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REPLY TO
ATTENTION OF

CENED-PD-L

April 8, 1991

New Bedford
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MEMORANDUM FOR THE RECORD

SUBJECT: New Bedford Harbor Superfund Site - Technical Impracticality of Lining Shoreline Confined Disposal Facilities

Reference: Report 11 of the Engineering Feasibility Study, " Evaluation of Conceptual Dredging and Disposal Alternatives"

The Feasibility Study (FS) for the Estuary, Lower Harbor /Bay portion of the site presents several remedial alternatives which include the use of shoreline confined disposal facilities (CDF) for the long term containment of contaminated sediments. These facilities would be unlined as currently proposed. This memorandum discusses the potential for contaminant loss through the bottom and sides of a CDF, conceptual approaches to lining these facilities and the difficulties associated with installing a liner, and contaminant release estimates associated with leachate from CDFs.

LEACHATE: Leachate from a CDF is produced by three potential sources: pore water from the dredged material placed in the facility, net precipatation percolating through the dredged material, and ground water or estuary water contacting the dredged material as a result of tidal pumping.

When material is initially placed in the CDF, it will all be flooded or saturated throughout the vertical profile. The saturated condition is anaerobic and reduced, which favors immobility of contaminants, particularly heavy metals. After the CDF is filled and dredging ceases, the dredged material above the high tide line begins to dewater and consolidate through movement of water downward as leachate, upward and out of the sediment as surface drainage or runoff, and laterally as seepage through the dike. This time frame during and immediately after CDF filling represents the greatest potential for leachate flow because it occurs during the maximum head (greatest difference in elevation) above the CDF bottom and when the dredged material permeability is greatest. The bottom of a nearshore CDF below the low tide or groundwater elevation remains saturated and anaerobic, favoring insolubility and contaminant attraction to particulate matter. After dewatering of the dredged material above the flooded zone ceases and consolidation of the material in the flooded zone reaches its final state, water movement through the flooded material is minimal and the potential for migration of contaminants is low.

The intermediate layer between the saturated and unsaturated layers will be a transition zone and may alternately be saturated and unsaturated as the tide ebbs and floods. The depth of this zone and the volume of dredged material effected depend on

the difference in tide elevations and on the permeability of the dike and of the dredged material. With low permeability material the volume of CDF material impacted by this tidal pumping is very small compared with the CDF total volume.

CONTROL MEASURES: These measures include surface covers to prevent or minimize surface water infiltration into the contaminated dredged material and liners along the bottom and sides of the CDF to act as an impermeable barrier to leachate flow. The remedial alternatives presented in the FS include CDFs with surface caps which would be installed after dredging has been completed and surface water has drained off the CDFs.

A reliable liner system for hazardous waste landfill is generally defined as a multilayer system consisting of a double-membrane liner system with leachate collection below the top membrane liner and leachate collection between the top and the bottom membrane liner. The foundation of the facility should be dry, compacted, and a low permeability soil.

Membrane liners are generally installed in dry conditions to allow construction of leakproof seams and to prepare the subgrade for proper installation of the liner. These conditions are not present at the proposed CDF locations along the New Bedford shoreline. Installing a liner in the shoreline setting presents unique and difficult construction requirements which have not been demonstrated on the scale that would be necessary at New Bedford. The difficulties result from the need to either dewater the area or bring the elevation of the base above the high water level. The soft, unconsolidated sediments that exist along the shoreline pose an additional problem because they do not provide a stable base on which to construct the liner. In addition to these weak foundation conditions, the changing shoreline environment with the fluctuating water levels, tidal pumping, and gas producing organic bottom sediments will place physical stresses on flexible membrane liners which would likely result in their failure.

Leachate detection and collection systems must be installed in a dry environment to be effective. The proposed locations for CDF's in New Bedford are all shoreline areas where the base of the facilities would be below the groundwater level unless extensive modifications were made. Leachate detection/collection would be meaningless in this setting.

Conceptual alternatives presented in Report 11 of the EFS contained lined CDFs. The conceptual approach taken in these designs required filling the nearshore sites with clean fill to above the high-tide elevation to provide the foundation for the liner system. Using such a construction sequence will require much additional time to allow for consolidation of the filled foundation to the point that it will support the liner system and subsequent contaminated sediment and cover system. The impact on project cost is also substantial as shown below:

CDF Location 1 (unlined)	$2.7 million
CDF Location 1 (lined)	$9.5 million

(Tables C7 and C8 from EFS Report 11 provide detailed cost estimates for constructing lined and unlined CDFs at location 1. A copy of the tables is attached to this memorandum.)

Less complex systems (no leachate collection/detection, single layer, etc.) could be proposed but they also would be subject to installation problems and physical forces that effect their integrity and effectiveness.

Other impacts associated with lining CDFs include:

*The quantity of contaminated sediment removed by the dredge would increase as the CDF locations must be dredged. For alternative SW-8 (CDFs 1,1A, 3) this would involve approximately 85,000 cubic yards of sediment. The removal of this contaminated sediment results in the need for additional CDF capacity to contain the dredged material.

* CDFs would need to be larger due to the need to raise/stabilize their bases prior to installing any type of liner. The alternatives contained in the EFS report 11 show the top of dike elevation of an unlined CDF to be +12 Mean Low Water (MLW) while the top of dike elevation of a lined facility would be +19 MLW.

* A large quantity of clean material would be needed to raise the CDF bases above the high water elevation. Using alternative SW-8 as an example, approximately 425,000 cubic yards of material would be needed which could be acquired from either a land source or by dredging.

CONTAMINANT RELEASE ESTIMATES: Report 11 of the EFS made contaminant release estimates for conceptual cleanup alternatives for the estuary portion of the site. The contaminant release pathway of most concern for the completed CDF is the loss of leachate from the sediment through the bottom of the facility or seepage through the dike adjacent to the shore. The primary contributor to leachate or seepage volume is the pore water associated with the dredged material placed in the CDF.

Results from the batch leaching tests conducted during the EFS (report 5) provide a basis for a conservative estimate of leachate and pore water quality for dredged material placed in CDFs. The contaminant concentrations from these batch leaching tests are worst case estimates because they are based on the estuary composite sample (1500 ppm PCB) and because these tests generally overestimate pore water concentrations for a flow through system.

A water balance was calculated to determine the quantity of water that would be available as leachate. Figure D2 form Report 11 is attached and shows how the estimate of 1.54 cubic yards of leachate for every cubic yard of sediment dredged was calculated. The quantity of leachate that actually crosses the CDF boundaries depends on local hydraulic gradients and the characteristics of the foundation materials. The analysis contained in Report 11 of the EFS assumed that the CDF foundation is free draining, i.e., there is no resistance to flow at the boundary of the CDF. This condition represents a worst case scenario because it is physically impossible to have a foundation with no resistance to flow.

Estimates of vertical percolation through the CDF bottom were made using the water balance from consolidation of the dredged material and EPA's Hydraulic Evaluation of Landfill Performance (HELP) model. During a 10 year simulation period, HELP2 computed the percolation rate from the base of a typical CDF profile, including a geomembrane cap, to average 1.6 inches of water per year. At the end of the tenth year the percolation rate was 0.36 inches per year. Leachate contaminant fluxes are based on 10 years at 1.6 inches per year and 20 years at 0.36 inches per year yielding a total of 24 inches for the 30 years following placement and capping in the CDFs.

Prior to the percolation losses predicted by HELP2, additional pore water is expelled from the dredged material slurry as the sediment consolidates. This water is released during the first 2-3 years after dredging is completed and is released in all directions, i.e., through the bottom ,sides and surface of the CDF. The evaluation of leachate release in Report 11 assumes that all this water leaves the CDF as leachate.

The volume of leachate was combined with the results of the batch leaching tests and the predicted movement through the CDF boundaries to estimate contaminant loss from CDFs. The contaminant release estimates contained in Report 11 for alternatives involving dredging of the entire estuary are shown below. The short term time frame refers to the 2-3 year period commencing with the completion of dredging. The long term time frame refers to the following 30 year period.

Leaching (PCBs)	short term	150 kg
	long term	40 kg

These numbers must be evaluated in light of the conditions at the site; contaminant release associated with other aspects of the project and the residual PCB levels that will remain after remedial activities are completed. The contaminant release estimate for dredging activities conducted in the estuary is 0.3 kg/day escaping through the Coggeshall Street Bridge.

SUMMARY: Lining CDFs would be difficult, expensive and would involve construction procedures which are unproven. The integrity and effectiveness of any liner installed would be questionable. The potential contaminant release associated

with unlined CDFs, when evaluated in terms of the other potential sources during and after remediation, is not significant.

Mark J. Otis
New Bedford Project Manager

Table C7

Construction Costs for Site 1 Unlined

Activity	Quantity	Unit Cost	Total Cost
Granular fill			
Inwater - stage 1	26,400 cu yd	$19.00	$ 501,600
Inwater - stage 2	29,555 cu yd	$19.00	$ 561,500
Land dike	7,100 cu yd	$ 6.35	$ 45,100
Geotextile	23,200 sq yd	$22.50	$ 522,000
Stone protection	2,800 cu yd	$50.50	$ 141,400
Sheetpile (secondary cell)	6,000 lin ft	$33.50	$ 201,000
Fence	2,400 lin ft	$23.50	$ 56,400
Walkway and weir	1		$ 28,500
Outlet structure	1		$ 14,500
Topsoil & seed (dike)	8,000 sq yd	$ 3.00	$ 24,000
Geotechnical monitoring	1		$ 50,000
Traffic control	55,700 cu yd	$ 0.70	$ 39,000
Capping material	34,300 cu yd	$ 6.35	$ 217,800
Topsoil & seed (cap)	103,000 sq yd	$ 3.00	$ 309,000
Geomembrane liner (cap)	103,000 sq yd	$ 2.00	$ 206,000
Silt curtain	1,200 lin ft	$25.00	$ 30,000
Total cost			$ 2,947,800

Table C8

Construction Costs for Site 1 Lined

Item	Quantity	Unit Price	Total
Cost			
Shoreline excavation	14,300 cu yd	$ 5.00	$ 71,500
Fill site (clean dredged material)	275,000 cu yd	$ 3.50	$ 962,500
Geotextile	36,000 sq yd	$22.50	$ 810,000
Granular fill			
Inwater - stage 2	46,500 cu yd	$19.00	$ 883,500
Inwater - stage 3	12,300 cu yd	$ 6.35	$ 78,100
Land dike	49,900 cu yd	$ 6.35	$ 316,900
Sheet-pile wall	78,000 lin ft	$33.50	$ 2,613,000
Liner			
Low-permeability material	34,300 cu yd	$ 8.00	$ 274,400
Sand	68,600 cu yd	$ 8.00	$ 548,800
Geomembrane liner	206,000 sq yd	$ 2.00	$ 412,000
Geotextile	103,000 sq yd	$ 2.50	$ 257,500
Leachate collection	171,000 lin ft	$ 4.25	$ 726,800
Stone protection	2,800 cu yd	$50.50	$ 141,400
Sheet-pile (secondary cell)	12,000 lin ft	$33.50	$ 402,000
Fence	2,400 lin ft	$23.50	$ 56,400
Walkway and weir	1		$ 28,500
Outlet structure	1		$ 14,500
Topsoil & seed (dike)	11,000 sq yd	$ 3.00	$ 33,000
Geotechnical monitoring	1		$ 50,000
Traffic control	108,700 cu yd	$ 0.70	$ 76,100
Capping material	34,300 cu yd	$ 6.35	$ 217,800
Geomembrane liner (cap)	103,000 sq yd	$ 2.00	$ 206,000
Topsoil & seed (cap)	103,000 sq yd	$ 3.00	$ 309,000
Silt curtain	1,200 lin ft	$25.00	$ 30,000
Total cost			$ 9,519,700

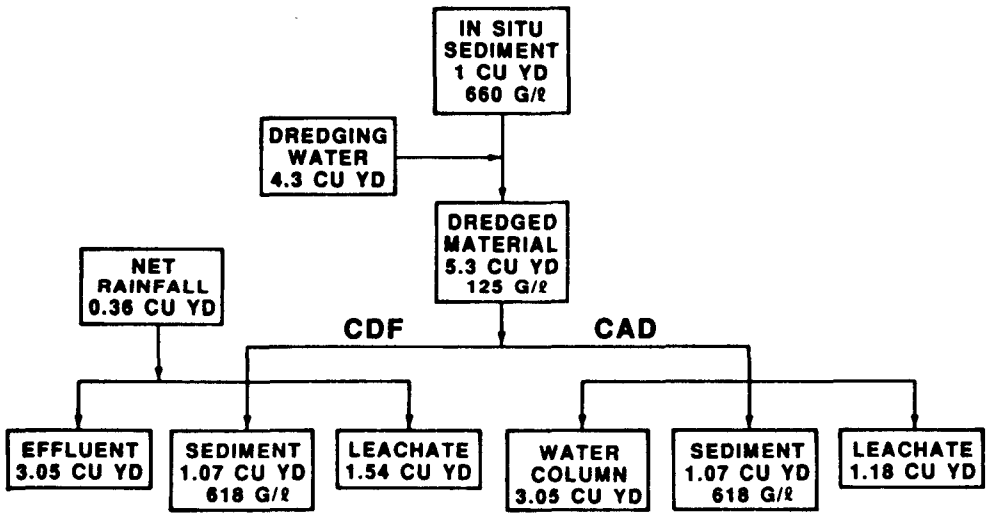

Figure D2. Water balance for dredging, CDF, and CAD disposal