/A	
Other Target:	N/A	
Environmental Sample Data References:	<ul style="list-style-type: none">• Sediment:	

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	<ul style="list-style-type: none">• Water:• Fish:	
Estimated Target Volume:	64 subtidal acres above the MCUL for PAHs; 121 subtidal acres above the SQS (neither of these totals include the existing capped area of 54 acres).	
Planned Disposal Method:	N/A	
Estimated Calendar Time to Implement Remedy:	3 to 4 years (design, preparation, remediation).	
Estimated Time to Implement Remedy:	Above (Estimated Calendar Time to Implement Remedy)	
Estimated Cost to Implement Remedy:	\$4.7 million (low end) to \$19.9 million (high end); includes \$0.5 to 1.0 million for maintenance of existing 54 acre cap (refer to Report 04).	
Stated Remedial Action Objectives (and Source):	<p>Source: ROD September 1994.</p> <p>"The selected remedy for subtidal sediments which exceed the MCUL chemical criteria is capping. As noted, subsequent to the 1991 Eagle Harbor Proposed Plan, a sediment cap over heavily contaminated areas of the East Harbor was completed under CERCLA removal authorities to address documented adverse biological effects in heavily contaminated areas. After significant sources of contamination have been sufficiently controlled, remaining subtidal sediments with contamination above the MCUL chemical criteria will also be capped. The areas to be capped will be based on final remedial design sampling. Biological testing in accordance with the Sediment Standards may be conducted during remedial design to refine cleanup areas. Areas which meet the MCUL biological criteria for all such tests to not require cleanup."</p> <p>"The assumed cap design is a layer of clean sediments approximately three feet thick. Contaminant concentrations in capping material must be at or below the SQS chemical criteria. Cap materials must provide suitable habitat for recolonization by benthic organisms. Placement of capping materials will be designed to minimize impacts on existing biota and habitat while depositing three feet of clean sediment in all areas where contaminant concentrations exceed the MCUL in the top ten centimeters."</p> <p>The selected remedy in Intertidal Cleanup Areas is natural recovery. Institutional controls (health advisory; use/access restrictions) apply to both subtidal and intertidal areas.</p>	
Measures of Success to be Used:		
Planned Monitoring and Restoration:	<p>Source: ROD September 1994.</p> <p>"In addition to sediment chemistry and biological test to document attainment of the clean-up objectives, the plans may include sampling for other environmental conditions, such as physical conditions, concentrations of contaminants in marine organisms of importance to human health or the environment, evaluations of the diversity and abundance of marine organisms, and integrative measures of exposure to, or effects from, sediment contamination."</p> <p>"EPA will review and approve the plans in consultation with the Washington Department of Ecology, the Suquamish Tribe, and the appropriate public health and natural resource agencies. Where possible, sampling and other activities will be conducted according to existing protocols (e.g., PSEP); will complement other Puget Sound monitoring efforts, such as the Puget Sound</p>	

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Ambient Monitoring Program; and will provide information for evaluating as any objectives as possible."

"As new information arises regarding sources, contaminants, or biological effects, sampling requirements may be modified by EPA. New or modified monitoring methods may be developed over this period. EPA will continue to evaluate these developments and, in consultation with Ecology, the Suquamish Tribe, natural resource agencies, and other technical resources, will adopt them as appropriate."

"Monitoring efforts will be tiered and will focus primarily on the first ten years after completion of remedial action. If monitoring after remedial action documents compliance with the MCUL by or before the tenth year, the type and frequency or monitoring may be adjusted, or monitoring may be phased out, provided continued compliance with the objectives is assured. Monitoring requirements may be re-evaluated at the CERCLA Five-Year Review. If monitoring indicates that the MCUL may not be attained within ten years, EPA will evaluate the need for additional remedial action during the CERCLA five-year review."

Agency Position on Sediment Removal (and Source):

Source: ROD, September 1994:

- "Investigation and remediation of sediment contamination pose inherent challenges, as briefly indicated below:"
 - "the accumulation of contaminants at the sediment-water interface, a significant zone for habitat and food sources, creates complex and sensitive ecological conditions and can lead to contaminant transfers through the food chain;"
 - "contaminants that accumulate in sediments are generally dispersed from their sources, resulting in relatively large areas of low level contamination;"
 - "surface sediment contamination reflects both historical and on-going contamination, because marine biological activity in the biologically active top layer mix recently deposited sediments with existing sediments and because disturbances from currents or propeller wash can redistribute surface contamination;"
 - "the relatively large volumes of sediments requiring remediation can present problems regarding disposal site availability and capacity;"
 - "underwater conditions compound the technical challenges associated with assessing, controlling, and remediating contamination of environmental media;" and
 - "ongoing active use of the harbor complicates implementation of remedies."

"Cleanup activities will require coordination and planning in nearshore areas, subtidal leased lands, and the navigational pathways used by the Washington State Ferries. These and other special features of a marine sediment site have been considered in the RI/FS and this ROD."

"Natural processes such as chemical breakdown, dispersion, or sedimentation may reduce levels of sediment contamination over time. The Sediment Standards allow selection of an objective which incorporates a reasonable period of time (ten years) for natural sediment recovery. . . . If mathematical modeling predicts that certain areas of contaminated sediment will meet the cleanup objectives within the natural recovery time frame without active remediation, natural recovery

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may be included among alternatives evaluated for these areas. . . . monitoring and compliance testing are required to confirm the predicted recovery."

From the EPA Responsiveness Summary in the ROD of September 1994
"When does EPA plan to address the following concerns?"

- "How will cap be designed to withstand erosive forces generated by ferry propeller wash?"
- "Will compression due to weight of overlying cap material force PAH out along the edge of the cap?"
- "Will geotextile material be used to prevent the cap from subsiding into the underlying contaminated sediments?"
- "Where will the cap material come from and what criteria will be used to determine that the cap material is clean?"
- "How will EPA evaluate dredge placement procedures?"

EPA Response: "For the East Harbor Removal Action, the following responses apply:"

- "The surface of the cap in areas affected by ferry propeller wash may be eroded somewhat after placement. Exact determinations of the nature and extent of the erosion isn't possible to determine in advance, however, and EPA intends to monitor the physical conditions of the cap during placement to identify erosional areas. These areas may require additional sediment placement and armoring, which could be addressed pursuant to a ROD as necessary."
- "Similarly, the potential compression by the cap of the most highly contaminated sediments will be monitored during and after placement. The cap will extend beyond areas of sediment containing free-phase PAHs in order to avoid releases at the edge of these localized zones. Long-term monitoring and maintenance pursuant to the ROD will provide for monitoring and additional actions as needed."
- "A clay or geotextile layer will not be used due to the difficulty of applying them in these areas and their questionable utility. Some subsidence may occur initially in areas of finer, less compacted sediments. If so, the material will serve as a foundation for additional sediment to provide a suitable layer of clean material, either during this action or in subsequent placement. (A three to six foot cap is generally considered sufficient to isolate sediment contamination, and the biologically active zone in Eagle Harbor is estimated at 10 cm.)"
- "The material to be used for this Removal Action will be obtained through routine navigation dredging in the Snohomish River. The sediments were tested and found to meet both the Puget Sound Dredge Disposal Authority criteria for open water disposal and the State of Washington Sediment Management Standards sediment quality criteria."
- "Two placement methods are proposed in the East Harbor, and the methods will be evaluated through initial placements at the PSDDA disposal site in Port Gardner to determine the appropriate placement rates. In addition, after initial placement of a portion of the sediments in the East Harbor, physical monitoring will be used to evaluate and, as necessary, modify the placement methods, rates, and sequencing."

RISK ASSESSMENT

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<i>RA Type:</i>	Human Health and Ecological	
<i>RA Status:</i>	Complete	
<i>RA Objectives:</i>		
<i>Company</i>	CH2M Hill	
<i>Performing RA:</i>		
<i>RA Reference Report:</i>		
<i>RA Summary and Conclusions:</i>	<p>Source: ROD September 1994.</p> <p>"Two data sets (1988 and 1990) were used in estimating the total excess lifetime cancer risks for consumption of clams. The highest risk of 10-3 was associated with clams collected from adjacent to the Wyckoff Facility. Background clam tissues collected near the mouth of Eagle Harbor produced risks from 1×10^{-4} to 5×10^{-4}."</p> <p>"A single data set from 1990 was available to evaluate cancer risks from consumption of fish and crabs. Risk levels depended on the type of tissue (whole fish, fish muscle, crab muscle, hepatopancreas). The highest risk from this route was 1×10^{-3} for consumption of whole perch. For all other tissues, both Eagle Harbor and background samples produced results in the 10-4 range; however, the fish tissue data for the PAH contributing most to the risk were qualified as estimates in these samples."</p> <p>"Summary: The risk assessment discussed uncertainties associated with the calculated risks. Among the uncertainties are the absence of complete toxicity information for all chemicals measured, uncertainties and variability in site data, the potential presence in seafood of other contaminants that may not be site-related, and uncertainties associated with exposure assumptions. The uncertainties can result either in underestimates or overestimates of the true health risks associated with the site."</p> <p>"In summary, chemical concentrations in Eagle Harbor sediments and seafood are elevated with respect to background locations. However, human health risk estimates for exposure to sediment contaminants through dermal contact and sediment ingestion are within or below EPA's range of acceptable risks. For seafood ingestion, calculated cancer risks are generally between 10-4 and 10-6 at both Eagle Harbor and background locations. Consumption of shellfish from specific areas (such as East Harbor areas near the former Wyckoff Facility) results in risks above 10-4. While similar cancer risk estimates were obtained for tissues such as whole perch, sole muscle, and crab hepatopancreas, uncertainties in these data should be considered. Noncancer hazard indices for seafood consumption at both Eagle Harbor and background locations were as high as 1 based on 1988 data, but subsequent data resulted in significantly lower values, suggesting similar uncertainties in data."</p> <p>"Human health risks for Eagle Harbor are thus primarily associated with the consumption of contaminated shellfish. For the East Harbor, specifically, cancer risks in the 10-3 range were associated with clam tissues from beaches adjacent to the Wyckoff Facility."</p> <p>"The assessment of ecological risks relied on the "triad approach" which links contamination to specific adverse ecological effects using a preponderance of field and laboratory evidence. The three elements are (1) sediment concentrations, (2) lab toxicity tests, and (3) abundance of benthic organisms."</p> <p>"The bioassays for acute toxicity indicated that sediments from many sampled locations in the East Harbor were toxic to amphipods, oyster larvae, or both. The bioassay responses were most severe in areas of high PAH contamination, such as areas of the East Harbor north of the Wyckoff Facility. Bioassays on benthic infauna are valuable indicators because the organisms live in direct contact with the sediments,</p>	

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are relatively stationary, and are important components of estuarine ecosystems. If sediment-associated impacts are not present in the infauna, then it is unlikely that such impacts are present in other biotic groups such as fish or plankton; unless contaminants are bioaccumulating at levels significant for higher food-chain organisms."

"Additional evidence of biological effects in Eagle Harbor includes the prevalence of liver lesions and tumors in English sole, as documented by NOAA (Malins, 1985). The high incidence of such effects in Eagle Harbor relative to other Puget Sound embayments was confirmed in the Puget Sound Ambient Monitoring Program, 1991 sampling. This and laboratory research citing the effects of PAH and other sediment contaminants on marine organisms add to the preponderance of evidence already indicating potential damage to Eagle Harbor marine life."

"Adverse biological effects were documented in much of the East Harbor. Most of the biological effects previously observed were associated with heavy sediment contamination. Potential redistribution of contaminants through sediment redistribution from these heavily contaminated areas was also of concern, as well as the potential for uptake by marine organisms. These heavily contaminated areas were addressed by the cap completed as the first phase of cleanup, under CERCLA removal authorities. Other areas of the East Harbor contain levels of contamination predicted to cause minor or, in some areas, significant biological effects. Cleanup is warranted to address sediments where significant biological effects are predicted, unless biological data indicating the absence of such effects is obtained."

"For East Harbor intertidal sediments, as with intertidal PAH areas in the West Harbor, the surface ten centimeters must achieve the MCUL within ten years from control of significant sources to these areas. Since this objective incorporates the ten-year recovery period, it is termed MCUL-10."

"The objective of the MCUL is supplemented by an objective of 1,200 ppb (dry weight), developed by EPA to address human health risks from consumption of contaminated shellfish in intertidal areas. This objective requires that intertidal sediment high molecular weight PAHs (HPAH) concentrations must not exceed 1,200 ppb (dry weight). HPAHs most closely approximate the carcinogenic PAHs evaluated in the risk assessment. The HPAH objective in sediments corresponds to the 90th percentile of Puget Sound subtidal background HPAH concentrations available at the time of the RI/FS. Clam tissue concentrations from the RI showed a moderate correlation with intertidal sediment concentrations, and carcinogenic PAH concentrations in clams from intertidal sediments with contamination above the HPAH criterion resulted in cancer risk estimates above EPA levels of concern."

"Achievement of the HPAH objective in intertidal sediments is expected to result in corresponding reductions in clam tissue contamination. This additional objective does not alter the requirement of achieving the MCUL throughout the East Harbor. Because institutional controls can be used to limit human exposure in intertidal areas until the cleanup objectives are achieved, however, ten years are allowed for sediments to meet the MCUL and the HPAH objectives. This ten year period begins once significant contaminant sources to intertidal sediments from the Wyckoff Facility have been controlled."

"Cleanup action is not required in areas with contamination below the MCUL chemical criteria, either in the East or West Harbor. Selection of the MCUL as an objective and as a means of defining cleanup areas is supported for the following reasons:"

- "Uncertainty about predicted biological effects,"
- "Predicted contaminant reduction in areas of marginal contamination," and
- "The costs and impacts of cleanup."

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Physical Target:	54-acre subtidal area in Eagle Harbor	
Goals:	54-acre subtidal area in Eagle Harbor. Place a uniform layer of sand material, about 3 feet (0.9 meters) thick, over the entire 54 acre target located in 30 - 50 foot water depths. (This is the "existing cap" referred to in Report 02.)	
Primary Contractor:	American Construction (Everett, WA)	
Other Contractors:	Science Application International Corporation (SAIC) (monitoring); Corps of Engineers; CH2M Hill (RI/FS)	
Generic Remediation Method:	Capping	
Equipment:	Bottom dump barge for placement of sand in Area 1; in Area 2 sand was placed by washing it off flat-deck barges with a high-pressure water wash.	
Material Handling:	The source of the cap material for the 54-acre cap was maintenance dredging of the Snohomish River; this material was loaded on barges and towed 31 miles down Puget Sound to Eagle Harbor. The material placed in Eagle Harbor was primarily silty sand with a low % of clay (21% sand, 15% silt, 4% clay, 60% water). Because a ferry ran directly across the northern portion (Area 1) of the target every 40 minutes, a rapid placement method was required in that area (placement between trips); because the southern portion (Area 2) of the target had soft sediments, a slow placement method was required to avoid resuspending sediments. The contractor was able to place one barge load (avg. 1,900 cy) in about 0.5 hours (the first method); placement using the high-pressure washoff method averaged about 4.6 cy per minute (750 cy per flat barge). Successful placement was critically dependent on the ability to monitor and record barge location (GPS was used). Bathymetric surveys checked placement thickness. A total of 67 trips were made with the bottom dump barge (127,500 cy) and 99 trips with the flat-deck barges (140,000 cy). An additional 9,500 cy was subsequently placed in the most critical areas of Area 1.	
Volume Removed:	None; 280,000 cy were placed to form a 54-acre cap. A subsequent 3' thick 15-acre cap extension was installed in 2001 extending from the southern boundary of the original cap, for which volume data have not yet been obtained.	
Calendar Time:	September 15, 1993 to March 11, 1994	
Time To Implement:	178 days	
Total Cost:	\$1.5 million; the overall cost for placement was \$0.5 million (\$1.77 per cy); remainder of costs were associated with mob/demob, navigational dredging, and placement of excess (not needed for Eagle Harbor capping) dredge spoils at an open water site. This total cost is for the 54-acre cap.	
Dredging Cost:	N/A	
Disposal of Sediment:	N/A	
Volume of Water:	N/A	
Method of Water Treatment:	N/A	
Water Discharge Limit:	N/A	

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Air Monitoring During Remediation:	N/A	
Water Monitoring During Remediation:	<p>As described in Reference M-167: "Chemical monitoring during cap placement included measurements of water quality (TSS, DO, ammonia, and sulfides) near the water surface and near the bottom and sediment chemical concentrations from six sediment traps (three per array) distributed outside of the capping area. State water quality criteria were not exceeded during cap placement, although it was worse in bottom samples. TSS tended to be higher when the split-hull bottom-dump barge was used to place the cap. DO was higher in the upper part of the water column. Sediment traps were deployed during two collection periods. Period 1 was from September 29, 1993 to January 7, 1994 and Period 2 was from January 10, 1994 to March 23, 1994. The average bulk sedimentation rates for both periods ranged from 0.37 to 0.49 cm/mo; the sedimentation rates for Period 2 averaged about 45% of the rates for Period 1. Pre-capping sedimentation rates had been documented at about 0.13 cm/yr (Hart Crowser, 1989) during capping suggesting that sedimentation rates outside of the remediation area increased during capping operations. Sediments in all traps were similar, containing 10 to 35% sand, an estimated 5 to 10% fine organics, and the remainder silt and clay. Chemical analyses of the sediments in the sediment traps demonstrated that three of the six stations failed to meet state MCL or SQS criteria for LPAHs (Total = 185% of SQS to 211% of MCL, naphthalene = 138% of SQS to 141% of MCL, acenaphthene = 240% to 467% of MCL, fluorene = 126% to 310% of MCL, phenanthrene = 293% of SQS to 161% of MCL, and 2-methyl naphthalene = 156% to 362% of MCL), one HPAH (fluoranthene = 113% to 223% of SQS), and dibenzofuran = 147% to 348% of MCL. However, at two of these stations State sediment chemistry criteria were only exceeded during Period 1, while at the third station State sediment criteria for both periods were exceeded. Modeling indicates that dilution after mixing in the sediment column and biodegradation of the LPAHs are expected to bring most areas surrounding the cap within state MCL criteria after a few months. This will be verified during long-term monitoring."</p>	
Outcome:	<p>280,000 cy successfully placed over 54 acres, to a typical depth of about 3 feet. As described in References B-114 and E-10: "The extent and thickness of the accumulating material were monitored by Science Application International Corporation (SAIC). SAIC used five different monitoring methods - bathymetric surveys, settling plates, sediment vertical profiling system (SVPS), underwater video, and subbottom sonar profiler."</p> <p>"Bathymetric surveys were carried out to ensure that areas of excessive thickness did not accumulate, particularly in the ferry lane. Consecutive surveys were compared to estimate the thickness of the placed material. Surveys were spot-verified using a series of "settling plates" placed at six locations along the project center line. Each settling plate was constructed of a large and a small steel plate attached to either end of a 2-meter-long post. The posts were mounted vertically on the large (1.2 by 1.2 meter) bottom plate. The second, smaller plate (0.3 by 0.3 meter) was mounted on the top of the post. Before placement was initiated, the device was lowered to the bottom. As sediment was deposited on the bottom plate, sonar images obtained during bathymetric surveys showed a corresponding decrease in the distance between the top plate and the "new" bottom. In addition, graduations on the posts were occasionally read directly by divers."</p> <p>"An SVPS was used to monitor the extent of newly placed material and to detect thin areas. The SVPS is a remotely operated camera that drives a prism into the bottom and takes a photograph of a 20-cm-high cross section of the sediment-water interface. Areas that were found to have less than a 15-cm thickness of new material were noted as requiring additional coverage. Approximately two thirds of the way into the project, a towed video camera was used to ensure visually that the newly placed material was not being recontaminated by creosote seeping out of bottom sediments or by</p>	

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an unknown upland source. At the completion of construction, the bathymetric and SVPS measurements were confirmed by a subbottom sonar profiling system."

"A comparison of pre- and post- bathymetric and SVPS measurements showed that a one to three foot layer of dredged material had been placed over essentially all of the area of concern."

In 2001, an additional 15-acre cap was placed over a 15-acre area extending from the southern boundary of the earlier, 54-acre cap at the Wyckoff property. Placement details have not yet been obtained.

Restoration and Post-Monitoring:

Source: ROD September 1994.

"While source control efforts continue, the existing cap will be monitored and any necessary work to maintain the cap completed. A portion of the cap is located in the ferry navigation path, and areas closest to the ferry terminal are subject to currents generated by docked ferries. If monitoring indicates significant erosion of cap materials due to ferry propeller wash or currents, it may be necessary to supplement the cap with additional sandy materials or to place coarser materials in some areas to limit cap erosion. These cap maintenance activities will be completed as necessary, either prior to or in coordination with design and implementation of final actions in other areas."

Site-Specific Difficulties:

- In Area 1, small oil slicks were occasionally created, generally caused by "clumps" of placement material exiting the barge.
- In Area 1, the barge had to be moving at a minimum speed of 2 knots, and the placement rate could not exceed 4 cy/sec. In Area 2, the barge position had to be changed frequently enough to prevent creation of mounds greater than 3 feet high.
- Eight days were lost to weather (high winds). Placement was suspended for an additional ten working days to evaluate the newly placed material.
- As described in Reference M-167 (for the 54-acre cap):

"Four of six 550 lb settling plates consisting of 6 ft square steel bottom plates connected to a 2.5 ft square top steel plate by a 7 ft graduated wood post, were overturned or the posts were broken. The designers, using the top and bottom plates, wanted the ability to measure the cap thickness by conventional bathymetry and by sub-bottom sonar without requiring divers. However, the narrow beam of the bathymetric survey equipment had difficulty in locating the top plates. The two surviving settling plates showed depths of 2.2 and 3.9 ft. According to the diver's report, cap thicknesses around the former were more likely closer to 3 ft."

"Sub-bottom profiles, 2800 ft long in north-south (40 lanes) and east-west trending (44 lanes) directions were taken to measure the thickness of cap material. Equipment consisted of an X-Star SB100 Full Spectrum Sonar system manufactured by Precision Signal of Boca Raton, Florida. Based on the analyses, all areas within the cap boundaries received a minimum of 1 ft. cover, except in the ferry lane. The east and west areas of the ferry lane near the boundary of cap placement may have only received 0 to 0.5 ft of cover. This is due to the propwash currents generated by the ferry traffic and idling at the terminal to keep the ferry in contact with the dock during cap placement."

"Diver and video surveys were conducted during a 10 day halt in capping activities in January 1994, to investigate the extent of free product spherules on the cap adjacent areas. A video towbody consisting of a Deep-Sea Power and Light video camera mounted on a frame attached to a finned tow-weight was used. The video camera recorded a plan view of the seabed. Free product

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ProjectID: 10-02

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spherules were seen in each of the four video transects and tended to be most frequent in the area of the hot spot. They appeared as shiny, black, flattened spherules on the sediment surface. Most averaged one cm or less in diameter; the largest was about 3 cm. The density of spherules was generally between 1 and 4 per 0.1 m²; the highest was 17 per 0.1 m². The higher densities were found only in the area of the hot spot, which is low topographically. The entire volume of confirmed free product was approximately 60 mL (93 mL if unconfirmed spherules are added) - less than one-tenth of a cup. Cap/native sediment boundaries determined by SVPS surveys were confirmed by the video surveys. Sea-bottom life observed in the capping area included: crab, flounder, anemones, shrimp, sea cucumbers, clam beds, sea stars, flatfish, seapens, ratfish, cabazon, and starry flounder."

Monitoring Data

References:

- *Sediment*
- *Water:*
- *Fish:*

POTENTIALLY RESPONSIBLE PARTIES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

PRP Name: PRP INFORMATION NOT RELEASED

PRPID:

Street Address:

City:

State:

KEY CONTACTS

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Last Name: KEY CONTACT INFORMATION NOT RELEASED

Contact ID:

First Name:

Title:

Company:

Address:

City:

State:

Postal Code:

Work Phone # :

Other Phone #:

Fax # :

Email Address:

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: A

ReferenceID: 31

Title: ***Record of Decision: Wyckoff/Eagle Harbor Superfund Site - East Harbor Operable Unit***

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: US EPA Region X (PB94-964628)

Preparer/Author Address: 1200 Sixth Avenue
Seattle, WA 98101

Prepared For: General Public

Date Published: September 29, 1994

Key Words and Phrases: ROD

Reference Type: A

ReferenceID: 61

Title: ***Navigation Restrictions Proposed for Eagle Harbor***

Location: AEM

Category: Remedial Design

Prepared by/Author: US EPA Region X and U.S. Coast Guard

Preparer/Author Address:

Prepared For: General Public

Date Published: March 8, 1999

Key Words and Phrases:

Reference Type: A

ReferenceID: 878

Title: ***Fact Sheet: Wyckoff Cleanup Moving Into High Gear***

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region X

Preparer/Author Address: Seattle, WA

Prepared For: General Public

Date Published: September 2000

Key Words and Phrases:

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: A

ReferenceID: 1038

Title: *Five-Year Review Plan*

Location: AEM

Category: Monitoring, Post

Prepared by/Author: US EPA Region X

**Preparer/Author
Address:**

Prepared For: General Public

Date Published: August 26, 2002

**Key Words and
Phrases:**

Reference Type: B

ReferenceID: 114

Title: *Environmental Effects of Dredging
Eagle Harbor Superfund Project*

Location: AEM

Category: Dredging: Miscellaneous

Prepared by/Author: Eric E. Nelson, Amy L. Vanderheiden and David Schuldt

**Preparer/Author
Address:** U.S. Army Corps of Engineers
Seattle District

Prepared For: Public Information Bulletin

Date Published: July 1995

**Key Words and
Phrases:**

Reference Type: B

ReferenceID: 119

Title: *EPA National Priorities List: Wyckoff Co. / Eagle Harbor*

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region X

**Preparer/Author
Address:** Internet Website
Seattle, WA

Prepared For: Public

Date Published: March 1996

**Key Words and
Phrases:**

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: B

ReferenceID: 496

Title: *EPA Completes Successful Construction Season at the Wyckoff/Eagle Harbor Superfund Site*

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region X

Preparer/Author Address: 1200 Sixth Avenue
Seattle, WA 98101

Prepared For: General Public

Date Published: March 2001

Key Words and Phrases:

Reference Type: B

ReferenceID: 536

Title: *Superfund Fact Sheet: Wyckoff/Eagle Harbor Superfund Site*

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region X

Preparer/Author Address: 1200 Sixth Avenue
Seattle, WA 98101

Prepared For: General Public

Date Published: June 2001

Key Words and Phrases:

Reference Type: B

ReferenceID: 673

Title: *Superfund Fact Sheet: Wyckoff/Eagle Harbor Superfund Site Update*

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region X

Preparer/Author Address: 1200 Sixth Avenue
Seattle, WA 98101

Prepared For: General Public

Date Published: February 2002

Key Words and Phrases:

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: B

ReferenceID: 1032

Title: *Dive Surveys of Contaminated Sediment Capping, Eagle Harbor, Bainbridge Island, WA*

Location: AEM

Category: Monitoring, Post

Prepared by/Author: US EPA Region X (website re Dive Team Projects)

**Preparer/Author
Address:**

Prepared For: Geneal Public

Date Published: 2001 circa

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 35

Title: *PRPs sign on to Wyckoff sediment cleanup*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Superfund Week

Date Published: April 18, 1997

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 38

Title: *Cap likely at Wyckoff/Eagle Harbor*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Superfund Week

Date Published: July 11, 1997

**Key Words and
Phrases:**

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: C

ReferenceID: 55

Title: *Natural sediment recovery cleanup option for shallow bays*

Location: AEM

Category: Site Update

Prepared by/Author: Clayton R. Patmont

**Preparer/Author
Address:** Hart Crowser, Inc. (Seattle)

Prepared For: Hazmat World

Date Published: March 1991

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 57

Title: *Wyckoff may need new g.w. treatment plant*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Superfund Week

Date Published: August 5, 1994

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 58

Title: *PRPs settle damages with land*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Superfund Week

Date Published: May 27, 1994

**Key Words and
Phrases:**

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: C

ReferenceID: 59

Title: *Removal to resume at Wyckoff*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: May 7, 1993

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 138

Title: *Wyckoff weighs high-dollar groundwater fixes*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: April 17, 1998

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 558

Title: *\$41M+ ROD for Wyckoff/Eagle Harbor Chooses Innovative
Treatment Option*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: February 11, 2000

**Key Words and
Phrases:**

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: C

ReferenceID: 608

Title: *Bay West to Build Sheet Pile Wall, Migration Beach at Eagle Harbor*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Superfund Week

Date Published: October 13, 2000

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 729

Title: *Contractors to Inject Steam Into Eagle Harbor Pollution*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Hazardous Waste/Superfund Week

Date Published: July 16, 2001

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 825

Title: *Wash.: Thermal Treatment Tested*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Hazardous Waste/Superfund Week

Date Published: March 4, 2002

**Key Words and
Phrases:**

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: C

ReferenceID: 963

Title: *Wash.: Injection Plant Operates*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Hazardous Waste/Superfund Week

Date Published: September 9, 2002

**Key Words and
Phrases:**

Reference Type: E

ReferenceID: 10

Title: *Eagle Harbor Superfund Project*

Location: AEM

Category: Dredging: Miscellaneous

Prepared by/Author: Eric E. Nelson, Amy L. Vanderheiden and A. David Schuldt

Preparer/Author U.S. Army Corps of Engineers

Address: Seattle District

Prepared For: Dredging 1994 - Proceedings of the Second International Conference on
Dredging and Dredged Material Placement
Volumes 1 & 2

Date Published: 1994

**Key Words and
Phrases:**

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: E

ReferenceID: 190

Title: *Natural Recovery of PAH-Contaminated Sediments At The Wyckoff/Eagle Harbor Superfund Site*

Location: AEM

Category: Monitored Natural Attenuation

Prepared by/Author: (1) Victor S. Magar; (2) Jennifer A. Ickes; (3) James E. Abbott; (4) Richard C. Brenner; (5) Scott A. Stout; (6) Richard M Uhler; (7) Eric A. Crecelius; (8) Linda S. Bingler

Preparer/Author Address: (1), (2), (3) Battelle
Columbus, OH)
(4) US EPA
Cincinnati, OH
(5), (6) Battelle
Duxbury, MA
(7), (8) Battelle
Sequim, WA

Prepared For: First International Conference on Remediation of Contaminated Sediments, Venice, Italy

Date Published: October 10-12, 2001

Key Words and Phrases:

Reference Type: G

ReferenceID: 43

Title: *Planning for Cap Design and Construction during the RI/FS (for complete presentation see Reference G-41)*

Location: AEM

Category: Capping/Placement

Prepared by/Author: (1) Karen Keeley, (2) John Wakeman

Preparer/Author Address: (1) U.S. EPA Region X
(2) U.S. Army Corps of Engineers
Seattle, WA

Prepared For: EPA Forum on Managing Contaminated Sediments at Hazardous Waste Sites

Date Published: May 30 - June 1, 2001

Key Words and Phrases:

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: I

ReferenceID: 86

Title: *Sheetpile Wall Installation - Prime Contractor*

Location: AEM

Category: Site Update

Prepared by/Author: Bay West, Inc.

Preparer/Author

Address:

Prepared For: Distribution

Date Published: 2002 circa

**Key Words and
Phrases:**

Reference Type: L

ReferenceID: 25

Title: *Memo re: Project Summary for Eagle Harbor Superfund Site*

Location: AEM

Category: Site Update

Prepared by/Author: AEM, Inc.

Preparer/Author Malvern, PA 19355

Address:

Prepared For: Internal file

Date Published: April 10, 1992

**Key Words and
Phrases:**

Reference Type: L

ReferenceID: 120

Title: *Sediment Remediation Projects in the U.S. Using Capping or
Burial*

Location: AEM

Category: Capping/Placement

Prepared by/Author: AEM, Inc.

Preparer/Author

Address:

Prepared For: Distribution

Date Published: September 25, 2001

**Key Words and
Phrases:**

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: L

ReferenceID: 149

Title: *Maximum Baseline Cancer Risks for Contaminated Sediment Sites*

Location: AEM

Category: Risk Assessment

Prepared by/Author: AEM, Inc.

**Preparer/Author
Address:**

Prepared For: Distribution

Date Published: October 22, 2001

**Key Words and
Phrases:**

Reference Type: L

ReferenceID: 182

Title: *EPA's Evolving Position on Remedial Dredging*

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: AEM, Inc.

**Preparer/Author
Address:** Malvern, PA 19355

Prepared For: Internal Distribution

Date Published: Undated

**Key Words and
Phrases:**

REFERENCES

Project Name WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)

ProjectID: 10-02

Reference Type: M

ReferenceID: 47

Title: *Biomarker and histopathologic responses demonstrate improvement in flatfish health after site remediation in Eagle Harbor, Washington, USA*

Location: AEM

Category: Fish/Biota

Prepared by/Author: Mark S. Myers, Bernadita F. Anulacion, Barbara L. French, Tom Hom, William L. Reichert, Jon Buzitis, Tracy K. Collier

Preparer/Author Address: Environmental Conservation Division
Northwest Fisheries Science Center
National Marine Fisheries Service (NOAA)
2725 Montlake Blvd. E.
Seattle, WA

Prepared For: Unknown

Date Published: 2000 circa

Key Words and Phrases:

Reference Type: M

ReferenceID: 455

Title: *Characterization and FATE of PAH-Contaminated Sediments at the Wyckoff/Eagle Harbor Superfund Site*

Location: AEM

Category: Contaminated Sediments: Investigation/Delineation

Prepared by/Author: (1) Richard C. Brenner, (2) Victor S. Magar, (3) Jennifer A. Ickes, (4) James E. Abbott, (5) Scott A. Stout, (6) Eric A. Crecelius, (7) Linda S. Bingler

Preparer/Author Address: (1) US EPA
(2), (3) & (4) Battelle
Columbus, OH
(5) Battelle Ocean Sciences Laboratory
(6) & (7) Battelle Marine Sciences Laboratory

Prepared For: Environmental Science & Technology 36(12): 2605-2613

Date Published: 2002

Key Words and Phrases:

FISH ADVISORIES

Project Name ***WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)*** ***ProjectID:*** 10-02

Advisory: Eagle Harbor ***AdvisoryID:*** 582

Extent: Bainbridge Island

Pollutant: mercury

Species: all bottomfish

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Estuary ***Advisory Number:*** 3339

Status (Active or Rescinded): Active ***Date Rescinded:***

Contact Name: Dave McBride ***Contact Number:*** 360-236-3176

Advisory: Eagle Harbor ***AdvisoryID:*** 583

Extent: Bainbridge Island

Pollutant: mercury

Species: shellfish

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Estuary ***Advisory Number:*** 3339

Status (Active or Rescinded): Active ***Date Rescinded:***

Contact Name: Dave McBride ***Contact Number:*** 360-236-3176

Advisory: Eagle Harbor ***AdvisoryID:*** 581

Extent: Bainbridge Island

Pollutant: mercury

Species: shellfish-crab

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Estuary ***Advisory Number:*** 3339

Status (Active or Rescinded): Active ***Date Rescinded:***

Contact Name: Dave McBride ***Contact Number:*** 360-236-3176

FISH ADVISORIES

Project Name ***WYCKOFF CO./EAGLE HARBOR - PROJECT 1 (East Harbor)*** ***ProjectID:*** 10-02

Advisory: Eagle Harbor ***AdvisoryID:*** 585

Extent: Bainbridge Island

Pollutant: PAHs

Species: all bottomfish

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Estuary ***Advisory Number:*** 3339

Status (Active or Rescinded): Active ***Date Rescinded:***

Contact Name: Dave McBride ***Contact Number:*** 360-236-3176

Advisory: Eagle Harbor ***AdvisoryID:*** 303

Extent: Bainbridge Island

Pollutant: PAHs

Species: shellfish

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Estuary ***Advisory Number:*** 3339

Status (Active or Rescinded): Active ***Date Rescinded:***

Contact Name: Dave McBride ***Contact Number:*** 360-236-3176

Advisory: Eagle Harbor ***AdvisoryID:*** 584

Extent: Bainbridge Island

Pollutant: PAHs

Species: shellfish-crab

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Estuary ***Advisory Number:*** 3339

Status (Active or Rescinded): Active ***Date Rescinded:***

Contact Name: Dave McBride ***Contact Number:*** 360-236-3176
