

16 August 1990

SUBJECT: DECISION ON THE SUITABILITY OF DREDGED MATERIAL TESTED UNDER PSDDA CRITERIA FOR THE US OIL & REFINING COMPANY MAINTENANCE DREDGING PROJECT (OYB-2-013226) TO BE DISPOSED OF AT THE COMMENCEMENT BAY OPEN-WATER DISPOSAL SITE.

1. The following summary reflects the PSDDA agencies' (Corps, Department of Ecology, Department of Natural Resources and the Environmental Protection Agency) consensus decision on the acceptability of the sampling plan and all relevant test data to make a determination of suitability of the 22,000 cubic yards of material proposed for dredging from the US Oil & Refining project site for disposal at a PSDDA open-water site.

2. Chemical and biological testing took place in two separate rounds. Due to exceedances of quality control standards in both chemical and biological testing in the first round, a second round of sampling and testing was required by the PSDDA agencies. Testing results and interpretation for both rounds follow:

3. Round 1 Sampling and Testing

a. Nine dredged material management units were characterized under the original sampling and analysis plan. Test samples S1 through S5 represented surface sediments (0-4 ft) from sampling stations 1-5 respectively (see Enclosure 1 - plan view). Test samples S6 through S8 represented uncomposited subsurface sediments (4-9 ft) from stations 1, 2 and 5 respectively. Test sample C1 represented a composite of subsurface sediments (4-9 ft) from throughout the project area.

b. Chemistry data indicated that one or more exceedances of the 1989 PSDDA screening levels (SL) occurred for test samples S1, S3, S4, S5 and C1. Exceedances of one bioaccumulation trigger (BT) and six maximum levels (ML) occurred for test sample S4. In addition, there were numerous sample-specific detection limit exceedances of PSDDA sediment quality values: detection limits exceeded numerous SLs for all nine test samples; detection limits exceeded one or more BT for test samples S2, S3, S4 and S5; and detection limits exceeded one or more ML for test samples S3, S4 and S5. See Enclosure 2 for a table of all PSDDA sediment quality value exceedances.

SL exceeded

c. The SL exceedances (both actual and detection limit exceedances) for all test samples trigger the requirement for biological testing; for this project concurrent bioassays were conducted. The amphipod 10-day mortality test, Echinoderm sediment larvae combined mortality and abnormality test, and the Microtox bacterial luminescence test were conducted. PSDDA interpretation guidelines specified in June 1988 EPTA, and Bivalve larvae/Echinoderm embryo bioassay interpretation guidelines clarified in the Phase II MPR were used to evaluate the bioassay data. Interpretation guidelines clarified in the Phase II MPR for the sediment larvae bioassay specified necessary clarifications/changes in the mortality and abnormality performance standards for control sediment, reference sediment, and dredged material relative to those specified in June 1988 EPTA. The

control sediment for the Amphipod bioassay was from West Beach. The reference sediment was from Carr Inlet.

None of the sediments demonstrated dose-responsiveness for Microtox. Testing occurred before revisions from the second annual PSDDA review meeting were placed in effect so that five replicates were not performed at the highest dilution in the absence of dose-responsiveness. There was substantial light enhancement which occurred in several of the test sediments but no interpretation guidelines exist at this time for that phenomenon.

There was one hit under the "two-hit" (Phase II MPR, page A-30) rule for test sample S4 in the Amphipod test. The mortality for S4 was 26% compared to 7% for the reference sediment and 0% for the control sediment; the difference between the test sediment and reference was significant at the $\alpha = .05$ confidence level. No other hits were seen in the Amphipod test. There were, however, high emergence numbers for several of the test sediments. At this time there are no interpretation guidelines for emergence.

The sediment larvae test results were discarded due to quality control violations. No reference sediment was run with this bioassay. Only three replicates were performed for each sediment. The abnormality in the seawater control was 21 percent which exceeded the 10 percent abnormality limit established by the Puget Sound Estuary Program.

d. Based on the results of the chemical and biological testing the following decisions were made by the PSDDA agencies in meetings on February 14 and March 15, 1990:

- All sediment from sampling station 4, as represented by test sample S4, failed PSDDA criteria based on the numerous detected exceedances of PSDDA MLs.
- In order to give any further consideration to open-water disposal of the remaining sediments, resampling and testing would need to be performed to eliminate QA/QC problems experienced in first-round testing. Requirements for round 2 sampling and analysis can be found in Enclosure 3.

4. Round 2 Sampling and Testing

- a. Four dredged material management units were characterized under the sampling and analysis plan for round 2. Test samples S1, S2, S3 and S5 represented surface sediments (0-4 ft) from sampling stations 1, 2, 3 and 5 respectively. Sampling locations coincided closely with sampling locations from round 1 (see Enclosure 1 - plan view).
- b. The PSDDA-approved sampling and testing plan was followed, and quality assurance/quality control guidelines specified by PSDDA were generally complied with. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the PSDDA program.

c. Test samples S1 and S3 were analyzed for semi-volatiles. The chemistry data indicated that numerous exceedances of the 1989 PSDDA SLs occurred for both test samples. Exceedances of eight MLs occurred for test sample S3. There were no exceedances of ML for test sample S1 and no exceedances of BT for either test sample. Test samples S2 and S5 were tested for pesticides and PCBs. There were no exceedances of any PSDDA sediment trigger values. See Enclosure 4 for a table of all PSDDA sediment quality value exceedances.

d. Concurrent biological testing was conducted for this round. The amphipod 10-day mortality test, Echinoderm sediment larvae combined mortality and abnormality test and the Neanthes juvenile infaunal 10-day mortality test were conducted. The control sediment for the Amphipod and Neanthes bioassay was from West Beach. The reference sediment was from Carr Inlet.

Test sample S3 failed the Amphipod bioassay under the "single-hit" rule (Phase II MPR, page A-30). Mortality was 99% compared to 9% for the reference sediment and 0% for the control sediment. There were no other hits for the Amphipod test.

Test sediments S2 and S3 failed the Echinoderm bioassay under the single-hit rule. Combined mortalities and abnormalities were 40.4% and 51.3% respectively compared to 9.7% for the reference sediment and 0% (normalized) for the seawater control; the differences between these test sediments and reference were statistically significant at the $\alpha = .05$ level and were greater than 30% over reference. There were no other hits for the Echinoderm bioassay.

Test sediment S3 failed the Neanthes bioassay under the single-hit rule. The mortality was 92% compared to a reference mortality of 14% and a control sediment mortality of 10%. There were no other hits for the Neanthes bioassay.

5. Based on the combined round 1 and round 2 results of chemical and biological testing the following decisions were made by the PSDDA agencies in a meeting on August 8, 1990:

- All sediment from sampling station 4, as represented by test sample S4, failed PSDDA criteria based on multiple detected exceedances of PSDDA MLs.
- All sediment from sampling station 3, as represented by test sample S3, failed PSDDA criteria based on multiple bioassay failures and multiple detected exceedances of PSDDA MLs.
- The surface sediment (0-4 ft) at station 2, as represented by test sample S2, failed PSDDA criteria based on its failure in the Echinoderm bioassay. The subsurface sediment (4-9 ft) at station 2 may be taken to a PSDDA open-water disposal site if it can be demonstrated that this material can be feasibly dredged separately from the surface material.
- All sediment from sampling stations 1 and 5, as represented by test samples S1, S5, S6 and S8 is acceptable for open-water disposal at a PSDDA site.

6. Based on the above discussion and summary of chemical and bioassay results for the US Oil & Refining project area, the PSDDA agencies concluded that 11,100 cubic yards of proposed dredged material was unsuitable for unconfined open-water disposal, whereas 10,900 cubic yards was suitable for disposal at the Commencement Bay PSDDA disposal site. Of this 10,900 cubic yards, subsurface sediments at sampling station 2 amount to 1,150 cubic yards and may only be taken to a PSDDA site if the dredging plan is feasible. A dredging plan must be approved by the Corps of Engineers which is adequate for separating the surface sediments from the subsurface sediments in this area.

Concur:

22 August 1990
Date

David R. Kendall
David Kendall, Ph.D
Seattle District Corps of Engineers

16 August 1990
Date

David J. Fox
David Fox
Seattle District Corps of Engineers

27 August 1990
Date

John Malek
John Malek
Environmental Protection Agency, Region X

3 Sept 90
Date

Richard L. Vining
Rick Vining
Washington Department of Ecology

30 August 1990
Date

Betsy Striplin
Betsy Striplin
Washington Department of Natural Resources

Enclosures

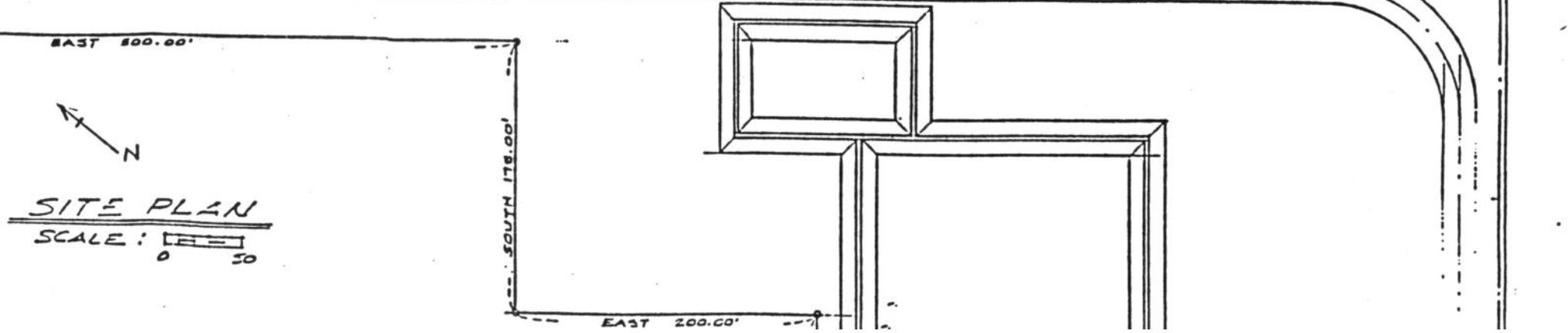
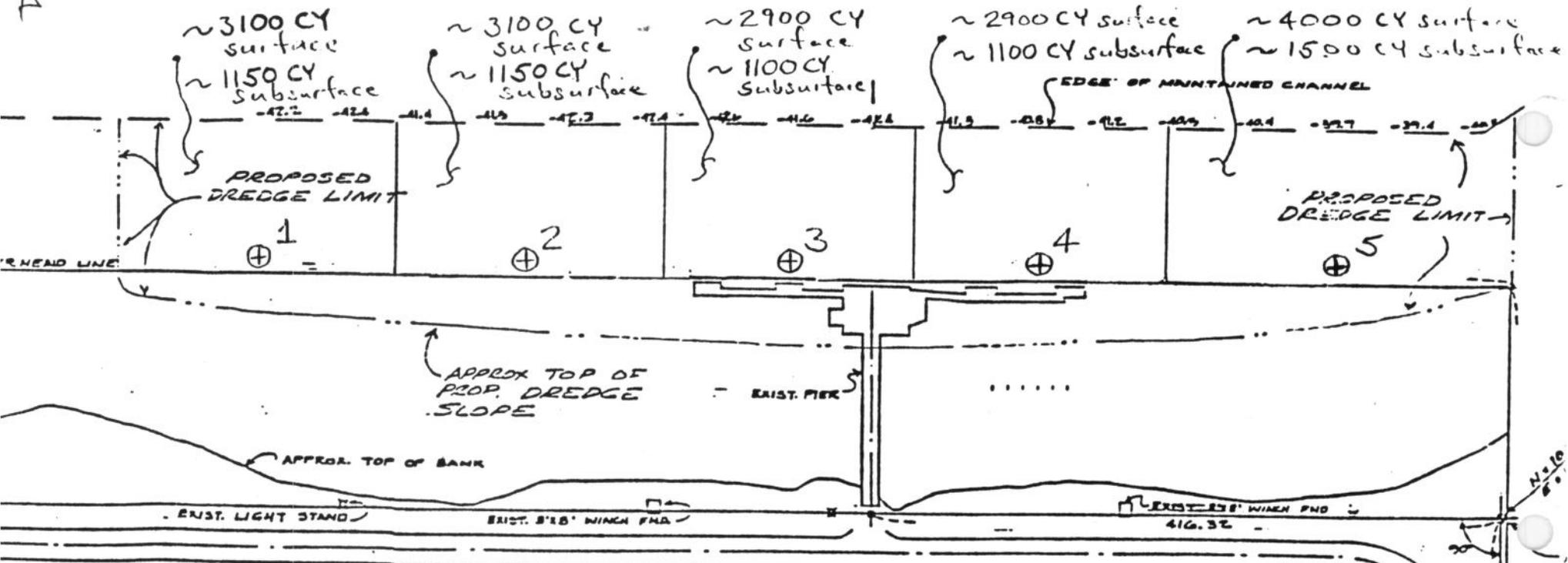
Copies Furnished:

Frank Urabeck/CENPS-EN-PL-PF
John Wakeman/CENPS-EN-PL-ER
Tom Mueller/CENPS-OP
Pat Cagney/Reg file/CENPS-OP-RG

EPA/John Malek
DOE/Rick Vining
DNR/Betsy Striplin
DMPMO file

Revised
Subsurface
Volumes
3/15/90

Enclosure 1



SUMMARY OF ANALYSIS RESULTS-ROUND 1
 US OIL AND REFINING
 OYB-2-013226

1. SEDIMENT QUALITY VALUE EXCEEDANCES:

CHEMICAL	1989 SL	1989 BT	1989 ML	S1 Sta 1 Surf	S6 Sta 1 Sub	S2 Sta 2 Surf	S7 Sta 2 Sub	S3 Sta 3 Surf
METALS (ppm dry):								
Antimony	20	126	200					
Arsenic	57	393.1	700					
Copper	81		810					
Nickel	140	504						
Cadmium	0.96		9.6					
Lead	66		660					
Mercury	0.21	1.5	2.1					
Silver	1.2	4.6	6.1					
Zinc	160		1,600					
ORGANIC CHEMICALS (ppb dry):								
Phenol	120	876	1,200					140 U
2-Methylphenol	10		72	49 U ✓			13 U ✓	140 U
4-Methylphenol	120		1,200					140 U
2-4-Dimethylphenol	10		50	49 U ✓				140 U
Pentachlorophenol	69	504	690	490 U ✓				1400 U
Naphthalene	210		2,100					220
Acenaphthylene	64		640					
Anthracene	130		1,300					450
Acenaphthene	63		630					400
Fluorene	64		640					320
Phenanthrene	320		3,200					1300
2-Methylnaphthalene	67		670					
TOTAL LPAH	610		6,100					2800
Chrysene	670		6,700					1100
Benzofluoranthenes	800		8,000					1700
Ideno(1,2,3-c,d)pyrene	69		5,200	98 U ✓				230
Benzo(a)anthracene	450		4,500					860
Dibenzo(a,h)anthracene	120		1,200					270 U
Fluoranthene	630	4,600	6,300					2100
Benzo(a)pyrene	680	4,964	6,800					
Pyrene	430		7,300	870 U ✓				5100
Benzo(g,h,i)perylene	540		5,400					
TOTAL HPAH	1,800		51,000	2200 U ✓				12000
MISCELLANEOUS								
Benzyl Alcohol	10		73	49 U ✓				140 U
Benzoic Acid	216		690	1200 U ✓				3400 U
Dibenzofuran	54		540					260
Hexachloroethane	1,400	10,220						
Hexachlorobutadiene	29	212	290	49 U ✓				140 U
N-Nitrosodiphenylamine	22	161	220	49 U ✓				140 U
PHTHALATES								
Dimethyl Phthalate	160	1,168						
Diethyl Phthalate	97							140 U
Di-n-butyl phthalate	1,400	10,220						
Butyl benzyl phthalate	470							
Bis(2-ethylhexyl)phthalate	3,100	13,870						
Di-n-octyl phthalate	6,200							
CHLORINATED HYDROCARBONS								
1,3-Dichlorobenzene	170	1,241						
1,4-Dichlorobenzene	26	190	260					
1,2-Dichlorobenzene	19	37	350					
1,2,4-Trichlorobenzene	6.4		64					
Hexachlorobenzene	23	168	230	49 U ✓				140 U
VOLATILES								
Trichloroethene	160	1,168	1,600					
Tetrachloroethene	14	102	210					
Ethylbenzene	10	27	50					
Total Xylene	12		160					
PESTICIDES								
Total DDT	6.9	50	69	8.4 U ✓	9.5 U	30 U	9.1 U ✓	12 U ✓
Aldrin	10	37		12 U ✓	14 U	150 U	13 U ✓	17 U ✓
Dieldrin	10	37		12 U ✓	14 U	150 U	13 U ✓	17 U ✓
Heptachlor	10	37		12 U ✓	14 U	150 U	13 U ✓	17 U ✓
Chlordane	10	37		12 U ✓	14 U	150 U	13 U ✓	17 U ✓
Lindane	10	37		12 U ✓	14 U	150 U	13 U ✓	17 U ✓
Total PCB's	130	38*	2,500	160 U ✓	180 U	190 U	170 U ✓	220 U
SEDIMENT CONVENTIONALS								
Ammonia (mg/kg dry)								17
Sulfide (mg/kg dry)				360	39			2200

* Value normalized to Total Organic Carbon

SUMMARY OF ANALYSIS RESULTS-ROUND 1
 US OIL AND REFINING
 OYB-2-013226

1. SEDIMENT QUALITY VALUE EXCEEDANCES:

CHEMICAL	1989 SL	1989 BT	1989 ML	S3-DUP Sta 3 Surf	S4 Sta 4 Surf	S5 Sta 5 Surf	S8 Sta 5 Sub	C1 Sta 1,2,4,5 Sub
METALS (ppm dry):								
Antimony	20	126	200					
Arsenic	57	393.1	700					
Copper	81		810					
Nickel	140	504						
Cadmium	0.96		9.6					
Lead	66		660					
Mercury	0.21	1.5	2.1					
Silver	1.2	4.6	6.1					
Zinc	160		1,600					
ORGANIC CHEMICALS (ppb dry):								
Phenol	120	876	1,200	140 U	170 U ✓			
2-Methylphenol	10		72	140 U	170 U ✓			
4-Methylphenol	120		1,200	140 U	170 U ✓			
2-4-Dimethylphenol	10		50	140 U	170 U ✓			
Pentachlorophenol	69	504	690	1400 U	1700 U ✓			
Naphthalene	210		2,100		290 ✓			
Acenaphthylene	64		640	140 U	190 ✓			
Anthracene	130		1,300		270 ✓	140 ✓		
Acenaphthene	63		630	140 U	670 ✓			110 ✓
Fluorene	64		640	230	620 ✓			130 ✓
Phenanthrene	320		3,200	1000	4200 ✓			380 ✓
2-Methylnaphthalene	67		670	180	220 ✓			
TOTAL LPAH	610		6,100	1800	8200 ✓			870 ✓
Chrysene	670		6,700	900	2800 ✓			
Benzo(a)fluoranthene	800		8,000	1400	3300 ✓			
Ideno(1,2,3-c,d)pyrene	69		5,200	160	350 ✓	110 U ✓		
Benzo(a)anthracene	450		4,500	630	2200 ✓			
Dibenzo(a,h)anthracene	120		1,200	270 U	340 U ✓			
Fluoranthene	630	4,600	6,300	1700	6500 ✓			
Benzo(a)pyrene	680	4,964	6,800		1100 ✓			
Pyrene	430		7,300		10000 ✓			820 ✓
Benzo(g,h,i)perylene	540		5,400					
TOTAL HPAH	1,800		51,000	5400	25000 ✓			
MISCELLANEOUS								
Benzyl Alcohol	10		73	140 U	170 U ✓			
Benzoic Acid	216		690	3400 U	4200 U ✓			
Dibenzofuran	54		540	220	430 ✓			85 ✓
Hexachloroethane	1,400	10,220						
Hexachlorobutadiene	29	212	290	140 U	170 U ✓			
N-Nitrosodiphenylamine	22	161	220	140 U	170 U ✓			
PHTHALATES								
Dimethyl Phthalate	160	1,168			170 U ✓			
Diethyl Phthalate	97			140 U	170 U ✓			
Di-n-butyl phthalate	1,400	10,220						
Butyl benzyl phthalate	470							
Bis(2-ethylhexyl)phthalate	3,100	13,870						
Di-n-octyl phthalate	6,200							
CHLORINATED HYDROCARBONS								
1,3-Dichlorobenzene	170	1,241						
1,4-Dichlorobenzene	26	190	260					
1,2-Dichlorobenzene	19	37	350					
1,2,4-Trichlorobenzene	6.4		64					
Hexachlorobenzene	23	168	230	140 U	170 U ✓			
VOLATILES								
Trichloroethene	160	1,168	1,600					
Tetrachloroethene	14	102	210					
Ethylbenzene	10	27	50					
Total Xylene	12		160					
PESTICIDES								
Total DDT	6.9	50	69		120 U ✓	95 U	9.3 U ✓	9.1 U ✓
Aldrin	10	37			170 U ✓	140 U	14 U ✓	13 U ✓
Dieldrin	10	37			170 U ✓	140 U	14 U ✓	13 U ✓
Heptachlor	10	37			170 U ✓	140 U	14 U ✓	13 U ✓
Chlordane	10	37			170 U ✓	140 U	14 U ✓	13 U ✓
Lindane	10	37			170 U ✓	140 U	14 U ✓	13 U ✓
Total PCB's	130	38*	2,500		2200 U ✓	1800 U	180 U ✓	170 U
SEDIMENT CONVENTIONAL								
Ammonia (mg/kg dry)					26		2.9	2.7
Sulfide (mg/kg dry)					3100	340		

* Value normalized to Total Organic Carbon



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX C-3755
SEATTLE, WASHINGTON 98124-2255

Regulatory Branch

Mr. Jay W. Spearman
Post Office Box 2176
Kirkland, Washington 98083-2176

APR 3 1990

Reference: OYB-2-013226
US Oil and Refining

Dear Mr. Spearman:

This letter is in response to the proposal (Enclosure 1) you submitted April 2, 1990 regarding resampling and testing of proposed dredged sediments at the US Oil and Refining Company in Tacoma, Washington. The proposal meets the requirements outlined by the PSDDA agencies in a letter to you dated March 21, 1990 (Enclosure 2) with the following clarifications:

1. Because the Echinoderm and Neanthes bioassays will be run concurrently with chemical testing it is not required to resolve quality assurance (QA) failures in which detection limits exceeded the screening level (SL) but did not exceed bioaccumulation triggers (BT) or maximum levels (ML). In these cases dredged material suitability decisions are based on bioassay results. Only exceedances of bioaccumulation triggers and maximum levels are required to be resolved. The requirements are as follows:

Sampling location 1: Semivolatiles

Sampling location 2: Pesticides/PCBs, Total Organic Carbon

Sampling location 3: Semivolatiles

Sampling location 5: Pesticides/PCBs, Total Organic Carbon

The specific chemicals-of-concern which had detection limits in exceedance of BT's and ML's are found on page 2 of Enclosure 2. It is necessary to determine total organic carbon on those samples for which PCBs will be analyzed because the bioaccumulation trigger for PCBs is carbon-normalized.

Enclosure 3

8. The Echinoderm bioassay must be run with a reference sediment as well as a seawater control. Five replicates must be run. The endpoint of the test is variable and must be determined by using a sacrificial seawater control. Abnormality in the seawater control must not exceed the Puget Sound Estuary Program standard of ten percent. See the PSDDA Management Plan Report-Phase II, pp. 5-16 to 5-24 for further protocol discussion.

9. Please advise your chemical and biological testing subcontractors that any questions regarding procedures or interpretation which arise before or during testing should be resolved by contacting me or David Fox at (206)-764-3768 before proceeding.

Sincerely,



David R. Kendall, Ph.D.
PSDDA Data Manager

Enclosures

Copies Furnished:

David Jamison/Betsy Striplin/WDNR
Frank Urabeck/CENPS-EN-PL-PF
John Wakeman/CENPS-EN-PL-ER

John Malek/EPA
Rick Vining/Ecology
David Fox/OP-RG

Additional spikes, surrogates, and method blank analyses will be conducted in accordance with PSEP protocol. Reference sediment will be obtained from Carr Inlet.

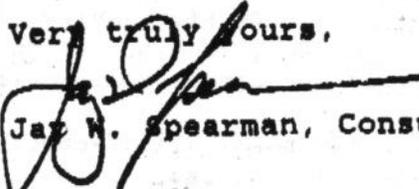
It is not proposed to conduct Amphipod or Microtox bioassays. If I understand correctly, increased luminescence will not be a principal issue on the suitability of these sediments for deep water disposal.

It is proposed to conduct Echinoderm and Neanthes bioassays on all of the sediment sample specimens listed above.

Resampling will occur as soon as possible after receipt of the response to this letter. Our objective remains to dredge as soon as possible after June 15.

If the decisionmaking process requires any additional issues to be resolved by analytical means. These should be identified in advance of resampling. Timely identification of issues or additional test requirements will facilitate resampling as soon as possible.

Very truly yours,


Jay W. Spearman, Consulting Engineer

JWS/lms

ws/H-2/armoil2

2. Detection limits for COC's in several other laboratory analyses exceeded PSDDA bioaccumulation triggers (BT) and/or maximum levels (ML): (Please see Enclosure 2 for a complete listing of all COC's exceeding PSDDA screening levels.)

<u>Analyte</u>	<u>BT(ppb)</u>	<u>ML(ppb)</u>	<u>Reported Detection Limit (ppb)</u>
Station 1 (surface):			
Benzoic acid		690	1,200
Station 2 (surface):			
Aldrin	37		150
Dieldrin	37		150
Heptachlor	37		150
Chlordane	37		150
Lindane	37		150
Total PCB's	38*		38*
Station 3 (surface):			
2-Methylphenol		72	140
2-4-Dimethylphenol		50	140
Pentachlorophenol	504	690	1,400
Benzyl Alcohol		73	140
Benzoic Acid		690	3,400
Station 5 (surface):			
Total DDT	50	69	95
Aldrin	37		140
Dieldrin	37		140
Heptachlor	37		140
Chlordane	37		140
Lindane	37		140
Total PCB's	38*		360*

* TOC-normalized ppm

You also responded to numerous entries in a chemistry QA checklist which included holding times, precision data, and matrix spike, surrogate and standard reference material recoveries. These are minor QA issues which are handled on a case-by-case basis and did not enter into the original decision reached by the PSDDA agencies. Also discussed were the high emergence numbers for several of the test sediments in the Amphipod bioassay and the strong light enhancement seen in Microtox. These are ancillary data which enter the decision-making process only in the absence of otherwise conclusive bioassay results. The results of the sediment larvae test were inconclusive given the QA problems cited previously.

The PSDDA agencies met for a second time on 15 March 1990 to resolve the QA problems mentioned previously and presented their position to you at that time. In the interest of establishing conclusive evidence to be used in the determination of dredged material suitability for open-water disposal the following requirements were established:

1) Resample surface sediments (0-4 feet) at Stations 1, 2, 3 and 5. Archived sediments cannot be used because the 42-day holding time for bioassays has been exceeded.

2) Retest for those COC's at each sampling station which had detection levels exceeding PSDDA screening levels (please see Enclosure 2). It is recommended that detection levels be brought below PSDDA screening levels but must, given concurrent biological testing, be brought below all bioaccumulation triggers and maximum levels. The PSDDA Management Plan Report - Phase II (pg 5-29) states that "Stable isotopic dilution is strongly recommended for compounds for which a stable isotope is available, along with the associated quality assurance and quality (QA/QC) control specifications in the [Puget Sound Estuary Program] Recommended Protocols. The modified CLP method is acceptable, providing specified LOD's (at or below SL's) and quality assurance steps are met". Testing must be conducted using sediments collected from the resampling effort so that chemistry values relate to the same sediments used in bioassays. All PSDDA QA requirements apply. Reported concentrations and detection limits must be on a dry-weight basis.

For those samples requiring PCB analysis, total organic carbon content (TOC) must also be determined. The bioaccumulation trigger for total PCB's is normalized to TOC and requires that all PCB concentrations be TOC-normalized for meaningful comparison.

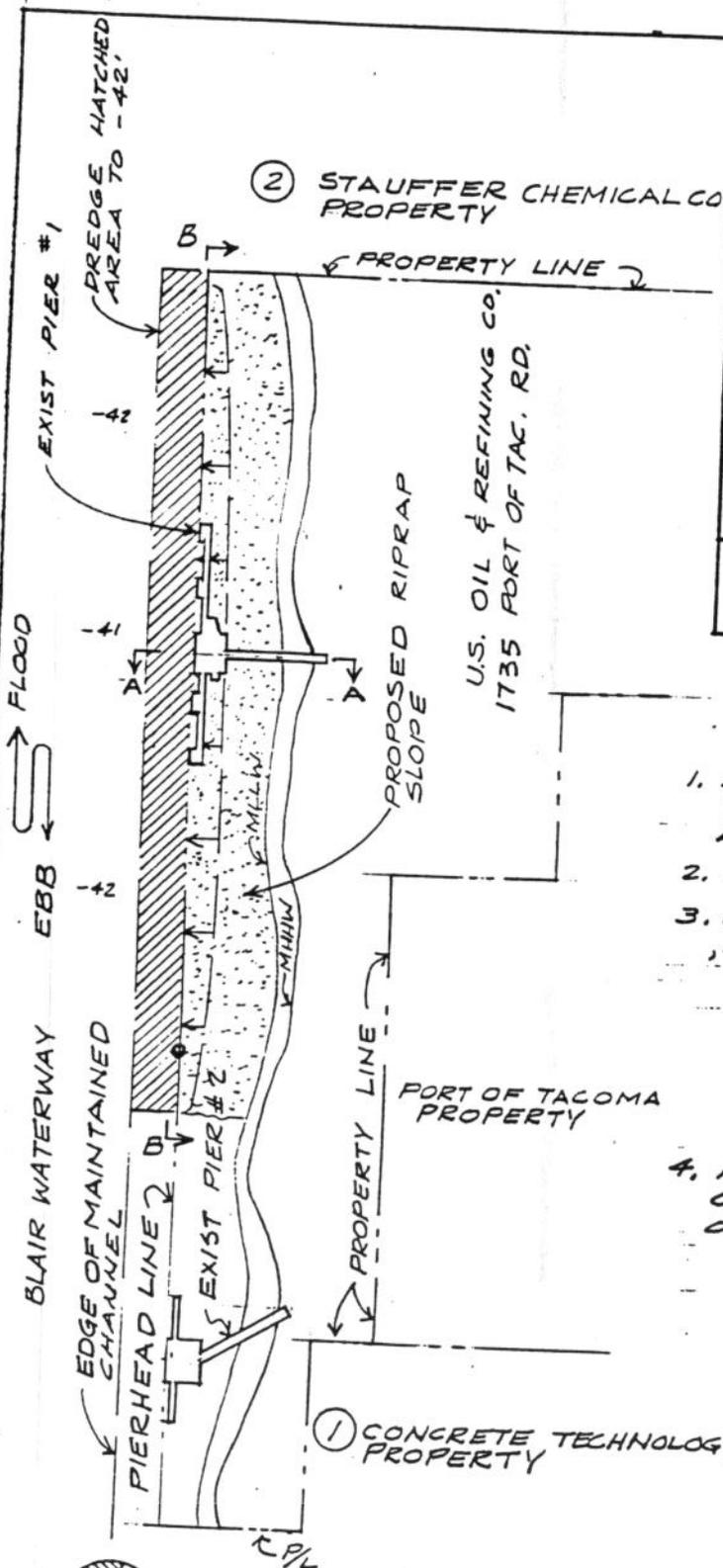
3) To provide more conclusive bioassay results the sediment larvae test must be rerun. In addition, with the implementation of the Phase II Management Plan on 13 January 1990, the juvenile infaunal bioassay (Neanthes) has been implemented and must be run.

SUMMARY OF ANALYSIS RESULTS-ROUND 2
 US OIL AND REFINING
 OYB-2-013226

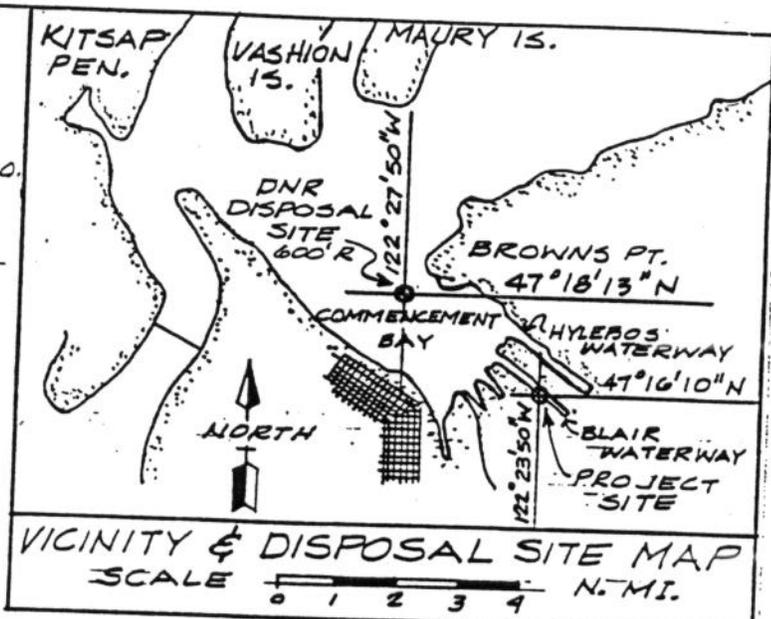
1. SEDIMENT QUALITY VALUE EXCEEDANCES:

CHEMICAL	1989 SL	1989 BT	1989 ML	S1 Sta 1 Surf	S2 Sta 2 Surf	S3 Sta 3 Surf	S5 Sta 5 Surf
ORGANIC CHEMICALS (ppb dry):							
Phenol	120	876	1,200			NA	NA
2-Methylphenol	10		72			NA	NA
4-Methylphenol	120		1,200			14 U	NA
2-4-Dimethylphenol	10		50			NA	NA
Pentachlorophenol	69	504	690			14 U	NA
Naphthalene	210		2,100			140 U	NA
Acenaphthylene	64		640			540	NA
Anthracene	130		1,300	150 /		310	NA
Acenaphthene	63		630	99 /		2300	NA
Fluorene	64		640	150 /		4900	NA
Phenanthrene	320		3,200	650 /		3500	NA
2-Methylnaphthalene	67		670			8800	NA
TOTAL LPAH	610		6,100	1123 /		330	NA
Chrysene	670		6,700			20680	NA
Benzo(a)fluoranthene	800		8,000			2900	NA
Indeno(1,2,3-c,d)pyrene	69		5,200			2300	NA
Benzo(a)anthracene	450		4,500			270	NA
Dibenzo(a,h)anthracene	120		1,200			3000	NA
Fluoranthene	630	4,600	6,300			11000	NA
Benzo(a)pyrene	680	4,964	6,800			720	NA
Pyrene	430		7,300	1200 /		10000	NA
Benzo(g,h,i)perylene	540		5,400			NA	NA
TOTAL HPAH	1,800		51,000	2779 /		30400	NA
MISCELLANEOUS							
Benzyl Alcohol	10		73			NA	NA
Benzoic Acid	216		690			14 U	NA
Dibenzofuran	54		540		93 /	350 U	NA
Hexachloroethane	1,400	10,220				1100	NA
Hexachlorobutadiene	29	212	290			NA	NA
N-Nitrosodiphenylamine	22	161	220			NA	NA
PHTHALATES							
Dimethyl Phthalate	160	1,168				NA	NA
Diethyl Phthalate	97					NA	NA
Di-n-butyl phthalate	1,400	10,220				NA	NA
Butyl benzyl phthalate	470					NA	NA
Bis(2-ethylhexyl)phthalate	3,100	13,870				NA	NA
Di-n-octyl phthalate	6,200					NA	NA
CHLORINATED HYDROCARBONS							
1,3-Dichlorobenzene	170	1,241				NA	NA
1,4-Dichlorobenzene	26	190	260			NA	NA
1,2-Dichlorobenzene	19	37	350			NA	NA
1,2,4-Trichlorobenzene	6.4		64			NA	NA
Hexachlorobenzene	23	168	230			28 U	NA
VOLATILES							
Trichloroethene	160	1,168	1,600			NA	NA
Tetrachloroethene	14	102	210			NA	NA
Ethylbenzene	10	27	50			NA	NA
Total Xylene	12		160			NA	NA
PESTICIDES							
Total DDT	6.9	50	69			NA	NA
Aldrin	10	37				NA	NA
Dieldrin	10	37				NA	NA
Heptachlor	10	37				NA	NA
Chlordane	10	37				NA	NA
Lindane	10	37				NA	NA
Total PCB's	130	38*	2,500			NA	NA

* Value normalized to Total Organic Carbon
 NA = Not Analyzed



SITE PLAN
 SCALE: 1" = 200'
 0 50 100 150 200



VICINITY & DISPOSAL SITE MAP
 SCALE 0 1 2 3 4 N.M.I.

NOTES

1. PURPOSE - TO MAINTAIN ADEQUATE WATER DEPTH FOR COMM'L VESSEL LOADING & UNLOADING.
2. ELEV. DATUM MLLW = 0.0' (NOS)
3. PROPOSED DREDGING BY CLAMSHELL, APPROX 22,000 C.Y. :
 11,000 C.Y. FOR DISPOSAL AT COMMENCEMENT BAY DEEPWATER DISPOSAL SITE.
 11,000 C.Y. FOR DISPOSAL AT APPROVED, UNSPECIFIED UPLAND DISPOSAL SITE.
4. PLACE UP TO APPROX. 11,600 C.Y. OF RIPRAP TO AVG. 2' THK OVER EXISTING RIPRAP SLOPE.

0YB-2-013226
 PROPOSED RIPRAP AND MAINTENANCE DREDGING WITH DEEP WATER DISPOSAL.
 LOCATED IN BLAIR WATERWAY AT CITY OF TACOMA, PIERCE COUNTY, WASH.
 APPLICANT:
 U.S. OIL & REFINING CO.
 AGENT:
 JAY W. SPEARMAN
 CONSULTING ENGINEER