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EVALUATION OF CHEMICAL DATA FOR THE PIER 1 MARINE RAILWAY NAVAL SUBMARINE BASE NEW LONDON GROTON, CT

Final Report

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1. INTRODUCTION

This report has been prepared under Contract Number N47408-97-D-0410, Delivery Order Number 0012. The statement of work required Science Applications International Corporation (SAIC) to provide chemical assessment support services to evaluate chemical relationships for sediments at the Pier 1 Marine Railway, Naval Submarine Base, to define an area of possible contamination and to assist with the evaluation of remedial alternatives (see Appendix 1).

The evaluation provided the necessary information for SAIC to develop this report of preliminary findings and conclusions regarding the degree and extent of chemical contamination and possible ecological risk associated with the Pier 1 Marine Railway. The objectives of this investigation were the following:

- Establish contaminants of concern (CoCs) for the Pier 1 Marine Railway sediments;
- Describe the extent of chemical contaminants in the Pier 1 Marine Railway sediments; and
- Derive some preliminary conclusions about the likelihood of environmental impact from CoC concentrations.

2. SAMPLE COLLECTION AND ANAYLSIS

This section describes the design for sample collection and the rationale and methods for chemical analysis and data interpretation.

2.1. SAMPLE COLLECTION

SAIC performed sediment sampling operations on 28 October 1999 As part of the initial chemical assessment at the sediments adjacent to the former Pier 1 Marine Railway. A series of surface sediment grab samples and deeper core samples were collected in order to characterize spatial and vertical distribution of contaminants within the depositional areas in close proximity to Pier 1. A small vessel, provided by the Groton Submarine Base,
was used to occupy each station and serve as a work platform for the deployment of sampling equipment and processing of sediment samples. The work plan specified that six composite surface grab samples and 2 composite core samples were to be obtained for chemical analyses (SAIC, 1999a). However, physical limitations at the site prevented our ability to collect 2 composite core samples. Thus, an additional composite surface sample was collected for a total of eight composite sediment samples (7 surface and 1 core) from seven individual stations
(Figure 1). Approximate sampling locations are listed in Table 1.

Surface sediment samples to a penetration depth of 15 cm were obtained using a stainless steel 0.025 m^2 Van Veen grab sampling device deployed via hand-line. Upon retrieval, individual sediment samples were transferred into pre-cleaned PVC buckets until three replicates or an ample volume of material had been collected. The sediments were then homogenized using a stainless steel spoon and transferred into precleaned sample jars, sealed, and held at 4° C until reaching a laboratory for chemical analysis. The grab sampling device and sampling tools were subjected to multiple decontamination washes with Alconox detergent solution and seawater rinses before each sample collection.

A 120-cm stainless steel hand coring device was utilized in an attempt to obtain deeper sediment samples to characterize the contaminant concentrations underlying the sediment surface. Although coring attempts were made at all stations occupied, coring operations over only one station (SBP-4) yielded sufficient penetration below 20 cm. Two replicate cores were collected from SBP-4 using the hand coring method. The sediments were retained within a pre-cleaned plastic core liner 5-cm in diameter held within the stainless steel coring device. Upon retrieval the cores were extruded into a plastic tub, split, described, and sub-sampled within the 20-30 cm horizon. The sub-sampled sediments from both replicates were homogenized, transferred into precleaned sample jars, and held at 4° C until analyzed for chemical content. Similar to the Van Veen grab sampler, the coring device was subjected to multiple decontamination washes with Alconox detergent solution and seawater rinses between stations.

2.2. SAMPLE ANALYSES

In total, seven composited surface grab samples and 1 composited core section were packed and mailed for overnight delivery to the Woods Hole Group Environmental Laboratories for chemical analyses of metals, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs), and butyltins. In addition, total organic carbon (TOC) and moisture content analyses were also conducted. A complete list of analytes is presented in the statement of work (Appendix 1). Detailed methods and results are provided in Appendix 2. All sediment values were reported on a dry weight basis.

2.3 BENCHMARK COMPARISONS

Assessments of potential environmental impacts associated with contaminants in Pier 1 sediments were accomplished by comparing the measured concentrations of each analyte for each sample to the NOAA Effects Range-Low (ER-L) and Effects Range-Median (ER-M) benchmarks (Long *et al.*, 1995). The ER-L values are concentrations equivalent to the lower 10 percentile of the data screened by Long *et al.*

(1995), and indicate the low end of the range of concentrations in which biological effects (e.g., increased mortality and decreased reproduction and growth) are observed or predicted. They are used as the concentrations above which adverse effects may begin or are predicted among sensitive life stages and/or species. The ER-M values for the chemicals are the concentrations equivalent to the 50 percentile point for the data screened during the study. They are used as the concentration above which effects are frequently or always observed or predicted among most species.

3. RESULTS

Raw analytical data are presented in Appendix 2 and are summarized in Table 2. Eight samples (seven grab samples at SBP-1 -SBP-7 and an additional core sample at SBP-4) were analyzed for nine metals, 24 PAHs, 25 PCBs, 27 pesticides, and 4 butyltins. TOC and moisture content were also measured in all samples.

3.1. METAL CONTAMINANTS

A total of 7 surface sediments and 1 core section from seven stations were analyzed for nine metals. Analytical results are presented in Table 2 and are shown graphically in Figure 2. In general, metal concentrations were higher in grab samples from SBP-1 to SBP-4 and the core sample from SBP-4 than at the remaining stations with the exception of cadmium at SBP-7. In general, however, cadmium concentrations in the sediments sampled were low (i.e., < 1 mg/kg) and did not exceed the ER-L of 1.2 mg/kg or the ER-M at any station. Chromium concentrations ranged between 39 mg/kg at SBP-7 and 130 mg/kg at SBP-1 with levels at SBP-1 and SBP-3 exceeding the ER-L of 81 mg/kg. None of the samples exceeded the chromium ER-M of 370 mg/kg. Silver concentrations ranged between 0.53 mg/kg at SBP-7 to 1.9 mg/kg at SBP-1. The silver ER-L of 1.0 mg/kg was only marginally exceeded in three of the eight samples (i.e., SBP-1, SBP-2, and SBP-4 (core)). Arsenic concentrations ranged between 8.3 mg/kg at SBP-7 and 19 mg/kg at SBP-3. These arsenic values exceeded the ER-L of 8.2 mg/kg for all samples but were well below the ER-M of 70 mg/kg. In general, the measured concentrations of cadmium, chromium, and silver being higher than the ER-L may indicate a potential for adverse biological effects among sensitive life stages and /or species.

In contrast to the above metals, ER-M exceedences were noted for mercury, copper, lead, nickel, and zinc. Mercury concentrations ranged between 0.43 mg/kg at SBP-6 and 1.6 mg/kg at SBP-1. The mercury ER-L of 0.15 mg/kg was exceeded for all samples and the ER-M was exceeded at SBP-1 to SBP-4. Copper concentrations in the samples ranged between 79 mg/kg at SBP-6 and 980 mg/kg at SBP-1. All measurements were higher than the ER-L (34 mg/kg) and were also higher than the ER-M of 270 mg/kg

at Stations SBP-1 to SBP-4. Lead levels ranged between 86 mg/kg at SBP-6 and 620 mg/kg at SBP-1. The lead ER-L of 46.7 mg/kg was exceeded at SBP-5, SBP-6, and SBP-7, and the ER-M of 218 mg/kg was also exceeded in the five remaining samples. Nickel concentrations ranged between 14 mg/kg and 130 mg/kg. The nickel ER-L (20.9 mg/kg) was exceeded at all stations but SBP-7 and the ER-M (51.6 mg/kg) was exceeded at SBP-1 to SBP-4 and SBP-4 (core). Zinc concentrations ranged between 160 mg/kg and 1900 mg/kg. Zinc concentrations were also higher than the ER-L of 150 mg/kg for all samples and, again, higher than the ER-M at SBP-1 - SBP-4 and SBP-4 (core). In general, measured concentrations of mercury, copper, lead, nickel, and zinc should be considered ecologically relevant since values are often much higher than the respective ER-M benchmark concentrations and thus represent concentrations at which adverse biological effects are considered to be probable among most species.

3.2. PAH CONTAMINANTS

A total of 7 surface sediments and 1 core section were analyzed for 24 PAHs. Selected low molecular weight (LMW) PAHs (i.e., benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, and perylene) and high molecular weight (HMW) PAHs (i.e., 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene) were summed for comparisons against NOAA ER-Ls and ER-Ms. Similarly, the LMW and HMW PAHs are summed to permit comparison to the NOAA Total PAHs benchmark. Results for individual PAHs and Total PAHs are provided in Figure 3 for each sample.

In general, the patterns of PAH constituent concentrations appear quite similar among stations, thus likely indicating a similar source (Figure 3). Collectively, PAHs were lowest at SPB-6 (19 out of 24 individual PAHs were lower at SBP-6 than at any other station) and highest at SBP-1 (24 out of 24 PAHs were higher at SBP-1 than at any other station). This reflects a decreasing contamination gradient away from the inner pier area.

ER-L and ER-M benchmark values are available for 13 of the 24 individual PAHs that were measured. Among these 13 PAHs (anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, phenanthrene, and pyrene) concentrations above the respective ER-M for samples SBP-1, SBP-3, SBP-7, and SBP-4 (core sample). Concentrations for the remaining samples were generally above the ER-L but were not greater than the ER-M benchmarks.

HMW PAHs ranged between 2,838 μg/kg at SBP-6 and 131,700 μg/kg at SBP-1 while LMW PAHs ranged between 666 μg/kg and 98,100 μg/kg in the same samples, respectively. Total PAHs (LMW + HMW)

ranged between 3,504 μg/kg at SBP-6 and 229,490 μg/kg SBP-1. HMW PAHs exceeded the ER-M of 3,160 μg/kg at all but one station (SBP-6) and LMW PAHs exceeded the ER-M benchmark of 9,600 μg/kg at SBP-1 and SBP-3. Total PAHs exceeded the ER-L of 4,022 μg/kg at all stations but SBP-6 and measured concentrations were also greater than the ER-M of 44,792 μg/kg at SBP-1 and SBP-3. As with the metals, ER-L and ER-M exceedences of the PAH benchmarks indicate potential and probable adverse ecological effects, respectively, on marine biota in the Pier 1 area.

3.3 PCBs

A total of 7 surface sediments and 1 core section were analyzed for 25 PCB congeners. The results are presented in Table 1 and Figure 4. The PCB patterns generally indicate the most prevalent congeners are BZ53 through BZ180 as is typical for Aroclor 1242/1254 mixtures. Congener 209 was also present at elevated concentrations and dominated the PCB mixture in the outer pier Stations SBP-6 and SBP-7. These unique values may indicate another PCB source.

PCB congener concentrations were summed and multiplied by 2 to permit comparison against the NOAA ER-L/ER-M benchmark concentrations for Total PCBs. Collectively, Total PCBs were generally highest at SBP-1 and lowest at SBP-6, reflecting the spatial pattern of decreasing concentration with distance from the inner pier area. In comparison to sediment benchmarks, the ER-L for Total PCBs of 22.7 μg/kg was exceeded in all of the samples while the ER-M benchmark of 180 μg/kg was also exceeded in five of eight samples. As with the metals and PAHs, these ER-L and ER-M exceedences indicate potential to probable adverse ecological effects of PCBs on marine biota of the Pier 1 study area.

3.4 PESTICIDE CONTAMINANTS

A total of 7 surface sediments and 1 core section were analyzed for 27 organochlorine pesticides (OCPs). Generally, pesticides were not detected in the samples (Table 2). Measured concentrations were observed for gamma chlordane at SBP-2, SBP-3, and SBP-4 (grab sample), hexachlorobenzene at SBP-5, methoxychlor and mirex at SBP-7, 2,4'-DDD at SBP-3, and 4,4'-DDD at SBP-4 (grab sample) and SPB-7.

ER-L and ER-Ms are available for only three of the six pesticides detected in the Pier 1 sediments. Gamma chlordane concentrations of 6.3, 7.1,and 18 μg/kg at SBP-2, SBP-3, and SBP-4 (grab sample) were greater than the ER-M of 6 μ/kg. The 2'4-DDD concentration in sediment at SBP-3 (3.6 μg/kg) was greater than the ER-L of 2 μg/kg but not greater than the ER-M of 20 μg/kg. 4'4-DDD concentrations at SBP-4 (grab sample) and SBP-7 (8.1 μg/kg and 17 μg/kg, respectively), exceeded the NOAA ER-L of 2

μg/kg but were lower than the ER-M of 20 μg/kg. The observed NOAA benchmark exceedences, particularly for gamma-chlordane, indicate possible to probable adverse biological effects due to pesticides in sediments of the Pier 1 study area.

3.5 BUTYLTINS

A total of 7 surface sediments and 1 core section were analyzed for the four butyltins, monobutyltin, dibutyltin, tributyltin, and tetrabutyltin. Butyltins were not detected in any of the samples.

3.6 TOC AND MOISTURE CONTENT

A total of 7 surface sediments and 1 core section were analyzed for TOC and moisture content (Table 2). TOC was found to have a wide range in concentration between 1.2% and 5.1%. This variability is significant because the bioavailability of organic compounds (PAHs, pesticides, and PCBs) is believed to be controlled by the partitioning between the organic carbon fraction of sediment with the associated interstitial water and the lipid fraction of tissue (Tracey, 1996; U.S. EPA, 1998). As a result, high TOC sediments will have lower contaminant bioavailability than low TOC sediments with the same unit organic contaminant concentration. In a previous study of Goss Cove, located in the southwestern portion of the Submarine Base Groton, sediment TOC values ranged between 5.1% and 8.8% in the 10 surface sediments sampled and organic chemical concentrations were lower such that adverse chemical impacts were not expected (SAIC, 1999b). Thus, the chemical availability of organics in Pier 1 sediments is expected to be higher than Goss Cove.

Solids content was also measured and found to range between 23.2% and 64%. Solids content is primarily used to convert wet weight data to dry weight to permit comparisons of chemical concentrations between sampling locations. As solids content increases, the firmness of the sediments increases. Solids content is also environmentally relevant because samples with a high solid content (e.g., > 50%) will be less subject to resuspension due to currents and waves than samples with a low solids content. The relatively low solids content of Pier 1 sediments suggest that associated chemicals may be subject to resuspension and transport away from the area.

4. CONCLUSIONS

A total of 7 surface sediments and 1 core section from seven stations were analyzed for nine metals, 24 PAHs, 25 PCBs, 27 pesticides, butyltins, TOC, and solid content. The results are summarized as follows:

- Metal concentrations were generally higher in grab samples from SBP-1 - SBP-4 and the core sample from SBP-4 than at the remaining stations. ER-M exceedences were noted for mercury, copper, lead, nickel, and zinc.

- The patterns of PAH constituent concentrations were similar among stations, indicating a similar source. Collectively, PAHs were lowest at SPB-6 and highest at SBP-1 reflecting a decreasing contamination gradient away from the inner pier area. Total PAHs exceeded the ER-L benchmark concentration at most stations and were also greater than the ER-M at SBP-1 and SBP-3.

- PCBs were highest at SBP-1 and lowest at SBP-6. The spatial pattern was one of decreasing PCB concentration with distance from the inner pier area. The ER-L was exceeded for all of the samples and the ER-M benchmark was also exceeded in the majority of samples.

- Pesticides were generally not detected in the samples. The most notable exception was gamma chlordane where concentrations at SBP-2, SBP-3, and SBP-4 (grab sample) exceeded the ER-M.

- Butyltins were not detected in any of the samples.

- The frequency, magnitude, and spatial extent of ER-L and ER-M benchmark exceedences indicate that chemical concentrations of metals and organic contaminants in the Pier 1 area was limited to the inner pier area (i.e., Stations SBP-1 through SBP-4 and somewhat at SBP-7) and showed a downward gradient (i.e., Stations SPB-5 and SBP-6) towards the river.

5. REFERENCES

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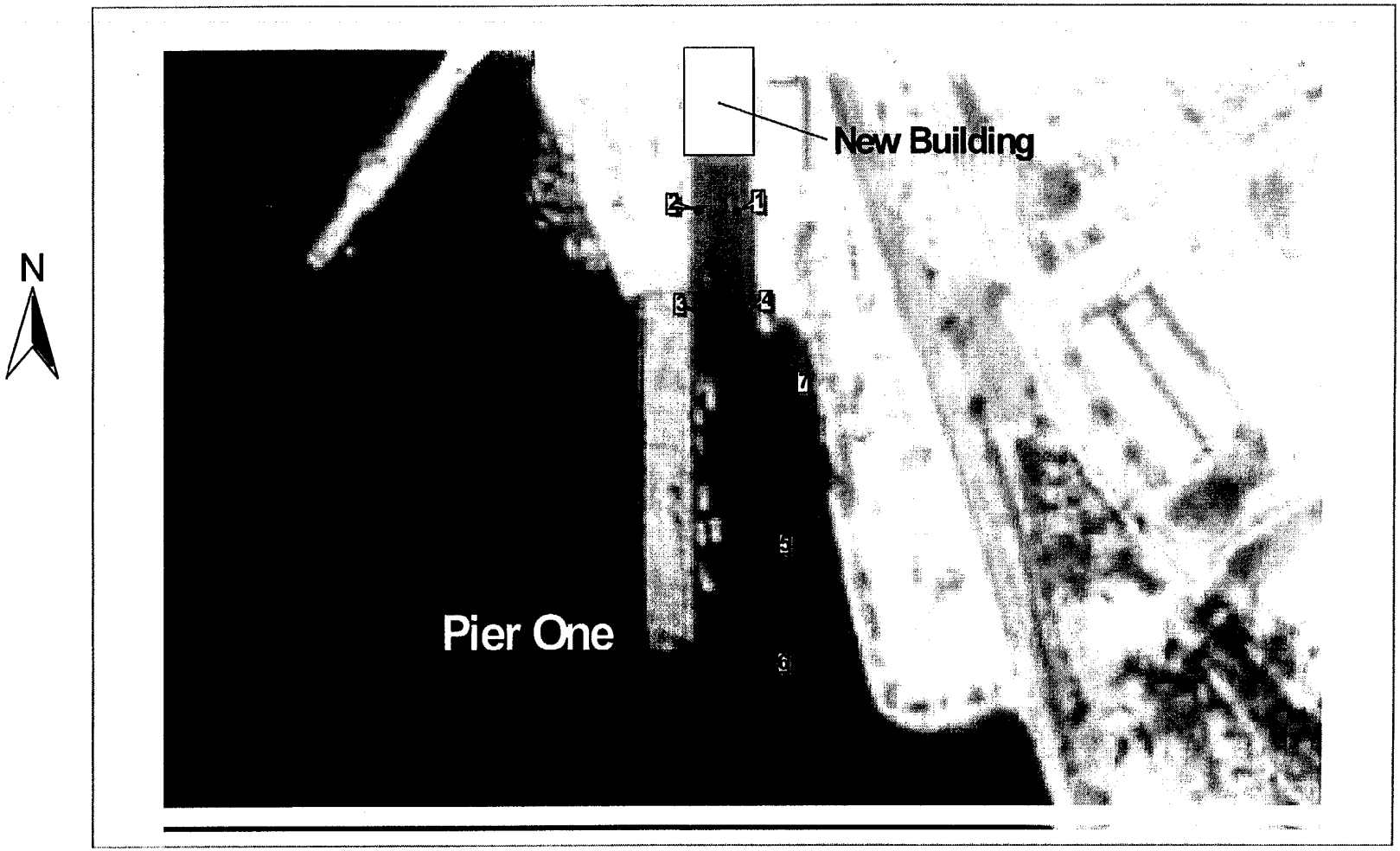
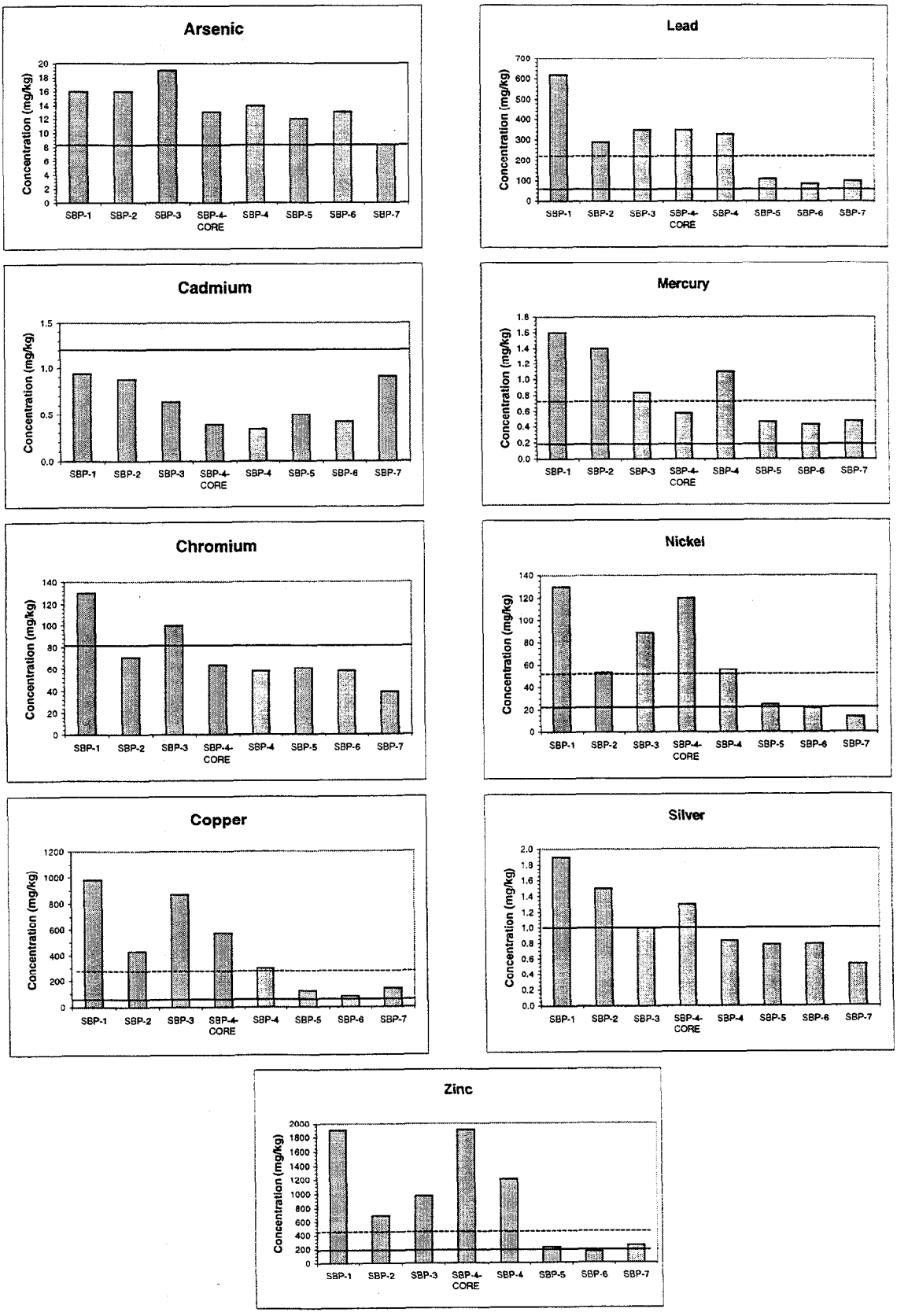
Figure 1. Pier 1 Marine Railway Study Area and Sampling Locations



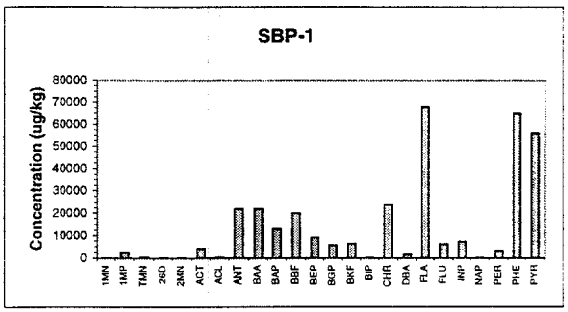
1994 Orthographic Photo provided by University of Connecticut MAGIC Program

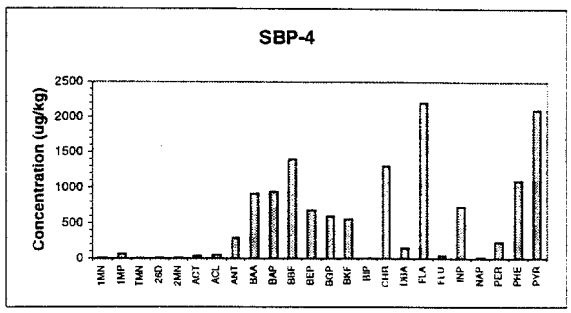
Figure 2. Concentrations of metals in samples collected from Pier 1.

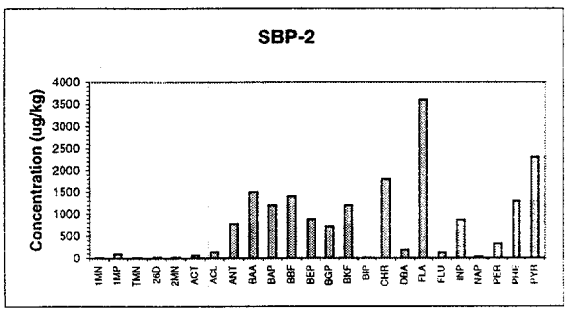


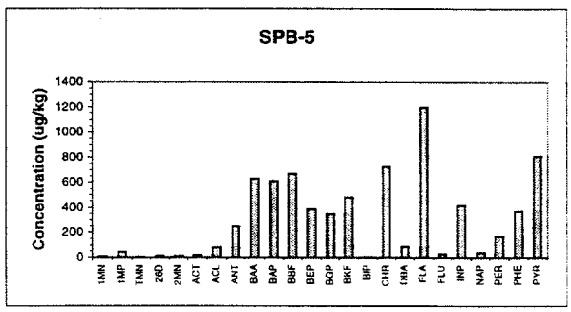
The horizontal lines are the ER-L (solid) and ER-M (dashed) benchmarks.

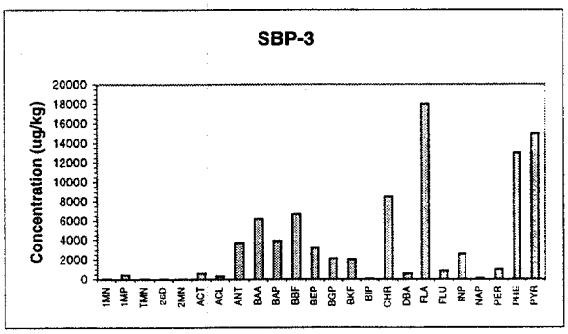
Figure 3. Concentrations of individual PAHs in samples from Pier 1.

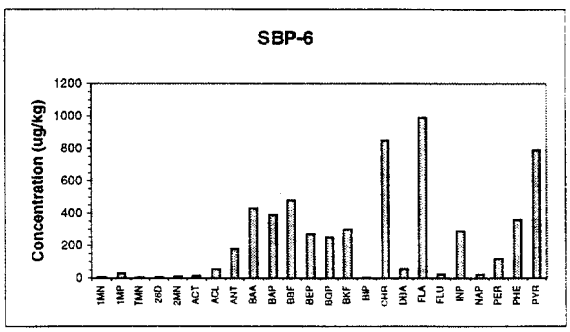


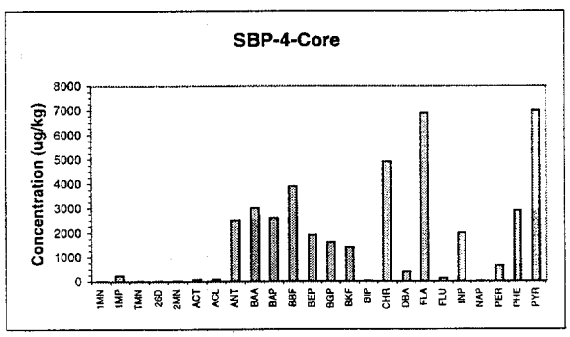


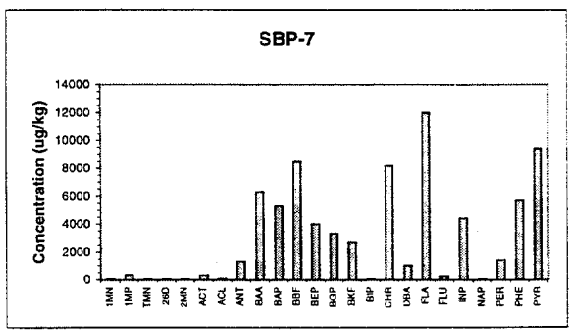




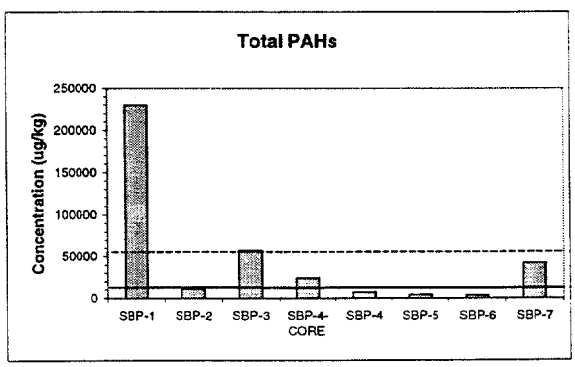






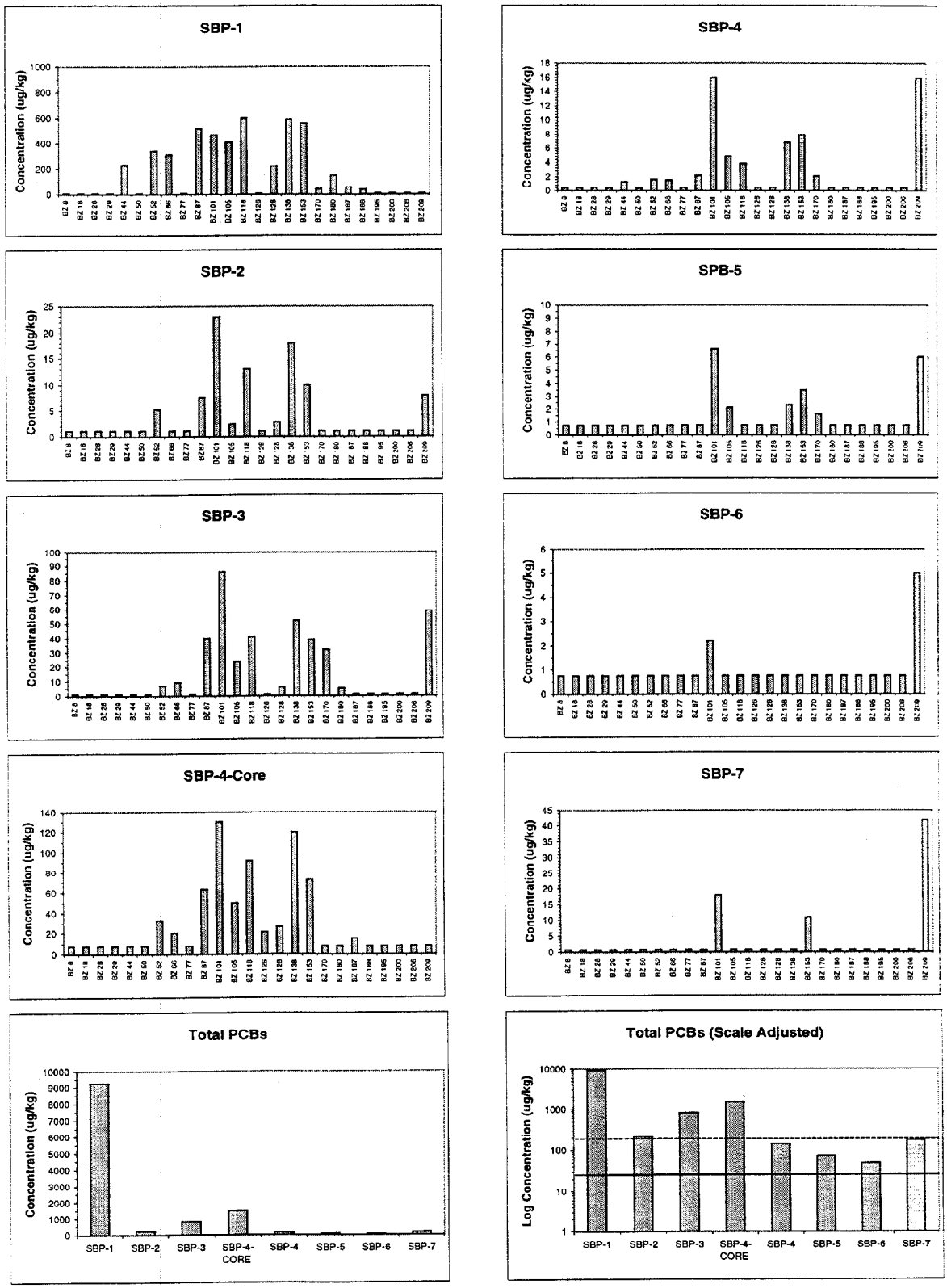


1MN	1-Methylnaphthalene	BGP	Benzo(g,h,i)Perylene
1MP	1-Methylphenanthrene	BKF	Benzo(k)fluoranthene
TMN	1,6,7-Trimethylnaphthalene	BIP	Biphenyl
26D	2,6-Dimethylnaphthalene	CHR	Chrysene/Triphenylene
2MN	2-Methylnaphthalene	DBA	Dibenzo(a,h)anthracene
ACT	Acenaphthene	FLA	Fluoranthene
ACL	Acenaphthylene	FLU	Fluorene
ANT	Anthracene	INP	Indeno(1,2,3-cd)pyrene
BAA	Benzo(a)anthracene	NAP	Naphthalene
BAP	Benzo(a)pyrene	PER	Perylene
BBF	Benzo(b,j,k)fluoranthene	PHE	Phenanthrene
BEP	Benzo(e)pyrene	PYR	Pyrene



The horizontal lines are the ER-L (solid) and ER-M (dashed) benchmarks.

Figure 4. Concentrations of individual PCBs and Total PCBs in samples from Pier 1.



The horizontal lines are the ER-L (solid) and ER-M (dashed) benchmarks for Total PCBs.

Table 1. Approximate sampling locations for Pier 1.

US Navy Submarine Base Groton, CT Pier One Marine Railway Study				
	CT State Plane feet (NAD 27)		Geographic Coordinates (NAD 83)	
Station	Northing	Easting	Latitude	Longitude
1	203,640.52	781,187.01	41° 23′ 25.574" N	72° 05′ 21.183" W
2	203,647.51	781,111.46	41° 23′ 25.649" N	72° 05′ 22.174" W
3	203,542.58	781,112.86	41° 23′ 24.612" N	72° 05′ 22.166" W
4	203,553.48	781,185.82	41° 23′ 24.714" N	72° 05′ 21.208" W
5	203,314.05	781,158.07	41° 23′ 22.350" N	72° 05′ 21.463" W
6	203,211.21	781.168.14	41° 23′ 21.335" N	72° 05′ 21.606" W
7	203,455.46	781,225.99	41° 23′ 23.743" N	72° 05′ 20.690" W

Table 2. Results of sediment chemical analyses for the Pier 1.

		SBP-1		SBP-2		SBP-3		SBP-4-CORE		SBP-4		SBP-5		SBP-6		SBP-7	
		Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Metals (MG/KG)	Arsenic	16		16		19		13		14		12		13		8.3	
	Cadmium	0.94		0.88		0.64		0.39		0.34		0.5		0.42		0.91	
	Chromium	130		71		100		64		58		61		58		39	
	Copper	980		430		870		570		300		120		79		140	
	Lead	620		290		350		350		330		110		86		100	
	Mercury	1.6		1.4		0.84		0.58		1.1		0.46		0.43		0.47	
	Nickel	130		53		89		120		56		25		22		14	
	Silver	1.9		1.5		1		1.3		0.83		0.78		0.79		0.53	
	Zinc	1900		690		970		1900		1200		220		160		250	
PAHs (UG/KG)	1-Methylnaphthalene	155	U	10		30	U	19	U	7		6		6		34.5	U
	1-Methylphenanthrene	2400		97		470		240		65		42		29		310	
	1,6,7-Trimethylnaphthalene	370		11		30	U	19	U	4	U	3	U	4		34.5	U
	2,6-Dimethylnaphthalene	155	U	25		30	U	19	U	7		9		6		34.5	U
	2-Methylnaphthalene	155	U	14		30	U	19	U	8		10		10		34.5	U
	Acenaphthene	4000		64		630		74		36		17		16		300	
	Acenaphthylene	380		140		330		80		49		81		55		79	
	Anthracene	22000		780		3700		2500		290		250		180		1300	
	Benzo(a)anthracene	22000		1500		6200		3000		910		630		430		6300	
	Benzo(a)pyrene	13000		1200		3900		2600		940		610		390		5300	
	Benzo(b)fluoranthene	20000		1400		6700		3900		1400		670		480		8500	
	Benzo(e)pyrene	9200		880		3200		1900		680		390		270		4000	
	Benzo[g,h,i]perylene	5600		710		2100		1600		600		350		250		3300	
	Benzo(k)fluoranthene	6400		1200		2000		1400		560		480		300		2700	
	Biphenyl	155	U	4.5	U	30	U	19	U	3.5	U	3	U	4		34.5	U
	Chrysene	24000		1800		8500		4900		1300		730		850		8200	
	Dibenz[a,h]anthracene	1600		180		580		400		150		89		58		1000	
	Fluoranthene	68000		3600		18000		6900		2200		1200		990		12000	
	Fluorene	6100		120		860		120		43		29		24		230	
	Indeno[1,2,3-cd]pyrene	7200		870		2600		2000		730		420		290		4400	
	Naphthalene	155	U	29		93		19	U	13		38		21		34.5	U
	Perylene	3100		330		1000		640		230		170		120		1400	
	Phenanthrene	65000		1300		13000		2900		1100		370		360		5700	
	Pyrene	56000		2300		15000		7000		2100		810		790		9400	
	Sum PAHs (6 HMW)[1]	131700		8610		38180		18440		5730		3429		2838		34200	
	Sum PAHs (7 LMW)[2]	97790		2447		18643		5712		1539		795		666		7678	
	Total PAHs (HMW + LMW)[3]	229490		11057		56823		24152		7269		4224		3504		41878	

Table 2. Results of sediment chemical analyses for the Pier 1.

		SBP-1		SBP-2		SBP-3		SBP-4-CORE		SBP-4		SBP-5		SBP-6		SBP-7	
		Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
PCB (UG/KG)	BZ 8	8	U	1.1	U	1.2	U	7.5	U	0.5	U	0.75	U	0.75	U	0.7	U
	BZ 18	8	U	1.1	U	1.2	U	7.5	U	0.5	U	0.75	U	0.75	U	0.7	U
	BZ 28	8	U	1.1	U	1.2	U	7.5	U	0.495	U	0.75	U	0.75	U	0.7	U
	BZ 29	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	BZ 44	230		1.1	U	1.2	U	7.5	U	1.3	U	0.75	U	0.75	U	0.7	U
	BZ 50	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	BZ 52	340		5.2		6.9		33		1.6	U	0.75	U	0.75	U	0.7	U
	BZ 66	310		1.1	U	9.3		20		1.5	U	0.75	U	0.75	U	0.7	U
	BZ 77	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	BZ 87	520		7.6		40		63		2.2	U	0.75	U	0.75	U	0.7	U
	BZ 101	470		23		86		130		16		6.6		2.2		18	
	BZ 105	410		2.4		24		50		4.8		2.1		0.75	U	0.7	U
	BZ 118	603		13		41		92		3.8	U	0.75	U	0.75	U	0.7	U
	BZ 126	8	U	1.1	U	1.2	U	21		0.45	U	0.75	U	0.75	U	0.7	U
	BZ 128	220		2.8		6		26		0.45	U	0.75	U	0.75	U	0.7	U
	BZ 138	590		18		52		120		6.8		2.3		0.75	U	0.7	U
	BZ 153	560		10		39		73		7.9		3.5		0.75	U	11	
	BZ 170	42		1.1	U	32		7.5	U	2.1		1.6		0.75	U	0.7	U
	BZ 180	150		1.1	U	5.2		7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	BZ 187	58		1.1	U	1.2	U	15		0.45	U	0.75	U	0.75	U	0.7	U
	BZ 188	40		1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	BZ 195	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	BZ 200	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	BZ 206	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	BZ 209	8	U	8		59		7.5	U	16		6		5		42	
	Sum PCBs[4]	4631		107.6		416		748		70.35		36.35		24.45		86.4	
	Total PCBs[5]	9262		215.2		832		1496		140.7		72.7		48.9		172.8	

Table 2. Results of sediment chemical analyses for the Pier 1.

		SBP-1		SBP-2		SBP-3		SBP-4-CORE		SBP-4		SBP-5		SBP-6		SBP-7	
		Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
PSTs (UG/KG)	Aldrin	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Alpha Chlordane	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Alpha-BHC	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Beta-BHC	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Delta-BHC	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Dieldrin	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Endosulfan I	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Endosulfan II	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Endosulfan Sulfate	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Endrin	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Endrin Aldehyde	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Endrin Ketone	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Gamma Chlordane	8	U	6.3		7.1		7.5	U	18		0.75	U	0.75	U	0.7	U
	Gamma-BHC	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Heptachlor	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Heptachlor Epoxide	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Hexachlorobenzene	8	U	1.1	U	1.2	U	7.5	U	0.45	U	33		0.75	U	0.7	U
	Methoxychlor	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	13	
	Mirex	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	13	
	Oxychlordane	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	Toxaphene	80	U	11	U	12	U	75	U	4.5	U	7.5	U	7.5	U	7	U
	2,4'-DDD	8	U	1.1	U	3.6		7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	2,4'-DDE	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	2,4'-DDT	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	4,4'-DDD	8	U	1.1	U	1.2	U	7.5	U	8.1		0.75	U	0.75	U	17	
	4,4'-DDE	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
	4,4'-DDT	8	U	1.1	U	1.2	U	7.5	U	0.45	U	0.75	U	0.75	U	0.7	U
Butyltins (UG/KG)	Monobutyltin	75	U	105	U	55	U	36	U	37	U	70	U	70	U	37.5	U
	Dibutyltin	75	U	105	U	55	U	36	U	37	U	70	U	70	U	37.5	U
	Tributyltin	75	U	105	U	55	U	36	U	37	U	70	U	70	U	37.5	U
	Tetrabutyltin	75	U	105	U	55	U	36	U	37	U	70	U	70	U	37.5	U
TOC (%)	Total Organic Carbon	4.4		5.1		3.3		1.2		2		4.3		4		2.2	
SOLIDS (%)	Solids	31		23.2		40.9		64		55.4		32.9		33.1		35.5	

1 - Sum of High Molecular Weight PAHs = Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, and Perylene

2 - Sum of Low Molecular Weight PAHs = 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene

3 - Total PAHs = HMW + LMW PAHs

4 - Sum PCBs does not include PCB77

5 - *Total PCBs = Sum PCBs X 2*

U = Analyzed but not detected, reported value is 1/2 the MDL (method detection limit)

Appendix 1. Work Plan for Evaluation of Chemical Data for the Pier 1 Marine Railway, Naval Submarine Base New London Groton, CT

WORK PLAN
FOR
EVALUATION OF CHEMICAL
DATA FOR THE
PIER 1 MARINE RAILWAY,
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CT

Final

Submitted to:
Northern Division
Naval Facilities Engineering Command (NAVFAC)
10 Industrial Highway, Mail Stop #82
Lester, PA 19113-2090

Submitted by:

Science Applications International Corporation
221 Third St.
Newport, RI 02840

CONTRACT NUMBER N47408-97-D-0410
DELIVERY ORDER NUMBER 0012

August 1999

1.0 INTRODUCTION

This Work Plan has been prepared under Contract Number N47408-97-D-0410, Delivery Order Number 0012. The statement of work requires Science Applications International Corporation (SAIC) to provide chemical assessment support services to evaluate chemical relationships for sediments at the Pier 1 Marine Railway, Naval Submarine Base, to define an area of possible contamination and to assist with the evaluation of remedial alternatives. This Work Plan outlines the requirements and describes the procedures for performing evaluations at the Pier 1 Marine Railway and the methods that will be used.

The purpose of this Work Plan is to describe the methodology to evaluate chemical relationships for sediments around the Pier 1 Marine Railway. The evaluation will provide the necessary information for SAIC to develop a report of preliminary findings and conclusions regarding the degree and extent of chemical contamination and possible ecological risk associated with the Pier 1 Marine Railway.

1.1 SITE-SPECIFIC INVESTIGATION OBJECTIVES

The objectives of this investigation are the following:

- establish contaminants of concern (CoCs) for the Pier 1 Marine Railway sediments;
- describe the extent of chemical contaminants in the Pier 1 Marine Railway sediments; and
- derive some preliminary conclusions about the likelihood of environmental impact from CoC concentrations.

1.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

SAIC will be responsible for the overall technical and fiscal management of the project including the field collection and laboratory analyses activities described below. NFESC personnel will be responsible for overall program management and technical oversight and coordination among federal and state regulatory agencies. NORTHDIV personnel will be responsible for on-site activities and coordination between SAIC and NFESC.

Key Navy personnel for this project are:
Barry Orlando, NFESC Contracting Officer's Representative (COR)
Ruth Owens, NFESC Technical Point of Contact (POC)
Mark Evans, NORTHDIV Technical Representative, NTR

Key SAIC personnel supporting the project include:

Gregory Tracey, Program Technical Lead for Ecological Risk

Chemical analyses will be subcontracted and are supported by the following:

Helder Costa, Woods Hole Group Environmental Laboratories.

1.3 PROJECT DELIVERABLES

In addition to this Work Plan, project deliverables to be submitted for this project are shown below.

Draft Report (5 - 10 pages) that will include:

- Summary of previously described site conditions and chemical data;
- Detailed description of methods for field sampling, sample manipulations, and chemical analyses;
- Assessment of primary CoCs relative to ecological benchmarks.
- Appendix data will be provided in a format appropriate for Tier 3 data validation.

A Final Report will be prepared that incorporates Navy and interested agency comments.

1.4 PROJECT SCHEDULE

The following schedule is proposed for this project that is based upon approval of the final work plan submitted by SAIC.

Submission of Final Work Plan ..... 5 work days after receipt of Government comments

Completion of Sample Collection ..... within 20 work days of work plan approval

Completion of Chemical Analyses ..... within 40 work days of collection of sediment samples

Submission of Draft Report ..... within 50 work days of completion of sample collection

Submission of Final Report ..... within 10 work days after receipt of comments

2.0 BACKGROUND INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

The Pier 1 Marine Railway is located in the southwestern portion of the Naval SubBase-New London (Figure 2-1). It is located along the shore in the Thames River. The area surrounding the Pier 1 Marine Railway generally does not have emergent vegetation and it is not used for drinking water by wildlife as the water is too brackish. It does support benthic macroinvertebrate communities, possibly small fish, and shellfish. The area also supports avian predators. A portion of this Marine Railway has been backfilled for the construction of a new building (Figure 2-2).

2.2 PREVIOUS SITE INVESTIGATIONS

Previously, Phase I and Phase II Remedial Investigations (RIs) were conducted at Naval Submarine Base New London (NSB-NLON) in Groton, Connecticut (Atlantic Environmental Services, 1992; Brown and Root, 1996a, 1997). The RIs determined that hazardous materials were present at several sites which represented potential risks to human health and the environment. However, data were not collected around the Pier 1 Marine Railway.

Currently, construction is underway on a new building adjacent to the Marine Railway. During building construction, visual evidence of blasting grit was apparent in excavated soils. Odor from petroleum contaminants was also evident (R. Conant, pers. comm.). Soil stockpiles were tested for chemistry, and elevated concentrations of lead were discovered. In two samples, lead concentrations were 9.45 mg/L and 11.34 mg/L, respectively, as compared to the EPA TCLP benchmark for lead of 5 mg/L. In another instance, a soil stockpile had a total lead concentration of 3370 mg/Kg. In addition, soil samples taken from silt bags on the ramp of the Marine Railway of Pier 1 revealed elevated concentrations of mercury, chromium and lead (R. Conant, pers. comm.). These sample results prompted the need for an investigation to examine the sediments adjacent to the Pier 1 Marine Railway. This sampling plan was devised to determine 1) whether the observed contamination extends into the marine portion of the railway; and 2) if so, the extent of contamination.

3.0 SAMPLE DESIGN, COLLECTION, TESTING, AND ANAYLSIS

This section describes the design for sample collection and the rationale and methods for chemical analysis and data interpretation.

3.1 SAMPLE DESIGN AND COLLECTION

The design of the sampling program was established to characterize the spatial distribution of sediment contaminants in the depositional portion of the Pier 1 Marine Railway area. It is also the intent of the study to perform a limited characterization of the vertical distribution of CoCs, *i.e.*, across apparent lithological layers within the sediment that may relate to patterns of deposition.

To address these data needs, 6 stations from the Pier 1 Marine Railway, New London, CT (Figure 2-2) will be sampled for chemical content. Three surface grab samples (0-15 cm depth) will be taken within a 3 meter distance of the station location. The grab samples will be composited, and one liter of sediment will be retained at each station and placed in precleaned glass containers. Care will be taken to prevent loss of fines as well as to minimize the entrainment of excess water into the sample.

In addition to surface grabs, subsurface samples will be collected as sediment cores at 2 stations (Figure 2-2) for characterization of vertical CoC distribution in relation to possible CoC sources. Cores will be collected at a depth of one meter or refusal, whichever occurs first. The bottom 20 cm of the depositional portion of the core will be composited, retained, and placed in precleaned glass containers.

In total, six composited surface grab samples and 2 composited core sections will be packed and mailed for overnight delivery to the Woods Hole Group Environmental Laboratories for chemical analyses (see Table 1 for list of analytes). TOC analyses will also be conducted.

4.0 REPORTING

A brief report summarizing the measured analytical data at each location will be prepared. A limited discussion of the measured values with respect to NOAA ER-L/ER-M benchmarks will be included so as to ascertain potential ecological risks.

5.0 REFERENCES

Atlantic Environmental Services. 1992. Phase I Remedial Investigation, Naval Submarine Base - New London, Groton, Connecticut.

Brown & Root Environmental. 1996. Preliminary Evaluation of Ecological Risk-Based Remedial Action Objectives for Goss Cove Sediments and Comparison with Human Risk-Based Remedial Action Objectives.

Brown & Root Environmental. 17 March 1997. Phase II Remedial Investigation (RI), Naval Submarine Base - New London, Groton, Connecticut.

National Oceanic and Atmospheric Administration. 1998. Sampling and Analytical Methods of the National Status and Trends Program Mussel Watch Project: 1993-1996 Update, NOSS Technical Memorandum NOS ORCA 130.

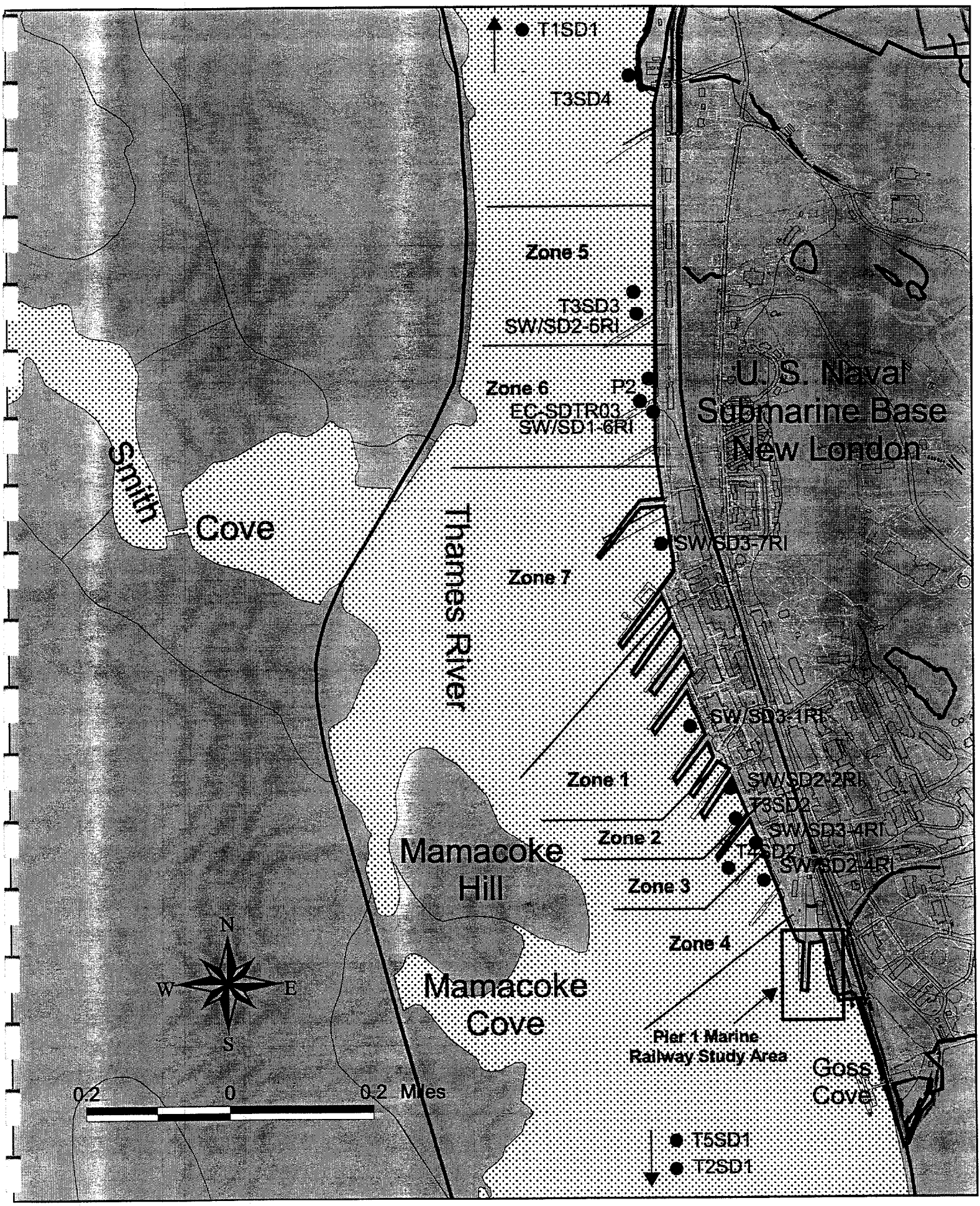


Figure 2-1. Location of bulk sediment chemistry sample sites in the Thames River.

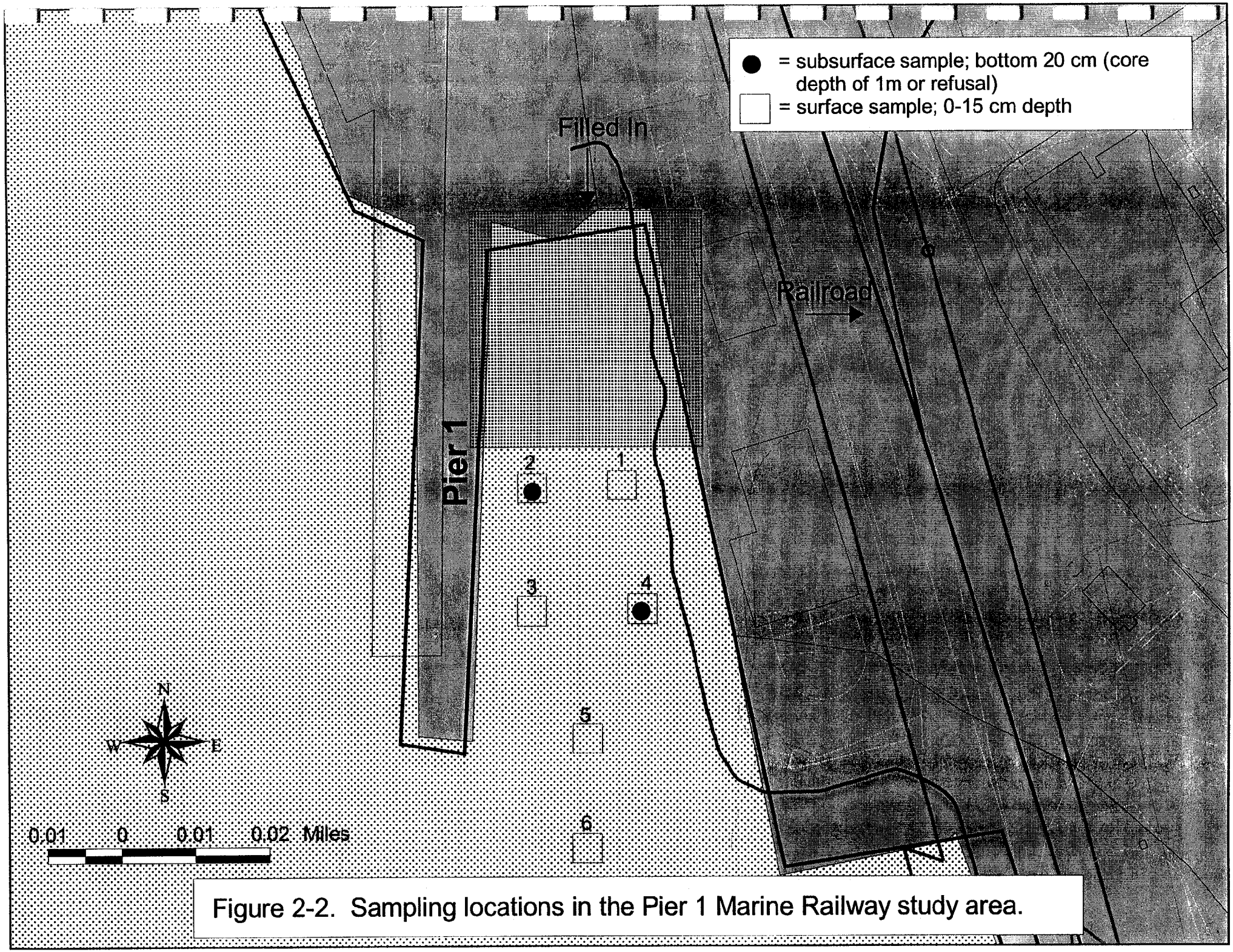


Figure 2-2. Sampling locations in the Pier 1 Marine Railway study area.

Table 1. List of analytes for chemical analysis.

Metals

Reporting Name	Analyte	CAS NO	Sediment Analysis Method	Sediment MDL mg/Kg dry	Sediment Reporting Limit mg/Kg dry
As	Arsenic	7440-38-2	GFAA 7060	0.04	0.5
Cd	Cadmium	7440-43-9	GFAA 7131	0.06	0.2
Cr	Chromium	7440-47-3	ICP 6010B	0.34	1.0
Cu	Copper	7440-50-8	GFAA 7211	0.1	0.5
Pb	Lead	7439-92-1	GFAA 7421	0.14	0.2
Hg	Total Mercury (cold vapor)	7439-97-6	CVAA 7471	0.005	0.006
Ni	Nickel	7440-02-0	ICP 6010B	1.2	2.0
Ag	Silver	7440-22-4	GFAA 7761	0.03	0.2
Zn	Zinc	7440-66-6	ICP 6010B	0.43	2.0

PAHs

Reporting Name	Analyte	CAS NO	Sediment MDL ug/Kg dry	Sediment Reporting Limit ug/Kg dry
T167NAP	1,6,7-Trimethylnaphthalene	2245387	0.10	2
M1NAPH	1-Methylnaphthalene	90120	0.11	2
M1PHEN	1-Methylphenanthrene	832699	0.16	2
D26NAPH	2,6-Dimethylnaphthalene	581420	0.17	2
M2NAPH	2-Methylnaphthalene	91-57-6	0.19	2
ACENAPH	Acenaphthene	83-32-9	0.14	2
ACENAPL	Acenaphthylene	208-96-8	0.13	2
ANTHRAC	Anthracene	120-12-7	0.23	2
BENAAN	Benzo(a)anthracene	56-55-3	0.19	2
BENAPYR	Benzo(a)pyrene	50-32-8	0.065	2
BENBFLU	Benzo(b)fluoranthene	205-99-2	0.34	2
BENEPYR	Benzo(e)pyrene	192972	0.19	2
BGHIPER	Benzo(g,h,i)perylene	191-24-2	0.19	2
BENKFLU	Benzo(k)fluoranthene	207-08-9	0.47	2
BIPHEN	Biphenyl	92524	0.46	2
CHRYSEN	Chrysene	218-01-9	0.18	2
DBAHANT	Dibenz(a,h)anthracene	53-70-3	0.26	2
FLUORAN	Fluoranthene	206-44-0	0.22	2
FLUOREN	Fluorene	86-73-7	0.082	2
I123CDP	Indeno(1,2,3-cd)pyrene	193-39-5	0.093	2
NAPH	Naphthalene	91-20-3	0.28	2
PERYL	Perylene	198550	0.13	2
PHENAN	Phenanthrene	85-01-8	0.22	2
PYRENE	Pyrene	129-00-0	0.24	2

Methods follow NS&T Program guidelines, and SW-846 Method 8270 Modified. Reporting limits based on 20-g sample, 50% moisture content, and 2-mL final extract volume.

Table 1. continued.

PCB congeners

Reporting Name	Analyte	CAS NO	Sediment MDL ug/Kg dry	Sediment Reporting Limit ug/Kg dry
PCB008	8 (2 4)	34883437	0.063	1
PCB018	18 (2 2'5)	37680652	0.29	1
PCB028	28 (2 4 4')	7012375	0.025	1
PCB029	29 (2 4 5)	15862074	NA	1
PCB044	44 (2 2'3 5')	41464395	0.18	1
PCB050	50 (2 2' 4 6)	62796650	NA	1
PCB052	52 (2 2'5 5)	35693993	0.083	1
PCB066	66 (2 3'4 4')	32598100	0.030	1
PCB077	77(3 3' 4 4')	32598133	0.047	1
PCB087	87(2 2' 3 4 5')	38380028	0.063	1
PCB101	101 (2 2'4 5 5')	37680732	0.086	1
PCB104	104 (2 2' 4 6 6')		NA	1
PCB105	105 (2 3 3'4 4')	32598144	0.040	1
PCB118	118 (2 3'4 4'5)	31508006	0.046	1
PCB126	126 (3 3' 4 4' 5)	57465288	0.060	1
PCB128	128 (2 2'3 3'4 4')	39380073	0.15	1
PCB138	138 (2 2'3 4 4'5)	35065282	0.075	1
PCB153	153 (2 2'4 4'5 5')	35065271	0.069	1
PCB154	154(2 2 4 4' 5 6')		NA	1
PCB170	170 (2 2'3 3'4 4'5)	35065306	0.14	1
PCB180	180 (2 2'3 4 4'5 5')	35065293	0.058	1
PCB187	187 (2 2'3 4'5 5'6)	52663680	0.046	1
PCB188	188 (2 2' 3 4' 5 6 6')		NA	1
PCB195	195 (2 2'3 3'4 4'5 6)	52663782	0.052	1
PCB200	200 (2 2' 3 3' 4 5 6 6')		NA	1
PCB206	206 (2 2'3 3'4 4'5 5'6)	40186729	0.050	1
PCB209	209 (2 2'3 3'4 4'5 5'6 6')	2051243	0.075	1

Methods follow NS&T Program guidelines and SW-846 Method 8082 Modified. Reporting limit based on 20-g sample, 50% moisture, 2-mL final extract volume; lower reporting limits may be achieved if required by the project QAPjP.

NA – Not available, congener not included in most recent MDL study.

Table 1. continued.

OCPs

Reporting Name	Analyte	CAS NO	Sediment MDL ug/Kg dry	Sediment Reporting Limit ug/Kg dry
ABHC	Alpha-BHC	319846	0.014	1
ACHLOR	Alpha-Chlordane	5103719	0.022	1
BBHC	Beta-BHC	319857	0.026	1
DBHC	Delta-BHC	319868	0.017	1
DIELDRIN	Dieldrin	6057	0.049	1
ENDOSFN1	Endosulfan I	959988	0.022	1
ENDOSFN2	Endosulfan II	33213659	0.031	1
ENDOSO4	Endosulfan Sulfate	1031078	0.059	1
ENDRIN	Endrin	72208	0.039	1
ENDRINAD	Endrin Aldehyde	7421934	0.048	1
GBHC	Gamma-BHC(Lindane)	58899	0.014	1
GCHLOR	Gamma-Chlordane	5103742	0.030	1
HPTCHLOR	Heptachlor	76448	0.037	1
HPTEPOX	Heptachlor Epoxide	1024573	0.032	1
MTXYCHLR	Methoxychlor		0.23	5
TOXPHNE	Toxaphene	8001352	NA	10
ALDRIN	Aldrin	309002	0.012	1
HCB	Hexachlorobenzene	118-74-1	NA	1
MIREX	Mirex	2385855	NA	1
DDD_PP	p,p'-DDD	72548	0.026	1
DDE_PP	p,p'-DDE	72559	0.033	1
DDT_PP	p,p'-DDT	50293	0.030	1
DDD_OP	o,p'-DDD	3424826	NA	1
DDE_PP	o,p'-DDE		NA	1
DDT_PP	o,p'-DDT		NA	1

Methods follow NS&T Program guidelines and SW-846 Method 8081 Modified. Reporting limit based on 20-g sample, 50% moisture, 2-mL final extract volume; lower reporting limits may be achieved if required by the project QAPjP.

NA – Not available, pesticide not included in most recent MDL study.

Butyltins

Reporting Name	Analyte	CAS NO	Sediment MDL ug/Kg dry
MBT	Monobutyltin		11.316
DBT	Dibutyltin		12.674
TBT	Tributyltin		10.720
TTBT	Tetrabutyltin		9.590

Appendix 2. Lab Results

Woods Hole Group
Environmental Laboratories
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Phone: 508-822-9300
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Case Narrative
ETR: 43169
Client: SAIC
Project: Pier 1 Marine Railway
Date Received: 10/29/99

The following samples were received for analyses of polynuclear aromatic hydrocarbons, pesticides, polychlorinated biphenyl congeners, metals, organotins, and total organic carbon. Samples were stored in a freezer after receipt and inspection. Sample containers for organotin analyses were re-packaged and shipped overnight to CEIMIC Corporation (Narragansett, RI). Please note that frozen storage extends all holding times in this scope up to one year. This narrative summarizes methods and quality control compliance for analyses performed by Woods Hole Group Environmental Laboratories. The case narrative/transmission letter for organotin analyses is included with those data as part of this submission.

Sample Field ID	WHG Lab ID	Matrix	Date Collected	Date Received
SBP-4-CORE A	43169-1	Sediment	10/28/1999	10/29/1999
SBP-1-GRAB A	43169-2	Sediment	10/28/1999	10/29/1999
SBP-4-GRAB A	43169-3	Sediment	10/28/1999	10/29/1999
SBP-3-GRAB A	43169-4	Sediment	10/28/1999	10/29/1999
SBP-2-GRAB A	43169-5	Sediment	10/28/1999	10/29/1999
SBP-6-GRAB A	43169-6	Sediment	10/28/1999	10/29/1999
SBP-5-GRAB A	43169-7	Sediment	10/28/1999	10/29/1999
SBP-7-GRAB A	43169-8	Sediment	10/28/1999	10/29/1999

Sample Extraction and Cleanup

Sediment samples were extracted using pressurized fluid extraction following procedures in Woods Hole Group Standard Operating Procedure (SOP) *Method 3545 Extraction of Soil, Tissues, Vegetation and Sediment Samples by Pressurized Fluid Extraction, Revision 0.* Sediment samples were aliquoted (20 g wet), mixed with pelletized diatomaceous earth (drying agent), spiked with surrogate compounds, and extracted by pressurized fluid extraction (Dionex ASE 200). Samples were extracted along with a method blank, a spiked blank (laboratory control sample, LCS), a matrix spike, matrix spike duplicate, and an aliquot of standard reference material sediment 1944. Solvent extracts were dried over sodium sulfate and concentrated to 4 mL. Extracts were cleaned with activated copper to remove sulfur (SOP *Sulfur Cleanup Method 3660B, Revision 0*) and then through gel permeation chromatography (SOP *Gel Permeation Chromatography, Revision 0*). Extracts were solvent exchanged into hexane, then underwent cleanup through amino-propyl resin to remove polar compounds (SOP *Amino-Propyl Cleanup of Tissues and Sediments. Revision 0*) prior to instrumental analyses.

Polynuclear Aromatic Hydrocarbons

Extracts were analyzed following procedures in SOP *Analysis of Parent and Alkylated Polynuclear Aromatic Hydrocarbons and Selected Heterocyclic Compounds by Gas Chromatography/Mass Spectrometry with Selected Ion Monitoring(GC/MS-SIM), Revision 1.0.* The procedure is modified to target and report only the specific list of PAHs requested for this project. Concentrations are measured based on the relative response of target compounds using internal standards, calibrated using multi-level initial calibration curves, and reported without surrogate recovery adjustment. Reporting limits are determined using an on-column concentration representing the lowest initial calibration standards and supported by our MDL results, which are lower than the reporting limits. The on-column reporting limit is adjusted by sample preparation factors (sample size, moisture content, extract volume/dilution) to yield sample-specific reporting limits. Peak signals that are below the 10 ng/mL on-column reporting limit are considered not confirmed, and the sample-specific reporting limit is reported with a "U" qualifier.

Summary results of the SRM analysis (1944, New York/New Jersey Waterway Sediment), reported with surrogate recovery adjustment (certified results are based on an isotope dilution-type approach), with calculated percent difference are attached to this narrative. Our acceptance criteria for SRM analyses are 1) measured concentrations must be within ± 30% of certified concentrations on average for all analytes measured above the reporting limit and 2) measured concentrations should not exceed ± 35% of the upper or lower 95% confidence limits on the certified concentrations for more than 30% of analytes measured above the reporting limit. The PAH analysis for the SRM met both acceptance criteria. The low recovery of naphthalene in the SRM is consistent with the observed low recoveries of the surrogate compound naphthalene-d8.

The following procedural clarifications or QC noncompliance are noted; all additional quality control criteria were met.

1. The associated blank, SS1107B1, contains naphthalene, phenanthrene, fluoranthene, and pyrene at 1 ug/Kg, which is the method reporting limit. The method requires that these analytes be flagged with a "B" on sample results reports, however, reported results are not in any way compromised by these blank contaminants at this very low reporting limit.

2. The following samples were analyzed at the following dilutions to get target compounds within the instrument calibration range. The nphthalene-d8 surrogate recoveries were below QC limits for all samples; acenaphthene-d10 was low for two samples. These noncompliant surrogate recoveries appear due to sample preparation, with concentration procedures most affecting these volatile PAHs. Naphthalene, acenaphthene, and acenaphthylene may be biased low in the associated samples, but the PAH assemblages in this sample set clearly indicates predominant pyrogenic PAH (4-, 5-, and 6-ringed PAHs) source influences.

Client ID	Lab ID	Dilution	Surrogate out
SBP-4-CORE-A	43169-1	1:25	Naphthalene-d8
SBP-1-GRAB-A	43169-2	1:100	Naphthalene-d8
SBP-4-GRAB-A	43169-3	1:4	Naphthalene-d8
SBP-3-GRAB-A	43169-4	1:25	Naphthalene-d8
SBP-3-GRAB-AMS	43169-4MS	1:25	Naphthalene-d8
SBP-3-GRAB-AMSD	43169-4MS	1:25	Naphthalene-d8
SBP-2-GRAB-A	43169-5	1:2	Naphthalene-d8/Acenaphthene-d10
SBP-6-GRAB-A	43169-6	1:1	Naphthalene-d8
SBP-5-GRAB-A	43169-7	1:2	Naphthalene-d8/Acenaphthene-d10
SBP-7-GRAB-A	43169-8	1:25	Naphthalene-d8

3. The associated MS/MSD on sample SBP-3-GRAB-A (43169-4) had several recoveries below the QC limits. The MS/MSD results are somewhat confounded by the presence of most spike PAHs at concentrations in the native sample much higher than the spike amount. When this occurs, the matrix variability and the analytical variability can be greater than the variability of the spike recovery. However, only two RPDs exceed the QC limit of 35% indicating that even with the above factors data reproducibility was generally acceptable.

Organochlorine Pesticides and Polychlorinated Biphenyl Congeners

Extracts were analyzed following procedures in SOP *Determination of Polychlorinated Biphenyls (PCBs) as Congeners and Organochlorine Pesticides by Gas Chromatography/Electron Capture Detection (GC/ECD), Revision 1.0.* Concentrations are measured based on the relative response of target compounds using internal standards, calibrated using multi-level initial calibration curves. For this sample set, separate initial calibrations were analyzed for the PCB congenbers and the organochlorine pesticides; a single analysis of each extract was then used to quantify the PCB congeners and the pesticides separately. The surrogate recoveries are reported on the PCB congener report forms; the surrogate recoveries apply to both the congeners and the pesticides.

Two columns of data are reported and merged based on method guidance and analyst judgement to report a single result for each analyte on a dry-weight basis without surrogate recovery adjustment. A "P" qualifier is applied on the Form I when the percent difference between the two columns exceeds 40% and the higher value is selected for reporting, following guidance in Methods 8081/8082 and our SOP. The higher value was selected in these particular cases when the chromatography between the two columns was comparable with no apparent matrix interference in the judgement of the analyst. Reporting limits are determined using an on-column concentration bracketed by the initial calibration standards and supported by our MDL results, which are lower than the reporting limits. The on-column reporting limit is adjusted by sample preparation factors (sample size, moisture content, extract volume/dilution) to yield sample-specific reporting limits. Peak signals that are below the on-column reporting limit for either column are considered not confirmed, and the reporting limit is reported with a "U" qualifier.

Summary results of the SRM analysis (1944, New York/New Jersey Waterway Sediment), reported without any surrogate recovery adjustment, with calculated percent difference are attached to this narrative. Our acceptance criteria for SRM analyses are 1) measured concentrations must be within $\pm$ 30% of certified concentrations on average for all analytes measured above the reporting limit and 2) measured concentrations should not exceed $\pm$ 35% of the upper or lower 95% confidence limits on the certified concentrations for more than 30% of analytes measured above the reporting limit. For the congener/pesticide analysis, 15 out of 21 targets met the accuracy criterion (71% of targets). The mean 30%D criterion was exceeded due to three apparent outliers: BZ 66, BZ 170, and BZ 209. Results for these three congeners in the associated samples may be biased high as a result of some analytical artifact (e.g., unidentified co-elution). We particularly note the suspect reporting of BZ 209 in several samples with few other target congeners, specifically SBP-6-GRAB A and SBP-7-GRAB A. No further corrective action was taken because all spiked congeners (including BZ 209) and pesticides met their respective recovery criteria in the spiked blank (laboratory control sample).

The following procedural clarifications or QC noncompliance are noted; all additional quality control criteria were met.

1. The pesticide Endrin Aldehyde is flagged with a "J" denoting an estimated result or reporting limit because this pesticide is not recovered consistently through the amino-propyl resin cleanup used in the procedure. This issue was discussed with SAIC during the project and this reporting convention was approved for this data set.

2. The following samples were analyzed at the following dilutions to get target compounds within the instrument calibration range. Surrogate recoveries were acceptable in all samples, but were diluted out in SBP-4-CORE A.The nphthalene-d8 surrogate recoveries were below QC limits for all samples; acenaphthene-d10 was low for two samples. These noncompliant surrogate recoveries appear due to sample preparation, with concentration procedures most affecting these volatile PAHs. Naphthalene, acenaphthene, and acenaphthylene may be biased low in the associated samples, but the PAH assemblages in this sample set clearly indicates predominant pyrogenic PAH (4-, 5-, and 6-ringed PAHs) source influences.

Client ID	Lab ID	Dilution	Surrogate out
SBP-4-CORE-A	43169-1	1:20	DBOB, BZ 202 diluted out
SBP-1-GRAB-A	43169-2	1:10	BZ 202 interference
SBP-3-GRAB-A	43169-4	1:2	None
SBP-3-GRAB-AMS	43169-4MS	1:2	None
SBP-3-GRAB-AMSD	43169-4MS	1:2	None

3. The need to dilute extracts for congeners increases the reporting limits, which take into account an extract dilutions, for non-identified congeners and for pesticides. Please note that this is unavoidable with these methods, because large peaks (in the neat extract) affect the retention behavior of neighboring peaks, which in turn limits analyst judgement in correctly identifying small peaks based on retention time. Thus, the elevated reporting limits for pesticides and non-identified congeners in the extracts noted in item 2 are not only mandated by method reporting requirements, but are also technically appropriate. In such cases, extreme caution should be applied in using "U" concentrations or any fraction thereof in statistical analyses of the data set.

4. The associated MS/MSD on sample SBP-3-GRAB-A (43169-4) had several recoveries below the QC limits for congeners because of the relatively high (relative to spike amounts) concentrations in the native sample. Endrin was recovered high in the MS, but acceptably in the MSD. All RPD criteria were met for congeneres in the MS/MSD analyses; only endrin exceeded the RPD criterion for the pesticides.

Metals

Sediments were digested for metals analyses using microwave-assisted digestion (Method 3051) with analysis by ICP-AES (Method 6010B) or ICP-MS (Method 6020) for arsenic, cadmium, and silver. Mercury was analyzed using CVAA (Method 7471). Sample SBP-4-CORE A (43169-1) was digested and analyzed in duplicate with a matrix spike. A marine sediment SRM (PACS-2) was analyzed with this batch. All QC measures were within acceptance criteria except for the following:

Arsenic: The RPD between duplicates was 21% and exceeds the method acceptance criteria of 20%.

Chromium: The RPD between duplicates was 22% and exceeds the method acceptance criteria of 20%.

Mercury: The RPD between duplicates was 83% and exceeds the method acceptance criteria of 20%.

Nickel: The RPD between duplicates was 28% and exceeds the method acceptance criteria of 20%.

These precision criterion exceedances are likely due to some sample inhomogeneity.

Total Organic Carbon

Total organic carbon was analyzed following Woods Hole group SOP *Total Organic Carbon in Soil/Sediment Modified from EPA Method 9060 (Revision 1).* The sample is dried and loaded into a quartz boat and treated with phosphoric acid to remove the inorganic carbon prior to analysis. The sample is then introduced into a furnace and combusted. The carrier gas (O_2) is combined with the carbon content of the sample to form CO_2. The CO_2 is then measured by an infrared detector. The amount of CO_2 derived from a sample is directly proportional to the concentration of organic carbonaceous material in the sample. Samples are analyzed with a method blank, a matrix spike, and a sample duplicate. SRMs are used for the calibration verification as part of the standard quality control. Single measurements are reported on a dry weight basis for this project. All QC criteria were met for these analyses: LCS: 109 %R, MS: 80 %R, Dup: 8% RPD.

The enclosed results of analyses are representative of the samples as received by the laboratory. Woods Hole Group makes no representations or certifications as to the method of sample collection, sample identification, or transporting/handling procedures used prior to the receipt of samples by Woods Hole Group. To the best of my knowledge, the information contained in this report is accurate and complete.

Approved by: _____ Date: 12/8/99

Woods Hole Group Environmental Laboratories

Woods Hole Group
Environmental Laboratories

Chain of Custody

Chain-of-Custody Record

Woods Hole Group
Environmental Laboratories

375 Paramount Drive
Raynham, MA 02767

TEL: (508) 822-9300
FAX: (508) 822-3288

43169

COMPANY INFORMATION

Name: SAIC - Newport
Address: 221 Third Street
Newport, RI 02840
Telephone: 401-847-4210
Facsimile: 401-849-1585
Contact Name: C. Mueller

COMPANY'S PROJECT INFORMATION

Regulatory Protocol:
For the State of:
Project Name:
Project Number:
P.O. #
Sampler Name(s):

SHIPPING INFORMATION

Carrier:
Airbill Number:
Date Shipped:
Quote #:

TAT — 10 Day — 5 Day — 3 Day — 48 Hr — 24 Hr — Other

WHG LAB #	SAMPLE ID (NOTE 1)	COLLECTION DATE	COLLECTION TIME	COMPOSITE GRAB	MATRIX	ANALYSIS/REMARKS (NOTE 2, 3)	NUMBER OF CONTAINERS (VOLUME/CONTAINER TYPE/PRESERVATIVE (NOTE 4))
43169 1	SBP-4-CORE A	10/28/99	10:15	✓		PAHs, Pesticides, PCB Congn, Metals, TOC	1 8oz glass
-2	SBP-1-GRAB A		12:37	✓			1
-3	SBP-4 GRAB A		12:10	✓			1
-4	SBP-3-GRAB A		10:24	✓			1
-5	SBP-2-GRAB A		12:45	✓			1
-6	SBP-6-GRAB A		11:45 ~~12:02~~	✓			1
-7	SBP-5 GRAB A		11:55	✓			1
-8	SBP-7-GRAB A		12:05	✓			1

Relinquished by: (signature)	DATE	TIME	Received by: (signature)
[signature]	10/28/99	15:45	
Relinquished by: (signature)	DATE	TIME	Received by: (signature)
FEDERAL EXPRESS	10/29/99	1000	[signature]
Relinquished by: (signature)	DATE	TIME	Received for Laboratory by: (signature)
			[signature]

NOTES TO SAMPLER (S): (1) Limit Sample Identification to 6 characters, if possible; (2) Indicate designated Lab Q.C. sample and type (e.g.; MS/MSD/REP) and provide sufficient sample; (3) Field duplicates are separate sample; (4) e.g.; 40ml/glass/H_2SO_4

Notes to Lab:

We cannot accept verbal changes - Please Fax written changes to (508) 822-3288

Woods Hole Group
Environmental Laboratories

Chain-of-Custody Record

375 Paramount Drive
Raynham, MA 02767

TEL: (508) 822-9300
FAX: (508) 822-3288

43169

COMPANY INFORMATION

Name: SAIC - Newport
Address: 221 Third Street
Newport, RI 02840
Telephone: 401-847-4210
Facsimile: 401-849-1585
Contact Name: C. Mueller

COMPANY'S PROJECT INFORMATION

Regulatory Protocol:
For the State of:
Project Name:
Project Number:
P.O. #
Sampler Name(s):

SHIPPING INFORMATION

Carrier:
Airbill Number:
Date Shipped:
Quote #:

TAT ___ 10 Day ___ 5 Day ___ 3 Day ___ 48 Hr ___ 24 Hr ___ Other

WHG LAB #	SAMPLE ID (NOTE 1)	COLLECTION DATE	COLLECTION TIME	COMPOSITE GRAB	MATRIX	ANALYSIS/REMARKS (NOTE 2, 3)	VOLUME/CONTAINER TYPE/ PRESERVATIVE (NOTE 4) NUMBER OF CONTAINERS					
43169-9	SBP-7-GRAB B	10/28/99	12:05	✓		Organotins	1	4	oz	glass		
-10	SBP-5-GRAB B		11:55	✓			1					
-11	SBP-3-GRAB B		10:24	✓			1					
-12	SBP-4-GRAB B		12:10	✓			1					
-13	SBP-2-GRAB B		12:45	✓			1					
-14	SBP-6-GRAB B		~~12:02~~ 11:45	✓			1					
-15	SBP-1-GRAB B		12:37	✓			1					
-16	SBP-4-CORE B		10:15	✓			1					

Relinquished by: (signature)	DATE	TIME	Received by: (signature)
[signature]	10/29/99	15:45	
Relinquished by: (signature)	DATE	TIME	Received by: (signature)
FEDERAL Express	10/29/99	1000	[signature]
Relinquished by: (signature)	DATE	TIME	Received for Laboratory by: (signature)
			[signature]

NOTES TO SAMPLER (S): (1) Limit Sample Identification to 6 characters, if possible; (2) Indicate designated Lab Q.C. sample and type (e.g.; MS/MSD/REP) and provide sufficient sample; (3) Field duplicates are separate sample; (4) e.g.; 40ml/glass/H_2SO_4

Notes to Lab:

We cannot accept verbal changes - Please Fax written changes to (508) 822-3288

Sample Receipt Checklist

Client:	SAIC1	**Receipt Date:**	10/29/99
Project:		**Log-in Date:**	
ETR #:	43169	**Inspection/ Log-in by:**	

Comments / Notes

Were Samples shipped? Yes, FedEx / UPS / Other:_____
No, Courier Pick-up / Hand Delivered

Is Bill of lading retained? Yes, Tracking #: 4253 4708 2181
No, Unavailable / N/A

Indicate Cooler Temperature upon opening:

Temperature taken from: 1° IR Gun 1.5° Temp. Blank / N/A

Were Samples on Ice? (Yes) / No

Chain-of-Custody present? (Yes) / No
Complete? Yes / No

Custody Seals present on Cooler? Yes / (No)
on Bottles? Yes / No
Intact? Yes / No / N/A

Were Sample Containers Intact? (Yes) / No

Did the VOAs contain Headspace? Yes / No If Yes, List Samples--→

If chemical preservation is appropriate-
Were Samples Field Preserved? Yes / No / (N/A)

☐ H=HCl ☐ N=HNO3 ☐ S=H2SO4 ☐ Other:_____ ☐ U= Unknown

Were 5035 VOC soils or VPH soils **covered** with MeOH? Yes / No
If NO, List Samples----------→

Preservation (pH) Verified at Lab for EVERY Bottle? (Not VOA/VPH/Sulfide)
YES <2 >12 (CN) / **NO**
If **NO**, Why?:

Preservation (pH) Verified for Sample #(s):

Were Samples Received Within Hold Time? (Yes) / No

Discrepancy Between Bottle Labels & Chain? Yes / (No)

Was Project Manager Notified of Any Problems? Yes / No / (N/A)

Project Manager Acknowledgement:

Woods Hole Group
Environmental Laboratories

Metals and Total Organic Carbon

Woods Hole Group
Environmental Laboratories
375 Paramount Drive • Suite B
Raynham, MA 02767-5154 • USA
Phone: 508-822-9300
Fax: 508-822-3288

Date : 12/06/99
ETR Number : 43169
Project No.: H99900
No. Samples: 16
Arrived : 10/29/99
P.O. Number: 4400018693

Science Applications
International Corporation
221 Third Street
Newport, RI 02840

Attention : Dr. Greg Tracey

Page 1

CC Results to : Shannon Behr

Project: Pier 1 Marine Railway

Standard analyses were performed in accordance with Methods for Analysis of Water and Wastes, EPA-600/4/79-020, Test Methods for Evaluating Solid Waste, SW-846, or Standard Methods for the Examination of Water and Wastewater. All results are in mg/l unless otherwise noted.

Lab No./ Method No.	Sample Description/ Parameter	Result		Prep Date	Analysis Date	Analyst
43169-1	SBP-4-CORE A:10/28/99 @1015(Sediment)					
9060	Total Organic Carbon	12000			11/10/99	MLS
6020	Arsenic, Total	13	f	11/12/99	11/19/99	LCP
6020	Cadmium, Total	0.39	f	11/12/99	11/19/99	LCP
6010	Chromium, Total	64	f	11/12/99	11/16/99	CLM
6010	Copper, Total	570	f	11/12/99	11/16/99	CLM
6010	Lead, Total	350	f	11/12/99	11/16/99	CLM
6010	Nickel, Total	120	f	11/12/99	11/16/99	CLM
6020	Silver, Total	1.3	f	11/12/99	11/19/99	LCP
6010	Zinc, Total	1900	f	11/12/99	11/16/99	CLM
7471	Mercury, Total	0.58	f	11/12/99	11/16/99	LMV
IN623	% Solids	64.0	c		11/08/99	KJB
43169-2	SBP-1-GRAB A:10/28/99 @1237(Sediment)					
9060	Total Organic Carbon	44000			11/10/99	MLS
6020	Arsenic, Total	16	f	11/12/99	11/19/99	LCP
6020	Cadmium, Total	0.94	f	11/12/99	11/19/99	LCP
6010	Chromium, Total	130	f	11/12/99	11/16/99	CLM
6010	Copper, Total	980	f	11/12/99	11/16/99	CLM
6010	Lead, Total	620	f	11/12/99	11/16/99	CLM
6010	Nickel, Total	130	f	11/12/99	11/16/99	CLM
6020	Silver, Total	1.9	f	11/12/99	11/19/99	LCP
6010	Zinc, Total	1900	f	11/12/99	11/16/99	CLM
7471	Mercury, Total	1.6	f	11/12/99	11/16/99	LMV
IN623	% Solids	31.0	c		11/08/99	KJB

Comments/Notes

f = mg/Kg dry weight
c = %

< Cont. Next Page >

Woods Hole Group
Environmental Laboratories

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Science Applications
International Corporation
221 Third Street
Newport, RI 02840

Attention : Dr. Greg Tracey

CC Results to : Shannon Behr

Date : 12/06/99
ETR Number : 43169
Project No.: H99900
No. Samples: 16
Arrived : 10/29/99
P.O. Number: 4400018693

Project: Pier 1 Marine Railway

Standard analyses were performed in accordance with Methods for Analysis of Water and Wastes, EPA-600/4/79-020, Test Methods for Evaluating Solid Waste, SW-846, or Standard Methods for the Examination of Water and Wastewater. All results are in mg/l unless otherwise noted.

Lab No./ Method No.	Sample Description/ Parameter		Result		Prep Date	Analysis Date	Analyst
43169-3	SBP-4-GRAB A:10/28/99 @1210(Sediment)						
9060	Total Organic Carbon		20000			11/10/99	MLS
6020	Arsenic, Total		14	f	11/12/99	11/19/99	LCP
6020	Cadmium, Total		0.34	f	11/12/99	11/19/99	LCP
6010	Chromium, Total		58	f	11/12/99	11/16/99	CLM
6010	Copper, Total		300	f	11/12/99	11/16/99	CLM
6010	Lead, Total		330	f	11/12/99	11/16/99	CLM
6010	Nickel, Total		56	f	11/12/99	11/16/99	CLM
6020	Silver, Total		0.83	f	11/12/99	11/19/99	LCP
6010	Zinc, Total		1200	f	11/12/99	11/16/99	CLM
7471	Mercury, Total		1.1	f	11/12/99	11/16/99	LMV
IN623	% Solids		55.4	c		11/08/99	KJB
43169-4	SBP-3-GRAB-A:10/28/99 @1024(Sediment)						
9060	Total Organic Carbon		33000			11/10/99	MLS
6020	Arsenic, Total		19	f	11/12/99	11/19/99	LCP
6020	Cadmium, Total		0.64	f	11/12/99	11/19/99	LCP
6010	Chromium, Total		100	f	11/12/99	11/16/99	CLM
6010	Copper, Total		870	f	11/12/99	11/16/99	CLM
6010	Lead, Total		350	f	11/12/99	11/16/99	CLM
6010	Nickel, Total		89	f	11/12/99	11/16/99	CLM
6020	Silver, Total		1.0	f	11/12/99	11/19/99	LCP
6010	Zinc, Total		970	f	11/12/99	11/16/99	CLM
7471	Mercury, Total		0.84	f	11/12/99	11/16/99	LMV
IN623	% Solids		40.9	c		11/08/99	KJB

Comments/Notes

f = mg/Kg dry weight
c = %

< Cont. Next Page >

Woods Hole Group
Environmental Laboratories
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Phone: 508-822-9300
Fax: 508-822-3288

Science Applications
International Corporation
221 Third Street
Newport, RI 02840

Attention : Dr. Greg Tracey

CC Results to : Shannon Behr

Date : 12/06/99
ETR Number : 43169
Project No.: H99900
No. Samples: 16
Arrived : 10/29/99
P.O. Number: 4400018693

Project: Pier 1 Marine Railway

Standard analyses were performed in accordance with Methods for Analysis of Water and Wastes, EPA-600/4/79-020, Test Methods for Evaluating Solid Waste, SW-846, or Standard Methods for the Examination of Water and Wastewater. All results are in mg/l unless otherwise noted.

Lab No./ Method No.	Sample Description/ Parameter		Result		Prep Date	Analysis Date	Analyst
43169-5	SBP-2-GRAB A:10/28/99 @1245(Sediment)						
	9060	Total Organic Carbon	51000			11/10/99	MLS
	6020	Arsenic, Total	16	f	11/12/99	11/19/99	LCP
	6020	Cadmium, Total	0.88	f	11/12/99	11/19/99	LCP
	6010	Chromium, Total	71	f	11/12/99	11/16/99	CLM
	6010	Copper, Total	430	f	11/12/99	11/16/99	CLM
	6010	Lead, Total	290	f	11/12/99	11/16/99	CLM
	6010	Nickel, Total	53	f	11/12/99	11/16/99	CLM
	6020	Silver, Total	1.5	f	11/12/99	11/19/99	LCP
	6010	Zinc, Total	690	f	11/12/99	11/16/99	CLM
	7471	Mercury, Total	1.4	f	11/12/99	11/16/99	LMV
	IN623	% Solids	23.2	c		11/08/99	KJB
43169-6	SBP-6-GRAB A:10/28/99 @1145(Sediment)						
	9060	Total Organic Carbon	40000			11/10/99	MLS
	6020	Arsenic, Total	13	f	11/12/99	11/19/99	LCP
	6020	Cadmium, Total	0.42	f	11/12/99	11/19/99	LCP
	6010	Chromium, Total	58	f	11/12/99	11/16/99	CLM
	6010	Copper, Total	79	f	11/12/99	11/16/99	CLM
	6010	Lead, Total	86	f	11/12/99	11/16/99	CLM
	6010	Nickel, Total	22	f	11/12/99	11/16/99	CLM
	6020	Silver, Total	0.79	f	11/12/99	11/19/99	LCP
	6010	Zinc, Total	160	f	11/12/99	11/16/99	CLM
	7471	Mercury, Total	0.43	f	11/12/99	11/16/99	LMV
	IN623	% Solids	33.1	c		11/08/99	KJB

Comments/Notes

f = mg/Kg dry weight
c = %

< Cont. Next Page >

Woods Hole Group
Environmental Laboratories
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Attention : Dr. Greg Tracey

CC Results to : Shannon Behr

Project: Pier 1 Marine Railway

Date : 12/06/99
ETR Number : 43169
Project No.: H99900
No. Samples: 16
Arrived : 10/29/99
P.O. Number: 4400018693

Standard analyses were performed in accordance with Methods for Analysis of Water and Wastes, EPA-600/4/79-020, Test Methods for Evaluating Solid Waste, SW-846, or Standard Methods for the Examination of Water and Wastewater. All results are in mg/l unless otherwise noted.

Lab No./ Method No.	Sample Description/ Parameter	Result		Prep Date	Analysis Date	Analyst
43169-7	SBP-5-GRAB A:10/28/99 @1155(Sediment)					
9060	Total Organic Carbon	43000			11/10/99	MLS
6020	Arsenic, Total	12	f	11/12/99	11/19/99	LCP
6020	Cadmium, Total	0.50	f	11/12/99	11/19/99	LCP
6010	Chromium, Total	61	f	11/12/99	11/16/99	CLM
6010	Copper, Total	120	f	11/12/99	11/16/99	CLM
6010	Lead, Total	110	f	11/12/99	11/16/99	CLM
6010	Nickel, Total	25	f	11/12/99	11/16/99	CLM
6020	Silver, Total	0.78	f	11/12/99	11/19/99	LCP
6010	Zinc, Total	220	f	11/12/99	11/16/99	CLM
7471	Mercury, Total	0.46	f	11/12/99	11/16/99	LMV
IN623	% Solids	32.9	c		11/08/99	KJB
43169-8	SBP-7-GRAB A:10/28/99 @1205(Sediment)					
9060	Total Organic Carbon	22000			11/10/99	MLS
6020	Arsenic, Total	8.3	f	11/12/99	11/19/99	LCP
6020	Cadmium, Total	0.91	f	11/12/99	11/19/99	LCP
6010	Chromium, Total	39	f	11/12/99	11/16/99	CLM
6010	Copper, Total	140	f	11/12/99	11/16/99	CLM
6010	Lead, Total	100	f	11/12/99	11/16/99	CLM
6010	Nickel, Total	14	f	11/12/99	11/16/99	CLM
6020	Silver, Total	0.53	f	11/12/99	11/19/99	LCP
6010	Zinc, Total	250	f	11/12/99	11/16/99	CLM
7471	Mercury, Total	0.47	f	11/12/99	11/16/99	LMV
IN623	% Solids	35.5	c		11/08/99	KJB

Comments/Notes

f = mg/Kg dry weight
c = %

< Last Page > Submitted By :

Inorganic Quality Control Summary

Client: Science Applications
Project: Pier 1 Marine Railway
ETR: 43169

Parameter	sample ID	analysis date	Blank (mg/L)	Sample Result (mg/kg)	RPD of duplicates	MS added (mg/kg)	%recovery matrix spike	LCS conc. (mg/kg)	% recovery LCS	quali -fier
Arsenic	43169-1	11/19/99	<0.001	13	21	3.85	52	21.1	108	N,C
Cadmium	43169-1	11/19/99	<0.001	0.39	X	3.85	101	2.15	100	
Chromium	43169-1	11/16/99	<0.01	64	22	296	87	41.6	100	N
Copper	43169-1	11/16/99	<0.01	570	18	296	50	276	100	C
Lead	43169-1	11/16/99	<0.1	350	18	740	85	163	99	
Mercury	43169-1	11/16/99	<0.0002	0.58	83	0.92	124	3.20	93	N
Nickel	43169-1	11/16/99	<0.02	120	28	296	94	26.6	100	N
Silver	43169-1	11/19/99	<0.001	1.3	14	3.85	89	0.8	138	
Zinc	43169-1	11/16/99	<0.02	1900	0	296	0	312	102	C

Qualifiers & Notes:
B = Reported QC is for associated batch
LCS = laboratory control standard
RPD = relative percent difference
C= Not spiked 2X> than sample concentration
L= LCS is a laboratory fortified blank.
N = See narrative
P = Post digestion spike recovery
R = RPD criteria not applicable to results <5X the detection limit.
X = It is not possible to calculate % RPD, result is BDL, duplicate is just above detection.

Woods Hole Group
Environmental Laboratories

Polynuclear Aromatic Hydrocarbons

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

SBP-4-CORE A

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: ETR No.: 43169 Project: Pier1 SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 43169-1

Sample wt/vol: 20.41 (g/ml) G Lab File ID: 43169-1E.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 35.96 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/17/99

Injection Volume: 2.0 (uL) Dilution Factor: 25.0

GPC Cleanup: (Y/N) Y pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	38	U
91-57-6	2-Methylnaphthalene	38	U
90-12-0	1-Methylnaphthalene	38	U
92-52-4	Biphenyl	38	U
581-42-0	2,6-Dimethylnaphthalene	38	U
208-96-8	Acenaphthylene	80	D
83-32-9	Acenaphthene	74	D
86-73-7	Fluorene	120	D
2245-38-7	1,6,7-Trimethylnaphthalene	38	U
85-01-8	Phenanthrene	2900	BD
120-12-7	Anthracene	2500	D
832-69-9	1-Methylphenanthrene	240	D
206-44-0	Fluoranthene	6900	BD
129-00-0	Pyrene	7000	BD
56-55-3	Benzo(a)anthracene	3000	D
218-01-9	Chrysene	4900	D
205-99-2	Benzo(b)fluoranthene	3900	D
207-08-9	Benzo(k)fluoranthene	1400	D
192-97-2	Benzo(e)pyrene	1900	D
50-32-8	Benzo(a)pyrene	2600	D
198-55-0	Perylene	640	D
193-39-5	Indeno[1,2,3-cd]pyrene	2000	D
53-70-3	Dibenz[a,h]anthracene	400	D
191-24-2	Benzo[g,h,i]perylene	1600	D

1B

SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SBP-1-GRAB A

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: ETR No.: 43169 Project: Pier1 SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 43169-2

Sample wt/vol: 20.73 (g/ml) G Lab File ID: 43169-2E.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 68.99 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/17/99

Injection Volume: 2.0 (uL) Dilution Factor: 100.0

GPC Cleanup: (Y/N) Y pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	310	U
91-57-6	2-Methylnaphthalene	310	U
90-12-0	1-Methylnaphthalene	310	U
92-52-4	Biphenyl	310	U
581-42-0	2,6-Dimethylnaphthalene	310	U
208-96-8	Acenaphthylene	380	D
83-32-9	Acenaphthene	4000	D
86-73-7	Fluorene	6100	D
2245-38-7	1,6,7-Trimethylnaphthalene	370	D
85-01-8	Phenanthrene	65000	BD
120-12-7	Anthracene	22000	D
832-69-9	1-Methylphenanthrene	2400	D
206-44-0	Fluoranthene	68000	BD
129-00-0	Pyrene	56000	BD
56-55-3	Benzo(a)anthracene	22000	D
218-01-9	Chrysene	24000	D
205-99-2	Benzo(b)fluoranthene	20000	D
207-08-9	Benzo(k)fluoranthene	6400	D
192-97-2	Benzo(e)pyrene	9200	D
50-32-8	Benzo(a)pyrene	13000	D
198-55-0	Perylene	3100	D
193-39-5	Indeno[1,2,3-cd]pyrene	7200	D
53-70-3	Dibenz[a,h]anthracene	1600	D
191-24-2	Benzo[g,h,i]perylene	5600	D

1B

SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SBP-4-GRAB A

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: _____ ETR No.: 43169 Project: Pier1 SDG No.: _____

Matrix: (soil/water) SOIL Lab Sample ID: 43169-3

Sample wt/vol: 20.16 (g/ml) G Lab File ID: 43169-3E.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 44.63 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/17/99

Injection Volume: 2.0 (uL) Dilution Factor: 4.0

GPC Cleanup: (Y/N) Y pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	13	BD
91-57-6	2-Methylnaphthalene	8	D
90-12-0	1-Methylnaphthalene	7	U
92-52-4	Biphenyl	7	U
581-42-0	2,6-Dimethylnaphthalene	7	U
208-96-8	Acenaphthylene	49	D
83-32-9	Acenaphthene	36	D
86-73-7	Fluorene	43	D
2245-38-7	1,6,7-Trimethylnaphthalene	8	D
85-01-8	Phenanthrene	1100	BD
120-12-7	Anthracene	290	D
832-69-9	1-Methylphenanthrene	65	D
206-44-0	Fluoranthene	2200	BD
129-00-0	Pyrene	2100	BD
56-55-3	Benzo(a)anthracene	910	D
218-01-9	Chrysene	1300	D
205-99-2	Benzo(b)fluoranthene	1400	D
207-08-9	Benzo(k)fluoranthene	560	D
192-97-2	Benzo(e)pyrene	680	D
50-32-8	Benzo(a)pyrene	940	D
198-55-0	Perylene	230	D
193-39-5	Indeno[1,2,3-cd]pyrene	730	D
53-70-3	Dibenz[a,h]anthracene	150	D
191-24-2	Benzo[g,h,i]perylene	600	D

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

SBP-3-GRAB A

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: ETR No.: 43169 Project: Pier1 SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 43169-4

Sample wt/vol: 20.27 (g/ml) G Lab File ID: 43169-4E.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 59.07 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/17/99

Injection Volume: 2.0 (uL) Dilution Factor: 25.0

GPC Cleanup: (Y/N) Y pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	93	BD
91-57-6	2-Methylnaphthalene	60	U
90-12-0	1-Methylnaphthalene	60	U
92-52-4	Biphenyl	60	U
581-42-0	2,6-Dimethylnaphthalene	60	U
208-96-8	Acenaphthylene	330	D
83-32-9	Acenaphthene	630	D
86-73-7	Fluorene	860	D
2245-38-7	1,6,7-Trimethylnaphthalene	60	U
85-01-8	Phenanthrene	13000	BD
120-12-7	Anthracene	3700	D
832-69-9	1-Methylphenanthrene	470	D
206-44-0	Fluoranthene	18000	BD
129-00-0	Pyrene	15000	BD
56-55-3	Benzo(a)anthracene	6200	D
218-01-9	Chrysene	8500	D
205-99-2	Benzo(b)fluoranthene	6700	D
207-08-9	Benzo(k)fluoranthene	2000	D
192-97-2	Benzo(e)pyrene	3200	D
50-32-8	Benzo(a)pyrene	3900	D
198-55-0	Perylene	1000	D
193-39-5	Indeno[1,2,3-cd]pyrene	2600	D
53-70-3	Dibenz[a,h]anthracene	580	D
191-24-2	Benzo[g,h,i]perylene	2100	D

1B

SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SBP-2-GRAB A

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: ETR No.: 43169 Project: Pier1 SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 43169-5

Sample wt/vol: 20.03 (g/ml) G Lab File ID: 431695E1.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 76.83 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/18/99

Injection Volume: 2.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) Y pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	29	BD
91-57-6	2-Methylnaphthalene	14	D
90-12-0	1-Methylnaphthalene	10	D
92-52-4	Biphenyl	9	U
581-42-0	2,6-Dimethylnaphthalene	25	D
208-96-8	Acenaphthylene	140	D
83-32-9	Acenaphthene	64	D
86-73-7	Fluorene	120	D
2245-38-7	1,6,7-Trimethylnaphthalene	11	D
85-01-8	Phenanthrene	1300	BD
120-12-7	Anthracene	780	D
832-69-9	1-Methylphenanthrene	97	D
206-44-0	Fluoranthene	3600	BD
129-00-0	Pyrene	2300	BD
56-55-3	Benzo(a)anthracene	1500	D
218-01-9	Chrysene	1800	D
205-99-2	Benzo(b)fluoranthene	1400	D
207-08-9	Benzo(k)fluoranthene	1200	D
192-97-2	Benzo(e)pyrene	880	D
50-32-8	Benzo(a)pyrene	1200	D
198-55-0	Perylene	330	D
193-39-5	Indeno[1,2,3-cd]pyrene	870	D
53-70-3	Dibenz[a,h]anthracene	180	D
191-24-2	Benzo[g,h,i]perylene	710	D

1B

SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SBP-6-GRAB A

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: ETR No.: 43169 Project: Pier1 SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 43169-6

Sample wt/vol: 20.14 (g/ml) G Lab File ID: 43169-6.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 66.89 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/13/99

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	21	B
91-57-6	2-Methylnaphthalene	10	
90-12-0	1-Methylnaphthalene	6	
92-52-4	Biphenyl	4	
581-42-0	2,6-Dimethylnaphthalene	6	
208-96-8	Acenaphthylene	55	
83-32-9	Acenaphthene	16	
86-73-7	Fluorene	24	
2245-38-7	1,6,7-Trimethylnaphthalene	4	
85-01-8	Phenanthrene	360	B
120-12-7	Anthracene	180	
832-69-9	1-Methylphenanthrene	29	
206-44-0	Fluoranthene	990	B
129-00-0	Pyrene	790	B
56-55-3	Benzo(a)anthracene	430	
218-01-9	Chrysene	850	
205-99-2	Benzo(b)fluoranthene	480	
207-08-9	Benzo(k)fluoranthene	300	
192-97-2	Benzo(e)pyrene	270	
50-32-8	Benzo(a)pyrene	390	
198-55-0	Perylene	120	
193-39-5	Indeno[1,2,3-cd]pyrene	290	
53-70-3	Dibenz[a,h]anthracene	58	
191-24-2	Benzo[g,h,i]perylene	250	

1B

SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SBP-5-GRAB A

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: _____ ETR No.: 43169 Project: Pier1 SDG No.: _____

Matrix: (soil/water) SOIL Lab Sample ID: 43169-7

Sample wt/vol: 20.23 (g/ml) G Lab File ID: 431697E1.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 67.11 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/18/99

Injection Volume: 2.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) Y pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	38	BD
91-57-6	2-Methylnaphthalene	10	D
90-12-0	1-Methylnaphthalene	6	D
92-52-4	Biphenyl	6	U
581-42-0	2,6-Dimethylnaphthalene	9	D
208-96-8	Acenaphthylene	81	D
83-32-9	Acenaphthene	17	D
86-73-7	Fluorene	29	D
2245-38-7	1,6,7-Trimethylnaphthalene	6	U
85-01-8	Phenanthrene	370	BD
120-12-7	Anthracene	250	D
832-69-9	1-Methylphenanthrene	42	D
206-44-0	Fluoranthene	1200	BD
129-00-0	Pyrene	810	BD
56-55-3	Benzo(a)anthracene	630	D
218-01-9	Chrysene	730	D
205-99-2	Benzo(b)fluoranthene	670	D
207-08-9	Benzo(k)fluoranthene	480	D
192-97-2	Benzo(e)pyrene	390	D
50-32-8	Benzo(a)pyrene	610	D
198-55-0	Perylene	170	D
193-39-5	Indeno[1,2,3-cd]pyrene	420	D
53-70-3	Dibenz[a,h]anthracene	89	D
191-24-2	Benzo[g,h,i]perylene	350	D

1B

SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SBP-7-GRAB A

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: ____ ETR No.: 43169 Project: Pier1 SDG No.: ____

Matrix: (soil/water) SOIL Lab Sample ID: 43169-8

Sample wt/vol: 20.2 (g/ml) G Lab File ID: 43169-8E.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 64.47 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/18/99

Injection Volume: 2.0 (uL) Dilution Factor: 25.0

GPC Cleanup: (Y/N) Y pH: ____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	69	U
91-57-6	2-Methylnaphthalene	69	U
90-12-0	1-Methylnaphthalene	69	U
92-52-4	Biphenyl	69	U
581-42-0	2,6-Dimethylnaphthalene	69	U
208-96-8	Acenaphthylene	79	D
83-32-9	Acenaphthene	300	D
86-73-7	Fluorene	230	D
2245-38-7	1,6,7-Trimethylnaphthalene	69	U
85-01-8	Phenanthrene	5700	BD
120-12-7	Anthracene	1300	D
832-69-9	1-Methylphenanthrene	310	D
206-44-0	Fluoranthene	12000	BD
129-00-0	Pyrene	9400	BD
56-55-3	Benzo(a)anthracene	6300	D
218-01-9	Chrysene	8200	D
205-99-2	Benzo(b)fluoranthene	8500	D
207-08-9	Benzo(k)fluoranthene	2700	D
192-97-2	Benzo(e)pyrene	4000	D
50-32-8	Benzo(a)pyrene	5300	D
198-55-0	Perylene	1400	D
193-39-5	Indeno[1,2,3-cd]pyrene	4400	D
53-70-3	Dibenz[a,h]anthracene	1000	D
191-24-2	Benzo[g,h,i]perylene	3300	D

1B

SAMPLE NO.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SBLK01

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: ____ ETR No.: 43169 Project: Pie1 SDG No.: ____

Matrix: (soil/water) SOIL Lab Sample ID: SS1107B1

Sample wt/vol: 20 (g/ml) G Lab File ID: SS1107B1.D

Level: (low/med) LOW Date Received: 10/29/99

% Moisture: 0 decanted:(Y/N) N Date Extracted: 11/7/99

Concentrated Extract Volume: 2000 (uL) Date Analyzed: 11/12/99

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y pH: ____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	1	
91-57-6	2-Methylnaphthalene	1	U
90-12-0	1-Methylnaphthalene	1	U
92-52-4	Biphenyl	1	U
581-42-0	2,6-Dimethylnaphthalene	1	U
208-96-8	Acenaphthylene	1	U
83-32-9	Acenaphthene	1	U
86-73-7	Fluorene	1	U
2245-38-7	1,6,7-Trimethylnaphthalene	1	U
85-01-8	Phenanthrene	1	
120-12-7	Anthracene	1	U
832-69-9	1-Methylphenanthrene	1	U
206-44-0	Fluoranthene	1	
129-00-0	Pyrene	1	
56-55-3	Benzo(a)anthracene	1	U
218-01-9	Chrysene	1	U
205-99-2	Benzo(b)fluoranthene	1	U
207-08-9	Benzo(k)fluoranthene	1	U
192-97-2	Benzo(e)pyrene	1	U
50-32-8	Benzo(a)pyrene	1	U
198-55-0	Perylene	1	U
193-39-5	Indeno[1,2,3-cd]pyrene	1	U
53-70-3	Dibenz[a,h]anthracene	1	U
191-24-2	Benzo[g,h,i]perylene	1	U

Polynuclear Aromatic Hydrocarbons
Laboratory Control Spike

Quality Control Report

Lab ID Number: SS1107L1
Associated Blank: SS1107B1

Sample ID: Laboratory Control Spike								
Date Received	Date Extracted	Date Analyzed	Analyzed By	Dilution Factor	Sample Amount	Matrix	% Solids	Recovery Corrected
N/A	11/7/99	11/12/99 11:49	CLM	2	20g	SOIL	100%	No

Compound	Results in µg/Kg	% Recovery
Naphthalene	95	48
Acenapthylene	140	70
Acenaphthene	140	70
Fluorene	120	60
Phenanthrene	140	70
Anthracene	140	70
Fluoranthene	170	85
Pyrene	140	70
Benzo(a)anthracene	170	85
Chrysene	160	80
Benzo(b)fluoranthene	150	75
Benzo(k)fluoranthene	170	85
Benzo(a)pyrene	140	70
Indeno(1,2,3-cd)pyrene	190	95
Dibenzo(a,h)anthracene	190	95
Benzo(g,h,i)perylene	180	90

Surrogate	% Recovery	Acceptable Range
Naphthalene-$_{d8}$	47%	30-100%
Acenapthene-$_{d10}$	65%	35-125%
Phenanthrene-$_{d10}$	73%	35-125%
Chrysene-$_{d12}$	82%	40-130%

Key:
U - Analyzed but not found.
J - Estimated value, below quantitation limit.
N/A - Not Applicable

SOIL SEMIVOLATILE SURROGATE RECOVERY

Lab Name: Woods Hole Group Environmental Client: SAIC
ETR NO 43169 Level: (low/med) LOW

	Sample NO.	S1 #	S2 #	S3 #	S4 #	TOT OUT
	SBLK01	37	55	62	67	0
1	SS1107L1	47	65	73	82	0
2	SBP-4-CORE A	26 *	40	69	77	1
3	SBP-1-GRAB A	30	45	72	70	0
4	SBP-4-GRAB A	25 *	35	46	42	1
5	SBP-3-GRAB A	28 *	40	59	60	1
6	SBP-3-GRAB AMS	24 *	35	55	60	1
7	SBP-3-GRAB AMSD	34	48	69	70	0
8	SBP-2-GRAB A	20 *	33 *	46	40	2
9	SBP-6-GRAB A	28 *	39	53	48	1
10	SBP-5-GRAB A	21 *	33*	46	42	2
11	SBP-7-GRAB A	29 *	41	63	62	1
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

	QC LIMITS
S1 = Naphthalene-d8	(30-100)
S2 =Acenaphthene-d10	(35-125)
S3 = Phenanthrene-d10	(35-125)
S4 = Chrysene-d12	(40-130)

Column to be used to flag recovery values
* Values outside of contract required QC limits
D Surrogates diluted out

SRM Sediment 1944
Analysis Results

Analyte	SRM 1944 Cert. Conc.	43169 SS1107S1 Dry Weight ug/Kg	% D
Naphthalene	1650	776	53.0
Phenanthrene	5270	4010	23.9
Anthracene	1770	1270	28.2
Fluoranthene	8920	6080	31.8
Pyrene	9700	7480	22.9
Benz[a]anthracene	4720	3790	19.7
Chrysene	4860	4380	9.9
Benzo[b]fluoranthene	3870	3380	12.7
Benzo[k]fluoranthene	2300	2710	17.8
Benzo[e]pyrene	3280	2500	23.8
Benzo[a]pyrene	4300	3280	23.7
Perylene	1170	886	24.3
Indeno[1,2,3-cd]pyrene	2780	2660	4.3
Dibenz[a,h + a,c]anthracene	759	642	15.4
Benzo[ghi]perylene	2840	2490	12.3
Mean % D			21.6

SAIC
Marine Railway #1

3D

SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: _____ ETR No.: 43169 Project: Pier1 SDG No.: _____

Matrix Spike - SAMPLE NO. SBP-3-GRAB A Level: (low/med) LOW

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMITS REC.
Naphthalene	470	93	150	13 *	35 - 125
Acenaphthylene	470	330	640	66	35 - 125
Acenaphthene	470	630	470	0 *	35 - 125
Fluorene	470	860	500	0 *	35 - 125
Phenanthrene	470	13000	3500	0 *	35 - 125
Anthracene	470	3700	2200	0 *	35 - 125
Fluoranthene	470	18000	7200	0 *	35 - 125
Pyrene	470	15000	6300	0 *	35 - 125
Chrysene	470	8500	5300	0 *	35 - 125
Indeno[1,2,3-cd]pyrene	470	2600	2100	0 *	35 - 125
Dibenz[a,h]anthracene	470	580	640	13 *	35 - 125
Benzo[g,h,i]perylene	470	2100	1700	0 *	35 - 125
Benzo(a)anthracene	470	6200	3500	0 *	35 - 125
Benzo(b)fluoranthene	470	6700	4700	0 *	35 - 125
Benzo(k)fluoranthene	470	2000	1600	0 *	35 - 125
Benzo(a)pyrene	470	3900	2700	0 *	35 - 125

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Naphthalene	480	230	29 *	42 ~~83~~ *	35	35 - 125
Acenaphthylene	480	840	106	27 ~~47~~ *	35	35 - 125
Acenaphthene	480	410	0 *	14 ~~0~~	35	35 - 125
Fluorene	480	410	0 *	20 ~~0~~	35	35 - 125
Phenanthrene	480	2000	0 *	55 ~~0~~ *	35	35 - 125
Anthracene	480	2200	0 *	0	35	35 - 125
Fluoranthene	480	7300	0 *	1 ~~0~~	35	35 - 125
Pyrene	480	6000	0 *	5 ~~0~~	35	35 - 125
Chrysene	480	6000	0 *	12 ~~0~~	35	35 - 125

mm 11/19/99

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: ~~2~~ out of 16 outside limits mm 11/19/99

Spike Recovery: ~~27~~ 30 out of 32 outside limits

COMMENTS: _____

3D

SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Woods Hole Group Environmental Client: SAIC

Lab Code: _____ ETR No.: 43169 Project: Pier1 SDG No.: _____

Matrix Spike - SAMPLE NO. SBP-3-GRAB A Level: (low/med) LOW

Indeno[1,2,3-cd]pyrene	480	2500	0 *	17 Ø	35	35 - 125
Dibenz[a,h]anthracene	480	740	33 *	14 ~~87~~ *	35	35 - 125
Benzo[g,h,i]perylene	480	2100	0 *	21 Ø	35	35 - 125
Benzo(a)anthracene	480	3800	0 *	8 Ø	35	35 - 125
Benzo(b)fluoranthene	480	5900	0 *	23 Ø	35	35 - 125
Benzo(k)fluoranthene	480	1600	0 *	0	35	35 - 125
Benzo(a)pyrene	480	2800	0 *	4 Ø	35	35 - 125

mm 11/18/99

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: ~~2~~ out of ~~Ø~~ 16 outside limits mm 11/19/99

Spike Recovery: ~~1~~ 30 out of ~~Ø~~ 32 outside limits

COMMENTS: _____

Woods Hole Group
Environmental Laboratories

Pesticides and PCB Congeners

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

ETR Number: 43169
Lab ID Number: 43169-1
Associated Blank: SS1107B1

Science Applications

Pier 1 Marine Railway

Sample ID: SBP-4-CORE A :[ ]10/28/99 @1015(Sediment)

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
10/29/99	SOIL	20.41 g	64	11/07/99	11/24/99	20	NLJr

BZ #	Cl	Isomer	Results in: µg/Kg
BZ 8	2	2,4'	15 U
BZ 18	3	2,2',5	15 U
BZ 28	3	2,3',5	15 U
BZ 29	3	2,4,5	15 U
BZ 44	4	2,2',3,5'	15 U
BZ 50	4	2,2',4,6	15 U
BZ 52	4	2,2',5,5'	33 I
BZ 66	4	2,3',4,4'	20 I
BZ 77	4	3,3',4,4'	15 U
BZ 87	5	2,2',3,4,5'	63
BZ 101	5	2,2',4,5,5'	130
BZ 105	5	2,3,3',4,4'	50
BZ 118	5	2,3',4,4',6	92
BZ 126	5	3,3',4,4',5	21
BZ 128	6	2,2',3,3',4,4'	26
BZ 138	6	2,2',3,4,4',5'	120
BZ 153	6	2,2',4,4',5,5'	73
BZ 170	7	2,2',3,3',4,4',5	15 U
BZ 180	7	2,2',3,4,4',5,5'	15 U
BZ 187	7	2,2',3,4',5,5',6	15
BZ 188	7	2,2',3,4',5,6,6'	15 U
BZ 195	8	2,2',3,3',4,4',5,6	15 U
BZ 200	8	2,2',3,3',4,5',6,6'	15 U
BZ 206	9	2,2',3,3',4,4',5,5',6	15 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	15 U

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range	
DBOB	DL	30% -150%	*
BZ 202	DL	30% -150%	*

Key:

U = Analyzed for but not detected.

E = Concentration exceeds the upper level of the calibration range of the instrument.

P = Greater than 40% RPD between the two channels, the higher value is reported (see narrative).

I = Greater than 40% RPD between the two channels, the lower value is reported due to matrix interference.

* = Surrogate value out of acceptance range.

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ANALYTICAL REPORT
EPA Method 8081A Pesticides

Science Applications **ETR Number: 43169**

Project: **Pier 1 Marine Railway** **Lab ID Number: 43169-1**

Associated Blank: SS1107B1

Sample ID: SBP-4-CORE A 10/28/99 @1015(Sediment)

Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
10/29/1999	11/07/1999	11/24/1999	20	64%	20.41 g	NLJr	SOIL

Compound	Results in: ug/Kg
Aldrin	15 U
Alpha-BHC	15 U
Beta-BHC	15 U
Delta-BHC	15 U
Gamma-BHC	15 U
Heptachlor	15 U
Heptachlor Epoxide	15 U
4,4'-DDD	15 U
4,4'-DDE	15 U
Endrin Aldehyde	15 UJ
4,4'-DDT	15 U
Dieldrin	15 U
Endosulfan I	15 U
Endosulfan II	15 U
Endosulfan Sulfate	15 U
Endrin	15 U
Methoxychlor	15 U
Alpha Chlordane	15 U
Gamma Chlordane	15 U
Endrin Ketone	15 U
Hexachlorobenzene	15 U
Oxychlordane	15 U
2,4'-DDD	15 U
2,4'-DDE	15 U
2,4'-DDT	15 U
Mirex	15 U
Toxaphene	150 U

Key:

U = Analyzed for but undetected.

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* =Surrogate value out of acceptance range

E = Concentration exceeds the upper level of the calibration range of instrument

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

ETR Number: 43169
Lab ID Number: 43169-2
Associated Blank: SS1107B1

Science Applications

Pier 1 Marine Railway

Sample ID: SBP-1-GRAB A :[ ]10/28/99 @1237(Sediment)

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
10/29/99	SOIL	20.73 g	31	11/07/99	11/24/99	10	NLJr

BZ #	Cl	Isomer	Results in: µg/Kg
BZ 8	2	2,4'	16 U
BZ 18	3	2,2',5	16 U
BZ 28	3	2,3',5	16 U
BZ 29	3	2,4,5	16 U
BZ 44	4	2,2',3,5'	230 I
BZ 50	4	2,2',4,6	16 U
BZ 52	4	2,2',5,5'	340 I
BZ 66	4	2,3',4,4'	310 I
BZ 77	4	3,3',4,4'	16 U
BZ 87	5	2,2',3,4,5'	520
BZ 101	5	2,2',4,5,5'	470 I
BZ 105	5	2,3,3',4,4'	410
BZ 118	5	2,3',4,4',6	603 I
BZ 126	5	3,3',4,4',5	16 U
BZ 128	6	2,2',3,3',4,4'	220
BZ 138	6	2,2',3,4,4',5'	590
BZ 153	6	2,2',4,4',5,5'	560
BZ 170	7	2,2',3,3',4,4',5	84 I
BZ 180	7	2,2',3,4,4',5,5'	150
BZ 187	7	2,2',3,4',5,5',6	58
BZ 188	7	2,2',3,4',5,6,6'	80 I
BZ 195	8	2,2',3,3',4,4',5,6	16 U
BZ 200	8	2,2',3,3',4,5',6,6'	16 U
BZ 206	9	2,2',3,3',4,4',5,5',6	16 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	16 U

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range	
DBOB	50%	30% -150%	I
BZ 202	207%	30% -150%	*

Key:

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I = Greater than 40% RPD between the two channels, the lower value is reported due to matrix interference.

* = Surrogate value out of acceptance range.

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ANALYTICAL REPORT
EPA Method 8081A Pesticides

Science Applications **ETR Number: 43169**

Project: **Pier 1 Marine Railway** **Lab ID Number: 43169-2**

Associated Blank: SS1107B1

Sample ID: SBP-1-GRAB A 10/28/99 @1237(Sediment)

Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
10/29/1999	11/07/1999	11/24/1999	10	31%	20.73 g	NLJr	SOIL

Compound	Results in: ug/Kg
Aldrin	16 U
Alpha-BHC	16 U
Beta-BHC	16 U
Delta-BHC	16 U
Gamma-BHC	16 U
Heptachlor	16 U
Heptachlor Epoxide	16 U
4,4'-DDD	16 U
4,4'-DDE	16 U
Endrin Aldehyde	16 UJ
4,4'-DDT	16 U
Dieldrin	16 U
Endosulfan I	16 U
Endosulfan II	16 U
Endosulfan Sulfate	16 U
Endrin	16 U
Methoxychlor	16 U
Alpha Chlordane	16 U
Gamma Chlordane	16 U
Endrin Ketone	16 U
Hexachlorobenzene	16 U
Oxychlordane	16 U
2,4'-DDD	16 U
2,4'-DDE	16 U
2,4'-DDT	16 U
Mirex	16 U
Toxaphene	160 U

Key:

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I = Greater than 40% difference between 2 columns, the lower value is reported

* =Surrogate value out of acceptance range

E = Concentration exceeds the upper level of the calibration range of instrument

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

ETR Number: 43169
Lab ID Number: 43169-3
Associated Blank: SS1107B1

Science Applications

Pier 1 Marine Railway

Sample ID: SBP-4-GRAB A :[ ]10/28/99 @1210(Sediment)

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
10/29/99	SOIL	20.16 g	55	11/07/99	11/24/99	1	NLJr

BZ #	Cl	Isomer	Results in: µg/Kg
BZ 8	2	2,4'	0.90 U
BZ 18	3	2,2',5	0.90 U
BZ 28	3	2,3',5	0.99 I
BZ 29	3	2,4,5	0.90 U
BZ 44	4	2,2',3,5'	2.6 I
BZ 50	4	2,2',4,6	0.90 U
BZ 52	4	2,2',5,5'	3.2 I
BZ 66	4	2,3',4,4'	3.0 I
BZ 77	4	3,3',4,4'	0.90 U
BZ 87	5	2,2',3,4,5'	4.4
BZ 101	5	2,2',4,5,5'	16 I
BZ 105	5	2,3,3',4,4'	4.8
BZ 118	5	2,3',4,4',6	7.6
BZ 126	5	3,3',4,4',5	0.90 U
BZ 128	6	2,2',3,3',4,4'	0.90 U
BZ 138	6	2,2',3,4,4',5'	6.8
BZ 153	6	2,2',4,4',5,5'	7.9
BZ 170	7	2,2',3,3',4,4',5	2.1 I
BZ 180	7	2,2',3,4,4',5,5'	0.90 U
BZ 187	7	2,2',3,4',5,5',6	0.90 U
BZ 188	7	2,2',3,4',5,6,6'	0.90 U
BZ 195	8	2,2',3,3',4,4',5,6	0.90 U
BZ 200	8	2,2',3,3',4,5',6,6'	0.90 U
BZ 206	9	2,2',3,3',4,4',5,5',6	0.90 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	16

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range	
DBOB	74%	30% -150%	I
BZ 202	54%	30% -150%	

Key:

U = Analyzed for but not detected.

E = Concentration exceeds the upper level of the calibration range of the instrument.

P = Greater than 40% RPD between the two channels, the higher value is reported (see narrative).

I = Greater than 40% RPD between the two channels, the lower value is reported due to matrix interference.

* = Surrogate value out of acceptance range.

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ANALYTICAL REPORT
EPA Method 8081A Pesticides

Science Applications **ETR Number: 43169**

Project: **Pier 1 Marine Railway** **Lab ID Number: 43169-3**

Associated Blank: SS1107B1

Sample ID: SBP-4-GRAB A 10/28/99 @1210(Sediment)

Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
10/29/1999	11/07/1999	11/24/1999	1	55%	20.16 g	NLJr	SOIL

Compound	Results in: ug/Kg	
Aldrin	0.90	U
Alpha-BHC	0.90	U
Beta-BHC	0.90	U
Delta-BHC	0.90	U
Gamma-BHC	0.90	U
Heptachlor	0.90	U
Heptachlor Epoxide	0.90	U
4,4'-DDD	8.1	P
4,4'-DDE	0.90	U
Endrin Aldehyde	0.90	UJ
4,4'-DDT	0.90	U
Dieldrin	0.90	U
Endosulfan I	0.90	U
Endosulfan II	0.90	U
Endosulfan Sulfate	0.90	U
Endrin	0.90	U
Methoxychlor	0.90	U
Alpha Chlordane	0.90	U
Gamma Chlordane	18	P
Endrin Ketone	0.90	U
Hexachlorobenzene	0.90	U
Oxychlordane	0.90	U
2,4'-DDD	0.90	U
2,4'-DDE	0.90	U
2,4'-DDT	0.90	U
Mirex	0.90	U
Toxaphene	9.0	U

Key:

U = Analyzed for but undetected.

P = Greater than 40% difference between 2 columns, the higher value is reported

I = Greater than 40% difference between 2 columns, the lower value is reported

* =Surrogate value out of acceptance range

E = Concentration exceeds the upper level of the calibration range of instrument

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

ETR Number: 43169
Lab ID Number: 43169-4
Associated Blank: SS1107B1

Science Applications

Pier 1 Marine Railway

Sample ID: SBP-3-GRAB-A :[ ]10/28/99 @1024(Sediment)

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
10/29/99	SOIL	20.27 g	41	11/07/99	11/24/99	2	NLJr

BZ #	Cl	Isomer	Results in: µg/Kg
BZ 8	2	2,4'	2.4 U
BZ 18	3	2,2',5	2.4 U
BZ 28	3	2,3',5	2.4 U
BZ 29	3	2,4,5	2.4 U
BZ 44	4	2,2',3,5'	2.4 U
BZ 50	4	2,2',4,6	2.4 U
BZ 52	4	2,2',5,5'	6.9 I
BZ 66	4	2,3',4,4'	9.3 I
BZ 77	4	3,3',4,4'	2.4 U
BZ 87	5	2,2',3,4,5'	40
BZ 101	5	2,2',4,5,5'	86 I
BZ 105	5	2,3,3',4,4'	24
BZ 118	5	2,3',4,4',6	41
BZ 126	5	3,3',4,4',5	2.4 U
BZ 128	6	2,2',3,3',4,4'	6.0 I
BZ 138	6	2,2',3,4,4',5'	52
BZ 153	6	2,2',4,4',5,5'	39
BZ 170	7	2,2',3,3',4,4',5	32 P
BZ 180	7	2,2',3,4,4',5,5'	5.2 I
BZ 187	7	2,2',3,4',5,5',6	2.4 U
BZ 188	7	2,2',3,4',5,6,6'	2.4 U
BZ 195	8	2,2',3,3',4,4',5,6	2.4 U
BZ 200	8	2,2',3,3',4,5',6,6'	2.4 U
BZ 206	9	2,2',3,3',4,4',5,5',6	2.4 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	59

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range	
DBOB	69%	30% -150%	I
BZ 202	101%	30% -150%	

Key:

U = Analyzed for but not detected.

E = Concentration exceeds the upper level of the calibration range of the instrument.

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I = Greater than 40% RPD between the two channels, the lower value is reported due to matrix interference.

* = Surrogate value out of acceptance range.

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ANALYTICAL REPORT
EPA Method 8081A Pesticides

Science Applications **ETR Number: 43169**

Project: **Pier 1 Marine Railway** **Lab ID Number: 43169-4**

Associated Blank: SS1107B1

Sample ID: SBP-3-GRAB A 10/28/99 @1024(Sediment)

Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
10/29/1999	11/07/1999	11/24/1999	2	41%	20.27 g	NLJr	SOIL

Compound	Results in: ug/Kg
Aldrin	2.4 U
Alpha-BHC	2.4 U
Beta-BHC	2.4 U
Delta-BHC	2.4 U
Gamma-BHC	2.4 U
Heptachlor	2.4 U
Heptachlor Epoxide	2.4 U
4,4'-DDD	2.4 U
4,4'-DDE	2.4 U
Endrin Aldehyde	2.4 UJ
4,4'-DDT	2.4 U
Dieldrin	2.4 U
Endosulfan I	2.4 U
Endosulfan II	2.4 U
Endosulfan Sulfate	2.4 U
Endrin	2.4 U
Methoxychlor	2.4 U
Alpha Chlordane	2.4 U
Gamma Chlordane	7.1 P
Endrin Ketone	2.4 U
Hexachlorobenzene	2.4 U
Oxychlordane	2.4 U
2,4'-DDD	3.6
2,4'-DDE	2.4 U
2,4'-DDT	2.4 U
Mirex	2.4 U
Toxaphene	24 U

Key:

U = Analyzed for but undetected.

P = Greater than 40% difference between 2 columns, the higher value is reported

I = Greater than 40% difference between 2 columns, the lower value is reported

* =Surrogate value out of acceptance range

E = Concentration exceeds the upper level of the calibration range of instrument

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

ETR Number: 43169
Lab ID Number: 43169-5
Associated Blank: SS1107B1

Science Applications

Pier 1 Marine Railway

Sample ID: SBP-2-GRAB A :[ ]10/28/99 @1245(Sediment)

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
10/29/99	SOIL	20.03 g	23	07/21/99	11/24/99	1	NLJr

Results in: µg/Kg

BZ #	Cl	Isomer	
BZ 8	2	2,4'	2.2 U
BZ 18	3	2,2',5	2.2 U
BZ 28	3	2,3',5	2.2 U
BZ 29	3	2,4,5	2.2 U
BZ 44	4	2,2',3,5'	2.2 U
BZ 50	4	2,2',4,6	2.2 U
BZ 52	4	2,2',5,5'	5.2
BZ 66	4	2,3',4,4'	2.2 U
BZ 77	4	3,3',4,4'	2.2 U
BZ 87	5	2,2',3,4,5'	7.6
BZ 101	5	2,2',4,5,5'	23
BZ 105	5	2,3,3',4,4'	4.8 I
BZ 118	5	2,3',4,4',6	13
BZ 126	5	3,3',4,4',5	2.2 U
BZ 128	6	2,2',3,3',4,4'	2.8
BZ 138	6	2,2',3,4,4',5'	18
BZ 153	6	2,2',4,4',5,5'	10
BZ 170	7	2,2',3,3',4,4',5	2.2 U
BZ 180	7	2,2',3,4,4',5,5'	2.2 U
BZ 187	7	2,2',3,4',5,5',6	2.2 U
BZ 188	7	2,2',3,4',5,6,6'	2.2 U
BZ 195	8	2,2',3,3',4,4',5,6	2.2 U
BZ 200	8	2,2',3,3',4,5',6,6'	2.2 U
BZ 206	9	2,2',3,3',4,4',5,5',6	2.2 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	8.0

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range	
DBOB	42%	30% -150%	P
BZ 202	52%	30% -150%	

Key:

U = Analyzed for but not detected.

E = Concentration exceeds the upper level of the calibration range of the instrument.

P = Greater than 40% RPD between the two channels, the higher value is reported (see narrative).

I = Greater than 40% RPD between the two channels, the lower value is reported due to matrix interference.

* = Surrogate value out of acceptance range.

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ANALYTICAL REPORT
EPA Method 8081A Pesticides

Science Applications **ETR Number: 43169**

Project: **Pier 1 Marine Railway** **Lab ID Number: 43169-5**

Associated Blank: SS1107B1

Sample ID: SBP-2-GRAB A 10/28/99 @1245(Sediment)

Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
10/29/1999	11/07/1999	11/24/1999	1	23%	20.03 g	NLJr	SOIL

Compound	Results in: ug/Kg
Aldrin	2.2 U
Alpha-BHC	2.2 U
Beta-BHC	2.2 U
Delta-BHC	2.2 U
Gamma-BHC	2.2 U
Heptachlor	2.2 U
Heptachlor Epoxide	2.2 U
4,4'-DDD	2.2 U
4,4'-DDE	2.2 U
Endrin Aldehyde	2.2 UJ
4,4'-DDT	2.2 U
Dieldrin	2.2 U
Endosulfan I	2.2 U
Endosulfan II	2.2 U
Endosulfan Sulfate	2.2 U
Endrin	2.2 U
Methoxychlor	2.2 U
Alpha Chlordane	2.2 U
Gamma Chlordane	6.3
Endrin Ketone	2.2 U
Hexachlorobenzene	2.2 U
Oxychlordane	2.2 U
2,4'-DDD	2.2 U
2,4'-DDE	2.2 U
2,4'-DDT	2.2 U
Mirex	2.2 U
Toxaphene	22 U

Key:

U = Analyzed for but undetected.

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* =Surrogate value out of acceptance range

E = Concentration exceeds the upper level of the calibration range of instrument

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

ETR Number: 43169
Lab ID Number: 43169-6
Associated Blank: SS1107B1

Science Applications

Pier 1 Marine Railway

Sample ID: SBP-6-GRAB A :[ ]10/28/99 @1145(Sediment)

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
10/29/99	SOIL	20.14 g	33	11/07/99	11/24/99	1	NLJr

BZ #	Cl	Isomer	Results in: µg/Kg
BZ 8	2	2,4'	1.5 U
BZ 18	3	2,2',5	1.5 U
BZ 28	3	2,3',5	1.5 U
BZ 29	3	2,4,5	1.5 U
BZ 44	4	2,2',3,5'	1.5 U
BZ 50	4	2,2',4,6	1.5 U
BZ 52	4	2,2',5,5'	1.5 U
BZ 66	4	2,3',4,4'	1.5 U
BZ 77	4	3,3',4,4'	1.5 U
BZ 87	5	2,2',3,4,5'	1.5 U
BZ 101	5	2,2',4,5,5'	2.2 I
BZ 105	5	2,3,3',4,4'	1.5 U
BZ 118	5	2,3',4,4',6	1.5 U
BZ 126	5	3,3',4,4',5	1.5 U
BZ 128	6	2,2',3,3',4,4'	1.5 U
BZ 138	6	2,2',3,4,4',5'	1.5 U
BZ 153	6	2,2',4,4',5,5'	1.5 U
BZ 170	7	2,2',3,3',4,4',5	1.5 U
BZ 180	7	2,2',3,4,4',5,5'	1.5 U
BZ 187	7	2,2',3,4',5,5',6	1.5 U
BZ 188	7	2,2',3,4',5,6,6'	1.5 U
BZ 195	8	2,2',3,3',4,4',5,6	1.5 U
BZ 200	8	2,2',3,3',4,5',6,6'	1.5 U
BZ 206	9	2,2',3,3',4,4',5,5',6	1.5 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	5.0

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range
DBOB	56%	30% -150%
BZ 202	65%	30% -150%

Key:

U = Analyzed for but not detected.

E = Concentration exceeds the upper level of the calibration range of the instrument.

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I = Greater than 40% RPD between the two channels, the lower value is reported due to matrix interference.

* = Surrogate value out of acceptance range.

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ANALYTICAL REPORT
EPA Method 8081A Pesticides

Science Applications **ETR Number: 43169**

Project: **Pier 1 Marine Railway** **Lab ID Number: 43169-6**

Associated Blank: SS1107B1

Sample ID:	SBP-6-GRAB A	10/28/99 @1145(Sediment)					
Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
10/29/1999	11/07/1999	11/24/1999	1	33%	20.14 g	NLJr	SOIL

Compound	Results in: ug/Kg
Aldrin	1.5 U
Alpha-BHC	1.5 U
Beta-BHC	1.5 U
Delta-BHC	1.5 U
Gamma-BHC	1.5 U
Heptachlor	1.5 U
Heptachlor Epoxide	1.5 U
4,4'-DDD	1.5 U
4,4'-DDE	1.5 U
Endrin Aldehyde	1.5 UJ
4,4'-DDT	1.5 U
Dieldrin	1.5 U
Endosulfan I	1.5 U
Endosulfan II	1.5 U
Endosulfan Sulfate	1.5 U
Endrin	1.5 U
Methoxychlor	1.5 U
Alpha Chlordane	1.5 U
Gamma Chlordane	1.5 U
Endrin Ketone	1.5 U
Hexachlorobenzene	1.5 U
Oxychlordane	1.5 U
2,4'-DDD	1.5 U
2,4'-DDE	1.5 U
2,4'-DDT	1.5 U
Mirex	1.5 U
Toxaphene	15 U

Key:

U = Analyzed for but undetected.

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* =Surrogate value out of acceptance range

E = Concentration exceeds the upper level of the calibration range of instrument

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

Science Applications

ETR Number: 43169
Lab ID Number: 43169-7
Associated Blank: SS1107B1

Pier 1 Marine Railway

Sample ID: SBP-5-GRAB A :[ ]10/28/99 @1155(Sediment)

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
10/29/99	SOIL	20.23 g	33	11/07/99	11/24/99	1	NLJr

BZ #	Cl	Isomer	Results in: µg/Kg
BZ 8	2	2,4'	1.5 U
BZ 18	3	2,2',5	1.5 U
BZ 28	3	2,3',5	1.5 U
BZ 29	3	2,4,5	1.5 U
BZ 44	4	2,2',3,5'	1.5 U
BZ 50	4	2,2',4,6	1.5 U
BZ 52	4	2,2',5,5'	1.5 U
BZ 66	4	2,3',4,4'	1.5 U
BZ 77	4	3,3',4,4'	1.5 U
BZ 87	5	2,2',3,4,5'	1.5 U
BZ 101	5	2,2',4,5,5'	6.6 I
BZ 105	5	2,3,3',4,4'	2.1
BZ 118	5	2,3',4,4',6	1.5 U
BZ 126	5	3,3',4,4',5	1.5 U
BZ 128	6	2,2',3,3',4,4'	1.5 U
BZ 138	6	2,2',3,4,4',5'	2.3
BZ 153	6	2,2',4,4',5,5'	3.5
BZ 170	7	2,2',3,3',4,4',5	1.6 I
BZ 180	7	2,2',3,4,4',5,5'	1.5 U
BZ 187	7	2,2',3,4',5,5',6	1.5 U
BZ 188	7	2,2',3,4',5,6,6'	1.5 U
BZ 195	8	2,2',3,3',4,4',5,6	1.5 U
BZ 200	8	2,2',3,3',4,5',6,6'	1.5 U
BZ 206	9	2,2',3,3',4,4',5,5',6	1.5 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	6.0 I

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range	
DBOB	84%	30% -150%	P
BZ 202	102%	30% -150%	

Key:

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ANALYTICAL REPORT
EPA Method 8081A Pesticides

Science Applications **ETR Number: 43169**

Project: **Pier 1 Marine Railway** **Lab ID Number: 43169-7**

Associated Blank: SS1107B1

Sample ID: SBP-5-GRAB A 10/28/99 @1155(Sediment)

Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
10/29/1999	11/07/1999	11/24/1999	1	33%	20.23 g	NLJr	SOIL

Compound	Results in: ug/Kg	
Aldrin	1.5	U
Alpha-BHC	1.5	U
Beta-BHC	1.5	U
Delta-BHC	1.5	U
Gamma-BHC	1.5	U
Heptachlor	1.5	U
Heptachlor Epoxide	1.5	U
4,4'-DDD	1.5	U
4,4'-DDE	1.5	U
Endrin Aldehyde	1.5	UJ
4,4'-DDT	1.5	U
Dieldrin	1.5	U
Endosulfan I	1.5	U
Endosulfan II	1.5	U
Endosulfan Sulfate	1.5	U
Endrin	1.5	U
Methoxychlor	1.5	U
Alpha Chlordane	1.5	U
Gamma Chlordane	1.5	U
Endrin Ketone	1.5	U
Hexachlorobenzene	33	
Oxychlordane	1.5	U
2,4'-DDD	1.5	U
2,4'-DDE	1.5	U
2,4'-DDT	1.5	U
Mirex	1.5	U
Toxaphene	15	U

Key:

U = Analyzed for but undetected.

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I = Greater than 40% difference between 2 columns, the lower value is reported

* =Surrogate value out of acceptance range

E = Concentration exceeds the upper level of the calibration range of instrument

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

ETR Number: 43169
Lab ID Number: 43169-8
Associated Blank: SS1107B1

Science Applications

Pier 1 Marine Railway

Sample ID: SBP-7-GRAB A :[ ]10/28/99 @1205(Sediment)

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
10/29/99	SOIL	20.2 g	36	11/07/99	11/24/99	1	NLJr

BZ #	Cl	Isomer	Results in: µg/Kg
BZ 8	2	2,4'	1.4 U
BZ 18	3	2,2',5	1.4 U
BZ 28	3	2,3',5	1.4 U
BZ 29	3	2,4,5	1.4 U
BZ 44	4	2,2',3,5'	1.4 U
BZ 50	4	2,2',4,6	1.4 U
BZ 52	4	2,2',5,5'	1.4 U
BZ 66	4	2,3',4,4'	1.4 U
BZ 77	4	3,3',4,4'	1.4 U
BZ 87	5	2,2',3,4,5'	1.4 U
BZ 101	5	2,2',4,5,5'	18 I
BZ 105	5	2,3,3',4,4'	1.4 U
BZ 118	5	2,3',4,4',6	1.4 U
BZ 126	5	3,3',4,4',5	1.4 U
BZ 128	6	2,2',3,3',4,4'	1.4 U
BZ 138	6	2,2',3,4,4',5'	1.4 U
BZ 153	6	2,2',4,4',5,5'	11
BZ 170	7	2,2',3,3',4,4',5	1.4 U
BZ 180	7	2,2',3,4,4',5,5'	1.4 U
BZ 187	7	2,2',3,4',5,5',6	1.4 U
BZ 188	7	2,2',3,4',5,6,6'	1.4 U
BZ 195	8	2,2',3,3',4,4',5,6	1.4 U
BZ 200	8	2,2',3,3',4,5',6,6'	1.4 U
BZ 206	9	2,2',3,3',4,4',5,5',6	1.4 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	42 I

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range	
DBOB	49%	30% -150%	P
BZ 202	48%	30% -150%	

Key:

U = Analyzed for but not detected.

E = Concentration exceeds the upper level of the calibration range of the instrument.

P = Greater than 40% RPD between the two channels, the higher value is reported (see narrative).

I = Greater than 40% RPD between the two channels, the lower value is reported due to matrix interference.

* = Surrogate value out of acceptance range.

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ANALYTICAL REPORT
EPA Method 8081A Pesticides

Science Applications **ETR Number: 43169**

Project: **Pier 1 Marine Railway** **Lab ID Number: 43169-8**

Associated Blank: SS1107B1

Sample ID:	SBP-7-GRAB A	10/28/99 @1205(Sediment)					
Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
10/29/1999	11/07/1999	11/24/1999	1	36%	20.2 g	NLJr	SOIL

Compound	Results in: ug/Kg
Aldrin	1.4 U
Alpha-BHC	1.4 U
Beta-BHC	1.4 U
Delta-BHC	1.4 U
Gamma-BHC	1.4 U
Heptachlor	1.4 U
Heptachlor Epoxide	1.4 U
4,4'-DDD	17
4,4'-DDE	1.4 U
Endrin Aldehyde	1.4 UJ
4,4'-DDT	1.4 U
Dieldrin	1.4 U
Endosulfan I	1.4 U
Endosulfan II	1.4 U
Endosulfan Sulfate	1.4 U
Endrin	1.4 U
Methoxychlor	13 I
Alpha Chlordane	1.4 U
Gamma Chlordane	1.4 U
Endrin Ketone	1.4 U
Hexachlorobenzene	1.4 U
Oxychlordane	1.4 U
2,4'-DDD	1.4 U
2,4'-DDE	1.4 U
2,4'-DDT	1.4 U
Mirex	13
Toxaphene	14 U

Key:

U = Analyzed for but undetected.

P = Greater than 40% difference between 2 columns, the higher value is reported

I = Greater than 40% difference between 2 columns, the lower value is reported

* =Surrogate value out of acceptance range

E = Concentration exceeds the upper level of the calibration range of instrument

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ANALYTICAL REPORT
EPA Method 8082 PCB Congeners

Lab ID Number: SS1107B1

Sample ID: Method Blank

Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
N/A	SOIL	20 g	100	11/07/99	11/23/99	1	NLJr

BZ #	Cl	Isomer	Results in: µg/Kg
BZ 8	2	2,4'	0.50 U
BZ 18	3	2,2',5	0.50 U
BZ 28	3	2,3',5	0.50 U
BZ 29	3	2,4,5	0.50 U
BZ 44	4	2,2',3,5'	0.50 U
BZ 50	4	2,2',4,6	0.50 U
BZ 52	4	2,2',5,5'	0.50 U
BZ 66	4	2,3',4,4'	0.50 U
BZ 77	4	3,3',4,4'	0.50 U
BZ 87	5	2,2',3,4,5'	0.50 U
BZ 101	5	2,2',4,5,5'	0.50 U
BZ 105	5	2,3,3',4,4'	0.50 U
BZ 118	5	2,3',4,4',6	0.50 U
BZ 126	5	3,3',4,4',5	0.50 U
BZ 128	6	2,2',3,3',4,4'	0.50 U
BZ 138	6	2,2',3,4,4',5'	0.50 U
BZ 153	6	2,2',4,4',5,5'	0.50 U
BZ 170	7	2,2',3,3',4,4',5	0.50 U
BZ 180	7	2,2',3,4,4',5,5'	0.50 U
BZ 187	7	2,2',3,4',5,5',6	0.50 U
BZ 188	7	2,2',3,4',5,6,6'	0.50 U
BZ 195	8	2,2',3,3',4,4',5,6	0.50 U
BZ 200	8	2,2',3,3',4,5',6,6'	0.50 U
BZ 206	9	2,2',3,3',4,4',5,5',6	0.50 U
BZ 209	10	2,2',3,3',4,4',5,5',6,6'	0.50 U

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range
DBOB	110%	30% -150%
BZ 202	109%	30% -150%

Key:

U = Analyzed for but not detected.

E = Concentration exceeds the upper level of the calibration range of the instrument.

P = Greater than 40% RPD between the two channels, the higher value is reported (see narrative).

I = Greater than 40% RPD between the two channels, the lower value is reported due to matrix interference.

* = Surrogate value out of acceptance range.

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Raynham, MA 02767-5154 • USA
Phone: 508-822-9300
Fax: 508-822-3288

QUALITY CONTROL REPORT
EPA Method 8081A Pesticides

Lab ID Number: SS1107B1

Sample ID: METHOD BLANK

Date Received	Date Extracted	Date Analyzed	Dilution Factor	% Solids	Sample Amount	Analyst	Matrix
N/A	11/07/1999	11/23/1999	1	100%	20 g	NLJr	SOIL

Compound	Results in: ug/Kg	
Aldrin	0.50	U
Alpha-BHC	0.50	U
Beta-BHC	0.50	U
Delta-BHC	0.50	U
Gamma-BHC	0.50	U
Heptachlor	0.50	U
Heptachlor Epoxide	0.50	U
4,4'-DDD	0.50	U
4,4'-DDE	0.50	U
Endrin Aldehyde	0.50	UJ
4,4'-DDT	0.50	U
Dieldrin	0.50	U
Endosulfan I	0.50	U
Endosulfan II	0.50	U
Endosulfan Sulfate	0.50	U
Endrin	0.50	U
Methoxychlor	0.50	U
Alpha Chlordane	0.50	U
Gamma Chlordane	0.50	U
Endrin Ketone	0.50	U
Hexachlorobenzene	0.50	U
Oxychlordane	0.50	U
2,4'-DDE	0.50	U
2,4'-DDD	0.50	U
2,4'-DDT	0.50	U
Mirex	0.50	U
Toxaphene	10	U

Key:

U = Analyzed for but undetected.

P = Greater than 40% difference between 2 columns, the higher value is reported

I = Greater than 40% difference between 2 columns, the lower value is reported

* =Surrogate value out of acceptance range

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QUALITY CONTROL REPORT
EPA Method 8082 PCBs

Lab ID Number: SS1107L1
Associated Blank: SS1107B1

Sample ID:	LABORATORY CONTROL SPIKE RECOVERY						
Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
N/A	SOIL	20 g	N/A	11/07/99	11/23/99	1	NLJr

Parameter	Spike Added µg/Kg	LCS Conc. µg/Kg	LCS %Recovery	QC Limits %Recovery
BZ 28	10.00	9.78	98	38% - 158%
BZ 44	10.00	9.07	91	38% - 158%
BZ 66	10.00	10.64	106	38% - 158%
BZ 128	10.00	9.12	91	38% - 158%
BZ 138	10.00	9.23	92	38% - 158%
BZ 153	10.00	8.95	89	38% - 158%
BZ 170	10.00	9.82	98	38% - 158%
BZ 195	10.00	9.29	93	38% - 158%
BZ 206	10.00	10.43	104	38% - 158%
BZ 209	10.00	8.75	88	38% - 158%

* =Value outside of QC limits

SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range
DBOB	135%	30% -150%
BZ 202	122%	30% -150%

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QUALITY CONTROL REPORT
EPA Method 8081A Pesticides

Lab ID Number: SS1107L1
Associated Blank: SS1107B1

Sample ID:	LABORATORY CONTROL SPIKE RECOVERY						
Date Received	Matrix	Sample Amount	% Solids	Date Extracted	Date Analyzed	Dilution Factor	Analyst
N/A	SOIL	20	100	11/07/99	11/23/99	1	NLJr

Parameter	Spike Added µg/Kg	LCS Conc. µg/Kg	LCS %Recovery	QC Limits %Recovery
Gamma-BHC	2.50	2.00	80	35% - 130%
Heptachlor	2.50	1.66	66	34% - 132%
Aldrin	2.50	2.41	96	46% - 127%
Dieldrin	2.50	1.28	51	31% - 134%
Endrin	2.50	2.13	85	42% - 139%
4,4'-DDT	2.50	2.09	84	23% - 134%

Surrogate	% Recovery	Acceptance Range
DBOB	78%	30% -150%
BZ 202	81%	30% -150%

SRM Sediment 1944
Analysis Results

Analyte	SRM 1944 Cert. Conc.	43169 SS1107S1 Dry Weight ug/Kg	% D
BZ 8	22.3	20	10.3
BZ 18	51	48	5.9
BZ 28	80.8	88	8.9
BZ 31	78.7	NT	
BZ 44	60.2	58	3.7
BZ 49	53	NT	
BZ 52	79.4	63	20.7
BZ 66	71.9	148	105.8
BZ 87	29.9	23	23.1
BZ 95	65	NT	
BZ 99	37.5	NT	
BZ 101/90	73.4	134	82.6
BZ 105	24.5	22	10.2
BZ 110	63.5	NT	
BZ 118	58	59	1.7
BZ 128	8.47	14	65.3
BZ 138/163/164	62.1	40	35.6
BZ 149	49.7	NT	
BZ 151	16.9	NT	
BZ 153	74	75	1.4
BZ 156	6.52	NT	
BZ 170/190	22.6	61	169.9
BZ 180	44.3	43	3.8
BZ 183	12.2	NT	
BZ 187/159/182	25.1	29	15.5
BZ 194	11.2	NT	
BZ 195	3.75	6.7 U	
BZ 206	9.21	11	19.4
BZ 209	6.81	63	869.2
Mean % D			80.7

NT Not Targeted

SAIC
Marine Railway #1

SRM Sediment 1944
Analysis Results

Analyte	SRM 1944 Cert. Conc.	43169 SS1107S1 Dry Weight ug/Kg	% D
Hexachlorobenzene	6.0	12	100.0
alpha-Chlordane (cis-Chlordane)	16.5	14	15.2
trans-Nonachlor	8.2	NT	
p,p'-DDT	119	110	7.6
Mean % D			30.7

SAIC
Marine Railway #1

NT Not Targeted

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QUALITY CONTROL REPORT
EPA Method 8082 PCB Congeners

Science Applications

Pier 1 Marine Railway **Lab ID Number: 43169-4**

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY (Page 1 of 2)

Sample ID: SBP-3-GRAB-A :[ ]10/28/99 @1024(Sediment)

Parameter	Spike Added µg/Kg	Sample Conc. µg/Kg	MS Conc. µg/Kg	MS %Recovery	QC Limits %Recovery	
BZ 28	23.74	2.4 U	16	67	38% - 158%	
BZ 44	23.74	2.4 U	21	87	38% - 158%	
BZ 66	23.74	9.3	8.0	-5	38% - 158%	*
BZ 128	23.74	6.0	25	78	38% - 158%	
BZ 138	23.74	52	28	-100	38% - 158%	*
BZ 153	23.74	39	29	-41	38% - 158%	*
BZ 170	23.74	32	25	-28	38% - 158%	*
BZ 195	23.74	2.4 U	19	80	38% - 158%	
BZ 206	23.74	2.4 U	19	81	38% - 158%	
BZ 209	23.74	59	35	-99	38% - 158%	*

MS SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range
DBOB	50%	30% -150%
BZ 202	56%	30% -150%

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QUALITY CONTROL REPORT
EPA Method 8082 PCB Congeners

Science Applications

Pier 1 Marine Railway **Lab ID Number: 43169-4**

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY (Page 2 of 2)

Sample ID: SBP-3-GRAB-A :[ ]10/28/99 @1024(Sediment)

Parameter	Spike Added µg/Kg	MSD Conc. µg/Kg	MSD % Recovery	% RPD	QC Limits % Rec.	QC Limits % RPD	
BZ 28	24.23	14.83	61	7	38 - 158	50%	
BZ 44	24.23	12.29	51	50	38 - 158	50%	
BZ 66	24.23	7.97	-5	1	38 - 158	50%	*
BZ 128	24.23	21.07	62	15	38 - 158	50%	
BZ 138	24.23	27.32	-102	3	38 - 158	50%	*
BZ 153	24.23	29.54	-39	1	38 - 158	50%	*
BZ 170	24.23	24.78	-30	2	38 - 158	50%	*
BZ 195	24.23	20.72	86	9	38 - 158	50%	
BZ 206	24.23	20.29	84	5	38 - 158	50%	
BZ 209	24.23	28.12	-127	23	38 - 158	50%	*

* =Value outside of QC limits

MSD SURROGATE RECOVERY

Surrogate	% Recovery	Acceptance Range
DBOB	56%	30% -150%
BZ 202	54%	30% -150%

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EPA Method 8081A Pesticides
Matrix Spike / Matrix Spike Duplicate Recovery

Science Applications **ETR Number:** 43169

Project: Pier 1 Marine Railway **Lab ID Number:** 43169-4

Associated Blank: SS1107B1

Sample ID: SBP-3-GRAB-A 10/28/99 @1024(Sediment)

Date Received	Date Extracted	Date Analyzed	Dilution Factor	Sample Amount	% Solids	Analyst	Matrix
10/29/99	11/7/99	11/24/99	2	20.18 g	0.409	NLJr	SOIL

Compound	Spike Added ug/Kg	Sample Conc. ug/Kg	MS Conc ug/Kg	MS % Rec	QC limits % Rec.
Aldrin	11.9	2.40 U	6.28	53%	46-127%
Gamma-BHC (Lindane)	11.9	2.40 U	8.75	74%	35-130%
Heptachlor	11.9	2.40 U	8.27	70%	34-132%
Dieldrin	11.9	2.40 U	10.14	85%	31-134%
Endrin	11.9	2.40 U	23.74	200%	42-139% *
4,4'-DDT	11.9	2.40 U	7.30	61%	23-134%

Compound	Spike Added ug/Kg	MSD Conc. ug/Kg	MSD % Rec	% RPD	QC limits RPD	QC limits % Rec.
Aldrin	12.1	6.64	55%	5%	50	46-127%
Gamma-BHC (Lindane)	12.1	6.62	55%	28%	50	35-130%
Heptachlor	12.1	9.68	80%	16%	50	34-132%
Dieldrin	12.1	8.38	69%	19%	50	31-134%
Endrin	12.1	11.88	98%	67%	50	42-139% *
4,4'-DDT	12.1	8.66	71%	17%	50	23-134%

* = Value outside of QC limits

MS Surrogate Recovery		
Surrogate	% Recovery	Acceptance Range
DBOB	86	30 % - 150 %
BZ 202	136	30 % - 150 %

MS Surrogate Recovery		
Surrogate	% Recovery	Acceptance Range
DBOB	41	30 % - 150 %
BZ 202	142	30 % - 150 %

CEIMIC Corporation

Organotins

CEIMIC
Corporation
"Analytical Chemistry for Environmental Management"

November 16, 1999

Mr. Helder Costa
Woods Hole Group
375 Paramount Drive, Suite B
Rayneham, MA 02767

Dear Mr. Costa:

Enclosed are the results for the analyses performed in support of the Woods Hole Group Project number 43169. The samples were taken from the field on October 28, 1999 and received at Ceimic Corporation on October 30 , 1999.

The samples were analyzed by GC/FPD for the analysis of organotins using a five point calibration and internal standard quantitation. Tetrapropyltin was used as the internal standard and tripropyltin was used as the surrogate. Results are reported on a dry weight basis as µg/Kg mono-, di-, tri- and tetrabutyltin.

All samples were stored at 4°C prior to extraction. Samples were extracted on November 8, 1999 and derivatized on November 9, 1999. Sample analysis was performed on a DB1701 analytical column on November 10, 1999.

These samples are reported under Ceimic Project Number 990928, which can be referenced when inquiring about this project.

If you have any questions or concerns regarding this data, please call me at the telephone number listed below.

Sincerely,

Henry Leibovitz, Ph.D.
Organic Laboratory Manager

HL/tls

Enclosures

10 Dean Knauss Drive, Narragansett, RI 02882 • Tel: (401) 782-8900 • Fax: (401) 782-8905

Chain-of-Custody Record

Jodi Mable Dupuis
Environmental Laboratories
375 Paramount Drive
Raynham, MA 02767
TEL: (508) 822-9300
FAX: (508) 822-3288

9909-0 (171)

PAGE ___ OF ___

COMPANY INFORMATION	COMPANY'S PROJECT INFORMATION	SHIPPING INFORMATION
Name: Woods Hole Group	Regulatory Protocol:	Carrier:
Address:	For the State of:	Airbill Number:
	Project Name:	Date Shipped:
	Project Number:	Quote #:
Telephone:	P.O. # 43169	
Facsimile:	Sampler Name(s):	
Contact Name: Hector Costa	TAT ___ 10 Day ___ 5 Day ___ 3 Day ___ 48 Hr ___ 24 Hr ___ Other	

VOLUME/CONTAINER TYPE/ PRESERVATIVE (NOTE 4)

WHG LAB #	SAMPLE ID (NOTE 1)	COLLECTION DATE	COLLECTION TIME	COMPOSITE GRAB	MATRIX	ANALYSIS/REMARKS (NOTE 2, 3)	NUMBER OF CONTAINERS
43169-9	SBP-7-Grab B	10/28/99	1205		Sediment	ORGANITIN	
-10	SBP-5-Grab B		1155				
-11	SBP-3-Grab B		1024				
-12	SBP-4-Grab B		1210				
-13	SBP-2-Grab B		1245				
-14	SBP-6-Grab B		1145				
-15	SBP-1-Grab B		1237				
-16	SBP-4-Core B		1015				

Relinquished by: (signature)	DATE	TIME	Received by: (signature)
[signature]	10/29/99	1600	Federal Express
Relinquished by: (signature)	DATE	TIME	Received by: (signature)
Relinquished by: (signature)	DATE	TIME	Received for Laboratory by: (signature)
	10/30/99	10 AM	Karen Williamson

NOTES TO SAMPLER (S): (1) Limit Sample Identification to 6 characters, if possible; (2) Indicate designated Lab Q.C. sample and type (e.g.; MS/MSD/REP) and provide sufficient sample; (3) Field duplicates are separate sample; (4) e.g.; 40ml/glass/H_2SO_4

Notes to Lab:

We cannot accept verbal changes - Please Fax written changes to (508) 822-3288

BUTYLTINS
by GC/FPD

lient: Woods Hole Group
Client Sample ID: SBP-7-GRAB B
ate Sampled: 10/28/99
ate Sample Received: 10/30/99
Matrix: Sediment
ercent Solids: 66

Laboratory ID: 990928-01
Date Sample Extracted: 11/08/99
Date Sample Analyzed: 11/10/99
Associated Method Blank: B1108-B1
Final Extract Volume (mL):1.0
Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

arget Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	75
ributyltin	ND	75
Dibutyltin	ND	75
Monobutyltin	ND	75

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

urrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	69	30 - 150

These limits are provided for advisory purposes.

Reported by: TS

Approved by: KL

Form I

BUTYLTINS
by GC/FPD

Client: Woods Hole Group
Client Sample ID: SBP-5-GRAB B
Date Sampled: 10/28/99
Date Sample Received: 10/30/99
Matrix: Sediment
Percent Solids: 35

Laboratory ID: 990928-02
Date Sample Extracted: 11/08/99
Date Sample Analyzed: 11/10/99
Associated Method Blank: B1108-B1
Final Extract Volume (mL):1.0
Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

Target Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	140
Tributyltin	ND	140
Dibutyltin	ND	140
Monobutyltin	ND	140

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

Surrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	50	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: KL

Form I

BUTYLTINS
by GC/FPD

lient: Woods Hole Group
Client Sample ID: SBP-3-GRAB B
ate Sampled: 10/28/99
Date Sample Received: 10/30/99
Matrix: Sediment
ercent Solids: 45

Laboratory ID: 990928-03
Date Sample Extracted: 11/08/99
Date Sample Analyzed: 11/10/99
Associated Method Blank: B1108-B1
Final Extract Volume (mL):1.0
Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

arget Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	110
ributyltin	ND	110
Dibutyltin	ND	110
Monobutyltin	ND	110

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

urrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	47	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: a

Form I

BUTYLTINS
by GC/FPD

Client: Woods Hole Group
Client Sample ID: SBP-4-GRAB B
Date Sampled: 10/28/99
Date Sample Received: 10/30/99
Matrix: Sediment
Percent Solids: 66

Laboratory ID: 990928-04
Date Sample Extracted: 11/08/99
Date Sample Analyzed: 11/10/99
Associated Method Blank: B1108-B1
Final Extract Volume (mL):1.0
Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

Target Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	74
Tributyltin	ND	74
Dibutyltin	ND	74
Monobutyltin	ND	74

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

Surrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	49	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: [illegible]

Form I

BUTYLTINS
by GC/FPD

lient: Woods Hole Group
Client Sample ID: SBP-2-GRAB B
ate Sampled: 10/28/99
Date Sample Received: 10/30/99
Matrix: Sediment
ercent Solids: 23

Laboratory ID: 990928-05
Date Sample Extracted: 11/08/99
Date Sample Analyzed: 11/10/99
Associated Method Blank: B1108-B1
Final Extract Volume (mL):1.0
Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

arget Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	210
ributyltin	ND	210
Dibutyltin	ND	210
Monobutyltin	ND	210

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

urrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	56	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: A

Form I

BUTYLTINS
by GC/FPD

lient: Woods Hole Group
Client Sample ID: SBP-6-GRAB B
ate Sampled: 10/28/99
Date Sample Received: 10/30/99
Matrix: Sediment
ercent Solids: 34

Laboratory ID: 990928-06
Date Sample Extracted: 11/08/99
Date Sample Analyzed: 11/11/99
Associated Method Blank: B1108-B1
Final Extract Volume (mL):1.0
Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

arget Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	140
ributyltin	ND	140
Dibutyltin	ND	140
Monobutyltin	ND	140

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

urrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	62	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: [illegible]

Form I

BUTYLTINS
by GC/FPD

'lient: Woods Hole Group
Client Sample ID: SBP-1-GRAB B
)ate Sampled: 10/28/99
Date Sample Received: 10/30/99
Matrix: Sediment
'ercent Solids: 34

Laboratory ID: 990928-07
Date Sample Extracted: 11/08/99
Date Sample Analyzed: 11/11/99
Associated Method Blank: B1108-B1
Final Extract Volume (mL):1.0
Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

'arget Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	150
:ributyltin	ND	150
Dibutyltin	ND	150
Monobutyltin	ND	150

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

Surrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	41	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: [illegible]

Form I

BUTYLTINS
by GC/FPD

lient: Woods Hole Group
Client Sample ID: SBP-4-CORE B
ate Sampled: 10/28/99
ate Sample Received: 10/30/99
Matrix: Sediment
ercent Solids: 69

Laboratory ID: 990928-08
Date Sample Extracted: 11/08/99
Date Sample Analyzed: 11/11/99
Associated Method Blank: B1108-B1
Final Extract Volume (mL):1.0
Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

arget Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	72
ributyltin	ND	72
Dibutyltin	ND	72
Monobutyltin	ND	72

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

urrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	61	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: _____

Form I

METHOD BLANK
BUTYLTINS
by GC/FPD

Client: Woods Hole Group

lank ID: B1108-B1

Matrix: Sediment

Ceimic Project: 990928

Date Sample Extracted: 11/08/99

Date Sample Analyzed: 11/10/99

Concentration in: ug/Kg (ppb)

Target Analyte	Sample Concentration	Quantitation Limit
Tetrabutyltin	ND	50
Tributyltin	ND	50
Dibutyltin	ND	50
Monobutyltin	ND	50

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

Surrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	65	30 - 150

* These limits are provided for advisory purposes.

Reported by: TG

Approved by: lk

Form I

LABORATORY CONTROL SUMMARY
BUTYLTINS
by GC/FPD

Client: Woods Hole Group

Blank Spike ID: B1108-LCS1

Matrix: Sediment

Ceimic Project: 990928

Date Sample Analyzed: 11/10/99

Date Sample Prepared: 11/08/99

Associated Method Blank: B1108-B1

Concentration in: ug/Kg (ppb)

Target Analyte	Spike Added	Blank Spike Result	Blank Spike Recovery(%)	QC Limits(%)*
Tetrabutyltin	250	150	60	30 - 150
Tributyltin	250	200	80	30 - 150
Dibutyltin	250	210	84	30 - 150
Monobutyltin	250	250	100	30 - 150

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

Surrogate Compound	Recovery(%)	QC Limits(%)*
Tripropyltin	67	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: KL

Form IIIA

MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY
BUTYLTINS
by GC/FPD

lient: Woods Hole Group

Client Sample ID: SBP-5-GRAB B

ate Sampled: 10/28/99

Date Sample Received: 10/30/99

latrix: Sediment

Percent Solids: 35

Laboratory ID: 990928-02MS

Date Sample Extracted: 11/08/99

Date Sample Analyzed: 11/10/99

Associated Method Blank: B1108-B1

Final Extract Volume (mL):1.0

Dilution Factor: 1

Concentration in: ug/Kg (ppb)+

arget Analyte	Spike Added	Sample Concentration	Matrix Spike Concentration	Matrix Spike Recovery(%)
etrabutyltin	1500	ND	1030	69
ributyltin	1500	ND	1040	69
Dibutyltin	1500	ND	978	65
Monobutyltin	1500	ND	925	62

arget Analyte	Matrix Spike Duplicate Concentration	Matrix Spike Duplicate Recovery(%)	RPD(%)	QC Limits(%)*	
				RPD	Recovery
etrabutyltin	910	61	12.4	20	30 - 150
ributyltin	945	63	9.6	20	30 - 150
Dibutyltin	830	55	16.4	20	30 - 150
Monobutyltin	1050	70	12.7	20	30 - 150

ND = Not detected
+ Dry weight basis.

Surrogate Spike Recovery

urrogate Compound	Matrix Spike Recovery(%)	Matrix Spike Duplicate Recovery(%)	QC Limits(%)*
ripropyltin	64	54	30 - 150

* These limits are provided for advisory purposes.

Reported by: TS

Approved by: [illegible]

Form IIIB