

MEMORANDUM FOR RECORD

25 June 2003

SUBJECT: DETERMINATION ON THE SUITABILITY OF DREDGED MATERIAL TESTED UNDER THE EAST WATERWAY STAGE II RECENCY CHARACTERIZATION, EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT (CWA) FOR OPEN-WATER DISPOSAL AT THE ELLIOTT BAY DISPOSAL SITE.

1. The following summary reflects the consensus determination of the Agencies' (U.S. Army Corps of Engineers, Department of Ecology, Department of Natural Resources, and the Environmental Protection Agency) with jurisdiction on dredging and disposal on the suitability for unconfined open-water disposal at the Elliott Bay disposal site of an estimated 12,030 cy of dredged material tested under recency guidelines as part of the Port of Seattle East Waterway Stage 2 Recency recharacterization within the East Waterway Superfund site located in Elliott Bay, Seattle, Washington.
2. **History.** Material testing in East Waterway is ranked high for testing and recency evaluation, and was sampled and tested during two major sampling efforts, the first being the East Waterway, Terminal 18 sampling effort conducted during March 1996 (March 17, 1997 Suitability Determination), and the second being the East Waterway, Stage 2 sampling effort conducted during July-August 1998 (November 2, 1999 Suitability Determination). A Recency Memorandum submitted to the DMMP agencies listed 29 stations within the Stage 2 footprint that were initially tested and found suitable for unconfined open-water disposal, where recency had expired. Of those covered in the memorandum, 3 were characterized during the 1997 sampling effort, and 26 DMMUs were characterized during 1998. The DMMP agencies responded to the Recency Memorandum, and generally agreed with the proposed sampling and compositing strategy (Attachment 1).
3. Relevant dates for regulatory tracking purposes are included in Table 1.

Table 1. Regulatory Tracking Dates

Port of Seattle Recency Memorandum to DMMP articulating proposed approach for Stage 2 retesting	November 27, 2002
DMMP Response letter to Recency Memorandum (Attachment 1)	December 19, 2002
Port of Seattle Recency Quality Assurance Project Plan (DMMP SAP)	January 13, 2003
DMMP SAP Approval date:	February 3, 2003
Sampling date(s):	February 4, 2003
Recency Sampling Data Report submittal	June 6, 2003
DAIS Tracking Number	POS2R-1-B-F-188
Recency Determination Date: High (2 years)	February 2005

4. The Port of Seattle subsequently submitted a Recency QA Project Plan (DMMP SAP), which was approved by the DMMP agencies on February 3, 2003, allowed compositing of DMMUs with similar chemistry, resulting in a proposed compositing strategy, where 3 composited DMMUs characterized under the 1997 SDM were proposed for retesting as originally configured, and the remaining 26

DMMUs characterized under the 1999 SDM were proposed for reanalysis as 8 larger composites (see Table 2).

Table 2. Representative sample volume, compositing, and testing strategy approved by DMMP

Suitability Determination date	Original Stage 2 DMMU ID	Volume (cv)	New DMMU ID	Volume (cv)
March 17, 1997	1C50	4,030	EWS2-COMP9	4,030 (retested)
March 17, 1997	2C13	4,000	EWS2-COMP10	4,000 (retested)
March 17, 1997	2C19	4,000	EWS2-COMP11	4,000 (retested)
November 2, 1999	S2	3,180	EWS2-COMP1	6,420
November 2, 1999	S3	3,240		
November 2, 1999	S4	3,290	EWS2-COMP2	16,220
November 2, 1999	S5	3,310		
November 2, 1999	S6	3,310		
November 2, 1999	S7	3,300		
November 2, 1999	S8	3,010		
November 2, 1999	S9	4,100		
November 2, 1999	S10	3,790		
November 2, 1999	S14	3,650		
November 2, 1999	S15	3,560		
November 2, 1999	S19	4,070		
November 2, 1999	S13	4,120	EWS2-COMP4	8,120
November 2, 1999	S21	4,000		
November 2, 1999	S18	3,870	EWS2-COMP5	8,040
November 2, 1999	S22	4,170		
November 2, 1999	S46	4,210	EWS2-COMP6	8,230
November 2, 1999	S47	4,020		
November 2, 1999	S49	3,840	EWS2-COMP7	7,730
November 2, 1999	S50	3,890		
November 2, 1999	S39	4,040	EWS2-COMP8	24,070
November 2, 1999	S40	4,040		
November 2, 1999	S52	3,910		
November 2, 1999	S53	4,090		
November 2, 1999	S54	3,860		
November 2, 1999	S55	4,130		

Sampling:

5. This Recency testing SDM documents sampling conducted by vibracore sampler on February 4, 2003 for a total of 3 dredged material management units (DMMUs) located within the high ranked Stage 2 footprint within the East Waterway, representing a total volume of 12,030 cubic yards (Figures 1 and 2). A total of fifteen core samples were collected, with five core samples collected within each of the three DMMUs. The five core samples were composited for one analysis for each DMMU. The material characterized by these three DMMUs represent a small subset of the material approved in the SAP for retesting under recency. The Port of Seattle submitted a data summary report to the

DMMP agencies on June 10, 2003, which provided data testing summaries for the 3 retested DMMUs (see Table 2).

6. The Agencies' approved sampling and analysis plan was not followed as approved. As indicated above, only 3 of the 11 DMMUs approved for retesting under recency were retested. The quality assurance/quality control guidelines specified by the Puget Sound Dredged Disposal Analysis Users Manual were generally achieved. The data gathered were deemed sufficient and acceptable for decision-making by the Dredged Material Management Program (DMMP) agencies based on best professional judgment.

Chemical Testing:

7. Attachment 2 summarizes the sediment conventional, chemical, biological testing results and suitability determination outcomes for all three DMMUs evaluated. Chemical analysis of the three DMMUs indicated that mercury was quantitated over the SL in 2 of 3 DMMUs analyzed, whereas PCBs were quantitated over the SL in all 3 DMMUs, and over the BT in one DMMU. Dieldrin exceeded the screening level, but was undetected in all three DMMUs, and DDT was undetected over the screening level in two of three DMMUs. Attachment 3 summarizes the full chemistry results for all analytes tested. All three DMMUs tested underwent concurrent bioassay toxicity testing and the results of these analyses are summarized below.

Biological Testing:

8. Standard bioassay testing was conducted on the three DMMUs within the 56 day biological holding time. Table 3 summarizes the solid phase bioassay Quality Control (QC) performance guidelines and also summarizes the solid phase bioassay interpretative guidelines for nondispersive sites, which were used to evaluate the bioassay data presented below. Table 4 summarizes the batch specific bioassay toxicity testing outcomes for the 3 DMMUs tested. Three reference samples were collected from Carr Inlet to block for grain size effects, but only one was utilized in the bioassay interpretation (e.g., CR-23). In general, all negative control and reference sediments met the DMMP performance limits for each of the three bioassay tests to assess toxicity. Results for each bioassay test are summarized in Table 4 for the East Waterway recency retesting area compared to the DMMP nondispersive interpretive guidelines. These bioassay results are discussed below for each of the bioassay tests.
 - a) **Amphipod Bioassay (*Eohaustorius estuarius*).** All three DMMUs showed single-hit responses for the amphipod bioassay. Interstitial total ammonia concentrations measured at the initiation of the test on day 0 were greater than 30 mg/l for two of the three DMMU tested (e.g., COMP-9 = 40 mg/l; COMP-11 = 50 mg/l). However, the applicant did not run an Ammonia LC50 to validate the sensitivity of *Eohaustorius* to Ammonia concentrations observed in the sediments, as required by the DMMP. Although it is likely that ammonia may have contributed to some of the toxicity observed, the significance of this observation remains unsubstantiated without direct toxicity information.
 - b) **Bivalve Larval Bioassay (*Mytilus galloprovincialis*).** The results of the larval bivalve test showed that two of the three DMMUs tested showed relatively low normalized combined percent mortality and abnormality (NCMA), but DMMU COMP-11 demonstrated a single-hit response relative to the reference sediment.

Table 3. BIOASSAY PERFORMANCE STANDARDS AND EVALUATION GUIDELINES

Bioassay	Negative Control Performance Standard	Reference Sediment Performance Standard	Dispersive Disposal Site Interpretation Guidelines		Nondispersive Disposal Site Interpretation Guidelines	
			1-hit rule	2-hit rule	1-hit rule	2-hit rule
Amphipod	$M_C < 10\%$	$M_R - M_C < 20\%$	$M_T - M_C > 20\%$ and M_T vs M_R SD (p=.05) and		$M_T - M_C > 20\%$ and M_T vs M_R SD (p=.05) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval	$N_C \div I > 0.70$	$N_R > N_C > 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and		$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and	
			$N_R/N_C - N_T/N_C > 0.15$	NOCN	$N_R/N_C - N_T/N_C > 0.30$	NOCN
Neanthes growth	$M_C < 10\%$ and $MIG_C > 0.38$	$M_R < 20\%$ and $MIG_R \div MIG_C > 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD (p=.05) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD (p=.05) and	
			$MIG_T/MIG_R < 0.70$	NOCN	$MIG_T/MIG_R < 0.50$	$MIG_T/MIG_R < 0.70$

M = mortality, N = normal survivors, I = initial count, MIG = mean individual growth rate (mg/individual/day)

SD = statistically different, NOCN = no other conditions necessary, N/A = not applicable

Subscripts: R = reference sediment, C = negative control, T = test sediment

Table 4. Bioassay testing interpretation summary.

Sample ID	Amphipod		Bivalve Larvae		Neanthes Growth		Overall DMMU Pass/Fail
	Mortality (%)	% over reference	NCMA (%)	% over reference	Growth (mg/day/worm)/ (% Survival)	% of reference	
Control	0		0		1.29 / 100	104	
CR-23 (reference)	19		11		1.24 /100		
COMP-9	77	58 (SH)	25.7	14.7	1.14 / 100	92	Fail
COMP-10	52	33 (SH)	20.3	9.3	1.27 / 100	102	Fail
COMP-11	80	61 (SH)	49.7	38.7 (SH)	1.06 /100	85	Fail
Ref. Tox. Test NAS WL	LC50/ CdCl ₂ 2.32 mg/l		EC50/Cu 9.69 ug/l 8.46-13.6 ug/l		LC50/ CdCl ₂ 10.2 mg/l 4.26-11.0 mg/l		

Legend: NCMA = normalized combined percent mortality and abnormality
 SH = single hit failure response relative to reference (DMMP guidelines)
 NAS WL = Northwest Aquatic Sciences warning limits

- c) **Neanthes 20-day Growth Bioassay (*Neanthes arenaceodentata*)**. The results of the *Neanthes* growth bioassay (Table 3) showed generally low mortality in tested sediments, and no toxicity relative to the DMMP interpretive guidelines for mean individual growth for all three DMMUs.
- d) **DMMP Bioassay Summary Determination**. Overall interpretation of the bioassay testing responses indicates that all three East Waterway recency DMMUs failed the DMMP unconfined-open-water disposal bioassay guidelines.

Suitability Determination

11. The DMMP agencies accepted the data as sufficient to make a suitability determination for open-water unconfined-disposal. Attachment 2 summarizes the final suitability determination for each of the 3 DMMUs and summarizes the essential chemical and biological testing information forming the basis for these determinations.
12. A total of 12,030 cubic yards of East Waterway recency material in 3 DMMUs failed DMMP evaluation guidelines and are unsuitable for open-water disposal at the Elliott Bay non-dispersive site.
13. This memorandum documents the suitability of the material tested during the East Waterway Recency characterization for dredging and disposal at the Elliott Bay non-dispersive open-water disposal site. However, this suitability determination does not constitute final agency approval of the project. A dredging plan for this project must be completed as part of the final project approval process. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under Section 404(b)(1) of the Clean Water Act.

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Concur:

_____	_____
Date	David Kendall, Ph.D., Seattle District Corps of Engineers
_____	_____
Date	Justine Barton, Environmental Protection Agency
_____	_____
Date	Tom Gries, Washington Department of Ecology
_____	_____
Date	Peter Leon, Washington Department of Natural Resources

Copies Furnished:

Jim Green, Corps Regulatory Branch
Justine Barton, EPA
Kevin Rochlin, EPA Superfund Project Manager
Tom Gries, Ecology
Peter Leon, DNR
Doug Hotchkiss, Port of Seattle
DMMO File

Attachment 1

December 19, 2002

Doug Hotchkiss
Port of Seattle
P.O. Box 1209
Seattle, WA 98111

Subject: Port of Seattle, East Waterway, Harbor Island Superfund Site: Nature and Extent of Contamination, Recency Memorandum

Dear Mr. Hotchkiss:

This letter provides the DMMP consensus review response to the November 27, 2002 memorandum prepared by Windward Environmental and Anchor Environmental, for the Port of Seattle, regarding the recency of East Waterway Stage I/II data collected in 1998/1999. The DMMP agencies generally agree with the proposed approach for compositing and archiving samples that were determined to be suitable for unconfined open-water disposal under previous suitability determinations in 1998 and 1999. However, the DMMP agencies have some concerns about some of the sampling/compositing strategies proposed and have some recommended changes outlined below.

Our comments and recommendation on changes to the sampling/compositing approach are discussed below.

1. The DMMP staff agrees that it may be efficient and reasonable to propose a sampling strategy that addresses recency concerns by a) initially analyzing composite samples formed by combining previous DMMUs and representing a volume of sediment larger than the 4000 cubic yard guideline (for a high-ranked area) and b) subsequently analyzing individual DMMUs from within composites that are found unsuitable for open-water disposal. We also agree that the main basis for selecting the DMMUs to be combined should be the overall similarity of their physical, chemical and biological characteristics. In general, the Port has proposed a compositing scheme where this is true. However, upon closer review of the data, we believe a few changes to the proposed scheme are warranted.
 - We recommend splitting out S2 and S3 as a separate composite from S4, S5, S6, S7, and S8, because S2 and S3 do not have BT exceedances for TBT and PCB. Compositing S2 and S3 with the other DMMUs, which had BT exceedances noted above, effectively dilutes the overall composite.
 - After looking over the chemistry for S13 and S21, we recommend splitting out these two as either individual uncomposited DMMUs or as a composited sample due to the overall similarity in the chemistry, and BT exceedances for both TBT and PCBs. We recognize that these two DMMUs are not contiguous, but can be analyzed and dredged separately as individual DMMUs based on the outcome of the retesting effort.
2. The column header in Table 1 highlighted as “**Bioassay Failures**” should be changed to “**Bioassay 2-hit response**”. All the bioassay hit responses depicted were 2-hit responses for the single species noted, except those where “none” were observed. Depicting the responses as “failures” is misleading as there were no corroborating bioassay hits (either 2-hit or 1-hit) from the

other two bioassays tested for the listed DMMUs, which would then have resulted in a collective bioassay response failure.

3. Also, in Table 1, change the “bioassay 2-hit response” for DMMU 1C50 from “amphipod” to “none”, as no amphipod hit was observed for this DMMU.
4. We note that the large number of BT exceedances displayed in Table 1 underscores the fact that nineteen DMMUs ultimately underwent bioaccumulation testing. Therefore, a number of the composited DMMUs proposed to undergo retesting are also likely to exceed BTs and be subject to DMMP bioaccumulation testing requirements.
5. Page 4, first sentence. Change two-hit bioassay failures to two-hit bioassay responses to be consistent with comment 2 above.

Also, please be aware that the DMMP agencies have some general concerns about recency resampling/retesting approaches allowing compositing within a superfund and high concern area. The DMMP agencies will deliberate further on this issue and will clarify future DMMP policy approaches on recency resampling in a clarification paper to be presented at the 2003 Sediment Management Annual Review Meeting.

Please call me (206/764-3768) if you have any questions about our comments and recommendations.

Sincerely,

David R. Kendall, Ph.D.
Chief, Dredged Material Management Office

Copies Furnished:
Erika Hoffman, EPA
Kevin Rochlin, EPA
Tom Gries, Ecology
Peter Leon, DNR
DMMO File

Attachment 2. DMMP Sediment Testing Summary and Evaluation for Port of Seattle Stage 2 Recency Footprint.

CHEMICAL NAME	Units	SL	BT	DMMU ID:		Stage 2: 1C50 (Init)		EWS2-COMP9		Stage 2: 2C13 (Init)		EWS2-COMP10		Stage 2: 2C19 (Init)		EWS2-COMP11	
				Rank:	ML	H	VQ	H	VQ	H	VQ	H	VQ	H	VQ	H	VQ
					Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.	Conc.
Mercury	mg/kg	0.41	1.5	2.3	0.39		0.55		0.569		0.22		0.55				
Dieldrin	ug/kg	10	37				20	U			19	U		20	U		
Total DDT	ug/kg	6.9	50	69	18.6	D	10	U	11	UD	11	UD	20	U			
Total PCBs	ug/kg	130		3,100	500	D	568		760	D	240		220	UD	1,260		
Total PCBs (TOC- normalized)	mg/kg		38		33		33		40		24		16.9		63		
Total Solids	%				60.3		60.8		65.0		63.6		63.3		60.0		
Total Volatile Solids	%				5.1				5.1		4.3						
Total Organic Carbon	%				1.5		1.7		1.9		0.98		1.3		2.0		
Total Ammonia	mg/kg				85.0		150.0		39.0		47.0		22.0		180.0		
Total Sulfides	mg/kg				1,200		480		370	J	190		320		900		
Gravel	%						-				0.1				0.1		
Sand	%						25.3				33.7				29.4		
Silt	%						47.9				55.2				47.1		
Clay	%						26.9				11.1				23.4		
Fines (percent silt + clay)	%				75.0		74.7		51.3		66.3		76.0		70.5		
preferred reference match:	%																
Eohaustorius estuarius hits:					NH		1-H		NH		1-H		NH		1-H		
Mytilus galloprovincialis hits:					NH		NH		NH		NH		NH		1-H		
Neanthes arenaceodentata hits:					NH		NH		NH		NH		NH		NH		
Bioassay Determination: (P/F)					PASS		FAIL		PASS		FAIL		PASS		FAIL		
BTs exceeded:					no		no		yes		no		no		yes		
Bioaccumulation conducted:					no		no		yes		no		no		no		
Bioaccumulation Determination:					Not Tested		Not Tested		PASS		Not Tested		Not Tested		Not Tested		
ML Rule exceeded:					no		no		no		no		no		no		
PSDDA Determination:					PASS		FAIL		PASS		FAIL		PASS		FAIL		
DMMU Volume:	cy				4,030		4,030		4,000		4,000		4,000		4,000		
DMMU ID:					1C50 (Initial)		COMP9		2C13 (Initial)		COMP10		2C19 (Initial)		COMP11		

Legend:
1H = one hit response failure (DMMP Guidelines)
2H = two hit response failure (DMMP Guidelines)
NH = no hit response (DMMP Guidelines)
P = Pass (Suitable for UCOWD)
F = Failure (Unsuitable for UCOWD)
VQ = Validation Qualifier
UCOWD = Unconfined open-water disposal
U = Undetected at the reported concentration
N = Presumptive evidence/tentative identification
J = analyte positively identified, estimated concentration
BT = bioaccumulation trigger sediment exceedance
SL = screening level (lower chemical guideline)

Total Volume: 12,030

Attachment 3. Summary of all chemicals analyzed for the Stage II Recency Characterization.

Parameter	DMMP			Comp-9		Comp-10		Comp-11	
	SL	BT	ML	Value	VQ	Value	VQ	Value	VQ
Metals (mg/kg dw)									
Arsenic	57	507.1	700	10		7	U	8	U
Cadmium	5.1	5.1	14	1		0.5		1	
Copper	390		1,300	57.7		37.1		61	
Lead	450	975	1,200	64		46		81	
Mercury	0.41	1.5	2.3	0.55		0.31		0.55	
Nickel	140	370	370	34		17		28	
Silver	6.1	6.1	8.4	0.85		0.6		1.3	
Zinc	410	2,783	3,800	121.5		85.1		135	
Organometals (ug/L interstitial)									
Tributyltin as ion	0.15	0.15		0.02	U	0.02	U	0.13	
Low Molecular Weight PAH (ug/kg)									
Total LPAH	5,200		29,000	420		330		880	
Napthalene	2,100		2,400	29		36		160	
Acenaphthylene	560		1,300	23		23		35	
Acenaphthene	500		2,000	100		69		120	
Fluorene	540		3,600	42		34		88	
Phenanthrene	1,500		21,000	200		150		410	
Anthracene	960		13,000	100		69		120	
2-Methylnaphthalene	670		1,900	26	U	27		160	
High Molecular Weight PAH (ug/kg)									
Total HPAH	12,000		69,000	2,400		1,500		2,500	
Fluoranthene	1,700	4,600	30,000	370		200		450	
Pyrene	2,600	11,980	16,000	550		420		650	
Benzo(a)anthracene	1,300		5,100	210		120		210	
Chrysene	1,400		21,000	290		170		270	
Benzofluoranthenes	3,200		9,900	470		310		410	
Benzo(a)pyrene	1,600		3,600	210		140		190	
Indeno(1,2,3-c,d)pyrene	600		4,400	100		67		110	
Dibenzo(a,h)anthracene	230		1,900	50		23		34	
Benzo(g,h,i)perylene	670		3,200	124		74		140	
Chlorinated Organic Compounds (ug/kg)									
1,3-dichlorobenzene	170			20	U	19	U	20	U
1,4-dichlorobenzene	110		120	32		1.5	U	74	
1,2-dichlorobenzene	35		110	19	U	1.5	U	12	U
1,2,4-trichlorobenzene	31		64	19	U	7.4	U	20	U
Hexachlorobenzene (HCB)	22	168	230	19	U	0.97	U	0.98	U
Phthalates (ug/kg)									
Dimethylphthalate	71			20	U	19	U	20	U
Diethylphthalate	200			110	U	110	U	110	U
Bis(2-ethylhexyl)phthalate	1,300			210		260		670	
Di-n-butylphthalate	1,400			20	U	19	U	20	U
Butylbenzylphthalate	63			20	U	19	U	20	U
Di-n-octylphthalate	6,200			20	U	19	U	20	U
Phenols (ug/kg)									
Phenol	420		1,200	95		54		130	
2-methylphenol	63		77	26		27		160	
4-methylphenol	670		3,600	38		47		77	
2,4-dimethylphenol	29		210	20	U	19	U	20	U
Pentachlorophenol	400	504	690	99	U	97	U	98	U
Miscellaneous Extractables (ug/kg)									
Benzyl alcohol	57		870	20	U	19	U	20	U

Attachment 3. Summary of all chemicals analyzed for the Stage II Recency Characterization.

Parameter	DMMP			Comp-9		Comp-10		Comp-11	
	SL	BT	ML	Value	VQ	Value	VQ	Value	VQ
Benzoic acid	650		760	200	U	190	U	200	U
Dibenzofuran	540		1,700	24		20		39	
Hexachlorobutadiene	29		270	19	U	0.97	U	0.98	U
N-Nitrosodipheylamine	28		130	20	U	19	U	20	U
Pesticides and PCBs (ug/kg)									
Total DDT	7	50	69	9.8	U	5	U	20	U
Dieldrin	10			20	U	19	U	20	U
Total PCBs	130		3,100	568		240		1268	
Total PCBs (mg/kg TOC normalized)		38*		33		24		63	

LEGEND:

VQ = validation qualifier

U = Undetected at the reported concentration



