which had total PAH concentration (ND=1/2DL) of 5,191 µg/kg. The total PAH concentration (ND=1/2DL) detected at PNS02-02 was approximately 3 times higher than the TEL value.

At the Pensacola Bay reference site, 14 of the 18 tested PAHs were detected. Total PAH concentrations were below the TEL value of 1,684.06 µg/kg for both ND=0 and ND=1/2DL. Detected concentrations of PAHs in the turning basin sediments were generally low and comparable to reference site concentrations, except for location PNS02-02. Total PAH concentrations (ND=1/2DL) at PNS02-02 were approximately 9 times higher than the total PAH concentration at the reference site.

4.3.5 PCB Congeners

Results of the PCB congener analyses are presented in Table 4-8. Of the 26 tested individual PCB congeners, 12 were detected at low concentrations in Naval Station Pensacola turning basin sediments. No individual PCB congeners were detected in sediments from PNS02-03 and PNS02-04. Total PCB concentrations (ND=1/2 DL) ranged from 2.15 to 8.99 µg/kg. The highest calculated total PCB concentration was approximately 2.4 times lower than the TEL of 21.55 µg/kg for total PCBs.

Six of the tested individual PCB congeners were detected at the Pensacola Bay reference site, and the total PCB concentration (ND=1/2DL) was 5.4 µg/kg, lower than the TEL and within the range of total PCB concentrations detected at the five Pensacola Naval Station turning basin locations.

4.3.6 Chlorinated and Organophosphorus Pesticides

Results of the chlorinated and organophosphorus pesticide analyses are presented in Tables 4-9 and 4-10, respectively. Chlorinated pesticides were detected at low concentrations in 4 of 110 cases (4 percent). Of the 22 tested chlorinated pesticides, three were detected in Naval Station Pensacola turning basin sediments. Each of the three detected pesticides (endosulfan II, endrin, and endrin aldehyde) was detected at location PNS02-01. Endosulfan II was also detected at location PNS02-04.

Three chlorinated pesticides (endosulfan I, endosulfan II, and endosulfan sulfate) were detected at the Pensacola Bay reference site. There are no established TEL/PEL values for any of the chlorinated pesticides detected at the Pensacola Bay reference site.

None of the five tested organophosphorus pesticides was detected in the Naval Station Pensacola turning basin sediment samples or the Pensacola Bay reference sediments.

4.3.7 Semivolatile Organic Compounds (SVOCs)

Results from the SVOC analyses are provided in Table 4-11. Of the 42 tested SVOCs, none was detected in Naval Station Pensacola turning basin sediments or Pensacola Bay reference sediment.

4.3.8 Butyltins

Results of the butyltin analyses are provided in Table 4-12. None of the three tested butyltins were detected in the sediments from Naval Station Pensacola turning basin or in the reference sediment from Pensacola Bay.

4.4 THEORETICAL BIOACCUMULATION POTENTIAL

Results of the bulk sediment analyses were used to calculate theoretical bioaccumulation potential (TBP). TBP is a screening tool that provides a partial basis for selecting appropriate tissue analyses for quantification of bioaccumulation (Chapter 7). The TBP represents the approximate equilibrium tissue concentration that would be expected if the sediment or dredged material were the only source of contaminants. TBP estimates the potential concentration of a neutral organic substance that would accumulate in an organism from continuous exposure to the contaminated sediment (USACE–WES 1999). TBP is only determined for nonpolar organic compounds (pesticides, PAHs, and PCB congeners) and is not calculated for metals, organic acids or salts, organotins, or methyl mercury.

According to the ITM, TBP is both an environmentally conservative value (USEPA/USACE 1998) and a conservative predictor of bioaccumulation (USACE–WES 1999). Calculated TBP values tend to be higher than the actual bioaccumulation values measured in tissues of organisms exposed to the same sediment, because the TBP calculation assumes continuous exposure to the sediment. In the field, the duration of exposure and the actual concentration to which an aquatic organism is exposed will vary. Although a substance may have the potential to cause an adverse effect, the actual likelihood of an adverse effect is a function of: (1) physical and chemical properties of the constituent, (2) actual concentration in the tissue, and (3) the period of exposure (USACE–WES 1999).

The TBP calculation requires the concentration of the contaminant found in the sediment, the percent TOC in each sediment sample, and the organisms' percent lipid content. TBP was calculated using the methods described in the ITM (USEPA/USACE 1998). The equation for determining the TBP is as follows:

$$TBP = BSAF\ (C_s/\%TOC)\ \%L$$

where TBP is expressed in the same concentration units as the $\mathbf{C_s}$ and

C_s = Concentration found in the sediment (expressed in any unit); these data are provided in Tables 4-7 (PAHs), 4-8 (PCB congeners), and 4-9 (chlorinated pesticides).

BSAF = Biota Sediment Accumulation Factor = 4 (Ankley et al. 1992);

% TOC = Total organic carbon in the sediment (expressed as a decimal fraction); and are provided in Table 4-5;

% L = Lipid content of the organism (expressed as a decimal fraction of whole body weight) (USEPA/USACE 1998).

For screening purposes, TBP conservatively identifies contaminants in dredged material that may cause bioaccumulation in aquatic organisms. TBP calculations have known limitations and uncertainty associated with estimating PAH bioaccumulation (MacFarland and Clarke 1999). A BSAF value of 4 (as recommended by the ITM) for all analytes has been referred to as "unreasonably conservative" for predicting bioaccumulation (USACE–WES 1996). A BSAF value of 4 was used for all analytical fractions in this project to identify a worst-case bioaccumulation potential.

TBP values were calculated using the sediment contaminant concentrations from each sampling location. If a compound was not detected in the sediment at a location, TBP was not calculated. Lipid concentrations for soft-bodied invertebrates vary depending upon the test organisms, but can range up to as high as 1-2 percent of total body wet weight (USEPA/USACE 1998). A 2 percent lipid value was used for the TBP calculations, assuming a worst-case bioaccumulation potential. For this project, TBP was calculated for PAHs, PCB congeners, and chlorinated pesticides. TBP was not calculated for organophosphorus pesticides because none of the organophosphorus pesticides were detected in the sediments.

4.4.1 PAHs

Calculated TBPs and comparison to reference site values for PAHs are provided in Table 4-13. TBP values of the PAHs exceeded the reference site value in 43 of 90 cases (48 percent). Locations PNS02-01 and PNS02-02 had the most PAHs that exceeded reference site values, and were the only locations where total PAH TBP values (for both ND=0 and ND=1/2DL) exceeded reference site values.

These results suggest some PAHs have the *potential* to bioaccumulate more in tissue exposed to sediments from the Naval Station Pensacola turning basin than in tissue exposed to sediments from the reference site. Specifically, comparative results of the TBP calculations indicate that there is the potential for a greater number of PAHs to bioaccumulate to concentrations greater than reference tissue concentrations for locations PNS02-01 and PNS02-02. Based on the TBP results and the frequency of detected PAHs in the sediments, PAHs were targeted for tissue analyses in the bioaccumulation studies for locations PNSREF02, PNS02-01, and PNS02-02 only.

4.4.2 PCB Congeners

Calculated TBPs and comparisons to reference site values for PCB congeners are provided in Table 4-14. TBP values of the PCB congeners exceeded the reference site value in 19 of 130 cases (15 percent). Twelve of the 26 tested PCB congeners detected in the sediment exceeded TBP values at the reference site. TBP values for total PCBs exceeded the reference value at PNS02-01 and PNS02-02 for ND=0 and ND=1/2DL.

These results suggest some PCB congeners have the *potential* to bioaccumulate more in tissue exposed to sediments from the Naval Station Pensacola turning basin than in tissue exposed to sediments from the reference site. Overall, PCB congeners were detected sporadically, and the majority of congeners were detected at low concentrations (estimated between the reporting limit and the method detection limit). Based on the TBP results, PCB congeners were included as target analytes in the tissue analyses for locations PNSREF02, PNS02-01, and PNS02-02 only.

4.4.3 Chlorinated Pesticides

Calculated TBPs and comparisons to reference site values for chlorinated pesticides are provided in Table 4-15. TBP values of the chlorinated pesticides exceeded the reference site value in 2 of 110 cases (2 percent). Two of the 22 tested chlorinated pesticides exceeded TBP values at the reference site. Endrin and endrin aldehyde exceeded the reference value at location PNS02-01.

These results suggest some chlorinated pesticides have the *potential* to bioaccumulate more in tissue exposed to sediments from the Naval Station Pensacola turning basin than in tissue exposed to sediments from the reference site. Based on the TBP results, chlorinated pesticides were included as target analytes in the tissue analysis only for locations PNSREF02 and PNS02-01.

4.5 SUMMARY OF RESULTS AND DISCUSSION

Results of the physical analyses indicated that the sediment proposed for dredging and placement from the Naval Station Pensacola turning basin was predominately comprised of sand (52-88 percent) at locations PNS02-01, PNS02-02, and PNS02-05, and predominately comprised of silt-clay (60 and 69.7 percent) at locations PNS02-03 and PNS02-04. The reference sediment, collected from eastern Pensacola Bay, was comprised of approximately 64 percent silt-clay, 34 percent sand, and 2 percent gravel.

Of the 142 chemical constituents tested in the sediments, 56 were detected in Naval Station Pensacola turning basin sediments (39 percent). Metals and PAHs were the most commonly detected chemical constituents in the sediment. Only 44 of the 142 tested constituents were detected in the Naval Station Pensacola reference site sediment (31 percent).

Comparisons of chemical concentrations in Naval Station Pensacola turning basin sediments to appropriate marine SQGs indicated that most of the organic contaminants are present in the sediment in concentrations that would not be expected to adversely affect aquatic organisms. Concentrations of eleven PAHs, total PAHs, and four metals were found to exceed TEL values

in at least one of the turning basin samples. The concentrations of two metals, copper and lead, exceeded PEL values at one location (PNS02-02).

Comparisons of TBP values calculated for the detected non-polar organic chemical constituents in the Naval Station Pensacola turning basin sediments (PAHs, PCB congeners, and chlorinated pesticides) indicated that several of these constituents have the potential to bioaccumulate to higher levels in tissues exposed to sediment from the Naval Station Pensacola turning basin than tissue exposed to sediment from the reference location. Based on an evaluation of the sediment chemistry analyses and the TBP calculations, metals, chlorinated pesticides, PCB congeners, and PAHs were targeted for analysis in tissues from the bioaccumulation studies. Results of the tissue analyses are discussed in Chapter 7.

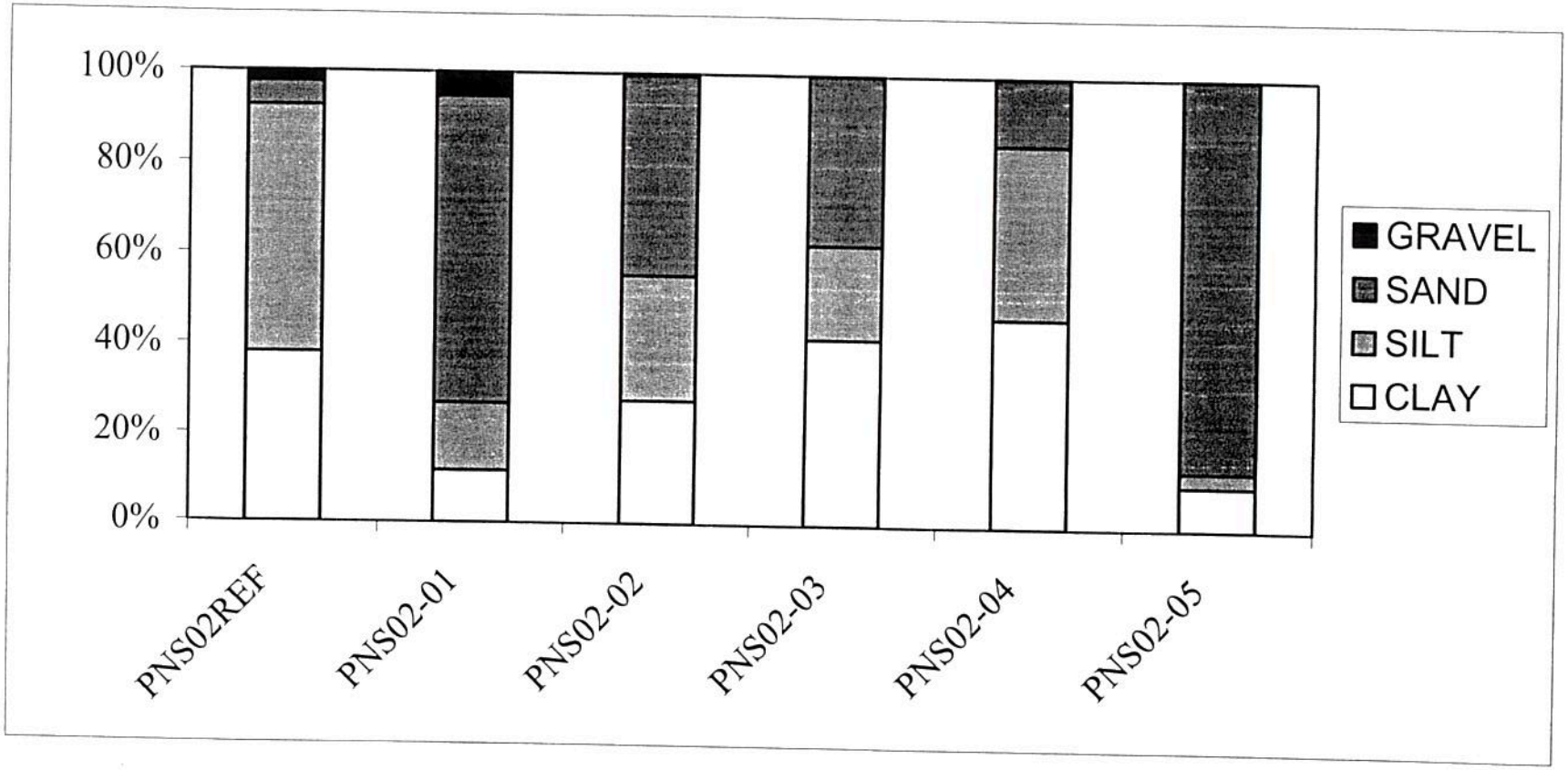

Figure 4-1. Grain size distribution for bulk sediments from Naval Station Pensacola turning basin, Florida.

TABLE 4-1. MARINE SEDIMENT QUALITY GUIDELINES (SQGs)

Chemical Name	Units	Threshold Effects Level (TEL)	Probable Effects Level (PEL)
METALS			
ARSENIC	MG/KG	7.24	41.6
CADMIUM	MG/KG	0.676	4.21
CHROMIUM	MG/KG	52.3	160.4
COPPER	MG/KG	18.7	108.2
LEAD	MG/KG	30.24	112.18
MERCURY	MG/KG	0.13	0.696
NICKEL	MG/KG	15.9	42.8
SILVER	MG/KG	0.73	1.77
ZINC	MG/KG	124	271
CHLORINATED PESTICIDES			
CHLORDANE	UG/KG	2.26	4.79
4,4-DDD	UG/KG	1.22	7.81
4,4-DDE	UG/KG	2.07	374.17
4,4-DDT	UG/KG	1.19	4.77
DIELDRIN	UG/KG	0.715	4.3
GAMMA-BHC	UG/KG	0.32	0.99
PAHs			
2-METHYLNAPHTHALENE	UG/KG	20.21	201.28
ACENAPHTHENE	UG/KG	6.71	88.9
ACENAPHTHYLENE	UG/KG	5.87	127.87
ANTHRACENE	UG/KG	46.85	245
BENZO(A)PYRENE	UG/KG	88.81	763.22
BENZO[A]ANTHRACENE	UG/KG	74.83	692.53
CHRYSENE	UG/KG	107.77	845.98
DIBENZ(A,H)ANTHRACENE	UG/KG	6.22	134.61
FLUORANTHENE	UG/KG	112.82	1493.54
FLUORENE	UG/KG	21.17	144.35
NAPHTHALENE	UG/KG	34.57	390.64
PHENANTHRENE	UG/KG	86.68	543.53
PYRENE	UG/KG	152.66	1397.6
PAHs, TOTAL	UG/KG	1684.06	16770.4
PCBs			
PCBs,TOTAL	UG/KG	21.55	188.79
SEMIVOLATILE ORGANIC COMPOUNDS			
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	182.16	2646.51

Source : MacDonald et al. 1996. Ecotoxicology 5: 253-278.

TABLE 4-2. ORGANIC DATA QUALIFIERS

Qualifiers other than those listed below may be required to properly define the results. If used, they are given an alphabetic designation not already specified in this table or in a project/program document such as a Quality Assurance Project Plan or a contract Statement of Work. Each additional qualifier is fully described in the Analytical Narrative section of the laboratory report (Appendix C).

U Indicates a target compound was analyzed for but not detected. The sample Reporting Limit (RL) is corrected for dilution and, if a soil sample, for percent moisture, if reported on a dry weight basis.

J Indicates an estimated value. This qualifier is used under the following circumstances:

1) when estimating a concentration for tentatively identified compounds (TICs) in GC/MS analyses, where a 1:1 response is assumed,
2) when the mass spectral and retention time data indicate the presence of a compound that meets the volatile and semivolatile GC/MS identification criteria, and the result is less than the RL but greater than the method detection limit (MDL).

B This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action. For GC/MS analyses, this qualifier is used for a TIC, as well as, for a positively identified target compound.

E This qualifier identifies compounds whose concentrations exceed the calibration range of the instrument for that specific analysis.

D When applied, this qualifier identifies all compound concentrations reported from a secondary dilution analysis.

A This qualifier indicates that a TIC is a suspected aldol-condensation product.

N Indicates presumptive evidence of a compound. This qualifier is only used for GC/MS TICs, where the identification is based on a mass spectral library search. For generic characterization of a TIC, such as chlorinated hydrocarbon, the N qualifier is not used.

P When applied, this qualifier indicates a reported value from a GC analysis when there is greater than 25% difference for detected concentrations between the two GC columns.

TABLE 4-3. INORGANIC DATA QUALIFIERS

C ***(Concentration) qualifiers:***

B Reported value is less than the project-specified Reporting Limit (RL), but greater than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).

U Analyte analyzed for but not detected (concentration is less than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).

Q ***(Quality control) qualifiers:***

E Reported value is estimated because of presence of interference.

M Duplicate injection precision not met.

N Spiked sample recovery is not within control limits.

S Reported value is determined by the method of standard additions (MSA).

W Postdigestion spike for furnace Atomic Absorption Spectrophotometric (AAS) AAS analysis is out of control limits (85-115%) and sample absorbance is less than 50% of spike absorbance.

* Duplicate analyses is not within control limits.

\+ Correlation coefficient for MSA is less than 0.995.

M ***(Method) qualifiers:***

P Inductively Coupled Plasma (ICP)

A Flame AAS

F Furnace AAS

CV Cold Vapor AAS

AV Automated Cold Vapor AAS

AS Semiautomated Spectrophotometric

C Manual Spectrophotometric

T Titrimetric

NR Analyte is not required to be determined.

TABLE 4-4. PHYSICAL CHARACTERISTICS OF SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	MDL	PNS02REF	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
GRAVEL	%	--	2.3	11	0.7	0	0	0
SAND	%	--	33.6	64.2	51.9	40	30.3	88.1
SILT	%	--	32.4	14.8	24.3	22.1	29.2	3.3
CLAY	%	--	31.7	10	23.1	37.9	40.5	8.6
SILT+CLAY	%	--	64.1	24.8	47.4	60	69.7	11.9
% MOISTURE	%	0.1	255.5	89.1	158.7	204.5	97.5	42.9
% SOLIDS	%	--	32.5	51.4	35.3	33.1	49.2	62.1
SPECIFIC GRAVITY	G/ML	0.008	2.44	2.55	2.33	2.20	2.22	2.55

MDL = average method detection limit

TABLE 4-5. NUTRIENTS AND GENERAL CHEMISTRY PARAMETERS IN SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	MDL	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
AMMONIA, as N	MG/KG	4.6	**23.7**	**26**	**145**	**259**	**140**	**43.1**
NITROGEN, NITRATE as N	MG/KG	1.2	1.5 U	1 U	1.4 U	1.5 U	1 U	0.81 U
NITROGEN, NITRITE as N	MG/KG	1.0	0.29 U	1 U	1.4 U	1.5 U	1 U	0.81 U
NITROGEN, TOTAL KJELDAHL	MG/KG	109.8	**2,370**	**1,370 J**	**1,910 J**	**2,600 J**	**1,730 J**	**912 J**
TOTAL ORGANIC CARBON	%	0.02	**3.34**	**0.819**	**2.24**	**2.74**	**2.21**	**1.45**
TOTAL CYANIDE	MG/KG	0.2	**0.45 B J**	0.16 U	**0.93 B J**	**0.75 B J**	**0.44 B J**	**0.34 B J**
TOTAL PHOSPHORUS	MG/KG	41.0	**53.4**	**12.7 B**	**312**	**46.7**	**63.9**	**96.1**
SULFIDE	MG/KG	8.7	**91.6**	**93.2**	**180**	**360**	**94.4**	**115**

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
B = compound was detected, but below the reporting limit (value is estimated)
J = detected in the laboratory method blank
U = compound was analyzed, but not detected

TABLE 4-6. METAL CONCENTRATIONS (MG/KG) IN SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	TEL*	PEL*	MDL	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
ALUMINUM	MG/KG	--	--	4.26	**9,550**	**5,550**	**10,300**	**14,300**	**13,000**	**6,770**
ANTIMONY	MG/KG	--	--	0.82	0.79 U	**1.6 B**	0.81 U	0.87 U	**1 B**	0.89 U
ARSENIC	MG/KG	7.24	41.6	0.85	**8.4**	**8.6**	**12.7**	**13.8**	**14.5**	**7.6**
BERYLLIUM	MG/KG	--	--	0.85	0.78 U	0.92 U	0.85 U	**1.1 B**	**0.97 B**	0.9 U
CADMIUM	MG/KG	0.676	4.21	0.17	0.16 U	0.18 U	0.17 U	0.17 U	0.16 U	0.18 U
CHROMIUM	MG/KG	52.3	160.4	0.85	**22.7**	**21.1**	**32.3**	**37.1**	**36.5**	**19.3**
COBALT	MG/KG	--	--	0.15	**3.3**	**3.3**	**3.4**	**4.1**	**2.6**	**2.1**
COPPER	MG/KG	18.7	108.2	0.85	**6.6**	**339**	**18.9**	**12.8**	**8.5**	**7.9**
IRON	MG/KG	--	--	4.26	**17,300**	**29,000**	**19,000**	**24,400**	**27,100**	**12,100**
LEAD	MG/KG	30.24	112.18	0.85	**13.6**	**27.9**	**130**	**18**	**8.8**	**11.7**
MANGANESE	MG/KG	--	--	0.85	**170**	**165**	**324**	**455**	**220**	**189**
MERCURY	MG/KG	0.13	0.696	0.02	**0.05**	**0.07**	**0.2**	**0.06 B**	**0.03 B**	0.04 U
NICKEL	MG/KG	15.9	42.8	0.85	**6.2**	**4.7**	**8.6**	**11.4**	**10.9**	**6.3**
SELENIUM	MG/KG	--	--	0.43	0.39 U	0.46 U	**0.48 B**	0.42 U	0.41 U	0.45 U
SILVER	MG/KG	0.73	1.77	0.09	**0.1 B**	**0.18 B**	**0.13 B**	**0.14 B**	**0.09 B**	0.09 U
THALLIUM	MG/KG	--	--	0.09	0.08 U	0.09 U	0.09 U	**0.09 B**	**0.12 B**	0.09 U
TIN	MG/KG	--	--	0.14	**0.76 B**	**1.9 B**	**1.1 B**	**1.2 B**	**0.34 B**	**0.58 B**
ZINC	MG/KG	124	271	0.85	**34.8**	**52.9**	**120**	**46.3**	**28**	**25.3**
SEM/AVS	--	--	--	--	0.41	0.13	0.076	0.043	NA	0.11

***Source**: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
TEL = threshold effects level
PEL = probable effects level
B = compound was detected, but below the reporting limit (value is estimated)
U = compound was analyzed, but not detected
NA = the AVS concentration was not detected, therefore the SEM/AVS ratio was not calculated

TABLE 4-7. PAH CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	TEL*	PEL*	MDL	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
ACENAPHTHENE	UG/KG	6.71	88.9	1.4	**5.4 J**	**6.2 J**	**32**	1.1 U	0.75 U	**1.9 J**
ACENAPHTHYLENE	UG/KG	5.87	127.87	1.3	**4.8 J**	**9.6**	**59**	**2.7 J**	0.68 U	**1.1 J**
ANTHRACENE	UG/KG	46.85	245	1.4	**10**	**21**	**130**	**3.4 J**	0.68 U	**5.1 J**
BENZ(A)ANTHRACENE	UG/KG	74.83	692.53	1.4	**44**	**84**	**400**	**15**	0.68 U	**13**
BENZO(A)PYRENE	UG/KG	88.81	763.22	1.4	**58**	**79**	**460**	**20**	0.68 U	**13**
BENZO(B)FLUORANTHENE	UG/KG	--	--	1.9	**91**	**70**	**400**	1.4 U	0.91 U	**12**
BENZO(K)FLUORANTHENE	UG/KG	--	--	1.7	2.6 U	**52**	**290**	**25**	0.91 U	**9.3**
BENZO(GHI)PERYLENE	UG/KG	--	--	1.5	**53**	**49**	**360**	**19**	0.76 U	**11**
CHRYSENE	UG/KG	107.77	845.98	1.4	**52**	**90**	**430**	**18**	0.68 U	**15**
DIBENZ(A,H)ANTHRACENE	UG/KG	6.22	134.61	1.4	**19**	**26**	**130**	**6.5 J**	0.68 U	**4.1 J**
FLUORANTHENE	UG/KG	112.82	1493.54	1.4	**82**	**190**	**940**	**31**	0.68 U	**30**
FLUORENE	UG/KG	21.17	144.35	1.4	**4.1 J**	**9.5**	**45**	1.1 U	0.72 U	**2 J**
INDENO(1,2,3-CD)PYRENE	UG/KG	--	--	1.5	**43**	**49**	**300**	**15**	0.74 U	**8.8**
1-METHYLNAPHTHALENE	UG/KG	--	--	2.9	4.4 U	1.5 U	**7.3 J**	2.3 U	1.5 U	1.4 U
2-METHYLNAPHTHALENE	UG/KG	20.21	201.28	1.4	2.1 U	**1.7 J**	**8.7 J**	1.1 U	0.75 U	0.71 U
NAPHTHALENE	UG/KG	34.57	390.64	1.3	2 U	**3 J**	**19 J**	1.1 U	0.7 U	**1.3 J**
PHENANTHRENE	UG/KG	86.68	543.53	1.4	**39**	**97**	**390**	**11**	0.68 U	**17**
PYRENE	UG/KG	152.66	1397.6	2.0	**80**	**120**	**790**	**26**	0.97 U	**25**
TOTAL PAHs (ND=0)	UG/KG	1684.06	16770.4	--	**585.3**	**957**	**5,191**	**192.6**	0	**169.6**
TOTAL PAHs (ND=1/2DL)	UG/KG	1684.06	16770.4	--	**590.85**	**957.75**	**5,191**	**196.65**	7.08	**170.66**

**Source*: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
TEL = threshold effects level
PEL = probable effects level
J = compound was detected, but below the reporting limit (value is estimated)
U = compound was analyzed, but not detected

TABLE 4-8. PCB CONGENER CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	TEL**	PEL**	MDL	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
BZ# 8*	UG/KG	--	--	0.135	**0.21 J PG**	**0.42**	**0.47 J**	0.17 U	0.12 U	0.091 U
BZ# 18*	UG/KG	--	--	0.212	0.25 U	**0.33 J**	0.25 U	0.27 U	0.18 U	0.14 U
BZ# 28*	UG/KG	--	--	0.295	0.36 U	0.25 U	0.34 U	0.37 U	0.25 U	0.2 U
BZ# 44*	UG/KG	--	--	0.155	0.19 U	0.13 U	0.18 U	0.2 U	0.13 U	0.1 U
BZ# 49	UG/KG	--	--	0.093	**0.28 J**	**0.3 J**	**0.22 J**	0.12 U	0.078 U	0.062 U
BZ# 52*	UG/KG	--	--	0.165	0.2 U	**0.36**	0.19 U	0.21 U	0.14 U	0.11 U
BZ# 66*	UG/KG	--	--	0.213	0.26 U	**0.24 J**	0.25 U	0.27 U	0.18 U	0.14 U
BZ# 77*	UG/KG	--	--	0.160	0.19 U	0.13 U	0.19 U	0.2 U	0.14 U	0.11 U
BZ# 87	UG/KG	--	--	0.170	0.21 U	0.14 U	0.2 U	0.22 U	0.14 U	0.11 U
BZ# 101*	UG/KG	--	--	0.143	**0.25 J PG**	**0.2 J**	**0.32 J PG**	0.18 U	0.12 U	**0.098 J**
BZ# 105*	UG/KG	--	--	0.175	0.21 U	0.15 U	0.2 U	0.22 U	0.15 U	0.12 U
BZ# 118*	UG/KG	--	--	0.129	**0.22 J**	**0.18 J PG**	**0.2 J**	0.16 U	0.11 U	0.086 U
BZ# 126*	UG/KG	--	--	0.145	0.18 U	0.12 U	0.17 U	0.18 U	0.12 U	0.097 U
BZ# 128*	UG/KG	--	--	0.188	0.23 U	0.16 U	0.22 U	0.24 U	0.16 U	0.12 U
BZ# 138*	UG/KG	--	--	0.155	**0.19 J PG**	**0.45**	**0.26 J**	0.2 U	0.13 U	0.1 U
BZ# 153*	UG/KG	--	--	0.173	**0.41 J**	**0.6**	**0.28 J PG**	0.22 U	0.15 U	0.12 U
BZ# 156	UG/KG	--	--	0.175	0.21 U	0.15 U	0.2 U	0.22 U	0.15 U	0.12 U
BZ# 169*	UG/KG	--	--	0.225	0.27 U	0.19 U	0.26 U	0.29 U	0.19 U	0.15 U
BZ# 170*	UG/KG	--	--	0.113	0.14 U	**0.33 J**	0.13 U	0.14 U	0.097 U	0.076 U
BZ# 180*	UG/KG	--	--	0.096	0.12 U	**0.53**	**0.2 J PG**	0.12 U	0.082 U	0.065 U
BZ# 183	UG/KG	--	--	0.118	0.14 U	0.099 U	0.14 U	0.15 U	0.1 U	0.079 U
BZ# 184	UG/KG	--	--	0.101	0.12 U	0.083 U	0.12 U	0.13 U	0.084 U	0.066 U
BZ# 187*	UG/KG	--	--	0.198	0.24 U	**0.29 J**	0.23 U	0.25 U	0.17 U	0.13 U
BZ# 195	UG/KG	--	--	0.165	0.2 U	0.14 U	0.19 U	0.21 U	0.14 U	0.11 U
BZ# 206	UG/KG	--	--	0.097	0.12 U	0.082 U	0.11 U	0.12 U	0.083 U	0.066 U
BZ# 209	UG/KG	--	--	0.213	0.26 U	0.18 U	0.25 U	0.27 U	0.18 U	0.14 U
TOTAL PCBs (ND=0)	UG/KG	21.54	188.78	--	**2.56**	**7.86**	**3.46**	0	0	**0.196**
TOTAL PCBs (ND=1/2DL)	UG/KG	21.55	188.79	--	**5.4**	**8.99**	**6.07**	3.89	2.619	**2.151**

* PCB congeners used for Total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998)

***Source*: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

NOTE: Shaded and bold values represent detected concentrations.

MDL = average method detection limit

TEL = threshold effects level

PEL = probable effects level

PG = the percent difference between the original and confirmation analyses is greater than 40%

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 4-9. CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	TEL*	PEL*	MDL	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
4,4'-DDD	UG/KG	1.22	7.81	0.50	0.59 U	0.41 U	0.57 U	0.62 U	0.41 U	0.39 U
4,4'-DDE	UG/KG	2.07	374.17	0.16	0.18 U	0.13 U	0.18 U	0.19 U	0.13 U	0.12 U
4,4'-DDT	UG/KG	1.19	4.77	0.18	0.21 U	0.14 U	0.2 U	0.22 U	0.14 U	0.14 U
ALDRIN	UG/KG	--	--	0.19	0.22 U	0.15 U	0.21 U	0.23 U	0.16 U	0.15 U
ALPHA-BHC	UG/KG	--	--	0.14	0.17 U	0.12 U	0.16 U	0.18 U	0.12 U	0.11 U
BETA-BHC	UG/KG	--	--	0.21	0.25 U	0.17 U	0.24 U	0.26 U	0.18 U	0.17 U
CHLORDANE	UG/KG	2.26	4.79	0.87	1 U	0.71 U	0.99 U	1.1 U	0.72 U	0.68 U
CHLOROBENSIDE	UG/KG	--	--	0.48	0.57 U	0.39 U	0.55 U	0.6 U	0.4 U	0.38 U
DACHTAL	UG/KG	--	--	0.35	0.41 U	0.28 U	0.4 U	0.43 U	0.29 U	0.27 U
DELTA-BHC	UG/KG	--	--	0.14	0.16 U	0.11 U	0.15 U	0.17 U	0.11 U	0.11 U
DIELDRIN	UG/KG	0.715	4.3	0.15	0.18 U	0.12 U	0.17 U	0.19 U	0.13 U	0.12 U
ENDOSULFAN I	UG/KG	--	--	0.36	**6**	0.29 U	0.4 U	0.43 U	0.29 U	0.27 U
ENDOSULFAN II	UG/KG	--	--	0.20	**11**	**0.35 J**	0.22 U	0.24 U	**0.64 J**	0.15 U
ENDOSULFAN SULFATE	UG/KG	--	--	0.21	**0.97 J**	0.17 U	0.24 U	0.26 U	0.17 U	0.17 U
ENDRIN	UG/KG	--	--	0.16	0.19 U	**0.15 J PG**	0.18 U	0.2 U	0.13 U	0.12 U
ENDRIN ALDEHYDE	UG/KG	--	--	0.17	0.2 U	**1.3 J**	0.19 U	0.21 U	0.14 U	0.13 U
GAMMA-BHC	UG/KG	0.32	0.99	0.18	0.21 U	0.15 U	0.21 U	0.22 U	0.15 U	0.14 U
HEPTACHLOR	UG/KG	--	--	0.23	0.27 U	0.19 U	0.26 U	0.29 U	0.19 U	0.18 U
HEPTACHLOR EPOXIDE	UG/KG	--	--	0.15	0.18 U	0.12 U	0.17 U	0.19 U	0.12 U	0.12 U
METHOXYCHLOR	UG/KG	--	--	0.61	0.72 U	0.5 U	0.69 U	0.75 U	0.5 U	0.48 U
MIREX	UG/KG	--	--	0.16	0.18 U	0.13 U	0.18 U	0.19 U	0.13 U	0.12 U
TOXAPHENE	UG/KG	--	--	3.85	4.6 U	3.1 U	4.4 U	4.8 U	3.2 U	3 U

***Source**: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
TEL = threshold effects level
PEL = probable effects level
PG = percent difference between the original and confirmation analyses is greater than 40%
J = compound was detected, but below the reporting limit (value is estimated)
U = compound was analyzed, but not detected

TABLE 4-10. ORGANOPHOSPHORUS PESTICIDE CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	MDL	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
AZINPHOS METHYL	UG/KG	7.12	8.4 U	5.8 U	8.1 U	8.9 U	5.9 U	5.6 U
DEMETON	UG/KG	12.07	14 U	9.9 U	14 U	15 U	10 U	9.5 U
ETHYL PARATHION	UG/KG	6.92	8.2 U	5.7 U	7.9 U	8.6 U	5.7 U	5.4 U
MALATHION	UG/KG	7.85	9.3 U	6.4 U	9 U	9.7 U	6.5 U	6.2 U
METHYL PARATHION	UG/KG	5.98	7.1 U	4.9 U	6.8 U	7.4 U	5 U	4.7 U

There are no TEL and PEL values for the organophosphorus pesticides.

MDL = average method detection limit
U = compound was analyzed, but not detected

TABLE 4-11. SVOC CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	TEL*	PEL*	MDL	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
1,2,4-TRICHLOROBENZENE	UG/KG	--	--	43	50 U	35 U	49 U	53 U	35 U	33 U
1,2-DIPHENYLHYDRAZINE	UG/KG	--	--	35	42 U	29 U	40 U	44 U	29 U	28 U
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/KG	--	--	66	79 U	54 U	76 U	82 U	55 U	52 U
2,4,6-TRICHLOROPHENOL	UG/KG	--	--	29	34 U	23 U	33 U	35 U	24 U	22 U
2,4-DICHLOROPHENOL	UG/KG	--	--	43	50 U	35 U	49 U	53 U	35 U	33 U
2,4-DIMETHYLPHENOL	UG/KG	--	--	35	42 U	29 U	40 U	44 U	29 U	28 U
2,4-DINITROPHENOL	UG/KG	--	--	613	730 U	500 U	700 U	760 U	510 U	480 U
2,4-DINITROTOLUENE	UG/KG	--	--	37	44 U	30 U	42 U	46 U	30 U	29 U
2,6-DINITROTOLUENE	UG/KG	--	--	31	36 U	25 U	35 U	38 U	25 U	24 U
2-CHLORONAPHTHALENE	UG/KG	--	--	37	43 U	30 U	42 U	45 U	30 U	29 U
2-CHLOROPHENOL	UG/KG	--	--	70	83 U	58 U	80 U	87 U	58 U	55 U
2-METHYLPHENOL	UG/KG	--	--	60	71 U	49 U	69 U	75 U	50 U	47 U
2-NITROPHENOL	UG/KG	--	--	56	66 U	46 U	64 U	69 U	46 U	44 U
3,3'-DICHLOROBENZIDINE	UG/KG	--	--	24	29 U	20 U	28 U	30 U	20 U	19 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	--	--	26	31 U	21 U	30 U	33 U	22 U	21 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	--	--	34	40 U	28 U	39 U	42 U	28 U	27 U
4-CHLORO-3-METHYLPHENOL	UG/KG	--	--	35	41 U	28 U	40 U	43 U	29 U	27 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	--	--	28	33 U	23 U	32 U	35 U	23 U	22 U
4-METHYLPHENOL	UG/KG	--	--	91	110 U	75 U	100 U	110 U	76 U	72 U
4-NITROPHENOL	UG/KG	--	--	28	33 U	23 U	32 U	35 U	23 U	22 U
BENZOIC ACID	UG/KG	--	--	47	56 U	39 U	54 U	59 U	39 U	37 U
BENZYL ALCOHOL	UG/KG	--	--	120	140 U	97 U	140 U	150 U	98 U	93 U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	--	--	46	54 U	38 U	52 U	57 U	38 U	36 U
BIS(2-CHLOROETHYL) ETHER	UG/KG	--	--	47	55 U	38 U	53 U	58 U	39 U	37 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	182.16	2646.51	40	47 U	33 U	45 U	49 U	33 U	31 U
BUTYL BENZYL PHTHALATE	UG/KG	--	--	44	51 U	36 U	50 U	54 U	36 U	34 U
DI-N-BUTYL PHTHALATE	UG/KG	--	--	37	43 U	30 U	42 U	45 U	30 U	29 U
DI-N-OCTYL PHTHALATE	UG/KG	--	--	35	42 U	29 U	40 U	44 U	29 U	28 U
DIBENZOFURAN	UG/KG	--	--	38	45 U	31 U	44 U	48 U	32 U	30 U
DIETHYL PHTHALATE	UG/KG	--	--	38	44 U	31 U	43 U	47 U	31 U	29 U
DIMETHYL PHTHALATE	UG/KG	--	--	33	39 U	27 U	38 U	41 U	27 U	26 U
HEXACHLOROBENZENE	UG/KG	--	--	33	39 U	27 U	38 U	41 U	28 U	26 U
HEXACHLOROBUTADIENE	UG/KG	--	--	56	66 U	46 U	64 U	70 U	46 U	44 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	--	--	28	33 U	23 U	31 U	34 U	23 U	22 U
HEXACHLOROETHANE	UG/KG	--	--	56	66 U	46 U	64 U	70 U	47 U	44 U
ISOPHORONE	UG/KG	--	--	53	63 U	44 U	61 U	66 U	44 U	42 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	--	--	41	48 U	34 U	47 U	51 U	34 U	32 U
N-NITROSODIMETHYLAMINE	UG/KG	--	--	54	64 U	44 U	62 U	67 U	45 U	43 U
N-NITROSODIPHENYLAMINE	UG/KG	--	--	46	54 U	37 U	52 U	57 U	38 U	36 U
NITROBENZENE	UG/KG	--	--	51	60 U	42 U	58 U	63 U	42 U	40 U
PENTACHLOROPHENOL	UG/KG	--	--	28	33 U	23 U	32 U	35 U	23 U	22 U
PHENOL	UG/KG	--	--	45	53 U	37 U	51 U	55 U	37 U	35 U

**Source*: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
TEL = threshold effects level
PEL = probable effects level
U = compound was analyzed, but not detected

TABLE 4-12. BUTYLTIN CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	UNITS	RL	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
DIBUTYLTIN	UG/KG	3.18	4.5 U	2.4 U	3.7 U	3.8 U	2.6 U	2.1 U
MONOBUTYLTIN	UG/KG	2.42	3.4 U	1.8 U	2.8 U	2.9 U	2 U	1.6 U
TRIBUTYLTIN	UG/KG	3.67	5.2 U	2.7 U	4.3 U	4.4 U	3 U	2.4 U

There are no TEL and PEL values for the tested butyltins.

RL = average reporting limit
U = compound was analyzed, but not detected

TABLE 4-13. THEORETICAL BIOACCUMULATION POTENTIAL FOR PAHs IN TISSUE

ANALYTE	UNITS	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
	% TOC	3.34	0.819	2.24	2.74	2.21	1.45
ACENAPHTHENE	UG/KG	12.93	**60.6**	**114**	ND	ND	10.5
ACENAPHTHYLENE	UG/KG	11.50	**93.8**	**211**	7.88	ND	6.07
ANTHRACENE	UG/KG	23.95	**205**	**464**	9.93	ND	**28.1**
BENZ(A)ANTHRACENE	UG/KG	105.4	**821**	**1,429**	43.8	ND	71.7
BENZO(A)PYRENE	UG/KG	138.9	**772**	**1,643**	58.4	ND	71.7
BENZO(B)FLUORANTHENE	UG/KG	218.0	**684**	**1,429**	ND	ND	66.2
BENZO(GHI)PERYLENE	UG/KG	126.9	**479**	**1,286**	55.5	ND	60.7
BENZO(K)FLUORANTHENE	UG/KG	ND	**508**	**1,036**	**73.0**	ND	**51.3**
CHRYSENE	UG/KG	124.6	**879**	**1,536**	52.6	ND	82.8
DIBENZ(A,H)ANTHRACENE	UG/KG	45.51	**254**	**464**	19.0	ND	22.6
FLUORANTHENE	UG/KG	196.4	**1,856**	**3,357**	90.5	ND	166
FLUORENE	UG/KG	9.82	**92.8**	**161**	ND	ND	**11.0**
INDENO(1,2,3-CD)PYRENE	UG/KG	103.0	**479**	**1,071**	43.8	ND	48.55
1-METHYLNAPHTHALENE	UG/KG	ND	ND	**26.1**	ND	ND	**7.72**
2-METHYLNAPHTHALENE	UG/KG	ND	**16.6**	**31.1**	ND	ND	**3.92**
NAPHTHALENE	UG/KG	ND	**29.3**	**67.9**	ND	ND	**7.17**
PHENANTHRENE	UG/KG	93.41	**947**	**1,393**	32.1	ND	**93.8**
PYRENE	UG/KG	191.6	**1,172**	**2,821**	75.9	ND	137.9
TOTAL PAHs (ND=0)	UG/KG	2,770	**9,348**	**18,539**	562	0	936
TOTAL PAHs (ND=1/2DL)	UG/KG	2,783	**9,355**	**18,539**	574	NA	942

Values based on a two percent lipid content for tissue

NOTE: Shaded and bold values represent TBP values that exceed the reference site

NA = not applicable

ND = chemical constituent was not detected in the sediment sample, therefore the TBP value was not calculated

TABLE 4-14. THEORETICAL BIOACCUMULATION POTENTIAL FOR PCB CONGENERS IN TISSUE

ANALYTE	% TOC UNITS	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
		3.34	0.819	2.24	2.74	2.21	1.45
BZ# 8*	UG/KG	0.50	**4.10**	**1.68**	ND	ND	ND
BZ# 18*	UG/KG	ND	**3.22**	ND	ND	ND	ND
BZ# 28*	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 44*	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 49	UG/KG	0.67	**2.93**	**0.79**	ND	ND	ND
BZ# 52*	UG/KG	ND	**3.52**	ND	ND	ND	ND
BZ# 66*	UG/KG	ND	**2.34**	ND	ND	ND	ND
BZ# 77*	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 87	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 101*	UG/KG	0.60	**1.95**	**1.14**	ND	ND	0.54
BZ# 105*	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 118*	UG/KG	0.53	**1.76**	**0.71**	ND	ND	ND
BZ# 126*	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 128*	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 138*	UG/KG	0.46	**4.40**	**0.93**	ND	ND	ND
BZ# 153*	UG/KG	0.98	**5.86**	**1.00**	ND	ND	ND
BZ# 156	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 169*	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 170*	UG/KG	ND	**3.22**	ND	ND	ND	ND
BZ# 180*	UG/KG	ND	**5.18**	**0.71**	ND	ND	ND
BZ# 183	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 184	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 187*	UG/KG	ND	**2.83**	ND	ND	ND	ND
BZ# 195	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 206	UG/KG	ND	ND	ND	ND	ND	ND
BZ# 209	UG/KG	ND	ND	ND	ND	ND	ND
TOTAL PCBs (ND=0)	UG/KG	6.13	**76.8**	**12.4**	0	0	1.08
TOTAL PCBs (ND=1/2DL)	UG/KG	12.93	**87.8**	**21.7**	NA	NA	11.87

Values based on a two percent lipid content for tissue

* PCB congeners used for Total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998)

NOTE: Shaded and bold values represent TBP values that exceed the reference site

NA = not applicable

ND = chemical constituent was not detected in the sediment sample, therefore the TBP value was not calculated

TABLE 4-15. THEORETICAL BIOACCUMULATION POTENTIAL FOR CHLORINATED PESTICIDES IN TISSUE

ANALYTE	% TOC UNITS	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
		3.34	0.819	2.24	2.74	2.21	1.45
4,4'-DDD	UG/KG	ND	ND	ND	ND	ND	ND
4,4'-DDE	UG/KG	ND	ND	ND	ND	ND	ND
4,4'-DDT	UG/KG	ND	ND	ND	ND	ND	ND
ALDRIN	UG/KG	ND	ND	ND	ND	ND	ND
ALPHA-BHC	UG/KG	ND	ND	ND	ND	ND	ND
BETA-BHC	UG/KG	ND	ND	ND	ND	ND	ND
CHLORDANE	UG/KG	ND	ND	ND	ND	ND	ND
CHLOROBENSIDE	UG/KG	ND	ND	ND	ND	ND	ND
DCPA	UG/KG	ND	ND	ND	ND	ND	ND
DELTA-BHC	UG/KG	ND	ND	ND	ND	ND	ND
DIELDRIN	UG/KG	ND	ND	ND	ND	ND	ND
ENDOSULFAN I	UG/KG	14.4	ND	ND	ND	ND	ND
ENDOSULFAN II	UG/KG	26.3	3.42	ND	ND	2.32	ND
ENDOSULFAN SULFATE	UG/KG	2.32	ND	ND	ND	ND	ND
ENDRIN	UG/KG	ND	**1.47**	ND	ND	ND	ND
ENDRIN ALDEHYDE	UG/KG	ND	**12.7**	ND	ND	ND	ND
GAMMA-BHC	UG/KG	ND	ND	ND	ND	ND	ND
HEPTACHLOR	UG/KG	ND	ND	ND	ND	ND	ND
HEPTACHLOR EPOXIDE	UG/KG	ND	ND	ND	ND	ND	ND
METHOXYCHLOR	UG/KG	ND	ND	ND	ND	ND	ND
MIREX	UG/KG	ND	ND	ND	ND	ND	ND
TOXAPHENE	UG/KG	ND	ND	ND	ND	ND	ND

Values based on a two percent lipid content for tissue

NOTE: Shaded and bold values represent TBP values that exceed the reference site

ND = chemical constituent was not detected in the sediment sample, therefore the TBP value was not calculated

5. SITE WATER AND ELUTRIATE CHEMISTRY

For the Naval Station Pensacola turning basin project, five standard elutriates were prepared according to ITM guidelines to evaluate open water or ocean placement for the dredged sediments (Table 5-1). The procedure for preparing the elutriates and the analytical results from the elutriate chemical analyses are presented in this chapter.

5.1 MATERIALS AND METHODS

Approximately 40 gallons of site water was collected from location PNS02-04 for chemical analyses and the preparation of elutriates in the laboratory. Water collection and preservation techniques are described in Chapter 2.

5.1.1 Sample Receipt

Water samples targeted for chemical analysis (site water and equipment blanks) were shipped via overnight delivery to STL–Pittsburgh on the day of collection. The holding time for the site water samples and equipment blanks was initiated at the time of sample collection.

The elutriate preparation water was transported with the sediment cores from Pensacola, Florida to EA's Ecotoxiocology Laboratory facility in Sparks, Maryland via refrigeration truck cooled to 4°C. Upon receipt, the water samples were visually inspected and the water containers were compared against the COC record. Elutriate preparation water for the water column toxicity tests was delivered to EA's Ecotoxicology lab on 14 March 2002 and was stored in a walk-in refrigeration unit until testing. The remaining elutriate preparation water was hand-delivered to STL–Pittsburgh for elutriate preparation and subsequent chemical analysis.

Upon receipt at the analytical laboratory, the samples were checked against the COC, logged, and given a unique accession number. Samples were stored in walk-in refrigeration units (cooled to 4°C) following receipt and prior to analysis. The holding time for each elutriate was initiated at the completion of the elutriate generation process (Section 5.1.2). Copies of COC forms for the site water, equipment blanks, and elutriate samples are provided in Attachment B.

5.1.2 Elutriate Preparation

Elutriates, which simulate the potential release of dissolved chemical constituents during open water placement, were prepared for Naval Station Pensacola turning basin sediments. Elutriates were prepared following the Standard Elutriate Preparation specified in the ITM (USEPA/USACE 1998). A sediment/water mixture, at a 1:4 ratio of sediment to site water, was thoroughly mixed for 30 minutes. The mixture was allowed to settle, and the supernatant was siphoned off. The supernatant was filtered to remove particulates, and then analyzed for the dissolved chemical constituents specified in the Analytical Quality Assurance Project Plan (QAPP) (STL–Pittsburgh 2002). Elutriates were prepared using site water from one location (PNS02-04) and whole-core sediment composites from each location. Elutriate samples that

were created and tested for the Naval Station Pensacola turning basin project are summarized in Table 5-1.

5.1.3 Analytical Methods and Detection Limits

Site water, equipment blanks, and elutriates were analyzed for target analytes identified in the approved Analytical QAPP (STL–Pittsburgh 2002). Project-specific analytical methods and detection limits for aqueous samples are provided in Tables 3-1 and 3-3, respectively.

5.1.4 Comparison to USEPA Water Quality Criteria

Analytes detected in the full-strength elutriates were compared to USEPA saltwater acute and chronic aquatic life water quality criteria. Criteria were derived from USEPA's (1998) *National Recommended Water Quality Criteria* (63 *Federal Register* 68354 – 68364). Criteria for chemical constituents that were detected in the elutriate samples are provided in Table 5-2. The acute criterion is based on 1-hr average exposure concentrations, and the chronic criterion is based on 4-day average exposure concentrations.

5.1.5 Comparisons to Florida Surface Water Quality Criteria

Analytes detected in the full strength elutriates were also compared to the state of Florida's surface water quality criteria for Class III waters (Florida Administrative Code 62-302.530). Class III waters are subject to water quality criteria adopted to protect waters for the uses of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. Florida Class III surface water quality criteria values for chemical constituents detected in Naval Station Pensacola turning basin elutriates are provided in Table 5-3.

5.1.6 Calculations of Total PCBs and Total PAHs

For each individual water sample, total PCB concentrations were determined by summing the concentrations of the 18 summation congeners (as specified in Table 9-3 of the ITM) and multiplying the total by a factor of 2. Multiplying by a factor of 2 estimated the total PCB concentration and accounted for additional congeners that were not tested as part of this program. These determinations were based upon testing of specific congeners recommended in the ITM and upon the NOAA (1993) approach for total PCB determinations.

Total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs. For both the total PCB and total PAH concentrations, two values are reported, each representing the following methods for treating concentrations below the analytical detection limit:

- Non-detects = 0 (ND = 0)
- Non-detects = 1/2 of the detection limit (ND = 1/2DL)

Substituting one-half the detection limit for all non-detects (ND = 1/2DL) provides a conservative estimate of the non-detected concentration. This method, however, tends to

produce results that are biased high, especially in data sets where the majority of samples are non-detects. This overestimation is important to consider when comparing calculated total values to criterion.

5.2 SITE WATER CHEMISTRY

Results of the site water and elutriate chemical analyses are presented in Tables 5-4 through 5-11. Site water that was used for the preparation of elutriates was collected from PNS02-04. Elutriates were prepared for each of the five Naval Station Pensacola turning basin locations and the Pensacola Bay reference (PNSREF02) location. Definitions of organic and inorganic data qualifiers are presented in Tables 4-2 and 4-3. Copies of final raw data sheets (Form I's) and analytical narratives that include an evaluation of laboratory QA/QC results are provided in Attachment D (site water) and Attachment E (elutriates).

Only a few dissolved constituents were detected in the site water (elutriate preparation water) from the Naval Station Pensacola turning basin. None of the tested chlorinated pesticides, organophosphorus pesticides, PAHs, or SVOCs was detected. Overall, low concentrations of three PCB congeners and four metals (arsenic, copper, manganese, and tin) were detected in the Naval Station Pensacola turning basin site water. None of the detected constituents exceeded state or federal water quality standards.

5.3 ELUTRIATE CHEMISTRY

5.3.1 Nutrients and General Chemistry Parameters

Results of the analyses of nutrients and general chemistry parameters for the site water and elutriates are presented in Table 5-4. In the elutriates, concentrations of TOC ranged from 1.1 to 3 mg/L. Nitrate and nitrite were not detected in the elutriate samples. Total phosphorus concentrations in the elutriates ranged from 0.02 to 0.61 mg/L, and TKN (organic nitrogen + ammonia nitrogen) concentrations in the elutriates ranged from 2.3 to 28.3 mg/L.

Total cyanide concentrations ranged from 3 mg/L to 265 mg/L in the elutriate samples. Cyanide concentrations exceeded the USEPA acute (0.001 mg/L) and chronic (0.001 mg/L) criteria and the Florida surface water (1.0 mg/L) criterion at each location and also in the method blank. Cyanide was detected in the method blank and resulted in biased high concentrations detected in elutriate chemistry results. The method detection limit (MDL) was greater than the water quality criterion for cyanide.

The USEPA acute and chronic criteria for determining the toxicity of NH_3-N to aquatic life was calculated based on a salinity of 25 ppt, a temperature of 12°C, and pH of 8. NH_3-N was detected in each elutriate sample with concentrations ranging from 1.2 to 12.4 mg/L. Concentrations of NH_3-N exceeded the USEPA chronic (1.4 mg/L) criteria for aquatic life in four of the five elutriates (PNS02-01, PNS02-02, PNS02-03, and PNS02-04) from Naval Station Pensacola turning basin. The concentration of NH_3-N detected at PNS02-04 (12.4 mg/L) exceeded both the USEPA acute and chronic criteria for aquatic life.

ELUT. CHEM

A 2-fold dilution would be required to comply with the acute criterion at each location, and a 9-fold dilution would be required to comply with chronic criterion for NH_3-N at PNS02-04. These dilutions would occur rapidly in the water column after placement. The exact time and distance required to dilute the concentration below the criterion would be dependent upon the water column characteristics at the placement site.

5.3.2 Metals

Results of the metals analyses are presented in Table 5-5. Of the 18 tested metals, eleven were detected in elutriates from the Naval Station Pensacola turning basin. Metals were detected in 33 of 90 cases (37 percent).

The majority of metals detected in the elutriates were present in concentrations well below the established water quality criteria. At PNS02-01, copper concentrations (3.2 µg/L) exceeded the USEPA chronic criteria of 3.1 µg/L. Copper (5.6 µg/L) concentrations exceeded the USEPA acute (4.8 µg/L) and chronic (3.1 µg/L) criteria, and the State of Florida surface water quality criteria of 3.7 µg/L at PNS02-03. A 2-fold dilution would be sufficient to reduce the metals concentrations below the criteria in the water column.

5.3.3 Polynuclear Aromatic Hydrocarbons (PAHs)

Results of the PAH analyses are presented in Table 5-6. Of the 18 tested PAHs, one was detected in the elutriate samples. The only detected PAH (acenaphthene), was found at low concentrations (0.04 µg/L) in the elutriate from location PNS02-02. This concentration was well below the Florida surface water quality criteria of 2,700 µg/L for acenaphthene.

The total PAH concentration (ND=1/2DL) at PNS02-02 (the only location were PAHs were detected) was 0.3145 µg/L. Total PAH concentrations (ND=1/2DL) exceeded the Florida surface water quality criteria of 0.03 µg/L by a factor of approximately 10. A 10-fold dilution would be sufficient to reduce the PAH concentrations below the criteria in the water column.

5.3.4 PCB Congeners

Results of the PCB congener analyses are presented in Table 5-7. Of the 26 tested individual PCB congeners only one, BZ#8, was detected in the Naval Station Pensacola turning basin elutriates. PCB congener BZ#8 was detected in low concentrations at all five locations. Total PCB concentrations (ND=1/2DL) ranged from 7.74 to 17.12 ng/L, below the State of Florida surface water quality criteria of 30 ng/L.

The elutriate from the reference site had total PCB concentrations (ND=1/2DL) of 10.21 ng/L. Concentrations for total PCBs were well below the Florida surface water quality criteria of 30 ng/L.

5.3.5 Chlorinated and Organophosphorus Pesticides

Results of the chlorinated pesticide and organophosphorus pesticide analyses are presented in Tables 5-8 and 5-9, respectively. Of the 22 tested chlorinated pesticides, none were detected in the Naval Station Pensacola turning basin elutriates and only two were detected in the reference elutriate.

In the reference site elutriate, the two detected chlorinated pesticides (endosulfan I and endosulfan II) had concentrations of 0.026 µg/L and 0.018 µg/L, respectively, exceeding the USEPA chronic criteria of 0.0087 µg/L and the State of Florida surface water criteria of 0.0087 µg/L.

None of the five tested organophosphorus pesticides was detected in either the Naval Station Pensacola turning basin elutriate samples or the elutriate from the Pensacola Bay reference location.

5.3.6 Semivolatile Organic Compounds (SVOCs)

Results of the SVOC analyses are presented in Table 5-10. Of the 45 SVOCs tested, only one, bis(2-ethylhexyl)phthalate, was detected in the Naval Station Pensacola turning basin elutriates. SVOCs were detected in only 4 of 225 cases (2 percent), and in all cases the individual SVOC was also detected in the laboratory method blank. Phthalates are a common laboratory contaminant.

5.3.7 Butyltins

Results of the butyltin analyses are presented in Table 5-11. Of the three tested butyltins, none was detected in the Naval Station Pensacola turning basin elutriates.

5.4 SUMMARY

Site water chemistry indicated that few chemical constituents were detected in the site water from Naval Station Pensacola turning basin. Of the 145 tested constituents, eleven (8 percent) were detected at low concentrations in the site water that was used to prepare the elutriates. Overall, low concentrations of three PCB congeners and four metals (arsenic, copper, manganese, and tin) were detected in the Naval Station Pensacola turning basin site water. None of the tested chlorinated pesticides, organophosphorus pesticides, PAHs, SVOCs, or butyltins were detected.

Only 20 of 145 chemical constituents (14 percent) were detected in the full strength elutriates from Naval Station Pensacola turning basin. In the elutriates, nutrients and metals were the most frequently detected constituents. Comparisons to water quality criteria for copper indicated that a maximum 2-fold dilution of the full strength elutriate would be required to comply with the acute and chronic water quality criteria. A maximum 9-fold dilution would be required to comply with the acute and chronic water quality criterion for NH_3-N. Results of the STFATE modeling indicated that a dilution of approximately 208-fold within the first hour exceeds the

What was inputs?
LAST MODEL SHOWED 55-fold (1 hr) & 950-fold (4 hr)

dilution to meet the acute and chronic water quality criteria for ammonia; therefore, the NH_3-N concentration detected in the elutriate meets the limiting permissible concentration (LPC) for ocean placement at the Pensacola offshore Ocean Dredged Material Disposal Site (ODMDS).

Results of the elutriate tests indicate that few inorganic and organic constituents would be expected to be released in dissolved form into the water column during open water placement. Based on the STFATE modeling, concentrations of the few constituents that could be released would quickly dissipate in the water column to concentrations below USEPA and State of Florida water quality criteria for aquatic life (Appendix H).

TABLE 5-1. SUMMARY OF NAVAL STATION PENSACOLA TURNING BASIN ELUTRIATE SAMPLES SUBMITTED FOR ANALYTICAL TESTING

Sediment Sample ID	Elutriate Preparation Water ID	Elutriate ID
PNS02-01-SED	PNS02-04-SW	PNS02-01-EL
PNS02-02-SED	PNS02-04-SW	PNS02-02-EL
PNS02-03-SED	PNS02-04-SW	PNS02-03-EL
PNS02-04-SED	PNS02-04-SW	PNS02-04-EL
PNS02-05-SED	PNS02-04-SW	PNS02-05-EL

TABLE 5-2. USEPA WATER QUALITY CRITERIA*

ANALYTE	UNITS	SALTWATER CRITERIA	
		ACUTE [a]	CHRONIC [b]
NUTRIENTS			
NITROGEN, AMMONIA	MG/L	9.42 [c]	1.41 [c]
METALS			
ALUMINUM**	UG/L		
ANTIMONY**	UG/L		
ARSENIC	UG/L	69 [d]	36 [d]
BERYLLIUM**	UG/L		
CHROMIUM	UG/L	1,100 [e]	50 [e]
COBALT**	UG/L		
COPPER	UG/L	4.8 [f]	3.1 [f]
IRON**	UG/L		
LEAD	UG/L	210 [g]	8.1 [g]
MANGANESE	UG/L		100
MERCURY	UG/L	1.8 [h]	0.94 [h]
NICKEL	UG/L	74 [j]	8.2 [j]
SILVER		1.9 [k]	
ZINC	UG/L	90 [l]	81 [l]
CHLORINATED PESTICIDES			
ENDOSULFAN I	UG/L	0.034	0.0087
ENDOSULFAN II	UG/L	0.034	0.0087
PCBs			
TOTAL PCBs**	UG/L		

Source: USEPA 1998 [63 Federal Register 68354-68364]
*water quality criteria (for saltwater) presented only for those chemical constituents detected in Naval Station Pensacola turning basin elutriate samples
**no USEPA acute or chronic saltwater quality criterion exists

Superscripts:
a = acute aquatic life criteria based on 1-hour average exposure concentrations
b = chronic aquatic life criteria based on 4-day average exposure concentrations
c = total ammonia as nitrogen; assume salinity=25 ppt, water temperature=12 C, and pH=8.0
d = total dissolved arsenic
e = dissolved hexavalent chromium
f = dissolved copper
g = dissolved lead
h = dissolved total mercury
j = dissolved nickel
k = dissolved silver
l = dissolved zinc

TABLE 5-3. FLORIDA SURFACE WATER QUALITY* STANDARDS

ANALYTE	UNITS	CLASS III CRITERIA [a]	COMMENTS [b]
GENERAL CHEMISTRY			
CYANIDE	UG/L	1	
METALS			
ALUMINUM	UG/L	1500	
ANTIMONY	UG/L	4300	
ARSENIC	UG/L	50	TOTAL
BERYLLIUM	UG/L	0.13	ANNUAL AVERAGE
CADMIUM	UG/L	9.3	
CHROMIUM	UG/L	50	HEXAVALENT
COBALT**	UG/L	--	
COPPER	UG/L	3.7	
IRON	UG/L	300	
LEAD	UG/L	8.5	
MANGANESE**	UG/L	--	
MERCURY	UG/L	0.025	
NICKEL	UG/L	8.3	
SELENIUM	UG/L	71	
SILVER**	UG/L	--	
ZINC	UG/L	86	
PESTICIDES			
4',4'-DDT	UG/L	0.001	MAXIMUM
ALDRIN	UG/L	1.3	MAXIMUM
BETA-BHC	UG/L	0.046	ANNUAL AVERAGE
CHLORDANE	UG/L	0.004	MAXIMUM
DIELDRIN	UG/L	0.0019	MAXIMUM
ENDOSULFAN I	UG/L	0.0087	
ENDOSULFAN II	UG/L	0.0087	
ENDRIN	UG/L	0.0023	
GAMMA-BHC	UG/L	0.16	MAXIMUM
HEPTACHLOR	UG/L	0.0036	MAXIMUM
METHOXYCHLOR	UG/L	0.03	
MIREX	UG/L	0.001	
TOXAPHENE	UG/L	0.0002	
AZINOPHOS METHYL	UG/L	0.01	
DEMETON	UG/L	0.1	
MALATHION	UG/L	0.1	
PARATHION	UG/L	0.04	
SVOCs			
2-CHLOROPHENOL	UG/L	400	
2,4-DICHLOROPHENOL	UG/L	790	
2,4-DINITROPHENOL	UG/L	14260	
2,4-DINITROTOLUENE	UG/L	9.1	ANNUAL AVERAGE
HEXACHLOROBUTADIENE	UG/L	49.7	ANNUAL AVERAGE
PENTACHLOROPHENOL	UG/L	7.9	
PHENOL	UG/L	300	
2,4,6-TRICHLOROPHENOL	UG/L	6.5	ANNUAL AVERAGE
PAHs			
ACENAPHTHENE	UG/L	2700	HUMAN HEALTH
ANTHRACENE	UG/L	110,000	HUMAN HEALTH
FLUORANTHENE	UG/L	370	HUMAN HEALTH
FLUORENE	UG/L	14,000	HUMAN HEALTH
PYRENE	UG/L	11,000	HUMAN HEALTH
TOTAL PAHs	UG/L	0.031	ANNUAL AVERAGE
PCBs			
TOTAL PCBs	UG/L	0.03	MAXIMUM

Source: Florida Administrative Code 62-302.530

*FL surface water criteria presented only for those chemical constituents analyzed in Naval Station Pensacola Turning Basin elutriate samples

**no FL surface water quality criteria exist

a Naval Station Pensacola Turning Basin is classified as a Class III waterway, meaning that surface water quality criteria for the recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife apply.

b *Annual average* means the maximum concentration at the average annual flow conditions.

Maximum means the maximum not to be exceeded at any time.

Human health indicates that the criteria are protective of human health, not aquatic life

TABLE 5-4. NUTRIENTS AND GENERAL CHEMISTRY PARAMETERS OF SITE WATER AND ELUTRIATES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	USEPA ACUTE CRITERIA*	USEPA CHRONIC CRITERIA*	FLORIDA SURFACE WATER*	UNITS	MDL	PNS02-04-SW	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
AMMONIA, as N[(a)]	9.42	1.41	--	MG/L	1.254	0.037 U	**0.12**	**1.8**	**2.5**	**8.6**	**12.4**	**1.2**
NITROGEN, NITRATE AS N	--	--	--	MG/L	0.5	**0.46**	**0.36**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NITROGEN, NITRITE AS N	--	--	--	MG/L	0.5	0.005 U	0.005 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NITROGEN, TOTAL KJELDAHL	--	--	--	MG/L	0.62	**1.1**	**1.7**	**4**	**19.8**	**28.3**	**11.3**	**2.3**
CYANIDE, TOTAL	0.001	0.001	1	UG/L	1.6	**4 B J**	**2 B J**	**4 B J**	**265 J**	1.6 U	**3 B J**	**4 B J**
CARBON, TOTAL ORGANIC	--	--	--	MG/L	0.16	0.22 U	0.22 U	**1**	**1.9**	**1.9**	**3**	**1.2**
PHOSPHORUS, TOTAL	--	--	--	MG/L	0.011	0.011 U	0.011 U	**0.015 B**	0.011 U	**0.052 B**	**0.61**	**0.049 B**
SULFIDE	--	--	--	MG/L	0.5	**2.5**	**2.5**	0.5 U	**2.1**	**12.8**	0.5 U	**11.4**

**Sources* : USEPA 1999 [63 Federal Register 68354-68364] and Florida Administrative Code 62-302.530
(a) based on salinity=25 ppt, water temperatute=12 C, and pH=8.

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
B = compound was detected, but below the reporting limit (value is estimated)
J = detected in the laboratory method blank
U = compound was analyzed, but not detected

TABLE 5-5. METAL CONCENTRATIONS (UG/L) IN SITE WATER AND ELUTRIATES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	USEPA ACUTE CRITERIA*	USEPA CHRONIC CRITERIA*	FLORIDA SURFACE WATER*	UNITS	MDL	PNS02-04-SW	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
ALUMINUM	--	--	1,500	UG/L	20	20 UN	20 UN	20 UN	20 UN	20 UN	**97 N**	20 UN
ANTIMONY	--	--	4,300	UG/L	0.6	0.6 U	0.6 U	**10.7**	**2.2 B**	**1.1 B**	**0.72 B**	**1.4 B**
ARSENIC	69	36	50	UG/L	0.2	**3**	**1.4**	**2.8**	**5.1**	**5.1**	**21.2**	**3.9**
BERYLLIUM	--	--	0.13	UG/L	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CADMIUM	42	9.3	9.3	UG/L	1.5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
CHROMIUM	1,100	50	50	UG/L	0.5	1.5 U	**0.99 B**	**0.71 B**	**0.9 B**	**1.1**	**2.4**	**1.1**
COBALT	--	--	--	UG/L	2	2 U	2 U	**3.6 B**	2 U	2 U	2 U	2 U
COPPER	4.8	3.1	3.7	UG/L	1	**1.5**	**3.5**	**3.2**	**1.4**	**5.6**	**1.3**	**1.4**
IRON	--	--	300	UG/L	15	15 U	**61.7**	**57.5**	15 U	15 U	**91.5**	15 U
LEAD	210	8.1	8.5	UG/L	0.6	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
MANGANESE	--	--	--	UG/L	1	**3.5**	**6.2**	**7**	**32.5**	**58.2**	**10.2**	**27**
MERCURY	1.8	0.94	0.025	UG/L	0.1	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
NICKEL	74	8.2	8.3	UG/L	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SELENIUM	290	71	71	UG/L	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SILVER	1.9	--	--	UG/L	0.6	0.6 U	**1.8 B**	**0.8 B**	0.6 U	0.6 U	0.6 U	0.6 U
THALLIUM	--	--	6.3	UG/L	0.6	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
TIN	--	--	--	UG/L	0.6	**0.66 B**	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	**0.61 B**
ZINC	90	81	86	UG/L	5	5 U	**11.4**	5 U	**8**	5 U	5 U	**6.2**

**Sources* : USEPA 1999 [63 Federal Register 68354-68364] and Florida Administrative Code 62-302.530

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
B = compound was detected, but below the reporting limit (value is estimated)
N = spiked sample recovery is not within control limits
U = compound was analyzed, but not detected

TABLE 5-6. PAH CONCENTRATIONS (UG/L) IN SITE WATER AND ELUTRIATES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	FLORIDA SURFACE WATER*	UNITS	MDL	PNS02-04-SW	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
ACENAPHTHENE	2,700	UG/L	0.038	0.038 U	0.038 U	0.038 U	**0.04 J**	0.038 U	0.038 U	0.038 U
ACENAPHTHYLENE	--	UG/L	0.035	0.035 U	0.035 U	0.035 U	0.035 U	0.035 U	0.035 U	0.035 U
ANTHRACENE	110,000	UG/L	0.025	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
BENZO(A)ANTHRACENE	--	UG/L	0.022	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U
BENZO(A)PYRENE	--	UG/L	0.025	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
BENZO(B)FLUORANTHENE	--	UG/L	0.025	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
BENZO(K)FLUORANTHENE	--	UG/L	0.02	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
BENZO(GHI)PERYLENE	--	UG/L	0.03	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
CHRYSENE	--	UG/L	0.017	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U
DIBENZO(A,H)ANTHRACENE	--	UG/L	0.031	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U
FLUORANTHENE	370	UG/L	0.031	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U
FLUORENE	14,000	UG/L	0.036	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U	0.036 U
INDENO(1,2,3-CD)PYRENE	--	UG/L	0.025	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
1-METHYLNAPHTHALENE	--	UG/L	0.084	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U	0.084 U
2-METHYLNAPHTHALENE	--	UG/L	0.05	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
NAPHTHALENE	--	UG/L	0.038	0.038 U	0.038 U	0.038 U	0.038 U	0.038 U	0.038 U	0.038 U
PHENANTHRENE	--	UG/L	0.031	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U
PYRENE	11,000	UG/L	0.024	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U
TOTAL PAHs (ND=0)	0.031	UG/L	--	0	0	0	**0.04**	0	0	0
TOTAL PAHs (ND=1/2DL)	0.031	UG/L	--	0.587	0.2935	0.2935	**0.3145**	0.2935	0.2935	0.2935

**Source*: Florida Administrative Code 62-302.530

There are no USEPA saltwater acute or chronic criteria for aquatic life for the tested PAHs or total PAH concentrations.

NOTE: Shaded and bold values represent detected concentrations.

MDL = average method detection limit

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 5-7. PCB CONGENER CONCENTRATIONS (NG/L) IN SITE WATER AND ELUTRIATES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	FLORIDA SURFACE WATER*	UNITS	MDL	PNS02-04-SW	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
BZ# 8*	--	NG/L	0.36	0.38 U	0.36 U	**0.39 J PG**	**0.89 J**	**0.56 J PG**	**1.3**	**0.85 J**
BZ# 18*	--	NG/L	0.32	0.38 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
BZ# 28*	--	NG/L	0.41	0.44 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
BZ# 44*	--	NG/L	0.43	**0.47 J PG**	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
BZ# 49	--	NG/L	0.43	0.28 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
BZ# 52*	--	NG/L	0.41	0.43 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
BZ# 66*	--	NG/L	0.43	0.48 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
BZ# 77*	--	NG/L	0.4	0.48 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BZ# 87	--	NG/L	0.34	0.43 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
BZ# 101*	--	NG/L	0.4	0.48 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BZ# 105*	--	NG/L	0.37	0.47 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
BZ# 118*	--	NG/L	0.44	0.49 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U
BZ# 126*	--	NG/L	0.47	0.32 U	**0.81 J PG**	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U
BZ# 128*	--	NG/L	0.38	0.5 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
BZ# 138*	--	NG/L	0.38	0.49 U	**0.64 J PG**	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
BZ# 153*	--	NG/L	0.39	0.46 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
BZ# 156	--	NG/L	0.4	0.44 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BZ# 169*	--	NG/L	0.43	0.24 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U	0.43 U
BZ# 170*	--	NG/L	0.45	0.23 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
BZ# 180*	--	NG/L	0.46	0.29 U	**0.65 J PG**	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
BZ# 183	--	NG/L	0.34	0.5 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
BZ# 184	--	NG/L	0.44	0.23 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U
BZ# 187*	--	NG/L	0.39	**0.53 J PG**	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
BZ# 195	--	NG/L	0.42	0.29 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
BZ# 206	--	NG/L	0.47	**0.52 J PG**	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U
BZ# 209	--	NG/L	0.46	0.26 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
TOTAL PCBs (ND=0)	30	NG/L	--	**4**	**4.2**	**0.78**	**1.78**	**1.12**	**2.6**	**1.7**
TOTAL PCBs (ND=1/2DL)	30	NG/L	--	**17.12**	**10.21**	**7.74**	**8.74**	**8.08**	**9.56**	**8.66**

***Source:* Florida Administrative Code 62-302.530

* PCB congeners used for Total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998)

There are no USEPA saltwater acute or chronic criteria for aquatic life for the tested PCB congeners or total PCB concentrations.

NOTE: Shaded and bold values represent detected concentrations.

MDL = average method detection limit

PG = the percent difference between the original and confirmation analyses is greater than 40%

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 5-8. CHLORINATED PESTICIDE CONCENTRATIONS (UG/L) IN SITE WATER AND ELUTRIATES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	USEPA ACUTE CRITERIA*	USEPA CHRONIC CRITERIA*	FLORIDA SURFACE WATER*	UNITS	MDL	PNS02-04-SW	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
4,4'-DDD	--	--	--	UG/L	0.002	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
4,4'-DDE	--	--	--	UG/L	0.0009	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U
4,4'-DDT	0.13	0.001	0.001	UG/L	0.0009	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U
ALDRIN	1.3	--	1.3	UG/L	0.0013	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U
ALPHA-BHC	--	--	--	UG/L	0.0012	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U
BETA-BHC	--	--	0.046	UG/L	0.0018	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U
CHLORDANE	--	--	0.004	UG/L	0.01	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
CHLOROBENSIDE	--	--	--	UG/L	0.0034	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U
DACHTAL	--	--	--	UG/L	0.0013	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U
DELTA-BHC	--	--	--	UG/L	0.00065	0.00065 U	0.00065 U	0.00065 U	0.00065 U	0.00065 U	0.00065 U	0.00065 U
DIELDRIN	0.71	0.0019	0.0019	UG/L	0.0015	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U
ENDOSULFAN I	0.034	0.0087	0.0087	UG/L	0.002	0.002 U	**0.026**	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
ENDOSULFAN II	0.034	0.0087	0.0087	UG/L	0.0015	0.0015 U	**0.018**	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U
ENDOSULFAN SULFATE	--	--	--	UG/L	0.0012	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U
ENDRIN	0.037	0.0023	0.0023	UG/L	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U
ENDRIN ALDEHYDE	--	--	--	UG/L	0.00084	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U
GAMMA-BHC	0.16	--	0.16	UG/L	0.0013	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U
HEPTACHLOR	0.053	0.0036	0.0036	UG/L	0.0015	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U
HEPTACHLOR EPOXIDE	0.053	0.0036	--	UG/L	0.00072	0.00072 U	0.00072 U	0.00072 U	0.00072 U	0.00072 U	0.00072 U	0.00072 U
METHOXYCHLOR	--	0.03	0.03	UG/L	0.0023	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.0023 U	0.0023 U
MIREX	--	0.001	0.001	UG/L	0.00064	0.00064 U	0.00064 U	0.00064 U	0.00064 U	0.00064 U	0.00064 U	0.00064 U
TOXAPHENE	0.21	0.0002	0.0002	UG/L	0.033	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U

**Sources*: USEPA 1999 [63 Federal Register 68354-68364] and Florida Administrative Code 62-302.530

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
U = compound was analyzed, but not detected

TABLE 5-9. ORGANOPHOSPHORUS PESTICIDE CONCENTRATIONS (UG/L) IN SITE WATER AND ELUTRIATES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	USEPA ACUTE CRITERIA*	USEPA CHRONIC CRITERIA*	FLORIDA SURFACE WATER*	UNITS	MDL	PNS02-04-SW	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
AZINPHOS-METHYL	--	0.1	0.01	UG/L	0.36	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U
DEMETON (TOTAL)	--	0.1	0.1	UG/L	0.53	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
ETHYL PARATHION	--	--	0.04	UG/L	0.53	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
MALATHION	--	0.1	0.1	UG/L	0.4	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL PARATHION	--	--	--	UG/L	0.27	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U

**Sources* : USEPA 1999 [63 Federal Register 68354-68364] and Florida Administrative Code 62-302.530
There are no USEPA saltwater acute criteria for aquatic life for the tested organophosphorus pesticides.

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
U = compound was analyzed, but not detected

TABLE 5-10. SVOC CONCENTRATIONS (UG/L) IN SITE WATER AND ELUTRIATES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	USEPA ACUTE CRITERIA*	USEPA CHRONIC CRITERIA*	FLORIDA SURFACE WATER*	UNITS	MDL	PNS02-04-SW	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
1,2,4-TRICHLOROBENZENE	--	--	--	UG/L	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
1,2-DICHLOROBENZENE	--	--	--	UG/L	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
1,2-DIPHENYLHYDRAZINE	--	--	--	UG/L	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
1,3-DICHLOROBENZENE	--	--	--	UG/L	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
1,4-DICHLOROBENZENE	--	--	--	UG/L	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
2,2'-OXYBIS(1-CHLOROPROPANE)	--	--	--	UG/L	1.7	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U
2,4,6-TRICHLOROPHENOL	--	--	6.5	UG/L	1.5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
2,4-DICHLOROPHENOL	--	--	790	UG/L	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
2,4-DIMETHYLPHENOL	--	--	--	UG/L	1.8	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
2,4-DINITROPHENOL	--	--	1426	UG/L	1.6	1.6 U	1.6 U	15 U	15 U	15 U	15 U	15 U
2,4-DINITROTOLUENE	--	--	9.1	UG/L	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
2,6-DINITROTOLUENE	--	--	--	UG/L	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
2-CHLORONAPHTHALENE	--	--	--	UG/L	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
2-CHLOROPHENOL	--	--	400	UG/L	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
2-METHYLPHENOL	--	--	--	UG/L	1.5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
2-NITROPHENOL	--	--	--	UG/L	3	3 U	3 U	3 U	3 U	3 U	3 U	3 U
3,3'-DICHLOROBENZIDINE	--	--	--	UG/L	3.9	3.9 U	3.9 U	25 U	25 U	25 U	25 U	25 U
4,6-DINITRO-2-METHYLPHENOL	--	--	--	UG/L	1.4	1.4 U	1.4 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
4-BROMOPHENYL PHENYL ETHER	--	--	--	UG/L	1.2	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
4-CHLORO-3-METHYLPHENOL	--	--	--	UG/L	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
4-CHLOROPHENYL PHENYL ETHER	--	--	--	UG/L	1.6	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
4-METHYLPHENOL	--	--	--	UG/L	3.5	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U
4-NITROPHENOL	--	--	--	UG/L	1.8	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
BENZOIC ACID	--	--	--	UG/L	2.1	2.1 U	2.1 U	39 U	39 U	39 U	39 U	39 U
BENZYL ALCOHOL	--	--	--	UG/L	1.9	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
BIS(2-CHLOROETHOXY)METHANE	--	--	--	UG/L	3.4	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
BIS(2-CHLOROETHYL) ETHER	--	--	--	UG/L	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	--	--	--	UG/L	0.91	0.91 U	0.91 U	0.91 U	**3.2 J B**	**1.7 J B**	**3.8 J B**	**3.8 J B**
BUTYL BENZYL PHTHALATE	--	--	--	UG/L	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U
DIBENZOFURAN	--	--	--	UG/L	1.5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
DIETHYL PHTHALATE	--	--	--	UG/L	1.1	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
DIMETHYL PHTHALATE	--	--	--	UG/L	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
DI-N-BUTYL PHTHALATE	--	--	--	UG/L	1.1	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
DI-N-OCTYL PHTHALATE	--	--	--	UG/L	0.95	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U
HEXACHLOROBENZENE	--	--	--	UG/L	0.00059	0.00059 U	0.00059 U	0.00059 U	0.00059 U	0.00059 U	0.00059 U	0.00059 U
HEXACHLOROBUTADIENE	--	--	49.7	UG/L	1.5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
HEXACHLOROCYCLOPENTADIENE	--	--	--	UG/L	6.3	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U
HEXACHLOROETHANE	--	--	--	UG/L	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
ISOPHORONE	--	--	--	UG/L	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
NITROBENZENE	--	--	--	UG/L	1.5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
N-NITROSODIMETHYLAMINE	--	--	--	UG/L	1.7	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U
N-NITROSODI-N-PROPYLAMINE	--	--	--	UG/L	1.5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
N-NITROSODIPHENYLAMINE	--	--	--	UG/L	4.2	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U
PENTACHLOROPHENOL	13	7.9	7.9	UG/L	0.82	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U
PHENOL	--	--	0.3	UG/L	2	2 U	2 U	2 U	2 U	2 U	2 U	2 U

Sources : USEPA 1999 [63 Federal Register 68354-68364] and Florida Administrative Code 62-302.530

NOTE: Shaded and bold values represent detected concentrations.
MDL = average method detection limit
B = detected in the laboratory method blank
J = compound was detected, but below the reporting limit (value is estimated)
U = compound was analyzed, but not detected

TABLE 5-11. BUTYLTIN CONCENTRATIONS (UG/L) IN SITE WATER AND ELUTRIATES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA (MARCH 2002)

ANALYTE	USEPA ACUTE CRITERIA*	USEPA CHRONIC CRITERIA*	FLORIDA SURFACE WATER*	UNITS	RL	PNS02-04-SW	PNSREF02	PNS02-01	PNS02-02	PNS02-03	PNS02-04	PNS02-05
DIBUTYLTIN	--	--	--	UG/L	0.0384	0.038 U	0.038 U	0.038 U	0.038 U	0.038 U	0.039 U	0.039 U
MONOBUTYLTIN	--	--	--	UG/L	0.031	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U
TRIBUTYLTIN	0.37	0.01	--	UG/L	0.0444	0.044 U	0.044 U	0.044 U	0.044 U	0.044 U	0.045 U	0.045 U

**Sources*: USEPA 1999 [63 Federal Register 68354-68364] and Florida Administrative Code 62-302.530

NOTE: Shaded and bold values represent detected concentrations.
RL = average reporting limit
U = compound was analyzed, but not detected

6. TOXICITY TESTING

EA's Ecotoxicology Laboratory performed water column and whole-sediment bioassay testing on sediment samples collected from the Naval Station Pensacola turning basin and from the reference site in Pensacola Bay. The toxicity testing program consisted of: acute water column bioassays with *Arbacia punctulata* (purple sea urchin), *Americamysis bahia* (opossum shrimp, formerly known as *Mysidopsis bahia*), and *Cyprinodon variegatus* (sheepshead minnow); 10-day whole-sediment bioassays with *Neanthes arenaceodentata* (polychaete worm) and *Leptocheirus plumulosus* (estuarine amphipod); and 28-day bioaccumulation tests with *Nereis virens* (marine sand worm) and *Macoma nasuta* (blunt-nose clam). The acute water column bioassays and the whole-sediment bioassays evaluated the effects of exposure to the sediment elutriates and whole-sediment, respectively, on the survival of the test organisms. Results of the bioaccumulation tests are presented in Chapter 7.

6.1 MATERIALS AND METHODS

Methodology for the water column and whole-sediment bioassays followed guidance in USEPA/USACE (1998), USEPA Region IV/USACE– SAD (1993), and USEPA/USACE (1991). The project Work Plan (EA 2002a) includes a comprehensive Quality Assurance Project Plan for the ecotoxicological testing program.

6.1.1 Sample Receipt and Preparation

Processing and homogenization of sediment followed procedures described in Chapter 2. After core processing, compositing, and homogenization, samples were delivered to EA's Ecotoxicology Laboratory in Sparks, Maryland on 25 March 2002. Upon receipt at EA, the sediments and site water samples were logged in and assigned EA laboratory accession numbers. The sediment and water samples were stored in the dark in a secured walk-in cooler at 4°C until used for testing. Prior to use in testing, the sediment from each site was homogenized and large rocks and debris were manually removed and discarded from the sample. Table 6-1 summarizes the sample identifications, accession numbers, collection, and receipt information for the Naval Station Pensacola turning basin sediments. Copies of chain-of-custody records for the ecotoxicology samples are provided in Attachment B.

6.1.2 Water Column Testing

For the water column toxicity testing, elutriates were prepared from the five turning basin sediments and one reference location using seawater collected from one location in Naval Station Pensacola turning basin (PNS02-04). A subsample of homogenized sediment was combined with site water in a 1:4 sediment to water ratio, on a volume/volume basis. The sediment/water combination was thoroughly mixed by vigorous aeration and manual stirring for 30 minutes at 20°C, and was then allowed to settle for one hour. After settling, the supernatant was siphoned off and adjusted to 30 ppt salinity using Forty Fathoms synthetic sea salts. The elutriates were used for the water column acute bioassays within 24 hours of preparation.

Test concentrations of 100, 50, and 10 percent elutriate were prepared by measuring aliquots of elutriate in a graduated cylinder and bringing to final volume with artificial seawater. A dilution water control of artificial seawater and a secondary control of undiluted site water were also prepared. The artificial seawater was prepared by mixing Forty Fathoms synthetic sea salts with laboratory water to a final salinity of 30 ppt. The source of the laboratory water was City of Baltimore municipal tap water that was passed through a high-capacity, activated carbon filtration system. This synthetic seawater formulation has proven acceptable for aquatic toxicological studies, and has been used successfully at EA for both maintaining multigeneration cultures of opossum shrimp, and holding healthy populations of estuarine and marine species. Batches of artificial seawater were aerated and aged at least 24 hours prior to use in testing. Ammonia concentrations were measured in each of the elutriates using a probe prior to introduction of the organisms on Day 0.

Static, non-renewal bioassays were conducted on the prepared elutriates using *A. punctulata* (purple sea urchin), *A. bahia* (opossum shrimp, formerly known as *M. bahia*), and *C. variegatus* (sheepshead minnow). The test organisms were acquired from outside vendors. Acquired lots of organisms were held at EA's culture facility (Sparks, Maryland) and gradually acclimated to test temperature and salinity prior to use in testing.

6.1.2.1 *Arbacia punctulata* Water Column Testing

Larval development tests were conducted with the purple sea urchin (*A. punctulata*). Adult sea urchins were acquired from Gulf Specimen Marine Laboratories (Panacea, Florida) and were received at EA on 9 April 2002. Upon receipt at EA, the adult sea urchins (lot number AP-011) were visually inspected and gradually acclimated to 20°C. Any adults that spawned in transit were immediately removed from the population and discarded.

The collection of sea urchin eggs and sperm and the preparation of gamete dilution were performed according to EA's protocol (EA 2002c) which follows guidelines in USEPA/USACE (1998). Just prior to test initiation, the sea urchins were injected with 0.5 mL of 0.5 M KCl, to induce spawning. Gametes were collected during the first 15 minutes of spawning and were microscopically inspected to determine normality of eggs and motility of sperm. Gametes that were determined to be acceptable for testing were pooled from a minimum of three males and three females, and were used to prepare the sperm and egg suspension for the fertilization procedures. Sperm and eggs were used within four hours of spawning. Care was taken to keep male and female urchins, gametes, and the equipment used in the collection and preparation of male and female gametes completely separate to avoid accidental fertilization during gamete preparation. Only combined gamete preparations that had achieved a minimum of 90 percent fertilization were used in testing. Bioassays were initiated within 1 hour of egg fertilization.

Test chambers were 30-mL scintillation vials with screw caps. Each test concentration and control had four replicate test chambers containing 10 mL of test solution. At test initiation, 250 µL of fertilized gamete preparation (approximately 1,000 embryos per mL) was delivered into each test chamber containing test dilution. Extra replicates of controls were prepared to monitor embryo counts at test initiation. The tests were maintained at 20±1°C with a 16-hour

light/8-hour dark photoperiod. Water quality parameters (temperature, pH, dissolved oxygen, and salinity) were measured at test initiation (Table 6-2A). The water column bioassays were initiated on 10 April 2002 and terminated on 13 April 2002.

The bioassay test duration for *A. punctulata* was extended past 48 hours in order to achieve full control development to the pluteus larval stage. The tests were terminated after 67 hours by adding 1 mL of 10 percent buffered formalin to each test chamber. The preserved samples were then observed microscopically to determine the percentage of embryos which had normally developed to the pluteus larval stage. Copies of the data sheets from the sea urchin toxicity tests are included in Attachment F, and the results of the testing are summarized in Table 6-3.

6.1.2.2 *Americamysis bahia* and *Cyprinodon variegatus* Water Column Testing

The 96-hour toxicity tests with *A. bahia* and *C. variegatus* were initiated on 3 April and completed on 7 April 2002. The test organisms were received from Aquatic BioSystems (Fort Collins, Colorado) on 3 April 2002. At test initiation, the *A. bahia* (lot number MB-481) were 4 days old and the *C. variegatus* (CV-367) were 12 days old. The opossum shrimp and sheepshead minnows were fed *Artemia* sp. nauplii (<24 hours old) during holding prior to use in testing.

The *A. bahia* and *C. variegatus* testing utilized 1-L beakers as test chambers. Each beaker contained 200 mL of test solution, and there were five replicate beakers per test concentration. Ten organisms were randomly introduced into each replicate for a total of 50 organisms per concentration. The test chambers were maintained at 20±1°C with a 16-hour light/8-hour dark photoperiod. Temperature, pH, and dissolved oxygen were measured in one replicate of each concentration daily for the 96-hour exposure period. Because of the size of the water quality probe and the danger of injury to the test organisms, salinity was measured in each concentration only at test initiation (prior to introduction of the test organisms) and at test termination. A summary of water quality measurements is presented in Table 6-2B and 6-2C. The number of live organisms were counted daily and recorded on the test data sheets. The *A. bahia* were fed *Artemia* sp. daily to avoid cannibalism. Copies of the *A. bahia* and *C. variegatus* acute toxicity test data sheets are included in Attachment F, respectively. Tables 6-4 and 6-5, respectively, present the results of the *A. bahia* and *C. variegatus* acute toxicity tests.

6.1.3 Whole-Sediment Testing

Whole sediment bioassays were conducted with the marine polychaete *N. arenaceodentata* and the estuarine amphipod *L. plumulosus*. The polychaete worms (organism lot number NA-011) were acquired from Dr. Donald Reish, California State University (Long Beach, California) on 26 March 2002. The amphipods (lot LP-020) were acquired from Aquatic BioSystems on 10 April 2002. During the holding period, the organisms were gradually acclimated to laboratory water at 20°C and the appropriate test salinity.

The whole sediment toxicity tests were conducted as static, non-renewal tests with 10 days of exposure to the whole sediments and overlying water. Artificial seawater (Forty Fathoms sea salts) at 30 ppt salinity for *N. arenaceodentata* and 20 ppt for *L. plumulosus* was used as the

overlying water. Porewater was extracted from each of the sediment samples by centrifugation in order to measure interstitial ammonia concentrations. For *L. plumulosus* whole sediment testing, US EPA/USACE (1998) guidance specifies that sediments with interstitial ammonia concentrations ≥60 mg/L NH_3-N should be ammonia purged prior to testing. None of the Pensacola Naval Station Turning Basin sediment samples had interstitial ammonia levels in excess of 60 mg/L NH_3-N; thus, purging prior to the whole sediment testing was not required.

The sediments and overlying water were added to the test chambers on 28 March 2002, and the suspended sediments were allowed to settle overnight. Ammonia concentrations were tested in the whole sediment and overlying water prior to the introduction of organisms. The addition of the test organisms to the exposure chambers on the following day marked the initiation of the toxicity tests. A clean natural sediment (Wye River, Maryland) was used as a laboratory control for the whole sediment toxicity tests. The *N. arenaceodentata* toxicity tests were initiated on 29 March 2002, and the *L. plumulosus* toxicity tests were initiated on 12 April 2002.

The *N. arenaceodentata* and *L. plumulosus* tests utilized 1-L beakers as the exposure chambers, with each beaker containing 200 mL of sediment and 700 mL of overlying water. There were five replicate chambers for each sediment sample and control. Test organisms were randomly assigned to the test chambers. The *N. arenaceodentata* test had 5 organisms per replicate for a total of 25 organisms exposed per sample, while the *L. plumulosus* test had 20 organisms per replicate chamber for a total of 100 organisms per sample.

The tests were maintained at 20±1°C with a 16-hour light/8-hour dark photoperiod. The test chambers were visually inspected daily for abnormal organism behavior/lack of burrowing. Water quality measurements of temperature, pH, dissolved oxygen, and salinity were recorded daily on one replicate of each sample and control. The water quality parameters measured during the *N. arenaceodentata* toxicity testing are summarized in Table 6-6. Table 6-7 presents the water quality parameters measured during the *L. plumulosus* testing. The test organisms were not fed during the 10-day exposure period.

After 10 days of exposure, the test organisms were retrieved from the samples, and the number of live organisms per replicate was recorded. Copies of the original data sheets for the *N. arenaceodentata* and the *L. plumulosus* testing are included in Attachment F, respectively. The results of the *N. arenaceodentata* toxicity tests are summarized in Table 6-8, and the *L. plumulosus* toxicity test results are summarized in Table 6-9.

6.1.4 Data Analysis/Statistics

Statistical analyses were performed on the water column and whole sediment test data according to USEPA/USACE (1998) guidance and using ToxCalc statistical software package (Version 5.0, Tidepool Scientific Software). For the elutriate testing, a 96-hour LC50 (median lethal concentration), or EC50 (median effective concentration) for *A. punctulata*, was calculated for each test species using the linear interpolation, Spearman-Karber, Trimmed Spearman-Karber, or probit method. Additionally, if survival in the 100 percent elutriate concentration was at least 10 percent lower than the dilution water control, then a statistical comparison (t-Test) was performed between the 100 percent elutriate concentration and the control. The t-Test was based

on the assumption that the observations were independent and normally distributed as determined by the Shapiro-Wilk's test. The F-Test was used to test for homogeneity of variance. When the data did not meet the normality assumption, the nonparametric test, Wilcoxon's Rank-Sum Test, was used to analyze the data. An arc sine (square root [Y]) transformation was performed on the survival percentages.

For the whole sediment bioassay data, statistical analyses were performed to determine if exposure to any of the sediment samples resulted in significantly lower survival of the test organisms as compared to the reference sediment. If survival in a test sample was at least 10 percent lower than the reference, then a t-Test or Wilcoxon's Rank-Sum Test (depending on normal or non-normal data distribution) was performed to compare the single test sample to the reference.

6.1.5 Reference Toxicant Testing

In conformance with EA's QA/QC program requirements, reference toxicant testing was performed on the acquired lots of *A. punctulata*, *N. arenaceodentata*, and *L. plumulosus*, utilized in the testing program. Reference toxicant data for the *A. bahia* and the *C. variegatus* were obtained from the organism supplier. The reference toxicant tests consisted of a graded concentration series of a specific toxicant in water only tests, with no sediment present in the test chambers. The results of the reference toxicant tests were compared to established control chart limits. Table 6-10 presents the results of the reference toxicant testing for the water column and whole sediment test organisms.

6.2 RESULTS

6.2.1 Water Column Testing

For the *Arabacia punctulata* toxicity tests, the test duration was extended past 48 hours in order to achieve full control development to the pluteus stage. The tests were terminated after 67 hours of exposure. The results of the elutriate testing with *A. punctulata* are presented in Table 6-3. The elutriates prepared from the reference sediment (PNSREF02) and the sediment from PNS02-01, PNS02-02, PNS02-05 were not acutely toxic to *A. punctulata,* as evidenced by 67-hour EC50s of >100 percent elutriate. Samples PNS02-03 and PNS02-04 were acutely toxic with 67-hour EC50s of 77.2 and 67.2 percent elutriate, respectively. The site water used to prepare the elutriates was not toxic to *A. punctulata*, with 99 percent normal development in the undiluted site water. All dilution water controls had a minimum of 95 percent normal development. In order to comply with placement site requirements with 0.01 EC50 within a 4-hour period, dilution factors of 130 and 149 would be required for locations PNS02-03 and PNS02-04, respectively.

Table 6-4 summarizes the results of the elutriate testing with *Americamysis bahia*. None of the five sediment samples or reference sediments were acutely toxic to *A. bahia*, with 96-hour LC50s of greater than 100 percent elutriate and less than a 10 percent difference in survival between the control and the 100 percent elutriate concentration. The site water had 94 percent

survival and was not acutely toxic to *A. bahia*. Survival in the control was 92 percent or greater in all *A.bahia* toxicity tests.

The results of the elutriate testing with *Cyprinodon variegatus* are presented in Table 6-5. None of the sediment samples or reference sediment were acutely toxic to *C. variegatus*, with 96-hour LC50s of greater than 100 percent elutriate and a minimum of 96 percent survival in the 100 percent elutriate concentrations. The site water had 100 percent survival, and was not acutely toxic to *C. variegatus*. There was a minimum of 98 percent survival in the control toxicity tests for *C. variegatus*.

6.2.2 Whole-Sediment Testing

The results of the *Neanthes arenaceodentata* whole sediment toxicity testing are summarized in Table 6-8. After 10 days of exposure, there was 96 percent survival in the reference sediment (PNSREF02). Sediments PNS02-04 and PNS02-05 also had 96 percent survival. Samples PNS02-02 and PNS02-03 had 88 and 90 percent survival, respectively, and were not significantly (p=0.05) less than the reference sediment. Sample PNS02-01 had 80 percent survival which was both significantly (p=0.05) less than, and more than 10 percent lower than, survival in the reference sediment, indicating that the PNS02-01 sediment was acutely toxic to *N. arenaceodentata*.

The *Leptocheirus plumulosus* whole sediment toxicity test results are presented in Table 6-9. At test termination on Day 10, there was 84 percent survival in the reference sediment (PNSREF02) and 95 percent survival in the control sediment. Sediments PNS02-02, PNS02-03, and PNS02-05 had 79 to 82 percent survival, none of which were significantly (p=0.05) less than the reference sediment. Therefore, sediments from PNS02-02, PNS02-03, and PNS02-05 were not acutely toxic to *L. plumulosus*. Sediments PNS02-01 (64 percent survival) and PNS02-04 (49 percent survival) had significantly (p=0.05) lower survival than the reference sediment. Survival at PNS02-04 was also more than 20 percent lower than the reference survival, indicating that the sediment from PNS02-04 is acutely toxic to *L. plumulosus*.

6.2.3 Reference Toxicant Tests

The results of the reference toxicant tests are summarized in Table 6-10. All of the reference toxicant test results fell within the established laboratory control chart limits, indicating that the acquired organisms were of acceptable quality.

6.3 LIMITING PERMISSIBLE CONCENTRATION (LPC) COMPLIANCE

6.3.1 Water Column Testing

The LPC for ocean placement is equivalent to 0.01 of the EC50/LC50 within a 4-hour dilution period inside the boundary of the placement site (USEPA/USACE 1991). The lowest EC50/LC50 value for the water column survival tests (67.2 percent for *A. punctulata* for location PNS02-04) would require a dilution or mixing of approximately 149-fold to achieve the LPC. STFATE modeling of the dilution using the specifications (i.e., dimensions and water column

properties) of the placement site was conducted to determine if the 149-dilution would be achieved within the 4-hour period inside the site boundary.

STFATE modeling indicated that a 1540-fold available dilution would be achieved within 4 hours following placement, which is sufficient to satisfy 1 percent of the EC50 value (Appendix H). Therefore, the EC50 value of 67.2 percent for *A. punctulata* meets the LPC for ocean placement at the Pensacola offshore ODMDS.

6.3.2 Whole Sediment Testing

Survival data for the individual stations within the Pensacola Naval Station turning basin indicated that material from station PNS02-01 and from PNS02-04 would not meet the LPC for benthic toxicity individually based on the results for *N. arenaceodentata and L. plumulosus*, respectively.

To determine overall compliance with the LPC for *N. arenaceodentata* and *L. plumulosus*, the survival data from each of the five sampling areas was pooled to calculate an overall mean survival value that would be representative of the material from the turning basin (as a whole) to be dredged and placed at the Pensacola ODMDS (Appendix H). For *N. arenaceodentata, r*esults for the pooled data (all locations combined) indicated a mean survival of 90 percent, which was not significantly lower than the reference survival (96 percent). For *L. plumulosus*, results for the pooled data (all locations combined) indicated a mean survival of 70 percent, which was not significantly lower than the reference survival (84 percent). Results of the pooled survival data (Appendix H) for *N. arenaceodentata and L. plumulosus* meet the LPC for benthic toxicity.

TABLE 6-1. SUMMARY OF COLLECTION AND RECEIPT INFORMATION FOR SAMPLES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA

Sample Identification	Sample Type	EA Accession Number	Collection Time and Date	Receipt Time and Date	Interstitial Ammonia (mg/L NH_3-N)
PNSREF02	Sediment	AT2-219	1300, 8 March 2002	1500, 25 March 2002	4.8
PNS02-01	Sediment	AT2-214	1500, 21 March 2002	1500, 25 March 2002	17.9
PNS02-02	Sediment	AT2-215	1300, 21 March 2002	1500, 25 March 2002	12.6
PNS02-03	Sediment	AT2-216	0930, 21 March 2002	1500, 25 March 2002	43.7
PNS02-04	Sediment	AT2-217	1000, 21 March 2002	1500, 25 March 2002	23.5
PNS02-05	Sediment	AT2-218	1200, 21 March 2002	1500, 25 March 2002	11.5
PNS02-04	Site Water	AT2-220	1015, 7 March 2002	1500, 25 March 2002	not applicable

TABLE 6-2A. WATER QUALITY PARAMETERS MEASURED DURING *Arabacia punctulata* (PURPLE SEA URCHIN) ELUTRIATE BIOASSAY TESTING ON SAMPLES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
PNSREF02	20.4-21.6[a] 21.1 (±0.3)	7.8-8.3 8.1 (±0.1)	6.8-7.9 7.1 (±0.3)	31.4-33.4[b] 32.3 (±0.7)
PNS02-01	20.4-21.6[a] 21.1 (±0.4)	8.2-8.3 8.2 (±0.1)	6.7-7.2 7.0 (±0.2)	31.6-33.6[b] 32.4 (±0.6)
PNS02-02	20.3-21.6[a] 20.9 (±0.5)	8.1-8.3 8.2 (±0.1)	6.8-7.2 7.0 (±0.2)	31.5-33.3[b] 32.2 (±0.6)
PNS02-03	20.4-21.6[a] 21.0 (±0.4)	8.1-8.3 8.2 (±0.1)	6.8-7.2 7.0 (±0.2)	31.4-33.3[b] 32.1 (±0.6)
PNS02-04	20.4-21.6[a] 21.0 (±0.4)	8.0-8.3 8.2 (±0.1)	6.7-7.2 7.0 (±0.2)	31.4-32.7 32.0 (±0.5)
PNS02-05	20.4-21.6[a] 21.0 (±0.4)	7.4-8.3 8.1 (±0.3)	6.8-7.2 7.0 (±0.1)	31.4-33.0 32.3 (±0.6)

(a) Temperatures of several replicates were outside the target range of 20±1°C for short periods of time.
(b) Salinity was greater than the target range of 30±3 ppt in the 100 percent elutriate concentration at test termination

TABLE 6-2B. WATER QUALITY PARAMETERS MEASURED DURING *Americamysis bahia* (OPOSSUM SHRIMP) ELUTRIATE BIOASSAY TESTING ON SAMPLES FROM NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
PNSREF02	18.0-21.0[a] 19.6 (±0.7)	7.8-8.3 8.1 (±0.1)	5.9-7.4 6.4 (±0.5)	28.6-33.3[b] 30.4 (±1.9)
PNS02-01	19.8-21.0 20.4 (±0.3)	7.6-8.5 8.0 (±0.2)	5.4-7.4 6.4 (±0.6)	28.6-33.8[b] 31.0 (±1.9)
PNS02-02	19.6-21.6[a] 20.7 (±0.6)	7.7-8.3 8.0 (±0.2)	5.1-8.4 6.3 (±0.8)	28.5-34.2[b] 30.5 (±2.1)
PNS02-03	20.1-21.0 20.6 (±0.3)	7.7-8.3 8.0 (±0.2)	5.7-7.3 6.4 (±0.5)	28.6-33.3[b] 30.5 (±1.8)
PNS02-04	19.9-21.2[a] 20.6 (±0.4)	7.8-8.3 8.0 (±0.1)	5.5-7.3 6.2 (±0.6)	28.3-32.4 30.2 (±1.7)
PNS02-05	19.6-21.0 20.2 (±0.4)	7.7-8.3 8.0 (±0.2)	5.6-7.4 6.3 (±0.5)	28.6-33.5[b] 30.5 (±1.9)

(a) Temperatures of several replicates were outside the target range of 20±1°C for short periods of time.
(b) Salinity was greater than the target range of 30±3 ppt in the 100 percent elutriate concentration at test termination

TABLE 6-2C. WATER QUALITY PARAMETERS MEASURED DURING *Cyprinodon variegatus* (SHEEPSHEAD MINNOW) ELUTRIATE BIOASSAY TESTING ON SAMPLES FROM NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA

Test Elutriate	Mean (±Standard Deviation)			
	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)
PNSREF02	20.0-21.4[(a)] 20.8 (±0.4)	7.8-8.3 8.1 (±0.2)	6.4-7.4 6.9 (±0.3)	28.6-34.1[(b)] 30.9 (±2.0)
PNS02-01	19.0-21.0 20.2 (±0.5)	7.9-8.5 8.1 (±0.2)	6.3-7.4 6.7 (±0.3)	28.6-34.0[(b)] 31.0 (±2.0)
PNS02-02	19.8-21.0 20.6 (±0.3)	7.9-8.3 8.1 (±0.1)	6.5-7.3 6.9 (±0.2)	28.5-32.9 29.9 (±1.8)
PNS02-03	20.2-21.0 20.7 (±0.3)	7.9-8.3 8.0 (±0.1)	6.5-7.3 6.9 (±0.2)	28.6-33.3[(b)] 30.2 (±1.8)
PNS02-04	20.5-21.0 20.8 (±0.2)	7.9-8.3 8.1 (±0.1)	6.5-7.3 6.9 (±0.3)	28.6-32.4 30.0 (±1.4)
PNS02-05	19.5-21.0 20.4 (±0.4)	7.7-8.3 8.0 (±0.2)	6.6-7.4 7.0 (±0.3)	28.2-32.8 30.2 (±1.8)

(a) Temperatures of several replicates were outside the target range of 20±1°C for short periods of time.
(b) Salinity was greater than the target range of 30±3 ppt in the 100 percent elutriate concentration at test termination

TABLE 6-3. RESULTS OF ELUTRIATE BIOASSAY TESTING WITH *Arbacia punctulata* (PURPLE SEA URCHIN) ON SAMPLES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA

Test Elutriate	*67-Hour Normal Development*				67-Hour EC_{50} (% elutriate)
	Lab Control	*Percent Elutriate*			
		10 %	50 %	100%	
PNSREF02[a]	97	99	98	99	>100
PNS02-01	98	99	93	95	>100
PNS02-02	98	100	99	100	>100
PNS02-03	95	94	92	12[b]	77.2
PNS02-04	95	97	85	6[b]	67.2
PNS02-05	97	99	98	98	>100

(a) Test duration was extended past 48 hours in order to achieve full control development to the pluteus stage
(b) Percent normal development in the 100 percent elutriate concentration was significantly (p=0.05) lower than the laboratory control.

TABLE 6-4. RESULTS OF ELUTRIATE BIOASSAY TESTING WITH *Americamysis bahia* (OPOSSUM SHRIMP) ON SAMPLES FROM THE NAVAL STATION PENSACOLA TURNING BASIN, PENSACOLA, FLORIDA

Test Elutriate	*96-Hour Survival*				96-Hour LC_{50} (% elutriate)
	Lab Control	*Percent Elutriate*			
		10 %	50 %	100%	
PNSREF02	96	98	96	94	>100
PNS02-01	100	94	100	98	>100
PNS02-02	92	96	88	92	>100
PNS02-03	96	96	96	98	>100
PNS02-04	96	100	98	96	>100
PNS02-05	96	96	98	90	>100