CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD July 12, 2001

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE PIERCE COUNTY TERMINAL (PCT) EXPANSION SITE IN THE BLAIR WATERWAY, COMMENCEMENT BAY, TACOMA, WASHINGTON, (PERMIT #2000-2-00765) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT THE COMMENCEMENT BAY OPEN WATER SITE.

1. Introduction. The following summary reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Departments of Ecology and Natural Resources, and the Environmental Protection Agency) on the suitability of approximately 2.1 million cubic yards (cy) of dredged material from the Port of Tacoma's Pierce County Terminal Expansion Site, in the Blair Waterway in Tacoma, Washington. Disposal of suitable material is planned for the Commencement Bay non-dispersive PSDDA disposal site, potentially in combination with approved upland sites, approved in-water contained sites, and/or approved beneficial use sites. Project depth of -51 ft. MLLW would be provided along with one foot of allowable overdepth (to -52 ft. MLLW) in the project area.

   This determination of suitability for open-water disposal is based on the acceptability of the sampling conducted in two events by Port of Tacoma contractors and subcontractors in September and December of 2000 (Table 1). All relevant test data from these sampling events is contained in a report submitted by GeoEngineers dated 7 May 2001, and a supplemental volume of data from AmTest Laboratories. These data were considered sufficient and acceptable for decision making by the Agencies based on best professional judgement.

Table 1. Regulatory Tracking Dates

SAP received	Initial Supplemental	August 31, 2000 December 4, 2000
SAP approved	Initial Supplemental	September 15, 2000 December 14, 2000
Sampling dates	Initial Supplemental	September 19 - 22, 2000 December 18 - 21, 2000
Data report submitted		May 9, 2001
Recency Determination: Low/LM Concern (5-7 years)		September 2005-2007
DAIS Tracking number		PCTEX-1-B-F-157

Table 2. Project Synopsis

Time of proposed dredging	1 July - 14 March of 2001-2002, 2002-2003, and 2003-2004
Proposed disposal sites	Commencement Bay open water non-dispersive site; and or at permitted beneficial use site(s); and/or at approved upland locations
Sediment ranking	low; low-moderate
Project last dredged	new work

2. **Background**. The Port of Tacoma's Blair Waterway was created incrementally over much of this century. As the waterway was extended, dredged material was used for fill in areas surrounding the waterway up through the 1970s. The waterway has also been dredged repeatedly in the last few years, beginning with the Sitcum Waterway Remediation Project completed in 1995. That project removed both contaminated and clean material from the waterway in a combined CERCLA cleanup and navigation deepening project. Since that time, Port of Tacoma development projects have led to further deepening of the Blair, expansion of the turning basin, and widening of some portions of the waterway. DMMP sampling for projects since the 1995 remediation has shown that all sediments proposed for dredging were suitable for open water disposal, and in 2000, with several rounds of data, the DMMP reduced the overall rank of the waterway to "low."

3. **Pre-sampling Issues**. Prior to any sampling activities, the DMMP responded to four requests from the Port of Tacoma regarding potential sampling and testing of the material to be removed for the PCT project, as summarized below (see Attachment 1 for full response):

   a. the material to be removed for the PCT expansion could be considered dredged material and thus eligible for open water disposal;
   b. the low ranking for the Blair Waterway would apply to the PCT project sediments;
   c. "native" material below fill needed only confirmatory testing (10% of cores), also based on a "reason-to-believe" analysis; and
   d. a portion of in-water material in the SW corner of the site needed to be characterized with surface grab samples.

4. **Initial Characterization (Phase I)**. Sampling for the initial characterization took place from September 19 - 22, 2000. Eight DMMU (noted as C1 - C8) were sampled with an upland drill rig that took borings (Attachment 2) according to the approved SAP. One DMMU (C9) was characterized with grab samples taken from the water, also as described in the SAP. Out of the 15 upland borings, two penetrated to the full dredging depth; the others penetrated only to the top of the native tideflat layer, as shown schematically in Figure 1. Borings initially randomly chosen for the full dredging depth (S11 and S4) were changed in the field to S5 and S13, due to obstructions in the area that prevented extended occupancy of the initial locations. Samples from all borings taken in a given DMMU were composited for analysis.

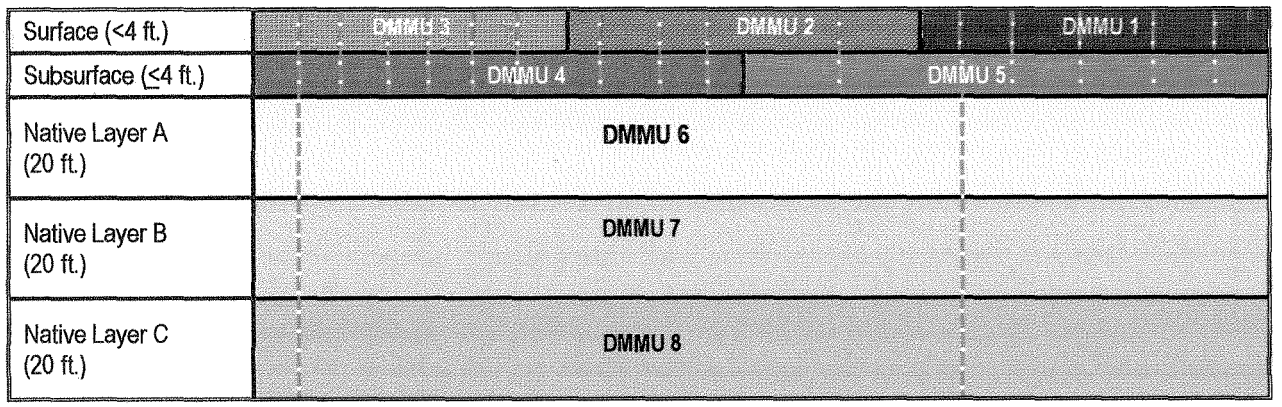

Figure 1. Schematic of Phase 1 boring plan, excluding the SW corner grab sampling.

4. Phase I Chemical Analysis. The Agencies' approved sampling and analysis plan was followed, and quality assurance/quality control guidelines specified by PSEP and the PSDDA program were generally complied with. Conventional results are presented in Table 3. Chemical analysis results (Table 4) demonstrated that the "fill"--surface and subsurface composites, C1 through C5--were predominately free of chemicals of concern, with almost no detections of any COCs. Grab samples from the SW corner DMMU (C9) showed a few detections but COCs found were also well below SLs. However, the DMMU representing the top 20 ft. "native" layer (C6) showed high levels of PCBs that exceeded both the SL and BT. C6 also exceeded the SL for total DDT. Other detections of COCs in C6, though higher than in other DMMUs, were still well below SLs. The deeper "native" layers (C7 and C8) showed no detected or non-detected exceedance of DMMP SLs.

   Given the high levels of PCBs found in the composite sample from C6, it was clear that the frequency of sampling for this DMMU was not suitable for making regulatory decisions. No biological testing was performed on any of the Phase I sediments pending further sampling and analysis to determine the extent of contamination.

Table 3. Sediment conventional results of Phase 1 characterization.

		SURFACE			SUBSURFACE NON-NATIVE		SUBSURFACE NATIVE			SW CORNER GRABS
PARAMETER		C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9
Volume (cubic yards)		36,090	32,675	42,828	49,035	37,474	624,000	624,000	624,000	4,000
Grain Size	% Gravel	1.4	10.5	8.0	<0.1	<0.1	0.3	<0.1	<0.1	6.2
	% Sand	70.0	73.1	66.2	55.1	65.1	30.0	48.9	71.5	74.0
	% Silt	24.9	13.9	20.4	38.5	29.5	51.2	34.7	24.3	12.0
	% Clay	3.8	2.4	5.4	6.5	5.3	18.4	16.8	4.2	7.8
	% Fines (clay+silt)	28.7	16.3	25.8	45.0	34.8	69.6	51.5	28.5	19.8
Total Solids, %		89.5	91.5	88.7	76.9	81.5	66.8	75.3	79.8	67.8
Volatile Solids, %		1.1	1.6	1.7	1.8	1.2	5.1	2.0	1.8	3.6
Total Organic Carbon, %		0.22	0.17	0.15	0.54	0.36	1.2	0.8	0.88	2.5
Total Sulfides, mg/kg		<11	<11	<11	<13	<12	<15	<13	<12	830
Total Ammonia, mg/kg		2.5	3.4	10	24	4.8	65	44	37	6.1

Project Notes:
- Subsurface native was sampled at 10% intensity
- detection limits exceeded SQS in several cases, according to the lab due to low TOC concentrations

Table 4. Chemistry Results for PCT Expansion, Phase I testing.

	DMMP PROGRAM			SURFACE			SUBSURFACE NON-NATIVE		SUBSURFACE NATIVE			SW GRABS
Chemical Parameter	SL (1998)	BT (1998)	ML (1998)	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9
Metals:	mg/kg dry weight											
Antimony	150	150	200	<0.5	<0.5	<0.4	<0.5	<0.5	0.5	<0.5	<0.4	0.3
Arsenic	57	507.1	700	2.8	6.8	2.6	2.6	1.8	22	2.1	2.6	6.9
Cadmium	5.1	--	14	<0.04	<0.04	<0.05	<0.05	<0.05	0.16	0.06	0.09	0.47
Chromium	--	--	--	9.4	9.3	9.5	9.2	8.2	13	10	11	12
Copper	390	--	1,300	15	27	19	20	14	37	22	23	24
Lead	450	--	1,200	1.9	1.1	2.1	1.0	0.8	13.0	0.8	0.8	6.1
Mercury	0.41	1.5	2.3	<0.011	0.049	0.045	<0.013	0.043	0.09	0.027	0.021	0.032
Nickel	140	370	370	9.5	5.8	9.0	7.8	6.0	24.0	8.8	9.6	10
Silver	6.1	6.1	8.4	<0.04	0.14	<0.05	<0.05	<0.05	0.09	<0.05	<0.05	0.13
Zinc	410	--	3,800	20	15	21	19	17	44	17	25	54
Nonionizable Organic Compounds:	ug/kg dry weight											
Aromatic Hydrocarbons												
Total LPAH	5,200	--	29,000	0	0	0	0	0	0	0	0	0
Naphthalene	2,100	--	2,400	<16	<16	<16	<19	<17	<21	<19	<18	<21
Acenaphthylene	560	--	1,300	<16	<16	<16	<19	<17	<21	<19	<18	<21
Acenaphthene	500	--	2,000	<16	<16	<16	<19	<17	<21	<19	<18	<21
Fluorene	540	--	3,600	<16	<16	<16	<19	<17	<21	<19	<18	<21
Phenanthrene	1,500	--	21,000	<16	<16	<16	<19	<17	<21	<19	<18	<21
Anthracene	960	--	13,000	<16	<16	<16	<19	<17	<21	<19	<18	<21
2-Methylnaphthalene *	670	--	1,900	<16	<16	<16	<19	<17	<21	<19	<18	<21
Total HPAH	12,000	--	69,000	0	0	0	0	0	935	43	0	271
Fluoranthene	1,700	4,600	30,000	<16	<16	<16	<19	<17	140	<19	<18	63
Pyrene	2,600	--	16,000	<16	<16	<16	<19	<17	120	<19	<18	47
Benz[a]anthracene	1,300	--	5,100	<16	<16	<16	<19	<17	58	<19	<18	40
Chrysene	1,400	--	21,000	<16	<16	<16	<19	<17	290	<19	<18	37
Total benzofluoranthenes	3,200	--	9,900	<16	<16	<16	<19	<17	167	<19	<18	58
Benzo[a]pyrene	1,600	3,600	3,600	<16	<16	<16	<19	<17	51	43	<18	26
Indeno[1,2,3-c,d]pyrene	600	--	4,400	<16	<16	<16	<19	<17	50	<19	<18	<21
Dibenzo[a,h]anthracene	230	--	1,900	<16	<16	<16	<19	<17	<21	<19	<18	<21
Benzo[g,h,i]perylene	670	--	3,200	<16	<16	<16	<19	<17	59	<19	<18	<21
Chlorinated Benzenes	ug/kg dry weight											
1,2-Dichlorobenzene	35	37	110	<2.2	<2.1	<2.3	<3.2	<2.5	<3	<2.5	<2.2	<3
1,3-Dichlorobenzene	170	1,241	--	<2.2	<2.1	<2.3	<3.2	<2.5	<3	<2.5	<2.2	<3
1,4-Dichlorobenzene	110	120	120	<2.2	<2.1	<2.3	<3.2	<2.5	<3	<2.5	<2.2	<3
1,2,4-Trichlorobenzene	31	--	64	<1.6	<1.6	<1.6	<1.8	<1.7	<2.1	<1.8	<1.8	<2.1
Hexachlorobenzene	22	168	230	<1.6	<1.6	<1.6	<1.8	<1.7	<2.1	<1.8	<1.8	<2.1
Phthalate Esters	ug/kg dry weight											
Dimethyl phthalate	1,400	1,400	--	<16	<16	<16	<19	<17	<21	<19	<18	<21
Diethyl phthalate	1,200	--	--	<16	<16	<16	<19	<17	<21	<19	<18	<21
Di-n-butyl phthalate	5,100	10,220	--	<16	<16	<16	<19	<17	<21	<19	<18	<21
Butyl benzyl phthalate	970	--	--	<16	<16	<16	<19	<17	<21	<19	<18	<21
Bis[2-ethylhexyl]phthalate	8,300	13,870	--	32	<16	<16	<19	<17	<21	<19	<18	150
Di-n-octyl phthalate	6,200	--	--	<16	<16	<16	<19	<17	<21	<19	<18	<21

Table 4, continued. Chemistry Results for PCT Expansion, Phase I testing.

	DMMP PROGRAM			SURFACE			SUBSURFACE NON-NATIVE		SUBSURFACE NATIVE			SW GRABS
Chemical Parameter	SL (1998)	BT (1998)	ML (1998)	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9
Miscellaneous	ug/kg dry weight											
Dibenzofuran	540	--	1,700	<16	<16	<16	<19	<17	<21	<19	<18	<21
Hexachlorobutadiene	29	212	270	<1.6	<1.6	<1.6	<1.8	<1.7	<2.1	<1.8	<1.8	<2.1
Hexachloroethane	1,400	10,200	14,000	<16	<16	<16	<19	<17	<21	<19	<18	<21
N-nitrosodiphenylamine	28	130	130	<8	<8	<8	<9	<9	<11	<9	<9	<10
Pesticides/PCBs	ug/kg dry weight											
p,p'-DDE	--	--	--	<0.63	<0.62	<0.64	<0.72	<0.69	3.8	<0.7	<0.72	<0.83
p,p'-DDD	--	--	--	<0.79	<0.77	<0.8	<0.9	<0.86	11	<0.88	<0.89	<1
p,p'-DDT	--	--	--	<1.6	<1.6	<1.6	<1.8	<1.7	3.3	<1.8	<1.8	<2.1
Total DDT	6.9	50.0	69.0	-	-	-	-	-	18.1	-	-	-
Aldrin	10	37	--	<0.48	<0.46	<0.48	<0.54	<0.52	2.0	<0.53	<0.54	<0.63
alpha-Chlordane	10	37	--	<1.3	<1.2	<1.3	<1.4	<1.4	<1.7	<1.4	<1.4	<1.7
Dieldrin	10	37	--	<0.63	<0.62	<0.64	<0.72	<0.69	<0.85	<0.7	<0.72	<0.83
Heptachlor	10	37	--	<0.48	<0.46	<0.48	<0.54	<0.52	<0.63	<0.53	<0.54	<0.63
gamma-BHC (Lindane)	10	37	--	<0.48	<0.46	<0.48	<0.54	<0.52	0.97	<0.53	<0.54	<0.63
PCBs												
PCBs (dry wt - ug/kg)	130	--	3,100	<32	<31	<32	<36	<34	900	<35	<36	<42
PCBs (TOC norm.- mg/kg)	--	38	--						75			
Volatile Organic Compounds:	ug/kg dry weight											
Trichloroethene	160	1,168	1,600	<2.2	<2.1	<2.3	<3.2	<2.5	<3	<2.5	<2.2	<3
Tetrachloroethene	57	102	210	<2.2	<2.1	<2.3	<3.2	<2.5	<3	<2.5	<2.2	<3
Ethylbenzene	10	27	50	<2.2	<2.1	<2.3	<3.2	<2.5	<3	<2.5	<2.2	<3
Total Xylene	40	--	160	<2.2	<2.1	<2.3	<3.2	<2.5	<3	<2.5	<2.2	<3
Ionizable Organic Compounds:	ug/kg dry weight											
Phenol	420	876	1,200	<16	<16	<16	<19	<17	<21	<19	<18	<21
2-Methylphenol	63	--	77	<8	<8	<8	<9	<9	<11	<9	<9	<10
4-Methylphenol	670	--	3,600	<16	<16	<16	<19	<17	<21	<19	<18	<21
2,4-Dimethylphenol	29	--	210	<8	<8	<8	<9	<9	<11	<9	<9	<10
Pentachlorophenol	400	504	690	<64	<62	<62	<74	<70	<85	<76	<71	<84
Benzyl alcohol	57	--	870	<16	<16	<16	<19	<17	<21	<19	<18	<21
Benzoic acid	650	--	760	<80	<78	<78	<93	<87	<110	<95	<89	<100

Notes:

- 2-Methylnaphthalene not summed with other LPAH's (not an SMS COC).
- blue shading indicates that compound was not detected at the given level
- yellow shading indicates SL exceedance
- red shading indicates BT exceedance

5. Phase II. A Sampling and Analysis Plan Addendum (SAPA) was submitted to the DMMP agencies on 4 December 2000, and approved on 14 December 2000. Phase II sampling concentrated on the upper eight feet of Phase I DMMU C6, immediately below the fill. Though it varies in elevation, the border between fill and native portions of the prism was easily identifiable in pre-sampling geotechnical borings as well as in both the Phase I and Phase II sampling activities. The entire 8 ft. thick test layer was separated into two 4 ft. thick layers, the "Upper Native" (UN) and "Lower Native" (LN) sections. A testing rank of "low-moderate" was used to determine sampling frequency. The DMMU boundaries and 15 sampling locations from Phase I were superimposed upon these layers, resulting in 6 DMMU of between 7,300 and 8,000 cy each, and designated as UN1, UN2, UN3 and LN1, LN2 and LN3 (Attachment 3). Discrete samples were taken every two feet in each core, with a portion of the sample contributing to a DMMU composite and a portion archived. Discrete samples from the area directly below the 8 foot sampling prism ("X" samples) were also archived. Chemical analysis was performed on composite samples from each DMMU, as well as on discrete samples from S5 and S13, the initial boring areas that contributed to the high PCB detections in Phase I. Because other detected COCs were well below screening levels in Phase I, chemical analysis during Phase II was for PCBs and pesticides only.

6. Phase II Chemical Analysis. The Agencies' approved sampling and analysis plan was followed, and quality assurance/quality control guidelines specified by PSEP and the PSDDA program were generally complied with. PCB and pesticide exceedances were again found in areas where there were previously found during Phase I (Table 5). No exceedances at all were seen in LN1, LN2 and UN2. UN1, UN3 and LN3 all exceeded the PCB SL, and LN3 exceeded the PCB BT. Three out of four discrete samples from these DMMU also exceeded DDT screening levels and one sample exceeded the PCB BT level. Based on these results, bioassays proceeded on composite samples from UN1, UN3 and LN3.

7. Phase II Bioassays. Bioassays were performed only in Phase II. The standard suite of three bioassay tests (amphipod toxicity, larval mortality/abnormality, and *Neanthes* growth) was performed on composite samples from UN1, UN3 and LN3.

   Performance standards and interpretation guidelines specified for the DMMP program were used to evaluate the bioassay data collected (Table 6). Two reference sediments were collected from the West Beach of Whidbey Island, one designated "low fines" (53% combined silt and clay) and one designated "high fines" (87% combined silt and clay).

   Control and reference sediments were within DMMP performance criteria for the amphipod (*Eohaustorius estuarius)* and the *Neanthes* bioassays. However, the "low fines" reference sediment (for comparison with LN3) did not meet performance criteria for the larval (*Mytilus edulis)* test (Table 7). Mortality of the *Mytilus* larvae in this reference sediment was too high for appropriate comparisons, and thus the data could not be used for decision-making for LN3 for these tests.

   All three test sediments passed non-dispersive site disposal guidelines for the amphipod and *Neanthes* bioassays. However, mortality in the sediment larval test was high enough to fail both UN1 and UN3 test sediments under the one-hit rule. Similar mortality in the LN3 sediment larval test indicated that, should the reference sediment have met performance standards, this DMMU would also have failed under the one-hit rule.

Based on these bioassay results, none of the sediment in UN1, UN3 or LN3 would be suitable for open-water disposal at a non-dispersive site. The project moved on to Phase III while bioassay results underwent a QA/QC review.

During the QA/QC review, it was discovered that all larval tests had very high levels of unionized ammonia (NH_3) and, contrary to cited protocols, were not aerated during the test period. PSEP protocols for the *Mytilus* bioassay specify that data should be qualified as potential false positives when unionized ammonia levels exceed 0.13 mg/L unionized ammonia (PSEP 1995). Initial levels of unionized ammonia for all three test sediments exceeded that level (range 0.28 to 0.40 mg/L NH_3), and all increased over the course of the test (range 0.74 to 1.15 mg/L NH_3). Based on this evidence, larval tests were considered potential false positives and not considered valid. Without valid bioassay results needed for decision-making, the sediments represented by UN1, UN3 and LN3 were still considered unsuitable for open-water disposal.

Table 5. Summary of Phase II Conventional and Chemical Analyses.

		DMMP PROGRAM			Composite Samples						Discrete Samples			
											from UN-1		from UN-3	
		SL (1998)	BT (1998)	ML (1998)	UN-1	LN-1	UN-2	LN-2	UN-3	LN-3	5A-1	5A-2	13A-1	13A-2
Volume (cy)					38,477	38,477	30,620	30,620	46,313	46,313	na	na	na	na
Conventionals														
Grain Size	% Gravel				0.8				0.1	0.3				
	% Sand				20.8				5.8	45.7				
	% Silt				69.5				75.7	42.7				
	% Clay				9.0				18.3	11.4				
	% Fines (clay+silt)				**78.5**				**94.0**	**54.1**				
Total Solids, %					70.4	68.5	64.8	68.8	65.1	68.6	63.4	63.4	69.6	63.6
TOC, %					0.73				2.5	1.2	2.7	2.0	0.83	1.80
Pesticides		**ug/kg dry weight**												
p,p'-DDE		--	--	--	<0.8	<0.83	<0.88	<0.83	6.0	<8.3	4.6	<1.8	<0.81	4.6
p,p'-DDD		--	--	--	1.4	1.2	<1.1	<1	17	26	19	4.4	<1	14
p,p'-DDT		--	--	--	<2	<2.1	<2.2	<2.1	3.9	<21	<4.4	10	<2	<2.2
Total DDT		6.9	50.0	69.0	1.4	1.2	<2.2	<2.1	26.9	26.0	23.6	14.4	<2	14
Aldrin		10	37	--	0.66	0.62	<0.66	<0.62	1.9	5.6	<1.3	<1.3	0.87	1.4
alpha-Chlordane		10	37	--	<1.6	<1.7	<1.8	<1.7	5.6	14	<3.6	2.9	<1.6	5.7
Dieldrin		10	37	--	<0.8	<0.83	<0.88	<0.83	<1.7	9.5	<1.8	2.0	<0.81	<0.88
Heptachlor		10	37	--	<0.6	<0.62	<0.66	<0.62	<1.3	<6.2	<1.3	<1.3	0.65	0.66
gamma-BHC (Lindane)		10	37	--	<0.6	<0.62	<0.66	<0.62	<1.3	<6.2	<1.3	<1.3	<0.61	<0.66
PCBs														
PCBs (dry wt - ug/kg)		130	--	3,100	154	<42	<44	<41	920	2040	1040	440	<40	670
PCBs (TOC norm.- mg/kg)		--	38	--	21.1	-	-	-	36.8	170.0	38.5	22.0	-	37.2

Notes:

- Conventionals were only run for those samples that underwent biological testing
- blue shading indicates that compound was not detected at the given level
- yellow shading indicates SL exceedance
- red shading indicates BT exceedance

Table 6. Summary of Phase II Bioassay Results.

STATION	% fines	Amphipod		Sed. Larval		20-day *Neanthes* Growth				DMMP
		E. estuarius Mortality (%)		*M. edulis* NCMA (%)		Survival (%)	Growth (mg/ind/day) 0.5 mg initial weight		Growth % of ref.	
		mean	sd	mean	sd		mean	sd		
Control (West Beach)	0	5	8.7	0.0	18.5	95	0.81	0.05		
Low fines Reference	53	22	18.9	44.4	12.7	84	0.91	0.21		
LN3	54	13	9.1	91.5	26.8	92	0.70	0.18	77%	invalid data
High fines Reference	87	12	9.1	31.3	15.7	92	0.70	0.18		
UN1	79	17	7.6	91.1	37.5	88	0.61	0.13	87%	fail
UN3	94	24	14.3	71.5	23.8	100	0.69	0.18	98%	fail
Reference toxicant		Cadmium chloride		Copper sulfate		Cadmium chloride				
96 hr LC50		9.5 mg/L Cd		7.5 mg/L Cu		9.2 mg/L Cd				

Table 7. Phase II Bioassay Performance Standards.

BIOASSAY	TEST SEDIMENT	NEGATIVE CONTROL PERFORMANCE STANDARD	REFERENCE SEDIMENT PERFORMANCE STANDARD	NONDISPERSIVE DISPOSAL SITE INTERPRETATION GUIDELINES	
				1-hit rule	2-hit rule
Amphipod	UN1 (high fines)	**5% ≤ 10%** (mortality)	**7% ≤ 20%** (mortality difference from control)	pass	pass
	UN3 (high fines)			pass	pass
	LN3 (low fines)		**17% ≤ 20%**	pass	pass
Sediment Larval	UN1 (high fines)	**100% ≥ 70%** (normal surviving larvae)	**69% ≥ 65%** (normal surviving larvae; % of control)	fail /invalid test*	fail/invalid test*
	UN3 (high fines)			fail/invalid test*	fail/invalid test*
	LN3 (low fines)		**56% ≥ 65%**	test does not meet performance standards/invalid test*	
Neanthes growth	UN1 (high fines)	**5% ≤ 10%** (mortality) **and 0.81 ≥ 0.38** (mean ind. growth rate)	**12% ≤ 20%** (mortality) **1.13 ≥ 0.80** (growth rate, % of control)	pass	pass
	UN3 (high fines)			pass	pass
	LN3 (low fines)		**16% ≤ 20%** **0.87 ≥ 0.80**	pass	pass

Notes:
- Numbers in **bold** are performance standards
- Numbers in red fail performance standards.
- * False positives may have occurred during the larval bioassay due to high concentrations of unionized ammonia during the test period as discussed in Section 7.

8. Phase III - Archive Analysis. Phase I and Phase II analyses both showed patchy PCBs that appeared to be concentrated in a portion of the dredge prism. Though Phase II somewhat narrowed down the spatial extent of contamination horizontally, it was still not clear whether the Phase II sampling--to eight feet into the native layer--had found the vertical extent of the contamination. Because of indeterminate bioassay results, the DMMP agencies, with the Port of Tacoma, decided to analyze archived discrete samples, again for pesticides and PCBs, in an attempt to further clarify both the horizontal and vertical extents of the contamination. These discrete samples were from every two feet of each core, as described in Section 5. The Port of Tacoma agreed to consider any areas with SL exceedances of PCBs or pesticides unsuitable for open water disposal. Because they likely did not contribute to the exceedances and potential bioassay failures seen in the Phase II composites, DMMP agencies agreed to consider those sub-areas with no PCB or pesticide exceedances suitable for open water disposal. The final limits of suitable and unsuitable DMMUs were drawn conservatively to account for uncertainty in the sampling process and to ensure that all contaminated material was removed for appropriate disposal.

9. Phase III Chemical Analysis. Nine out of 34 samples exceeded total DDT and/or PCB SLs (Tables 8-10), and the areas they represent are considered unsuitable for open-water disposal. All of the contaminated sub-samples were in the top six feet of the 8-foot prism tested in Phases II and III, so further analysis of the "X" samples was not considered necessary.

Table 8. Summary of Phase II Archive Analysis, UN-1

	DMMP PROGRAM			UN-1									
	SL (1998)	BT (1998)	ML (1998)	1A-1	1A-2	2A-1	2A-2	3A-1	3A-2	4A-1	4A-2	5A-1*	5A-2*
Approx. Volume (cy) (see section 11)				*3,800*	*3,800*	*3,800*	*3,800*	*3,900*	*3,900*	*3,900*	*3,900*	*3,900*	*3,900*
Conventionals													
Total Solids, %				62.3	64.3	71.4	91.2	70.3	75.8	93.0	69.2	63.4	63.4
Total Organic Carbon, %				1.9	1.6	0.81	0.68	0.55	0.63	0.27	0.81	2.7	2.0
Pesticides	ug/kg dry weight												
p,p'-DDE	--	--	--	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	4.6	<1.8
p,p'-DDD	--	--	--	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	19	4.4
p,p'-DDT	--	--	--	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<4.4	10
Total DDT	6.9	50.0	69.0	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	23.6	14.4
Aldrin	10	37	--	<0.93	<0.94	<0.94	<0.96	<0.97	<0.93	<0.92	<0.94	<1.3	<1.3
alpha-Chlordane	10	37	--	<0.93	<0.94	<0.94	<0.96	<0.97	<0.93	<0.92	<0.94	<3.6	2.9
Dieldrin	10	37	--	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.8	<1.9	<1.8	2.0
Heptachlor	10	37	--	<0.93	<0.94	<0.94	<0.96	<0.97	<0.93	<0.92	<0.94	<1.3	<1.3
gamma-BHC (Lindane)	10	37	--	<0.93	<0.94	<0.94	<0.96	<0.97	<0.93	<0.92	<0.94	<1.3	<1.3
PCBs													
PCBs (dry wt - ug/kg)	130	--	3,100	<37	<37	<38	<38	<39	<37	<37	<38	1040	440
PCBs (TOC norm.- mg/kg)	--	38	--	-	-	-	-	-	-	-	-	38.5	22.0

Notes:
- *starred subunits analyzed during Phase II by AmTest; remainder of subunits analyzed by ARI during Phase III
- blue shading indicates that compound was not detected at the given level
- yellow shading indicates SL exceedance
- red shading indicates BT exceedance

Table 9. Summary of Phase II Archive Analysis, UN-3

	DMMP PROGRAM			UN-3											
	SL (1998)	BT (1998)	ML (1998)	10A-1	10A-2	11A-1	11A-2	12A-1	12A-2	13A-1 *	13A-2 *	14A-1	14A-2	15A-1	15A-2
Approx. Volume (cy) (see section 11)				*3,800*	*3,800*	*3,900*	*3,900*	*3,800*	*3,800*	*3,900*	*3,900*	*3,900*	*3,900*	*3,900*	*3,900*
Conventionals															
Total Solids, %				66.4	94.4	69.2	61.6	68.3	77.5	69.6	63.6	66.8	66.3	66.2	67.9
TOC, %				1.90	0.16	1.2	1.7	1.5	2.3	0.83	1.80	1.5	1.1	1.3	1.60
Pesticides	**ug/kg dry weight**														
p,p'-DDE	--	--	--	7.6	<1.9	<1.9	<1.9	<1.9	<8.1	<0.81	4.6	<2.0	<2.0	<2.0	4.8
p,p'-DDD	--	--	--	18	<1.9	<1.9	<1.9	<1.9	9.0	<1	14	<2.0	<2.0	<2.0	12
p,p'-DDT	--	--	--	<2.9	<1.9	<1.9	<1.9	<1.9	<2.4	<2	<2.2	<2.0	<2.0	<2.0	<3.9
Total DDT	6.9	50.0	69.0	25.6	<1.9	<1.9	<1.9	<1.9	9	<2	14	<2.0	<2.0	<2.0	16.8
Aldrin	10	37	--	2.5	<0.94	<0.95	<0.97	<0.96	<1.0	0.87	1.4	<0.99	<0.99	<0.99	<0.97
alpha-Chlordane	10	37	--	<0.95	<0.94	<0.95	<0.97	<0.96	<0.94	<1.6	5.7	<0.99	<0.99	<0.99	<0.97
Dieldrin	10	37	--	4.9	<1.9	<1.9	<1.9	<1.9	<5.7	<0.81	<0.88	<2.0	<2.0	<2.0	<3.2
Heptachlor	10	37	--	<1.4	<0.94	<0.95	<0.97	<0.96	<1.0	0.65	0.66	<0.99	<0.99	<0.99	<0.97
gamma-BHC (Lindane)	10	37	--	<1.8	<0.94	<0.95	<0.97	<0.96	<0.61	<0.61	<0.66	<0.99	<0.99	<0.99	<2.9
PCBs															
PCBs (dry wt - ug/kg)	130	--	3,100	260	<38	<38	50	<38	240	<40	670	<39	<40	<40	150
PCBs (TOC norm.- mg/kg)	--	38	--	13.7	-	-	2.9	-	10.4	-	37.2	-	-	-	9.4

Table 10. Summary of Phase II Archive Analysis, LN-3

	DMMP PROGRAM			LN-3											
	SL (1998)	BT (1998)	ML (1998)	10A-3	10A-4	11A-3	11A-4	12A-3	12A-4	13A-3	13A-4	14A-3	14A-4	15A-3	15A-4
Approx. Volume (cy) (see section 11)				*3,800*	*3,800*	*3,900*	*3,900*	*3,800*	*3,800*	*3,900*	*3,900*	*3,900*	*3,900*	*3,900*	*3,900*
Conventionals															
Total Solids, %				75.4	81.5	74.9	91.7	74.6	69.2	64.6	75.7	60.7	90.9	75.3	90.1
TOC, %				0.27	0.97	0.22	0.14	3.8	0.41	2.6	0.17	3.0	0.36	0.14	0.46
Pesticides	**ug/kg dry weight**									dilute d		dilute d			
p,p'-DDE	--	--	--	<1.9	<1.9	<1.9	<1.9	<4.3	<1.9	<13	<1.9	<18	<2.0	<2.0	<2.0
p,p'-DDD	--	--	--	<1.9	<1.9	<1.9	<1.9	5.5	<1.9	41	<1.9	55	<2.0	<2.0	<2.0
p,p'-DDT	--	--	--	<1.9	<1.9	<1.9	<1.9	<2.0	<1.9	<7.9	<1.9	<12	<2.0	<2.0	<2.0
Total DDT	6.9	50.0	69.0	<1.9	<1.9	<1.9	<1.9	5.5	<1.9	41	<1.9	55	<2.0	<2.0	<2.0
Aldrin	10	37	--	<0.97	<0.96	<0.96	<0.94	<0.98	<0.95	<3.5	<0.97	4.1	<0.98	<0.98	<0.99
alpha-Chlordane	10	37	--	<0.97	<0.96	<0.96	<0.94	<0.98	<0.95	2.6	<0.97	<2.5	<0.98	<0.98	<0.99
Dieldrin	10	37	--	<1.9	<1.9	<1.9	<1.9	<3.7	<1.9	18	<1.9	<19	<2.0	<2.0	<2.0
Heptachlor	10	37	--	<0.97	<0.96	<0.96	<0.94	<0.98	<0.95	<4.8	<0.97	<0.98	<0.98	<0.98	<0.99
gamma-BHC (Lindane)	10	37	--	<0.97	<0.96	<0.96	<0.94	<1.8	<0.95	<11	<0.97	<9.6	<0.98	<0.98	<0.99
PCBs															
PCBs (dry wt - ug/kg)	130	--	3,100	<39	<38	<38	<37	170	25	750	<39	950	<39	<39	<40
PCBs (TOC norm.- mg/kg)	--	38	--	-	-	-	-	4.5	6.1	28.8	-	31.7	-	-	-

10. **DMMU Borders and Buffers**. Subunits considered unsuitable for open water disposal are 5A-1, 5A-2, 10A-1, 12A-2, 12A-3, 13A-2, 13A-3, 14A-3, and 15A-2. All subunit areas were initially defined as roughly equivalent volumes of the original DMMU. But because these subunit areas were not defined as part of the original sampling plan, and because sampling intensity did not anticipate smaller DMMUs, buffer zones around unsuitable subunits were established as follows:

    - Horizontal boundaries between suitable and unsuitable DMMU subunits were located 3/4 of the distance from a sampling point (boring) where unsuitable material was identified and the adjacent sampling point where suitable material was identified.

    - An additional one foot of vertical buffer overlying and underlying unsuitable material will be removed with the unsuitable material.

    Based on the DMMU borders and buffer zones defined above, approximately 69,593 cy of the 2.1 million cy anticipated to be dredged during this project were found unsuitable for open water disposal.

11. **Comparison to SMS Guidelines.** All results of the chemical analyses were organic carbon normalized, if necessary, and compared to Washington State Sediment Management Standards. Except for PCBs, all detected chemicals were well below Sediment Quality Standards (SQS). (There are no defined SQS levels for pesticides). All PCBs over the SMS level of 12 ppm TOC normalized are included in the sub-areas not suitable for open-water disposal. Thus, all project sediment suitable for open water disposal is below SMS criteria for all contaminants and is also suitable for beneficial uses.

12. **Suitability**. This memo documents the suitability of proposed dredged sediments for the Pierce County Terminal expansion in the Blair Waterway for open water disposal. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program. Based on the results of the previously described testing, the DMMP agencies concluded that **2,004,509 cubic yards are suitable** for open water disposal. Suitable areas include Phase I DMMUs C1, C2, C3, C4, C5, C7, C8 and C9; Phase II DMMUs LN1, UN2 and LN2; and Phase III subunits 1A-1, 1A-2, 2A-1, 2A-2, 3A-1, 3A-2, 4A-1, 4A-2, 10A-2, 10A-3, 10A-4, 11A-1, 11A-2, 11A-3, 11A-4, 12A-1, 12A-4, 13A-1, 13A-4, 14A-1, 14A-2, 14A-4, 15A-1, 15A-3 and 15A-4. Open water disposal may be at the Commencement Bay non-dispersive site or at an approved beneficial use site.

    A total of **69,593 cubic yards are not suitable** for open water disposal and must be disposed at an approved upland or confined site. Not suitable units are those subareas defined in Phase III: 5A-1, 5A-2, 10A-1, 12A-2, 12A-3, 13A-2, 13A-3, 14A-3, and 15A-2, along with associated buffer areas as described in Section 10.

    It should be noted that the Port of Tacoma may propose to resample and retest portions of the dredge prism due to the potential occurrence of false positives during the larval bioassays. New bioassays would not supersede the need for bioaccumulation testing for those composites that exceeded the BT. All resampling/retesting would be conducted under a DMMO-approved SAPA. This suitability decision would be amended as appropriate based on the results of the retesting, if conducted.

A Dredging and Disposal plan for this project must be completed as part of the final project approval process. For this project, the contract plans and specifications will need to provide strict surveying control and documentation procedures to limit the potential for unsuitable material to be inadvertently disposed at the DMMP site. The project Dredging and Disposal Plan shall describe these procedures in detail, and all procedures will be subject to review and approval by the DMMO prior to commencement of dredging. The Dredging and Disposal plan shall be provided to all DMMP agency representatives at least two weeks prior to the pre-dredge meeting.

The Port must verify that all approved control procedures are used during dredging operations. The Port shall provide documentation that all unsuitable material was effectively segregated from suitable material and disposed at appropriate locations. Disposal locations for unsuitable material shall also be documented, along with the volume of material disposed at each location.

This suitability determination does not constitute final agency approval of the project. A final decision on project approval 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.

13. References.

AmTest 2000. Laboratory data and cover letter to GeoEngineers, dated October 20, 2000.

GeoEngineers 2001. Dredge material characterization, Pierce County Terminal expansion project, Tacoma, Washington. Report to the Port of Tacoma, File No. 0454-054-05-3150/050701.

PSEP 1995. Puget Sound Estuarine Protocols: Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Prepared for US EPA and PSWQA, revised July 1995.

Concur:

7/13/01
Date

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