Umpqua River Sediment Evaluation 1996

ABSTRACT

Sediments from the Federal channel in the Umpqua River estuary, including Winchester Bay and Gardiner channel and the Reedsport boat turning basin were sampled on 30 July 1996 and subjected to physical and chemical analysis under an ongoing sediment quality characterization effort conducted by the Corps of Engineers. Sediment in the Umpqua estuary is typically sand and gravel with low organic content which meets exclusionary criteria. Under the tiered testing approach fines, the silt and clay-sized fraction which can form bonds with contaminants, undergo chemical analysis. Chemical testing was performed on fine-grained sediment samples from the Gardiner channel and Reedsport turning basin where there is reason to believe contaminant sources may exist. Contaminant values for all sediments analyzed were well below established levels of concern; therefore sediments were determined to be acceptable for unconfined in-water disposal according to CWA and MPRSA criteria.

INTRODUCTION

1. The mouth of the Umpqua River is located 180 miles south of the Columbia River in Oregon's mid coastal region. The Umpqua drainage system covers 4,560 square miles. The river originates in the Cascade mountains and delivers 5,400,000 annually to the Pacific Ocean. The estuary of the Umpqua covers approximately 6,430 acres (1) and is the third largest in Oregon. Tidal water can extend up river to the town of Scottsburg at River Mile (RM) 27.5.

2. The federally authorized channel consists of an entrance channel 26 feet deep and 400 feet wide; a river channel 22 feet deep and 200 feet wide to Reedsport (RM 11.4); and a turning basin at Reedsport 22 feet deep, 600 feet wide and 1,000 feet long. A side channel 12 feet deep and 75 feet wide extends into Winchester Bay with a mooring basin 16 feet deep, 175 feet wide and 300 feet long located at its inner end. Another side channel 22 feet deep and 200 feet wide extends from RM 8.0 to Gardiner and includes a turning basin 500 feet wide and 800 feet long.

3. Physical and chemical analyses of potential dredge material was conducted to provide a technical evaluation as required by sections 401 and 404 of the Clean Water Act (CWA) and the Marine Protection Research and Sanctuaries Act (MPRSA). The evaluation prior to dredging is necessary to determine if significant environmental impacts will result from dredging or disposal operations.

BACKGROUND

4. Previous studies of Umpqua River sediment were conducted in 1970-71, 79, 80, 87-88, 89. Results of these studies revealed the sediment, especially in Federal channel areas, to be predominately fine grained sands with a low organic content. Sediment from the access channels into Winchester Bay grade from fine sands in the entrance areas in each channel to sediments high in fines, clay, and organic content in the dock areas. Gardiner Channel sediments are fine-grained sand low in organic content. The 1980 study was extensive, in that sediment from all areas of the Federal project from RM 1.8 to RM 11.4 including the main channel, side channels

and turning basins (2) were sampled and analyzed. Bulk sediment samples were analyzed for metals pesticides, PCBs and nutrients. Elutriate tests were also performed in 1980 to measure releases of contaminants to receiving waters during proposed disposal operations. Standard water quality parameters were measured at various locations. Based on the results of the 1980 study, Umpqua River sediments were considered acceptable for in-water disposal at sites in the Umpqua River and the ocean. Upland disposal was also acceptable. In 1979, liquid phase, solid phase and suspended particulate phase bioassays were conducted on Winchester Bay sediment to test for acceptability of in-water disposal (3). The bioassays showed that the sediment was not toxic to benthic invertebrates except perhaps to one organism, a burrowing amphipod, Rhepoxynius epistomus in the solid phase test. The solid phase mortality was thought to be due to grain size differences between Winchester Bay sediment and that preferred by the organism. The 1987-88 Umpqua estuary study was conducted to monitor the effects of in-water disposal of fine-grained, highly organic material from Winchester Bay on the benthic invertebrate community at RM 0.9 (4). The results showed an increase in the numbers of benthic invertebrates after disposal, probably because of transfer of organisms from the dredge site to the disposal site. The 1989 study focused on sediment from Gardiner Channel (5). The sediments sampled were primarily fine-grained sands. A couple of samples contained layers of fine-grained material that were subsampled and subjected to chemical analyses. Pesticides, PCBs and PAHs were not detected. Metals were below concern levels and TOC was approximately 1.3%. The Gardiner Channel material was determined to be acceptable for unconfined in-water disposal. Dredging of the Gardiner Channel during the summer of 1991 revealed a location where there is possible contamination by Bunker C fuel oil. While dredging to the authorized depth of 22 feet in the reach of the Federal channel off the fueling dock, at RM 8.4, an oily substance was seen bubbling to the surface. Dredging operations were stopped, two water samples were taken for analysis and a video was taken of the surface where the oil was observed. The water sample was sent out for analysis and the oily substance was identified as weathered Bunker C fuel oil. Dredging to 18 feet has been undertaken since 1991 without encountering fuel oil-contaminated sediment. This depth is meeting user needs. This indicates there is no contamination at shallower depths, although contamination might still be present in deeper sediment at this location. The source of the oil remains unknown. Oil was not detected during either dredging or sampling operations since the incident in 1991, consequently, there has been no further attempt to identify the source of the oil. However, the site is still considered a potential source of contaminants and sediments from the general vicinity of the fueling dock were sampled and analyzed during the 1996 sediment quality study.

5. The 1991 study includes samples from the shoals in the main channel and from the turning basins in Gardiner Channel and near Reedsport Docks. Physical analyses were performed on all samples. Chemical analyses were performed on one sample where there was reason to believe contamination might exist because of potential nearby sources of contamination at a ship repair facility on the Reedsport Docks. Metals, pesticides, PCBs and PAHs were undetected, however, detection limits for these contaminants were slightly above recommended limits but below concern levels. Ten samples were also taken in the two channels leading into Winchester Bay. Results from Winchester Bay sampling stations were presented in a separate report entitled "Update on Suitability of Winchester Bay Sediment for Development of Wetlands Habitat in Constructed Dunal Ponds on the North Spit of the Umpqua River" (6). In summary, metals and tributyltin were below the concern levels and pesticides and PCBs were undetected. The results

of the 1991 study indicate the Umpqua River sediments are acceptable for unconfined in-water disposal according to the guidelines of the CWA and MPRSA; with the exception noted below. Most of the Umpqua River sediments meet the exclusionary criteria of the CWA and the MPRSA and are exempt from further testing requirements. The fine-grained Winchester Bay sediments were considered acceptable for in-water disposal because the contaminant levels remained below concern levels and were not substantially different from those from past Winchester Bay sediment quality studies, which have passed bioassay tests. It is understood that dredging the area of the Gardiner Channel to its full authorized depth is neither planned nor necessary at this time. Consequently, the reach where the Bunker C fuel oil was found in 1991 will not be dredged to depth unless the source is located and the extent of the contamination problem is identified.

METHODS

6. Nine samples were collected on 30 July 1996 using a box corer sampling gear which takes a one-foot-square sample approximately 9 cm thick that represents the surface sediments. These samples were subjected to physical tests including density, void ratio, volatile solids, specific gravity, particle size classification (ASTM D2487) and particle roundness.

7. Sample UQR-BC-3, from the Reedsport turning basin, and samples UQR-BC -4, -7, and -8, taken from the Gardiner channel and turning basin, and UQR-BC-9 sampled from immediately downstream of the confluence of the Gardiner and main channels were silty and were therefore also subjected to chemical analysis. The sediments were extracted from the box corer sampler using acid washed stainless implements and were placed in "clean" jars and transported in ice to the North Pacific Division Laboratory. Sediment samples were cold-stored and shipped to Columbia Analytical Services, NPD's contract laboratory, for analysis. Sediments were analyzed for the following chemicals of interest:

total organic carbon (TOC);
metals (arsenic, cadmium, chromium, copper, mercury, lead, silver, zinc);
organotins, mono- to tributyltin (TBT);
polycyclic aromatic hydrocarbons (PAH);
polychlorobiphenyls (PCB);
pesticides.

Chemical analysis was accomplished according to standard or modified EPA methods.

RESULTS / DISCUSSION

8. The raw data from the physical and chemical analysis are on file at the Portland District, Corps of Engineers. Sampling locations are shown on Figure 1.

PHYSICAL

9. Results of the physical analysis are shown in Table 1. The sediment in the Umpqua River mainstem tend to be medium or fine-grained, poorly graded sands with little or no silt. Compared to these coarser grained sediments, the silty sands taken in the Gardiner and Reedsport

channels were much finer. The volatile solids (which gives a rough indication of organic content) in the Gardiner channel sediment was the highest of all samples analyzed, ranging from 4.8 to 5.9 percent; the remaining samples had a volatile solids content ranging from 0.7 to 2.8 percent. These values are believed to be more representative of the wood fragments present in the sediment than an organic compound fraction that could form physicochemical bonds with compatible contaminants in reducing environments. Interestingly, none of the sediment had an organic odor and this also reflects a lack of reducing chemical environments in the Umpqua Federal channel.

CHEMICAL

10. Table 2 shows the results of total organic carbon (TOC) analysis. Values of TOC for the samples ranged from 0.15 to 1.65. UQR-BC-3 obtained in the Federal turning basin near the Reedsport commercial docks is the only sample that can be compared with the 1991 survey. In 1991 the TOC reported value for the Reedsport Docks area was 0.16, the current study has a reported value of 0.15. These values are low compared to sediments which classify as organic silt or clay and reflects the lack of contaminant bonding sites in such sediments, as well as the reasoning behind the excluding much of the Umpqua Federal channel sediment from chemical analysis.

11. Results of metals analysis are presented in Table 2. Concentrations of all metal in the samples tested were below screening levels. Mercury was not detected in any of the samples; however, the detection limit for total mercury (0.05 ppm) was above the project-specified limit of 0.02 ppm.

12. Pesticide and PCB results are shown in Table 3. Four of the five samples analyzed yielded low levels of 4,4'DDE, however, the values are estimated since each analyte was below the laboratory reporting limits of 0.01 ppb but above the method detection level of 0.0003 ppb. At this level it is difficult to distinguish between the actual presence of the analyte and background noise due to testing methods. In any event, the samples tested below established levels of concern. There were no PCB's found in any of the samples tested.

13. All sediment samples analyzed contained PAH's (see Table 4), however, total PAH in all samples was far below both screening and the Corps' established concern levels.

14. Organotins were detected in all samples in or near the Gardiner turning basin. Table 3 shows the analytical results for TBT. Each analyte is below the laboratory reporting limits of 3 ppb for the compound, but above the method detection limit of 0.3 ppb.

QUALITY CONTROL

15. Matrix spike and surrogate recoveries were within +/- 40 percent, which is within acceptable quality control limits for all compounds submitted for testing except for the cases noted below. The laboratory's detection limit for mercury was 0.05 ppm and is above the project specified detection limit of 0.02 ppm. The analyses for the other eight metallic analytes were performed

by EPA method 200.8 (ICP-MS) rather than the stipulated 7000-series graphite furnace atomic absorption methods; however, the required detection limits and other QC objectives were met. there were no further deficiencies noted in the total metals data or in the data for TOC and AVS, and the data quality is acceptable for these analyses. Seven of the 18 PAH targeted analytes were detected in the method blank, as a result some PAH reported in samples UQR-BC-3, -4, -8, and -9, should be considered due to laboratory contamination. Sample UQR-BC-7 required re-analysis for organotin analytes due to surrogate recoveries below the LE acceptance limits and matrix interference which caused an elevated reporting limit in the first analysis attempt. The second attempt was performed after the recommended holding time and should be considered an estimate. Analyses were performed in conformance with the quality assurance program of Columbia Analytical Services, Inc. (CAS). The analyses were consistent with the Corps' Tier II data requirements. Method blank or surrogate recoveries, as applicable to each analytical method are reported in the raw data received from CAS and on file in the Portland District. All EPA recommended holding times were met for analyses of these samples except as noted.

CONCLUSIONS

16. Most of the sediment in the Umpqua River estuary is sand and gravel which meets the criteria for exclusion from further testing to determine suitability for unconfined in-water disposal according to guidelines of the CWA and MPRSA. This includes the main channel, the two turning basins, Winchester Bay channels and Gardiner channel except as noted below. Those sediments of the Umpqua River that do not meet the exclusionary criteria of the CWA and the MPRSA were fine-grained silty sands, with organic materials which have potential for forming physicochemical bonds with a wide range of contaminants. The current study found fine-grained, sediments with low TOC values in the area of Gardiner Channel where the Bunker C fuel oil was discovered in the 1991 dredging operation, however, PAH values do not reflect contamination in shallow sediments at this location. Fine-grained sediment with low TOC values was also recovered from the Reedsport channel, however, chemical testing conducted during this study yielded no indication that contaminants have formed bonds with any of the fine-grained sediments analyzed from the Umpqua River estuary. Volatile solids and TOC values are believed to derive largely from wood fragments rather than from organic compounds. There was no characteristic "organic" odor noted during the sampling operation indicating a lack of a reducing environment in Umpqua sediments. Additionally, acid volatile sulfide values indicate an oxidizing environment in the Federal channel which would tend to form relatively inert compounds with available contaminants. Therefore, there is no reason to believe contamination would be present in the Umpqua Federal channel sediments and further testing is not recommended. All sediments evaluated are considered to be acceptable for unconfined in-water disposal.

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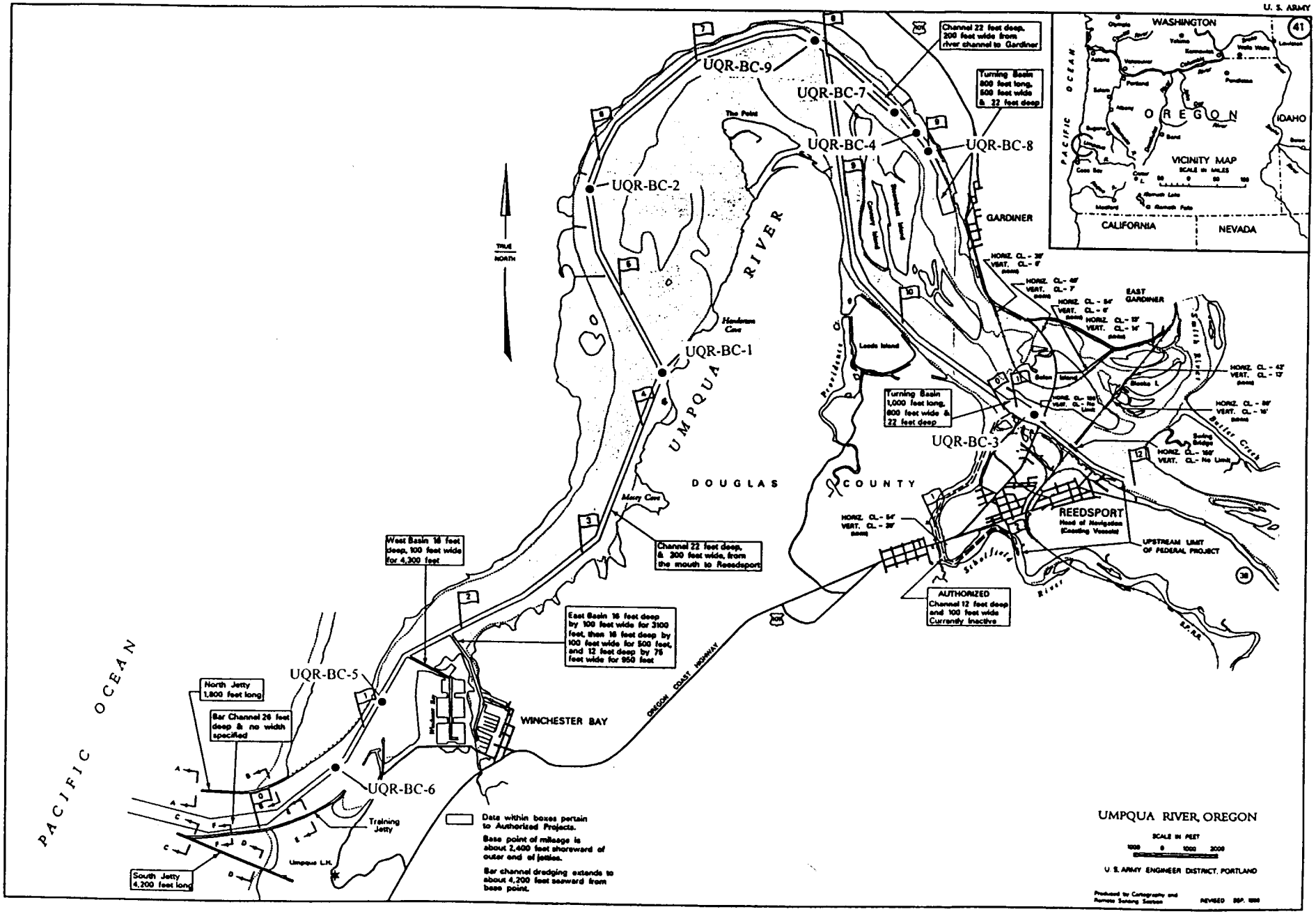

UMPQUA RIVER, OREGON

SCALE IN FEET

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U. S. ARMY ENGINEER DISTRICT, PORTLAND

Produced by Cartography and Remote Sensing Section

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Table 1. Results of physical analyses of the Umpqua River sediment samples, 1996

sample	mean gr. size	sand	silt	clay	volatile solids
	mm			%	
UQR-BC-1	0.300	99.9	0.1	0.0	1.6
UQR-BC-2	0.230	94.4	3.9	1.7	1.3
UQR-BC-3	0.300	93.4	4.6	2.0	2.4
UQR-BC-4	0.100	79.9	15.6	4.5	4.8
UQR-BC-5	0.240	99.7	0.3	0.0	0.7
UQR-BC-6	0.500	99.6	0.4	0.0	0.7
UQR-BC-7	0.094	63.0	29.9	7.1	5.9
UQR-BC-8	0.100	74.2	18.1	7.7	4.9
UQR-BC-9	0.160	81.2	15.4	3.4	2.8

Table 2. Concentrations of metals, AVS, and TOC in the Umpqua River sediments samples, 1996

sample	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	TOC	AVS
					ppm					%	um/g
UQR-BC-4	5.7	0.16	42.6	19.9	6.3	ND	37.1	0.08	67.7	1.3	13
UQR-BC-7	5.9	0.23	51.2	25.8	7.5	ND	45.4	0.11	73.6	1.65	170
UQR-BC-8	5.0	0.08	39.0	18.2	5.7	ND	34.1	0.07	60.2	1.22	36
UQR-BC-9	4.2	0.10	31.4	9.8	4.0	ND	25.4	0.04	42.3	0.49	4.2
UQR-BC-3	3.6	0.14	23.2	9.4	3.6	ND	30.4	0.03	40.2	0.15	1.3
mean	4.9	0.14	37.5	16.6	5.4	ND	34.5	0.07	56.8	1.0	44.9
screening levels	57	0.96	180	81	66	0.21	140	1.2	160		

Table 3. Concentrations of pesticides and PCBs in the Umpqua River sediment samples, 1996

sample	Alpha-BHC	4,4'DDE	4,4' DDD	endosulfan II	PCBs	TBT
			ppb			
UQR-BC-4	ND	0.0006	ND	ND	ND	0.6
UQR-BC-7	ND	0.0004	ND	ND	ND	0.9
UQR-BC-8	ND	0.0003	ND	ND	ND	0.4
UQR-BC-9	ND	ND	ND	ND	ND	ND
UQR-BC-3	ND	0.0004	ND	ND	ND	ND
mean		0.000425				0.7

Screening Levels:	
Pesticides DDT	15-20
PCB's	400-500

Table 4. Concentrations of PAHs and phenols in the Umpqua River sediment samples, 1996

Sample	naphthalene	2-methyl naphthalene	acenaphthylene	acenaphthene	dibenzofuran	fluorene	phenanthrene	anthrancene	fluoranthene	pyrene	benz (a) anthracene	chrysene	benzo (b) fluoranthene	benzo (k) fluoranthene	benzo (a) pyrene	indeno (1,2,3-c,d) pyrene	dibenz (a,h) anthracene	benzo (g,h,i) perylene	total
								ppb											
UQR-BC-4	3	ND	0.6	6	5	5	17	2	17	14	4	4	ND	ND	2	2	0.8	3	85
UQR-BC-7	5	7	ND	18	10	12	64	7	52	41	10	9	7	ND	4	3	1	4	254
UQR-BC-8	12	6	ND	3	4	3	16	3	10	7	3	3	ND	ND	1	1	0.5	2	75
UQR-BC-9	2	ND	ND	0.5	ND	ND	ND	ND	1	2	0.5	0.8	ND	ND	ND	0.6	0.4	0.6	8
UQR-BC-3	1	ND	ND	ND	ND	ND	ND	ND	6	5	2	2	ND	ND	0.4	ND	ND	0.5	17
																		MEAN	88

Screening levels Total PAH's 1500-2000