



DECISION CRITERIA

Site: NEW BEDFORD
Draw: 44
Other: 49837

New Bedford Harbor Pilot Study

November 14, 1988

PURPOSE

Section 4 of the U.S. Army Corps of Engineers report entitled "Pilot Study of Dredging and Dredged Material Disposal Alternatives", dated November 1987, describes how the data acquired through the monitoring program will be used to determine if pilot study operations are causing an unacceptable risk to public health or the environment. Section 4.3.C of the Corps report states that a document would be developed that lists numerical decision criteria.

The purpose of this decision criteria document is to set forth chemical and biological criteria which, if exceeded, would require a decision to be made regarding the suspension, continuation and/or modification of operations. This decision will be made by a decision criteria committee, chaired by EPA, with representatives from EPA's Environmental Research Laboratory, the Massachusetts Department of Environmental Quality Engineering, the Massachusetts Office of Coastal Zone Management, the Corps of Engineers-New England Division and the Corps of Engineers-Waterways Experiment Station.

The Decision Criteria outlined herein are based on the best information available to date and are conservative in nature. The Criteria are intended to serve as an early warning system to the Committee of potential problems requiring a review of project operations and resulting in a

decision concerning continuation, modification or suspension of those operations. Consistent with the overall developmental nature of the Pilot Study, however, the Decision Criteria will be continuously evaluated and may be adjusted as necessary to reflect the availability of additional analytical data and actual field observations and experience.

INTRODUCTION

Decision criteria are required to determine if there are unacceptable releases of contaminants or toxicity to the environment during dike construction, dredging or other activities that are part of the New Bedford Harbor pilot dredging study. If releases exceed numerical decision criteria, the decision criteria committee will evaluate the monitoring data and other information related to the operation and a decision on an appropriate action will be made. Decision criteria cannot be based on existing state or general water quality standards for PCBs, and some metals, because concentrations in water at this site currently exceed standards. In addition, decision criteria cannot be based on accumulation of biologically available PCB concentrations to the 2 ug/g FDA action level in seafood, because PCB concentrations in indigenous organisms presently exceed this level. Finally, decision criteria cannot be based on concentrations of specific chemicals in water or sediments alone, because sediments to be dredged are toxic, and the cause of toxicity may not be related to chemicals monitored. Therefore, both chemical monitoring and tests with marine organisms are required to determine the environmental acceptability of this project.

Decision criteria for this project are based on pre-operational monitoring which provides data on baseline contaminant concentrations, bioaccumulation and toxicity and their respective variability. These data can then be used to identify a contaminant concentration or biological response that is acceptable in light of pre-existing conditions. These concentrations and responses can then be compared with similar monitoring data collected during operational phases of the project to detect statistically significant or numerically relevant changes that may require a management decision. The decision criteria must reflect the need to accept the risk of short-term moderate increases in the release of contaminants or associated toxicity in the near-field, as long as the goal of long-term clean up is achieved. The procedure for deriving decision criteria must be fixed prior to initiating the project, but numerical values should be flexible to allow incorporation of additional pre-operational monitoring data. Decision criteria should be sufficiently sensitive to permit detection of potentially unacceptable conditions so that the operation can be suspended and if necessary, a decision on an appropriate action can be made. Actions which might be recommended include, but are not limited to, the following: Monitor rates of return to normal, confirm reasonableness of observations using monitoring data from other locations, install additional silt curtains, change dredges, change dredging operational procedures, limit CDF discharge to non-dredging periods or resume dredging.

PRE-OPERATIONAL MONITORING

Physical, chemical and biological data, relevant to the derivation of decision criteria, were monitored prior to the operational phase of the project to define baseline contaminant concentrations in water and biota and biological responses to receiving waters (ERL-Narra-

gansett, 1988). This monitoring focused on stations above the dredging site (NBH-1), at the Coggeshall Street Bridge (NBH-2), north of Popes Island (NBH-3), near the Hurricane Barrier (NBH-4) and at a reference site near West Island (NBH-5).

Although all data on pre-operational conditions should be examined when evaluating the implications of operational phases, baseline data from endpoints and locations pertinent to the decision criteria are most important (Table 1). Total contaminant concentrations in flow-proportional composite samples during ebb tides at NBH-2 were 0.60 ug/l (C.V.=53%) for total PCBs, 0.23 ug/l (C.V.=22%) for Cd, 2.6 ug/l (C.V.=33%) for Pb and 5.3 ug/l (C.V.=17%) for Cu. Net transport of PCBs from the upper estuary averaged 0.09 Kg/tidal cycle (C.V.=212%).

Concentrations of PCBs in mussel tissues were greater near the Coggeshall Street Bridge, 45.7 ug/g (C.V.=21%) on day 7 and 94.7 ug/g (C.V.=18%) on day 28, than at the Hurricane Barrier, 7.1 ug/g (C.V.=49%) on day 7 and 13.7 ug/g (C.V.=21%) on day 28. Variability of all data, except for net transport at NBH-2, lead concentration at NBH-4 and mussel scope for growth, were low. Composite water samples from the ebb tide at NBH-2 were not lethal to fish, invertebrates or plants tested. No sublethal responses were measured in waters collected at NBH-4.

Data from pre-operational monitoring conducted by EPA's Environmental Research Laboratory at Narragansett, Rhode Island (ERLN) are the basis for development of numerical decision criteria. In addition, data from other sources may provide the decision criteria committee with insight into the variability of biological and chemical data which may aid in selection of appropriate actions if criteria are exceeded during an operational phase. Available data on chemical concentrations and biological effects from other

sites within New Bedford Harbor need to be compiled for use by the decision criteria committee.

DECISION CRITERIA

Decision criteria are based on data from the baseline monitoring study and are intended to: (1) limit transport of contaminants from the upper estuary to the lower harbor and bay, (2) prevent excessive mortalities of species below the upper estuary, (3) limit to the harbor, sublethal biological effects.

Decision criteria adopted by EPA are presented in Table 2. Statistical analyses revealed exceptionally small variation in most chemical and biological data (Table 1). Decision criteria values for chemical monitoring are now based solely on a statistically significant increase in chemical concentrations and transport using the one-tailed "t-test" at $\alpha=0.01$. If monitoring during an operational phase indicates PCB, copper, or lead concentrations significantly increased above baseline at any time during any operational phase, the decision criteria committee will evaluate all available monitoring data and other information related to the operation prior to resumption of the operation. For biological monitoring data, decision criteria are based on effect endpoints that are both biologically meaningful and statistically significant (Table 2). Detection of high mortality or dramatic sublethal effects in one species, or lesser levels of effects in two of the five species tested, will require the decision criteria committee to evaluate the monitoring data and other information related to the operation prior to the resumption of operations. Details of specific numerical decision criteria, station locations and decisions required follow.

CRITERIA

I. Total Contaminant Concentrations in Water:

NBH-2: 1.4 ug/l PCBs, 7.2 ug/l Pb, 13 ug/l Cu, - These values are statistically greater ($\alpha=0.01$) than the mean concentration observed in ebb tide water samples collected during the pre-operational monitoring at this site. Exceedance of one of these values requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

NBH-2: 9.3 ug/l Cd - This value is the Criteria Continuous Concentration (CCC) from the EPA Water Quality Criteria for cadmium. Exceedance of this value requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

NBH-4: 0.44 ug/l PCBs, 15 ug/l Pb and 6.0 ug/l Cu - These values are statistically greater ($\alpha=0.01$) than the mean concentration observed in ebb tide water samples collected during the pre-operational monitoring at NBH-4. If one of these values is exceeded during the operation and if concentrations are significantly elevated at NBH-2, the decision criteria committee must evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

NBH-4: 9.3 ug/l Cd - This value is the Criteria Continuous Concentration from the cadmium water quality criteria document. If this value is exceeded during the operation and if concentrations are significantly elevated at NBH-2, the decision criteria committee must evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

II. Net Transport of PCBs:

NBH-2: 0.71 kg PCBs/tidal cycle - This value is statistically greater ($\alpha=0.01$) than the mean net transport of PCBs observed at NBH-2 during pre-operational monitoring. Exceedance of this value during any operation requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

III. Bioaccumulation in Mussels:

NBH-2: 80 ug/g PCBs on day 7 or 160 ug/g PCBs on day 28 - These values are statistically greater ($\alpha=0.01$) than the mean concentration observed in mussel samples collected during the pre-operational monitoring. Exceedance of one of these values requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of the next phase of operation.

NBH-4: 19 ug/g PCBs on day 7 or 23 ug/g PCBs on day 28 - These values are statistically greater than the mean concentration observed in mussel samples collected during the pre-operational monitoring. Exceedance of one of these values requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of the next phase of the operation.

IV. Organism Responses - Mortality:

NBH-2: ≥ 20 % mortality (or 80% fertilization for sea urchins) for two species or > 50 % mortality (or < 50 % fertilization for sea urchins) for one species - The value of 80% survival (20% mortality) was selected as the level of significant biological impact for each species and 50% mortality as representing an imminent threat to one species. Exceedance

of 20% mortality for two species or 50% mortality for one species requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of the operations on the next day.

V. Organism Responses - Sublethal Impacts:

NBH-4: Values for significant sublethal impacts on growth or reproduction are species specific and represent magnitudes of impact of probable long-term significance to local populations (Table 2). Exceedance of these values for two species or two times these values for any one species at NBH-4 and occurrence of similar or more severe responses for the same species at NBH-2 requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of the next phase of the operation.

Table 1. Results of the pre-operational monitoring efforts for the New Bedford Harbor Pilot Project. Data shown for each station and endpoint include the mean, the coefficient of variation (%), the statistically significant ($\alpha = 0.01$) critical value (underlined), and the number of samples used to calculate the mean (n). Chemical data were transformed using logarithms and survival data using arcsines to normalize distributions prior to calculation of means, variances, and critical values. The numbers in brackets next to the values for the biological responses are the mean values at the West Island control station (NBH-5) for that endpoint. Only values from stations and endpoints used in the Decision Criteria are listed.

Endpoint	New Bedford Harbor Station Location		
	Coggeshall St. Bridge (NBH-2)	Hurricane Barrier (NBH-4)	
Water Chemistry			
	Ebb (ug/l)	Net Transport (kg)	
		Ebb (ug/l)	
PCB	0.60, 53% <u>1.4</u> , (8)	0.09, 212% <u>0.71</u> , (7)	0.11, 19% <u>0.44</u> , (7)
Cd	0.23, 22% <u>0.65</u> , (8)		0.12, 30% <u>0.90</u> , (8)
Pb	2.6, 33% <u>7.2</u> , (8)		2.1, 82% <u>15.</u> , (8)
Cu	5.3, 17% <u>13.</u> , (8)		2.5, 30% <u>6.0</u> , (8)
Mussel PCB Tissue Residues (ug/g)			
7-day exposure		46, 21% <u>80</u> , (7)	7.1, 49% <u>19</u> , (7)
28-day exposure		95, 18% <u>160</u> , (6)	14, 21% <u>23</u> , (7)
Biological Responses			
Acute (% Survival)		Ebb	
Fish		88, 6%, <u>66</u> , (6) [93, 11%, (6)]	
Mysids		100, 0%, <u>100</u> , (8) [99, 15%, (8)]	
Mussels *		95, 25%, <u>0</u> , (5) [99, 14%, (7)]	
Sea Urchins (% Fert.)		93, 4%, <u>84</u> , (12) [94, 3%, (11)]	
Plants		100, 0%, <u>100</u> , (2) [100, 0%, (2)]	
Chronic Effects			Ebb
Fish (dry wt., mg)			1.22, 11%, <u>0.73</u> , (6) [1.10, 7%, (6)]
Mysids (dry wt., mg)			0.285, 7%, <u>0.222</u> , (8) [0.290, 7%, (8)]
Mussels: *			1.3, 174%, <u>13.</u> , (4) 24%, 0.50%, (2)
Scope for growth (J/h) **			
Shell growth (mm) ***			
Sea Urchin (% Fert.)			93, 5%, <u>81</u> , (12) [94, 3%, (11)]
Plant (# cystocarps) ****			17.5, 29%, <u>4.8</u> , (30)

* Mussels were deployed continuously in the field, therefore, any biological responses reflect the integrated effect of both the ebb and flood tides.

** The absolute value of this index can vary throughout the year, therefore, it is used as a relative measure. The value in this table reflects the difference in the endpoint between stations NBH-4 and NBH-5.

*** The absolute shell growth of mussels changes throughout the year. The values shown are the mean coefficient of variation (%) of shell growth for the two deployments, the critical value (%) in mean growth between the NBH-4 and NBH-5 stations, and the number of deployments (n).

**** Values shown are representative of the response of control treatments in tests with this species completed over the past year.

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Table 2. Monitoring program endpoints and the numerical decision criteria requiring temporary or permanent cessation of any operational phase or an increase in sampling or sample processing.

			New Bedford Harbor Station Location		
Endpoint	Time to obtain first value	Coggeshall St. Bridge (NBH-2)		Hurricane Barrier (NBH-4)	
		Ebb (ug/l)	Net Transport (kg)	Ebb (ug/l)	
Water Chemistry					
PCB (total)	24 hr	1.4	0.71/cycle	0.44	
Cd	24 hr	9.3		9.3	
Pb	24 hr	7.2		15.	
Cu	24 hr	13.		6.0	
Mussel PCB Tissue Residues (ug/g)					
7-day exposure	10 days		80	19	
28-day exposure	30 days		160	23	
Biological Responses					
Acute (% Survival)		Ebb			
Fish		Mortality > 20% of Control value for two species or > 50% for one species			
Mysids	All tests monitored daily				
Mussels					
Sea Urchins (% Fert.)					
Plants					
Chronic Effects					
		Ebb			
Fish (dry wt., mg)	8 days	20% (40%)			
Mysids (dry wt., mg) (reproduction)	8 days	20% (40%) 50% (100%)			
Mussels:					
Scope for growth (J/h)	8 days	7.5 J/h (15 J/h)			
Shell growth (mm)	28 days	50% (100%)			
Sea Urchin (% Fert.)	1 day	25% (50%)			
Plant (# cystocarps)	8 days	50% (100%)			